STATE OF HAWAII 1959
UA MAU KE EA O KA AINA I KA PONO

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

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Ref. No. P-12769

September 24, 2009

Mr. Ingvar Larsson
Vice President for Engineering
Honolulu Seawater Air Conditioning, LLC
7 Waterfront Plaza, Suite 407
500 Ala Moana Boulevard
Honolulu, Hawaii 96813

Dear Mr. Larsson:

Subject: Acceptance of Final Environmental Impact Statement (EIS) for the Honolulu Seawater Air Conditioning Project

This is to convey our acceptance of the final EIS for the Honolulu seawater air conditioning project. We have determined that it complies with provisions and guidelines of Chapter 343, Hawaii Revised Statutes, and Title 11, Chapter 200, Hawaii Administrative Rules.

The availability of this EIS for public review was published by the Office of Environmental Quality Control in its September 23, 2009, issue of the *Environmental Notice*.

We note in Chapter 5 of the final EIS that there are unresolved issues including (1) the final depth of seawater intake; (2) the position of the onshore jacking pit; and (3) the final routing of the distribution system. We also note that no soil borings and testing to gauge the environmental consequences of the hazardous waste contained in the former landfill were conducted, and that no mitigation plans to prevent endangered marine species monk seals from probably entering the intake pipe were prepared. These will need to be resolved before the applicable permits can be issued.

This acceptance notice is an affirmation of the adequacy of the EIS under the applicable laws and does not constitute an endorsement of the proposed action.

Sincerely,

Abbey Seth Mayer
Director

c: TEC, Inc.
Department of Health,
Office of Environmental Quality Control
Department of the Attorney General

SL/do
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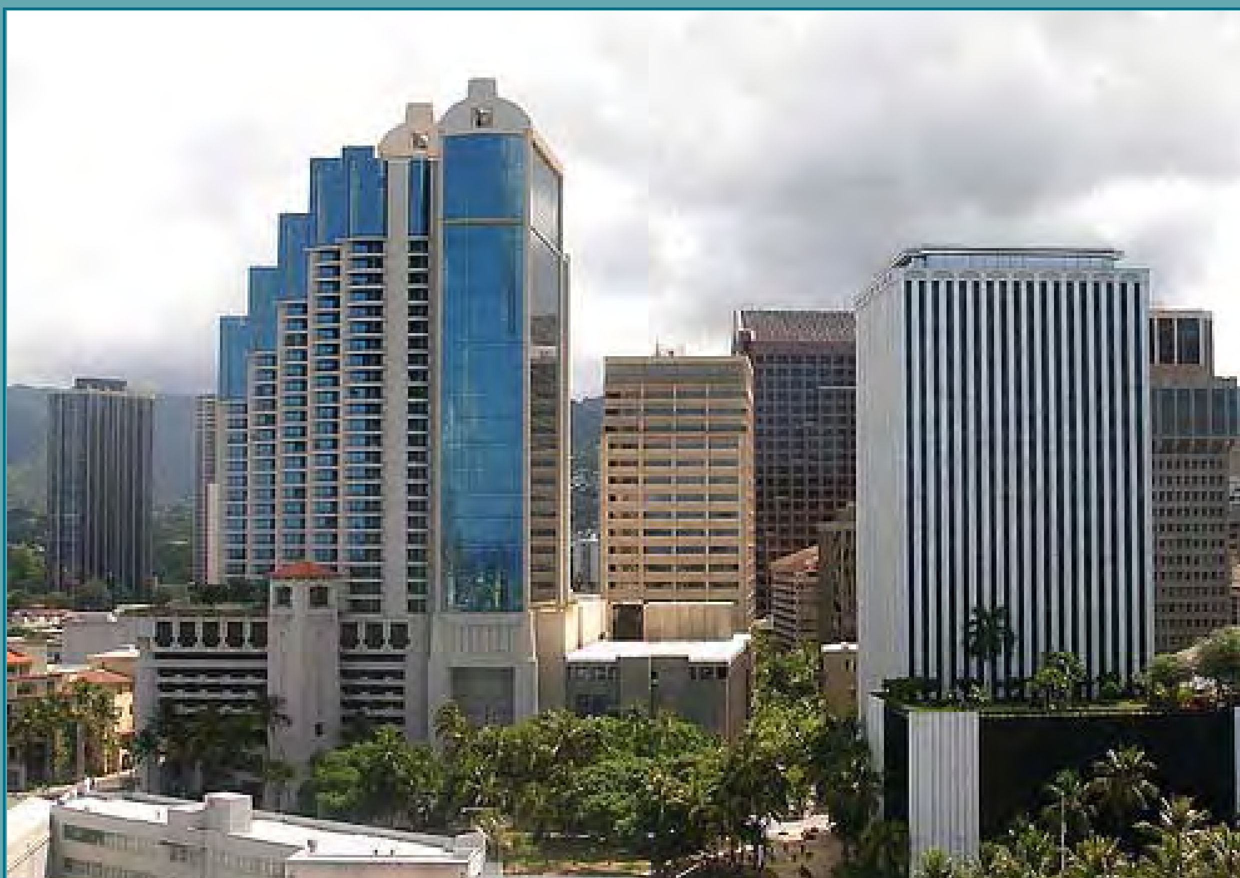
Honolulu Seawater Air Conditioning
Final Environmental Impact Statement
August 2009



Prepared for:
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Prepared by:
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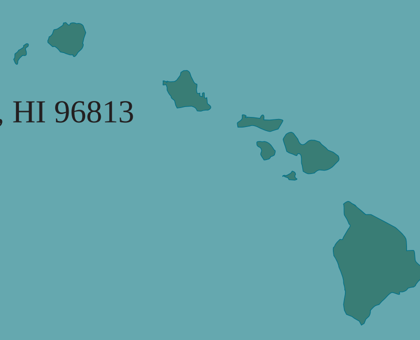
1001 Bishop Street, ASB Tower, Suite 1400, Honolulu, HI 96813



HONOLULU SEAWATER AIR CONDITIONING FINAL ENVIRONMENTAL IMPACT STATEMENT

This document was prepared pursuant to Chapter 343 of the Hawai'i Revised Statutes and the Hawai'i Administrative Rules Title 11, Chapter 200.

State Lead Agency: Hawai'i Office of Planning

Authorities: State permitting action under HRS 343 (Use of lands in the Special Management Area and in the Conservation District)

State Lead Agency Contact Person: Shichao Li, Office of Planning, P.O. Box 2359, Honolulu, HI 96804
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Closing Date for Comments on the Draft EIS: December 23, 2008

Prepared by:
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Prepared for:
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This Final Environmental Impact Statement was prepared under my direction, and the information submitted, to the best of my knowledge, fully addresses the document content requirements set forth in Hawaii Administrative Rules Section 11-200-17.

Ingvar Larsson

Ingvar Larsson
Vice President for Engineering
Honolulu Seawater Air Conditioning, LLC

8/17/09
Date

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SUMMARY SHEET

Brief Description of the Action:

Honolulu Seawater Air Conditioning (HSWAC) proposes to construct a seawater air conditioning system in downtown Honolulu. The system would consist of: 1) a 63-inch seawater intake pipe extending offshore approximately four to five miles to approximately 1,600 to 1,800 feet deep off Kaka‘ako; 2) a 54-inch seawater return pipe extending offshore approximately 3,500 feet to 150 feet deep off Kaka‘ako; 3) a pump station containing pumps, heat exchangers and auxiliary chillers in the Makai District of the Kaka‘ako Community Development District; and 4) a network of chilled water distribution pipes from the pump station to customer buildings in the downtown area. A staging area for pipe assembly is proposed for an area along the western shore of Sand Island and in the adjoining channel in Ke‘ehi Lagoon.

Significant Beneficial and Adverse Effects:

The proposed project would have positive effects on the local economy, reduce O‘ahu’s dependence on imported oil for electrical generation, reduce potable water consumption, reduce sewage generation, and reduce use of ozone depleting substances and chemicals used in maintaining existing air conditioning systems. Environmental resources potentially impacted by the action include: archaeological and historic sites; marine biota and water quality; traffic; noise; and air quality.

Proposed Mitigation Measures:

Mitigation measures would include archaeological, marine biological and water quality monitoring during construction, marine biological and water quality monitoring during operations, implementation of construction “Best Management Practices” to minimize offshore turbidity and on shore dust, implementation of a traffic management plan, and limitations on night construction near residences.

Alternatives Considered:

Technological alternatives were considered, but rejected as incapable of meeting project objectives. Alternatives for all system components including routes and terminal locations of seawater pipes, trenchless technologies and routes from the cooling station to an offshore breakout point, cooling station location and configuration, and distribution system routes were evaluated and a Preferred Alternative developed based on technical, economic and environmental considerations. The impacts of the Preferred Alternative were compared with those of a No Action Alternative and a Second Alternative differing from the Preferred Alternative in key aspects of the proposed facilities, construction/installation methods and system operations, and consequently differing in potential impacts to environmental resources.

Unresolved Issues:

The depth of the seawater intake is being further evaluated. It would be within the range of 1,600 to 1,800 feet deep. The final depth is essentially an economic choice between higher capital costs for pipe lengths and installation at greater depth, and higher operational costs for a shallower intake that would necessitate more supplemental cooling of slightly warmer water. A second unresolved issue is the position of the on shore jacking pit, which could, depending on the contractor’s plan, be anywhere from behind the shoreline to near the makai end of Keawe Street. The third unresolved issue is the final routing of the distribution system (and hence the length of the system) necessary to accommodate future customers.

Compatibility with Land Use Plans and Policies:

The proposed project is compatible with the Hawai‘i State Plan, the Hawai‘i Coastal Zone Management Plan, the Hawai‘i Ocean Resources Management Plan, the Kaka‘ako Community Development District Makai Area Plan, Hawai‘i Conservation District Policies and Regulations, the City and County of Honolulu General Plan and Primary Urban Center Development Plan.

Listing of Permits and Approvals:

Several permits would be required for preliminary engineering data gathering including a Special Management Area Minor Permit and rights-of-entry. A number of ministerial permits including those for grubbing, grading, stockpiling, trenching, excavation in a public right-of-way, building (electrical, plumbing, sidewalk/driveway, and demolition), construction dewatering, flammable and combustible liquids (fuel tank installation), rights-of-entry, street usage and construction, drain connection, oversized loads on highways, minor shoreline structure, temporary use, work within a state highway right-of-way, street usage, NPDES General Permits, etc. would be required for construction. A sewer connection agreement for the cooling station and an effluent discharge permit must be obtained from the City and County of Honolulu. A Certificate of Occupancy would be required after construction is complete. Noise permits would be required to allow the noise level to exceed regulatory limits during construction. A noise variance would be necessary for nighttime work when noise limits would be exceeded. A modification from HCDA would be required for the number of parking spaces at the cooling station. Easements would be required offshore and through both city and State roadways. Discretionary permits required would include: HCDA Project Eligibility Permit and Development Permit, Coastal Zone Management Program Consistency, Hawai‘i Revised Statutes (HRS) Chapter 6E clearance, State of Hawai‘i Environmental Impact Statement (EIS) as per Hawai‘i Revised Statutes (HRS) Chapter 343, Special Management Area (SMA) Use Permits (Major) for both the Kaka‘ako facilities and the Sand Island staging area, Shoreline Setback Variances for Kaka‘ako and Sand Island, Conservation District Use Permit (CDUP), National Pollutant Discharge Elimination System (NPDES) Individual Permit, Zone of Mixing (ZOM) Approval for Return Seawater, Clean Water Act, Section 401 Water Quality Certification, Permit to Discharge Process Wastewater, Essential Fish Habitat (EFH) Consultation (only required if U.S. ACOE determines project may have adverse effect on EFH), Endangered Species Act (ESA) Section 7 Consultation (only required if U.S. ACOE determines project may have adverse effect on a listed threatened or endangered species or its designated critical habitat), National Environmental Policy Act (NEPA) EIS, Department of the Army Permit.

EXECUTIVE SUMMARY

PURPOSE AND NEED

There is a need, based on economic and environmental considerations, to increase the use of renewable energy resources and decrease the use of imported oil to generate electricity in Hawaiʻi. Further, there are mandates at both State and Federal levels to increase energy efficiency and renewable energy use in their facilities, reduce potable water consumption and decrease toxic chemical use. The purpose of the Honolulu Seawater Air Conditioning (HSWAC) project is to significantly contribute to meeting these needs.

BRIEF ACTION DESCRIPTION

Seawater air conditioning (SWAC) uses available deep cold seawater instead of energy-intensive refrigeration systems to cool the chilled water in one or more buildings. Typical air conditioning systems use refrigerant-based chillers to cool water which is then used to cool the air that is circulated throughout the building. In a SWAC system, rather than cycling water through a chiller, the water is routed through a heat exchanger. Fresh water circulates through one side of a system of titanium (or other corrosion-resistant alloy) plates, giving up its heat to the cold seawater on the other side of the plates. The fresh water loop is closed, that is, the water circulates around and around from connected buildings to the heat exchanger, while the cold seawater passes through the heat exchanger only once before being returned to the sea. (A small portion of the cold seawater would also be used as condenser water to cool the auxiliary chillers.) The main components of a basic seawater air conditioning system are the seawater supply and return system, the heat exchanger or cooling station and the fresh water distribution system.

The HSWAC project is proposed for the downtown area of Honolulu, on the leeward shores of Oʻahu. The island of Oʻahu is part of the City and County of Honolulu. The HSWAC project would provide 25,000 tons of centralized air conditioning for downtown Honolulu. Four areas near downtown Honolulu would be used in four discrete functions associated with construction and operation of the HSWAC system:

- Seawater intake and return pipes would be deployed offshore of Honolulu in the area between Honolulu Harbor and Kewalo Basin;
- A cooling station would be built on a site in Kakaʻako;
- Freshwater distribution pipes would be installed beneath streets in the downtown area; and
- A shoreline site in Keʻehi Lagoon would be used for staging and pipeline assembly.

A 63-inch diameter pipe is proposed to supply cold seawater to the heat exchangers on shore. The pipe would be made from high density polyethylene (HDPE). The maximum flow rate through the pipe would be 44,000 gpm. Temperature of the intake water would be approximately 44-45°F.

The length of the pipe from shore to the intake location would be approximately four to five miles depending on the intake depth selected. Individual pipe segments would be heat-fused to form longer segments and then flange bolted into a single pipeline. The pipe would terminate with an elbow, such that water would be drawn down into the pipe from about 14 feet above the bottom. For example, water depth at the intake point would be approximately 1,770 feet, if the deepest portion of the pipe sitting on the bottom would be at about 1,784 feet.

Deployment of the seawater pipes would be done once all the segments are fused together. The pipelines would be towed into place, the land side temporarily secured to allow the pipelines to be put under tension, and the pipeline sunk in a controlled manner from shallow to deep water by controlled flooding. At least three tugs would be used to maneuver the pipelines to their final position. As the pipelines would be deployed off the south side of Oʻahu, deployment would likely be scheduled during the winter, when large southern swells are absent. The pipelines would be pulled into place in a single day and sunk at night to avoid the effects of differential heating of the pipe segments during the day.

The simplest and most economical pipe deployment scenario would be to lay the pipe directly on the bottom right up to the shoreline. This scenario, however, would expose the pipe to high waves and storm surge in the nearshore zone, have potential negative effects on benthic ecosystems including coral reefs, and probably necessitate a restriction on uses in the immediate area. For these reasons it was concluded that the pipes must be buried from behind the shore to some depth offshore. Trenching through the nearshore zone was considered to have unacceptable impacts on benthic ecosystems so a microtunneled shaft is proposed. The preferred break-out point for the drilled shaft and the offshore route of the seawater intake pipe were determined in consideration of the following factors:

- Bathymetry,
- Biological characteristics, and
- Use of the area.

Bathymetry was considered to find the shortest pipe length required to get to the desired intake depth.

The primary biological criterion was avoidance of areas of high coral coverage. A marine biological survey of the breakout area was conducted. The proposed pipe route traverses an area that historically has been seriously impacted by industrial discharges, sewage disposal, freshwater runoff into Honolulu Harbor, and disposal of dredged materials. The nearshore area where the proposed pipe would be installed is not a pristine coral reef environment. Four biotopes are present in a seaward direction:

- The biotope of scoured limestone.
- The biotope of scattered corals.
- The biotope of dredged rubble.
- The biotope of sand.

The breakout point for the seawater intake and discharge shaft was selected to be at about 31 feet deep in the biotope of dredged rubble. This point is approximately 1,800 feet offshore, and is the closest point to shore where the biotope of scattered corals can be avoided. Beyond that point, the intake pipe would be pinned to the bottom with hollow steel piles driven through anchor collars mounted on the pipeline and filled as necessary with concrete.

The presence of the pipes would have no effect on current recreational uses of the offshore area. Because they would increase bottom relief and provide habitat, they may enhance fishing opportunities. The primary concern with respect to use of the area was to protect the pipes from barge tow cables. Tug-towed barges entering and exiting Honolulu Harbor use very long tow wires which, in the shallow water near the harbor entrance, drag on the seabed. Consequently, specially designed snag-resistant anchor weights would be used down to a depth of 150 feet.

A seawater return pipe would lie adjacent to the intake pipe from the shaft breakout point to a depth of 150 feet. The seawater return pipe would be constructed of the same material using the same techniques as the intake pipe, but be somewhat smaller in diameter (54 inches) than the intake pipe. This is possible because the return flow would be under pressure. The return mass would equal the intake mass in this open loop system. (Volume would vary slightly because of density changes with temperature and pressure.) The temperature of the return seawater would vary between 53°F and 58°F depending on system demand. The two pipes would be secured in combination anchor collars that would hold both pipes. The seawater return pipe would terminate in a diffuser extending from 120 to 150 feet deep. A zone of mixing (ZOM) around the diffuser is proposed. Computer simulations using CORMIX software and very conservative assumptions project a dilution factor of 100 is necessary at the fringe of the ZOM. Depending on water currents this criterion is expected to be met within from 59 to 148 feet measured horizontally from the plume centerline. As the plume is denser than the receiving water, it would tend to sink and would not approach the surface.

From 150 feet deep to the end of the pipeline, the pipe would be held in place by gravity anchors. Each anchor would weigh approximately 17,800 pounds in air, and provide an effective weight of 10,300 pounds when submerged. Approximately 850 pipe weights would be required for both pipelines.

A number of candidate sites were evaluated for suitability for a cooling station. Technical criteria evaluated for each site included:

- Size, configuration and existing structures;
- Soil conditions;
- Exposure to waves and tsunami run-up;
- Site contamination or presence of old buried utilities;
- Availability of access corridors for tunneling. It is higher risk to tunnel under adjacent sites (the contractor may not be able to retrieve his machine if it gets stuck), permission may not be granted, and there may be obstacles such as foundation piles; and
- Distances for tunneling both toward the sea and toward downtown.

Four potential sites in the Makai District of the Kakaʻako Community Development District, the preferred area, were offered by the Hawaiʻi Community Development Authority (HCDA), but only one of them could potentially meet all of the technical criteria. Several additional alternative sites in the Makai District of Kakaʻako that are privately-owned were subsequently evaluated. These included: (1) the parking lot adjacent to HECO's downtown generating station; (2) the parking lot makai of 677 Ala Moana Blvd.; and (3) the former Honolulu Ford location Diamond Head of 677 Ala Moana Blvd. The latter two sites are owned by Kamehameha Schools. HSWAC has reached agreement with Kamehameha Schools to construct its cooling station on the parcel makai of the 677 Ala Moana Building.

A zone of mixing (ZOM) around the diffuser is proposed. Computer simulations using CORMIX software and very conservative assumptions project a dilution factor of 100 is necessary at the fringe of the ZOM.

Deployment of the seawater pipes would be done once all the segments are fused together. The pipelines would be towed into place, the land side temporarily secured to allow the pipelines to be put under tension, and the pipeline sunk in a controlled manner from shallow to deep water by controlled flooding. At least three tugs would be used to maneuver the pipelines to their final position. As the pipelines would be deployed off the south side of Oʻahu, deployment would likely be scheduled during the winter, when large southern swells are absent. The pipelines would be pulled into place in a single day and sunk at night to avoid the effects of differential heating of the pipe segments during the day.

A dry sump - direct connect type of cooling station (i.e., pumps directly coupled with the intake pipe rather than through an intermediate wet sump) is proposed as it would be most practical and economical for this application. It would provide an overall lower cost, less flooding risk, and less impact on cooling station site selection. A two-story facility with pumps in the basement (30 feet below ground, 20 feet below sea level) and heat exchangers and chillers on the ground floor is proposed. The overall space required is about 23,500 square feet, with 22,000 square feet at grade and a 1,500 square feet basement.

The HSWAC system would use from 6 to 18 large plate heat exchanger units to provide the bulk of the cooling capacity. Each unit contains hundreds of 0.02-inch thick titanium (or other corrosion-resistant alloy) plates. The freshwater returning from the connected buildings at 54°F would pass through the heat exchangers where it would transfer heat into the cold 44-45°F seawater. The seawater would exit the heat exchanger after warming up to approximately 53°F. To maintain an optimum temperature in the fresh water distribution loop, auxiliary chillers would be available to provide supplemental chilling.

A system of pipes would be installed beneath the streets of downtown Honolulu to provide chilled freshwater to customer buildings. Depending on the specific locations of HSWAC's customers, the total length of the distribution system could vary from approximately 16,000 to 19,000 feet. The total volume of fresh water in the distribution system would be close to one million gallons.

USE OF PUBLIC FUNDS OR LANDS

The project is anticipated to cost approximately $200 million. No public funds would be used for the project; however, HSWAC intends to seek federal grants and loan guarantees for the project. Approximately $145 million would be financed using special purpose tax exempt revenue bonds approved by the Hawai‘i State Legislature. The remainder would be from non-exempt bonds and from equity sources.

Use of public lands would include State and Federal submerged lands where the seawater pipes would be installed, State highways and city streets where the distribution system pipes would be installed, and State lands on Sand Island where the seawater pipelines would be assembled.

ALTERNATIVES CONSIDERED

The economic feasibility of the project depends on sourcing seawater cold enough to necessitate little if any supplemental chilling of the distribution water. Ideally this temperature would be approximately 40-42°F. However, there is an economic trade-off between installing a longer, deeper pipe to access colder seawater and providing some supplemental chilling of the distribution water. For the HSWAC project, this decision was driven substantially by the bathymetry offshore of Honolulu and the unit cost of fabrication and deployment of the intake pipe. Beyond about 1,000 feet deep, the bottom slope flattens considerably compared with the relatively steep slopes seen at shallower depths.

Preliminary system analysis and optimizations by Makai Ocean Engineering (2004, 2005a, 2005b) based on levelized lifetime costs showed a relatively flat optimum for intake depths between 1,600 feet and 1,800 feet with average seawater temperatures varying between 44°F and 45°F. Initially an intake depth of 1,600 feet with an average seawater temperature of 45°F was selected. Subsequent evaluations have shown that a deeper intake depth may be operationally desirable. The final depth of the intake remains unresolved. It is primarily an economic choice; the environmental impacts would not be significantly different for any intake within this depth range. The economic trade-off is that a deeper intake would increase capital costs for additional pipe lengths and installation, while a shallower intake would increase operational costs because additional supplemental cooling of the slightly warmer water would be required. The benthic conditions are not significantly different between 1,600 and 1,800 feet deep.

The deep, offshore portion of the pipe would be constructed in segments on-shore. A staging area of approximately18 acres near the shore would be required to store pipe, concrete anchor blocks and other components, and to fuse the pipeline lengths into longer segments. Several potential locations for the staging area were investigated, including Kalaeloa Harbor (Barbers Point), Ke‘ehi Lagoon, Kaneohe Bay and Moloka‘i Harbor.

The latter two locations were evaluated and rejected for the following reasons:

- Kaneohe Bay: This large bay on the windward side of O‘ahu is well protected, but is an intensively used recreation area, typically has many recreational vessels present, is a popular dive location, has many shallow patch reefs, and is the home of the Hawai‘i Institute of Marine

Biology. Using this bay could inconvenience users and is not likely to get community acceptance. Furthermore, access to an appropriate shoreside staging area might be difficult and maneuvering the fully-assembled pipeline could also be difficult.

- Molokaʻi Harbor: The harbor on Molokaʻi was considered, but it is too small. In addition, it is far from the final deployment area, which would significantly increase costs and risks related to towing the pipeline.

Use of an area within either Kalaeloa Harbor or Keʻehi Lagoon was discussed with representatives of the Harbors Division of the State Department of Transportation. Each of these sites has the advantage of being very close to the heaviest industrial infrastructure in the Hawaiian Islands on the south side of Oʻahu, but storage of pipe sections in Kalaeloa Harbor waters could impede ship movements.

HSWAC's preferred location, therefore, would be in the southeastern channel in Keʻehi Lagoon. Five to eight sections of floating pipeline easily could be stored in this region, and adequate unused land is present adjacent to the shoreline to permit storage of pipe sections and anchors.
A number of candidate sites were evaluated for suitability for a cooling station. Technical criteria evaluated for each site included:

- Size, configuration and existing structures;
- Soil conditions;
- Exposure to waves and tsunami run-up;
- Site contamination or presence of old buried utilities;
- Availability of access corridors for tunneling. It is higher risk to tunnel under adjacent sites (the contractor may not be able to retrieve his machine if it gets stuck), permission may not be granted, and there may be obstacles such as foundation piles; and
- Distances for tunneling both toward the sea and toward downtown.

Four potential sites in the Makai District of the Kakaʻako Community Development District, the preferred area, were offered by the Hawaiʻi Community Development Authority (HCDA), but only one of them could potentially meet all of the technical criteria. Several additional alternative sites in the Makai District of Kakaʻako that are privately-owned were subsequently evaluated. These included: (1) the parking lot adjacent to HECO's downtown generating station; (2) the parking lot makai of 677 Ala Moana Blvd.; and (3) the former Honolulu Ford location Diamond Head of 677 Ala Moana Blvd. The latter two sites are owned by Kamehameha Schools.

Several criteria were used to identify potential routes through downtown Honolulu for the distribution system piping. Economy and efficiency would be best served by connecting the buildings with the largest air conditioning loads using the shortest system of pipes. However, as it is not known at this time which buildings would become customers of the HSWAC system, route optimization by customer location is not yet possible. Two other criteria were used to derive a preliminary preferred route for the distribution system: existing utility installations within the right-of-way and potential traffic impacts during construction. The results of this screening analysis were used to construct the preliminary preferred distribution system route. This route was subsequently adjusted to accommodate the proposed route of the City's rapid transit system, bus operations and to avoid areas of high potential for archaeological and cultural remains.

Distribution pipes would be larger in diameter closer to the pumping station and smaller at greater distances. Pipe sizes would vary between 8 inches and 42 inches, with a length-weighted average of 26 inches.

Except where the pipes exit the cooling station where a microtunnel would be used to pass beneath Ala Moana Boulevard, distribution pipes would be installed in trenches dug into the street or adjoining right-of-way.

MAJOR CONCLUSIONS

The HSWAC project is feasible and economical. An environmentally and economically acceptable offshore route for the seawater intake and return pipes has been identified. A suitable site for the cooling station has been located and an agreement has been reached with the landowner. All necessary equipment either exists or can be fabricated. Construction and pipe deployment methodologies are well-defined. Potential adverse impacts of construction and operation of the system can be adequately mitigated.

SIGNIFICANT BENEFICIAL AND ADVERSE IMPACTS

The net public benefits of SWAC systems in general and the Honolulu SWAC system in particular greatly exceed the unavoidable adverse effects. A SWAC system has significant environmental benefits over conventional chillers. These include large reductions in electricity consumption which reduces air pollution and greenhouse gas production, and substitution of simple heat exchangers for chiller machinery which use ozone-depleting and global warming refrigerants. Elimination of cooling towers used in conventional AC systems also reduces potable water use, sewage generation and toxic chemical use.

At a 25,000 ton size, the HSWAC system is estimated to have the following environmental benefits:

- Reduction of 178,000 barrels of imported fossil fuels used on Oʻahu per year;
- Reduction of associated emissions of air pollutants by the following amounts:
  - CO_2 – 84,000 tons/year
  - VOC – 5 tons/year
  - CO – 28 tons/year
  - PM_{10} – 19 tons/year
  - NO_x – 169 tons/year
  - SO_x – 165 tons/year
- Savings of 77.5 million kWh/year;
- Savings of 75 percent of energy use compared to conventional chiller equipment;
- Reduction of thermal pollution of the environment by about 40% compared to conventional, electricity-powered air conditioning systems;
- Savings of about 260 million gallons/year of potable water;
- Reduction of up to 84 million gallons/year of wastewater;
- Elimination of cooling tower treatment chemicals for connected buildings;
- Elimination of up to 14 megawatts of new generating capacity (equivalent to one year of Hawaiian Electric Company's [HECO] projected load growth);
- Stabilization of consumer electric rates by delaying the need for investment in new generating capacity;
- Lower operating and maintenance costs for connected buildings;
- Local expenditures of millions of dollars in construction costs;
- Providing employment during construction and operations; and
- Economic multiplier effects on money that stays in Hawaiʻi's economy.

Clearly, the net benefits to society from the proposed HSWAC system would be substantial and enduring.

There would be some unavoidable impacts during construction. During installation of the seawater pipes temporary impacts to offshore ecosystems and water quality are possible, primarily due to anchoring of work vessels and increased turbidity due to excavation of a receiving pit for the microtunneling machine. Construction of the cooling station and distribution network would create noise, dust and traffic congestion in the Kaka'ako and downtown areas. Dewatering would be necessary at the cooling station site and for installation of some of the distribution pipes, but mitigating conditions attached to an NPDES permit would be adhered to.

The most significant impact of system operations would be to offshore water quality. Operation of the system would require a USEPA and DOH designated Zone of Mixing within which the return seawater flow would be diluted sufficiently to meet State water quality standards.

PROPOSED MITIGATION MEASURES

Impact mitigation for the HSWAC project began in earliest planning when it was decided to use some form of trenchless technology to route pipes beneath the nearshore area and under major roadways. Planning and engineering design for the project also incorporated decisions about siting, routing, construction methods, etc., which had the effect of reducing the potential impacts of the project. For example, facilities have been sited and engineered to withstand anticipated forces resulting from natural hazards. The decision to surface mount the seawater pipes with piles minimized the potential impacts to water quality and marine communities. The proposed microtunnel breakout point was selected to avoid coral reefs or coral-dominated communities. The breakout point would be within the biotope of dredged rubble where corals are very sparse.

Specific mitigation measures were developed to address potential impacts to archaeological, marine biological, and terrestrial biological resources; marine and surface water quality; noise; air quality; and traffic.

All appropriate regulations and permit conditions would be complied with for grading, excavation, dewatering, trenching, repaving, etc. All existing utility installations would be accurately mapped to avoid conflicts or accidents resulting in service outages. Where pipes would be installed by trenching, standard mitigation measures would be employed to minimize impacts to traffic and return the pavement surface to a condition equal to or better than what existed previously. Specific mitigation measures would be detailed in a construction management plan. The grading, grubbing, and stockpiling permit would require a project-specific soil erosion control plan. The construction contractor would be required to comply with Section II (Storm Water Quality) of the City's Rules Relating to Storm Drainage Standards. Dewatering effluent would be discharged under a National Pollutant Discharge Elimination System (NPDES) discharge general permit. Best Management Practices (BMPs) would be used to remove suspended particulates and meet all other permit requirements prior to discharge. Treatment would include settling ponds or tanks, filtration systems, or both. Water would be tested to ensure that discharges meet general water quality parameters and toxic contaminant parameters as specified in the permit.

During staging and pipe assembly, a management plan for vessel traffic in Ke'ehi Lagoon would be implemented to minimize safety risks and inconvenience to users. The Sand Island staging area would be re-established in equal or better condition upon the demobilization of HSWAC's contractor.

A traffic management plan would be developed to identify specific potential traffic management strategies that can be implemented to minimize the effect of HSWAC construction on the downtown Honolulu roadway system. The traffic management plan would describe the construction management, public information program, construction schedule, construction traffic, and traffic control plans during construction.

Special considerations would be given to minimizing after hours noise in the vicinity of residential buildings near the distribution route. Typical noise mitigation measures employed, in addition to the time of day restrictions, include use of proper mufflers on any gas or air-powered equipment and restricting night work when necessary to less noisy tasks.

To mitigate fugitive emissions a dust control plan for project construction would be prepared in advance. This plan would include BMP techniques to minimize dust such as water spray, wind screens, covering soil piles, establishing temporary ground cover, or halting work during windy conditions. All construction equipment would meet State emission control regulations.

The area of high probability for encountering subsurface cultural sites is believed to be Keawe Street from its intersection with Auahi Street to Ala Moana Boulevard. The Preferred Alternative is to microtunnel under this segment to avoid contact with cultural remains as well as to eliminate impacts to traffic on Ala Moana Boulevard. The areas of moderate and high probability for finding subsurface cultural sites would undergo on-site archaeological monitoring during trenching. SHPD would be given the opportunity to review and concur with any portions of the HSWAC project that may affect privately- owned and State-owned historic properties on the HRHP. Any ground surfaces and landscaping associated with any historic building would be restored to their original condition if they are disturbed by trenching or other activities.

Potential cultural impacts would be mitigated using a proactive approach including consulting with and involving concerned parties who have traditional and/or family ties to the Downtown and Kakaʻako areas.

Turbidity impacts of pipeline installation would be minimized by implementing Best Management Practices (BMPs) during construction, including:

- The employment of standard BMPs for construction in coastal waters, such as daily inspection of equipment for conditions that could cause spills or leaks;
- Cleaning of equipment prior to deployment in the water;
- Proper location of storage, refueling, and servicing sites; and
- Implementation of adequate spill response and storm weather preparation plans.

The offshore receiving pit would be contained with sheet piles to minimize turbidity. The feasibility of employing silt screens around the receiving pit in this open water environment will be evaluated during permitting. All soil removed from the tunnel, jacking pits and receiving pit would be processed appropriately and disposed of on land. Only washed granular or gravel backfill would be used.

Water quality monitoring would be conducted during the construction period. Pursuant to section 401 of the Clean Water Act, HSWAC would obtain and comply with the conditions of a Water Quality Certification from the HDOH. The proposed action is expected to meet the conditions of the NPDES permit required by the Hawaiʻi DOH. To minimize impacts of the return seawater on the ambient receiving water quality a diffuser was computer-designed and optimized. The design of the diffuser facilitates significant near-field initial mixing of the return water for all current cases considered. During operations, a water quality and marine biota monitoring program would be implemented.

Construction activities would cease if listed (endangered or threatened) marine species are observed entering the active project construction site, and work would be allowed to resume only after the listed species departs the construction site on its own volition. The Pacific Islands Regional Office of the National Marine Fisheries Service (NMFS) would be notified of each such occurrence.

White terns would be surveyed prior to construction in the project area. If any are nesting within 100 ft of construction activity, noise and visual barriers would be used to prevent any disturbance to the birds.

COMPATIBILITY WITH LAND USE PLANS AND POLICIES

The HSWAC project would not conflict with any Federal, State or local land use plan, policy or control. The project would further the objectives of numerous plans and policies, including the Hawaiʻi State Plan, the Hawai‘i Coastal Zone Management Plan, the Hawai‘i Ocean Resources Management Plan, the Kaka‘ako Community Development District Makai Area Plan, and the City and County of Honolulu General Plan and Primary Urban Center Development Plan.

UNRESOLVED ISSUES (INCLUDING CHOICE AMONG ALTERNATIVES)

Preliminary system analysis and optimizations by Makai Ocean Engineering (2004, 2005a, 2005b) based on levelized lifetime costs showed a relatively flat optimum for intake depths between 1,600 feet and 1,800 feet with average seawater temperatures varying between 44°F and 45°F. Initially an intake depth of 1,600 feet with an average seawater temperature of 45°F was selected. Subsequent evaluations have shown that a deeper intake depth may be operationally desirable. The final depth of the intake remains unresolved. It is primarily an economic choice; the environmental impacts would not be significantly different for any intake within this depth range. The economic trade-off is that a deeper intake would increase capital costs for additional pipe lengths and installation, while a shallower intake would increase operational costs because additional supplemental cooling of the slightly warmer water would be required. The benthic conditions are not significantly different between 1,600 and 1,800 feet deep.

The position of the jacking pit in the Preferred Alternative is behind and close to the shoreline. Depending on the contractor’s installation plan, it may be preferable to position this pit further away from the shoreline. The final position could be anywhere from near the shoreline to near the makai end of Keawe Street.

The final routing of the distribution system will have to reflect the eventual system customers not all of whom are currently known. Future routing decisions would be made using the same criteria as described for the current Preferred Alternative and the types of impacts to be expected would be the same as those evaluated in this document.

AREAS OF CONTROVERSY

A comprehensive, broad-based public involvement program has to date not surfaced controversy. Issues raised thus far can be mitigated.

STATUS OF PERMITS, LICENSES AND APPROVALS REQUIRED

Many of the permits and approvals necessary for planning work such as geotechnical testing of soils and rights-of-entry for such testing have been acquired. Applications for many of the discretionary permits listed in section 5.11 would be accompanied by the final EIS. Those applications are currently in progress.

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LIST OF ACRONYMS AND ABBREVIATIONS

µg	Microgram
µg/m^3	Microgram per Cubic Meter
µM	Micromole
µmole/kg	Micromole per Kilogram
<	Less Than
≤	Less Than or Equal to
§§	Sections
©	Copyright
3-D	Three Dimensional
º	Degrees
ºF	Degrees Fahrenheit
ºC	Degrees Celsius
AAQS	Ambient Air Quality Standards
AC	Air Conditioning
ACOE	U.S. Army Corps of Engineers
APE	Area of Potential Effect
bbl	barrel
BCOE	Barrels of Crude Oil Equivalent
BLNR	Board of Land and Natural Resources
BLVD.	Boulevard
BMPs	Best Management Practices
BOD	Basis of Design
Btu	British Thermal Unit
CDUP	Conservation District Use Permit
CEQ	Council on Environmental Quality
CF	Capacity Factor
CFC	Chlorofluorocarbon
CFR	Code of Federal Regulations
CIA	Cultural Impact Assessment
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
cm/s	centimeters per second
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CORMIX	Cornell Mixing Zone Expert System
CPD	Coastal Program Division
CV	Coefficient of Variation
CWA	Clean Water Act
CWB	Hawai‘i Department of Health Clean Water Branch
CZM	Coastal Zone Management
DAR	Hawai‘i Division of Aquatic Resources
dB	Decibel(s)
DBEDT	Hawai‘i Department of Business, Economic Development and Tourism
DEIS	Draft Environmental Impact Statement
DLNR	Hawai‘i Department of Land and Natural Resources
DP	Development Plan
EO	Executive Order
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIC	Energy Issues Committee
EIS	Environmental Impact Statement
EISPN	Environmental Impact Statement Preparation Notice
ESA	Endangered Species Act
FAR	Floor Area Ratio
FCC	Frank Coluccio Construction Co.
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FMP	Fishery Management Plan
fps	feet per second
FPVC	Fusible Polyvinyl Chloride (PVC)
FRP	Fiberglass Reinforced Plastic
ft	foot/feet
FTEPY	Full-time Equivalent Person-years
GDP	Gross Domestic Product
GPD	Gallons per Day
gpm	gallons per minute
GSP	Gross State Product
HAPC	Habitat Area of Particular Concern
HAR	Hawai‘i Administrative Rules

HCDA	Hawai‘i Community Development Authority
HCFC	Hydrochlorofluorocarbon
HDD	Horizontal Directional Drilling
HDOH	Hawai‘i Department of Health
HDOT	Hawai‘i Department of Transportation
HDPE	High Density Polyethylene
HECO	Hawaiian Electric Company
HFC	Hydrofluorocarbon
HMS	Hawaiian Monk Seal
HRHP	Hawai‘i Register of Historic Places
HRS	Hawai‘i Revised Statutes
HSWAC	Honolulu Seawater Air Conditioning, LLC
ID	Inside Diameter
IUCN	International Union for the Conservation of Nature
IWC	International Whaling Commission
JABSOM	John A. Burns School of Medicine
kg	Kilogram
kg/m^3	kilograms per cubic meter
kV	kilovolt
kW	Kilowatt
kWh	Kilowatt Hour
L	Limited Subzone of the Conservation District
l	liter
L_{dn}	Day-Night Sound Level
LBE	Lead by Example
LFA	Low Frequency Active (Sonar)
LLC	Limited Liability Corporation
LSFO	Low Sulfur Fuel Oil
LUC	Land Use Commission
LUO	Land Use Ordinance
m	meter
MBTA	Migratory Bird Treaty Act
mg/l	Milligrams per Liter
MGD	Million Gallons per Day
MHI	Main Hawaiian Islands
MLLW	Mean Lower Low Water
mm	millimeter
MMPA	Marine Mammal Protection Act
MOE	Makai Ocean Engineering, Inc.
MPA	Marine Protected Area
mph	Miles per Hour
MSA	Magnuson-Stephens Act
MSL	Mean Sea Level
MSW	Municipal Solid Waste
MTBM	Microtunnel Boring Machine
MUS	Management Unit Species
MW	Megawatt
N	North
NAAQS	National Ambient Air Quality Standards

NELH	Natural Energy Laboratory of Hawai‘i
NELHA	Natural Energy Laboratory of Hawai‘i Authority
NEPA	National Environmental Policy Act
NHL	National Historic Landmark
NHP	Hawai‘i Natural Heritage Program
nm or nmi	Nautical Mile(s)
NMFS	U.S. National Marine Fisheries Service
NO_X	Nitrogen Oxide
NO_2	Nitrogen Dioxide
NOAA	National Oceanic and Atmospheric Administration
NOTMAR	Notices to Mariners
NPDES	National Pollutant Discharge Elimination System
NPSH	Net Positive Suction Head
NRHP	National Register of Historic Places
ntu	Nephelometric Turbidity Unit
NWHI	Northwestern Hawaiian Islands
OD	Outside Diameter
OEQC	Hawai‘i Office of Environmental Quality Control
OHV	Off-highway Vehicle
OMPO	O‘ahu Metropolitan Planning Organization
OP	Hawai‘i Office of Planning
ORMP	Ocean Resources Management Plan
p	Probability
P	Protected Subzone of the Conservation District
PCB	Polychlorinated Biphenyls
PET	Polyethylene Terephthalate
$PM_{2.5}$	Particulate Matter Less Than 2.5 Microns in Aerodynamic Diameter
PM_{10}	Particulate Matter Less Than 10 Microns in Aerodynamic Diameter
ppm	parts per million
ppt	parts per thousand
psi	pounds per square inch
PUC	Primary Urban Center (Honolulu County)
R	Resource Subzone of the Conservation District
RCP	Reinforced Concrete Pipe
ROV	Remotely Operated Vehicle
RPS	Renewable Portfolio Standards
SAAQS	State of Hawai‘i Ambient Air Quality Standards
SCUBA	Self-contained Underwater Breathing Apparatus
SDWA	Safe Drinking Water Act
sec	Second(s)

SHPD	Hawai‘i Historic Preservation Division
SHPO	Hawai‘i Department of Land and Natural Resources State Historic Preservation Officer
SIHP	State Inventory of Historic Places
SMA	Special Management Area
SOH	State of Hawai‘i
SO_x	Sulfur Oxide
SO_2	Sulfur Dioxide
SS	Stainless Steel
SWAC	Seawater Air Conditioning
TBM	Tunnel Boring Machine
TMDL	Total Maximum Daily Load
UBC	Uniform Building Code
UH	University of Hawai‘i
UIC	Underground Injection Control
U.S.	United States
U.S.C.	United States Code
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
UST	Underground Storage Tank
VOC	Volatile Organic Compound
WPRMFC	Western Pacific Regional Fishery Management Council
WWPS	Wastewater Pumping Station
WWTP	Wastewater Treatment Plant
yr	Year
ZOM	Zone of Mixing

CHAPTER 1.
PROJECT PURPOSE, NEEDS AND BENEFITS

1.1 PURPOSE AND NEED

The purpose of the Honolulu Seawater Air Conditioning (HSWAC) project is to provide reliable, lower-cost air conditioning for major government and commercial buildings in downtown Honolulu while reducing electricity and potable water use and the environmental and economic impacts associated with generation of electricity from imported oil and maintenance of conventional air conditioning systems.

There is a need, based on economic, environmental and energy independence considerations, to increase the use of renewable energy resources, decrease the use of imported oil to generate electricity in Hawaiʻi, and reduce the generation of greenhouse gases that contribute to global climate change. Further, there are mandates at the Federal level and policies at the State of Hawaiʻi and City and County of Honolulu levels to increase energy efficiency and renewable energy use, reduce potable water consumption, and decrease toxic chemical use in their facilities. The State of Hawaiʻi has also established mandates for increased use of renewable energy resources through a Renewable Portfolio Standard (RPS) and to reduce the generation of greenhouse gas emissions to 1990 levels. The HSWAC project would significantly contribute to meeting these needs.

1.1.1 Fossil Fuel Energy Use on Oʻahu

Hawaiʻi's heavy dependence on imported oil for energy has negative consequences for the economy and the environment. Hawaiʻi's abundant potential renewable energy sources could replace a significant amount of imported oil in electricity production.

On Oʻahu, Hawaiian Electric Company (HECO) continues to promote renewable energy use. In its Integrated Resource Plan: 2006 - 2025 (HECO, 2005), HECO makes

> "….a strong commitment to increase the use of distillate fuels like naphtha, and indigenous renewable resources including biofuels, and in general to decrease the use of imported oil."

Every barrel of oil saved by using renewable energy sources means more dollars in the local economy, in addition to the many environmental benefits. The HSWAC project represents one of the largest potential substitutions of a renewable resource for imported oil now being planned for Oʻahu.

1.1.1.1 Overall Use

Hawaiʻi is the most fossil fuel-dependent of the 50 states, importing fossil fuels for more than 94% of its primary energy (DBEDT, 2006). Most of this is oil, and most of it is imported from foreign nations.

The State's primary energy consumption increased by 4.0% from 1990 to 2005 (i.e., from 53.8 million barrels of crude oil equivalent [BCOE] to 56.0 million BCOE), and, fossil fuel use increased by even more (7.6%), from 49.2 million BCOE to 52.9 million BCOE. Unfortunately, during this same period, renewable energy use statewide actually decreased from 8.6% to 5.4% (DBEDT, 2006).

1.1.1.2 Electricity Generation

Statewide, fossil fuels are used to generate 91.5% of electricity, with the remainder coming from various renewable energy resources. Nearly 86% of the fossil fuel-generated electricity is from increasingly more expensive imported fossil fuels (HECO, 2007).

The situation is even worse on Oʻahu, the site of the proposed HSWAC Project. On Oʻahu, fossil fuels are used to generate 96.0% of electricity. Only 4.0% comes from renewable energy (primarily municipal solid waste combustion at the waste to energy power plant) (HECO, 2007).

1.1.1.3 Electricity Use for Air Conditioning

Building cooling (i.e., chillers, cooling towers, and chilled water circulation) is the largest single component of commercial and industrial electricity use (Figure 1-1), accounting for 33.4% of commercial and industrial electricity use on Oʻahu in 2006. This represents more than 20% of total electricity use on Oʻahu. No other electricity use component has as great a potential for reduction.

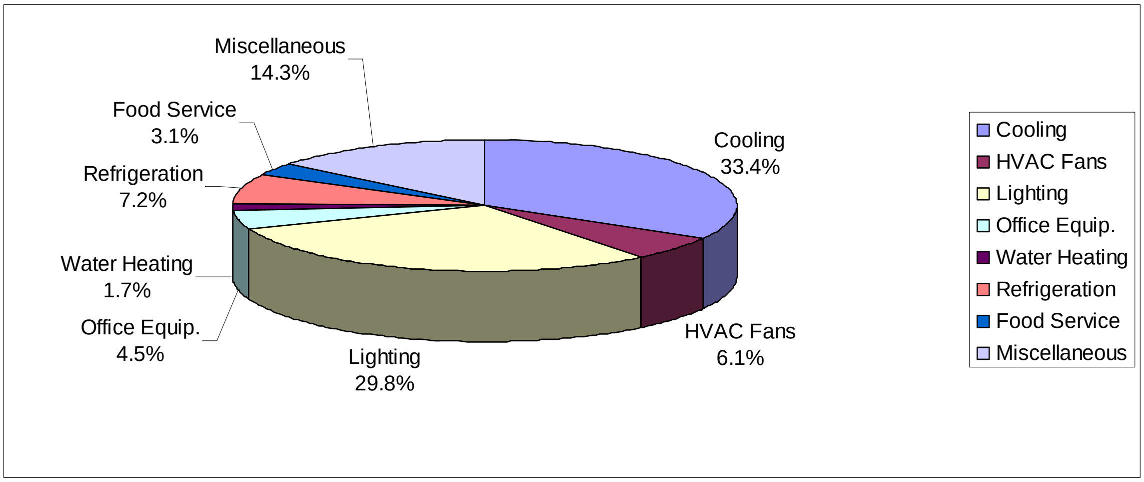

Figure 1-1: Components of Commercial and Industrial Electricity Use for Oʻahu (2006)
(Sources: DBEDT, 2004; HECO and Rebuild Hawaiʻi, 2003)

1.1.2 Environmental Impacts of Fossil Fuel Use

Widespread use of formerly cheap fossil fuels has been the engine that drives the world's economy. Unfortunately, fossil fuels are rich in carbon and the combustion of fossil fuels produces the main greenhouse gas – carbon dioxide (CO_2). Combustion of fossil fuels also produces a host of other air and water pollutants. Further, because the combustion of fossil fuels and their conversion to other energy sources is not 100% efficient, a significant amount of thermal pollution is also introduced into the environment. Other adverse environmental impacts occur during the exploration, production, and transportation phases of fossil fuel use.

1.1.2.1 Greenhouse Gas Emissions

Increasing levels of CO_2, and other greenhouse gases (methane, chlorofluorocarbons [CFCs], hydrochlorofluorocarbons [HCFCs], etc.) in the atmosphere contribute to the greenhouse effect. Sunlight is composed of a range of wavelengths. As sunlight impinges on the earth, it warms the land and the oceans. A portion of this energy is re-radiated as infrared (heat). The atmosphere then achieves an equilibrium temperature and this helps maintain livable temperatures.

However, as the concentration of greenhouse gases increases, the atmosphere retains more of the heat re-radiated by the land and oceans, and warms up. This is referred to as the greenhouse effect and is the cause of global warming. The effects of global warming are greatest in the polar regions. The largest temperature increases are expected in these areas.

Ever increasing temperatures in polar and temperate regions can have some drastic effects. For example, huge ice sheets on Antarctica and Greenland and other glaciers elsewhere are beginning to melt at a rapid pace. This has the potential for a relatively rapid sea level rise which is of particular concern to island areas such as Hawaiʻi. Some contend that increased temperatures in the ocean surface and atmosphere will create more intense and more frequent storms. This is also a concern to tropical island areas such as Hawaiʻi which are susceptible to hurricanes. (For additional information, see Russell, 2007 and MSN Encarta, 2009.)

Global climate change can produce significant changes in rainfall distribution, patterns, and amounts. This can severely impact our ability to grow food. Again, because Hawaiʻi imports more than 90% of its food, we will be very susceptible to any changes in food growing capacity and sources (islandsolutions, 2007).

1.1.2.2 Other Air Emissions

Combustion of fossil fuels can also produce emissions of volatile organic compounds (VOCs); carbon monoxide (CO); particulate matter in regulated size ranges (under 10 microns in size [PM_{10}] and under 2.5 microns in size [$PM_{2.5}$]); nitrogen oxide (NO_x); and sulfur oxides (SO_x).[1]

Ground level ozone is a primary constituent of smog and is created when NO_x reacts with VOCs in the presence of heat, sunlight, and catalysts. Breathing ozone can exacerbate a variety of human respiratory problems. It can have a similar effect on animals and can damage vegetation and crops.[2]

CO is formed from the incomplete combustion of carbon. Chronic exposure to CO can create, or exacerbate, cardiovascular problems. High levels can cause vision problems, mental or physical impairment, and in extreme cases – death.[3]

Particulate matter is composed of very small solid particles and liquid droplets. PM_{10} particulate matter is comprised of particles of less than 10 microns in diameter. Typically, the smaller the particle size the greater the impact. Inhalation of PM_{10} particles can lead to, or exacerbate, respiratory and cardiovascular problems. Particles less than 2.5 microns in diameter are believed to pose the greatest health risks. Because of their small size (less than one-seventh the average width of a human hair), these fine particles can lodge deeply into the lungs.[4]

As stated previously, NO_x can combine with VOCs to create ground level ozone and smog. Nitrate particles and acid aerosols can also contribute to respiratory, cardiovascular, and environmental problems. NO_x can contribute to acid rain. One NO_x compound, nitrous oxide (NO_2) is a potent greenhouse gas.[5] NO is also a carcinogen.

SO_x dissolves in water vapor and can combine with other gases and particulates to form harmful pollutants. These pollutants can contribute to respiratory problems and heart disease. SO_2 can also contribute to acid rain and create visibility-reducing haze.[6]

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[1] Effects if Air Pollution Effects of Air Pollution on Health and the Environment, Green Motors, http://www.gogreenmotors.com/problem4.htm; Major Air Pollutants, Grinning Planet, July 10, 2007, http://www.grinningplanet.com/2007/07-10/major-air-pollutants-article.htm

[2] Ground-Level Ozone, EPA, http://www.epa.gov/air/ozonepollution/index.html; Clean Energy Glossary, EPA, http://www.epa.gov/RDEE/energy-and-you/glossary.html

[3] Carbon Monoxide, EPA, http://www.epa.gov/air/urbanair/co/index.html; Clean Energy Glossary, EPA, http://www.epa.gov/RDEE/energy-and-you/glossary.html

[4] Particulate Matter, EPA, http://www.epa.gov/air/particlepollution/PM2.5 NAAQS Implementation, EPA, http://epa.gov/ttn/naaqs/pm/pm25_index.html

[5] Nitrogen Oxides, Environment Agency, http://www.environment-agency.gov.uk/business/topics/pollution/39161.aspx Clean Energy Glossary, EPA, http://www.epa.gov/RDEE/energy-and-you/glossary.html

[6] Clean Energy Glossary, EPA, http://www.epa.gov/RDEE/energy-and-you/glossary.html

1.1.2.3 Thermal Pollution

The efficiency of conversion of the energy content of fossil fuels to electricity or to motive power is always less than 100%. In the case of combustion of fossil fuels to generate electricity, this efficiency is only about 32%.[7] This means that 68% of the energy content of these fossil fuels is exhausted to the atmosphere as heat, or thermal pollution.

Some of this heat is exhausted to the atmosphere in the form of hot combustion gases, some as heat radiated from various components of the power plant (along with other minor losses), but most is exhausted to a lake, river or ocean in the form of heated power plant cooling water. This warmer water can affect aquatic organisms by decreasing oxygen content, killing juvenile fishes, and impacting the numbers and composition of species.[8]

1.1.3 Economic Impacts of Fossil Fuel Use

Hawai‘i has no fossil fuel resources. Hawai‘i is currently highly dependent on imported fossil fuels for its energy supply. The vast majority of this fossil fuel is oil. As a result of this dependency, the cost of oil has a very big impact on Hawai‘i’s economy.

Energy consumers in Hawai‘i spent $2.2 billion for energy in 1991, or 6.6% of Hawai‘i’s gross domestic product (GDP) in that year. By 2005, total energy expenditures had increased to nearly $5.5 billion, or 9.4% of GDP (DBEDT, 2006). Total energy expenditures are projected to be more than $6.5 billion in 2007 (nearly 11% of GDP) with even higher expenditures and percentages projected for 2008 based on a nearly 50% increase in oil prices from 2007 to 2008. It is critical that Hawai‘i reduces its oil use in order to reduce its adverse economic impact.

1.1.3.1 Cost of Oil

1.1.3.1.1 Historical World Oil Prices

World oil prices reached a recent minimum in 1998. Since then they have increased at an alarming rate. World crude oil prices increased by more than 539% from $14.50/barrel (bbl) in 1998, to $92.98/bbl in 2008. This is an average annual increase of more than 20% over this period.[9]

1.1.3.1.2 HECO’s Low Sulfur Fuel Oil Prices

HECO primarily uses low sulfur fuel oil (LSFO) for its power plants on O‘ahu. LSFO is a byproduct of the oil refining process. LSFO prices track well with world oil prices, but are typically higher and lag world oil prices by 60 – 90 days. Figure 1-2 shows trends in LSFO prices since 1990.

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[7] Typical efficiency of HECO's electricity generation (heat rate = 10,689 Btu/kWh) (0.319 = 3,412/10,689). This heat rate varies slightly from year to year.

[8] Pollution Issues. 2007. “Thermal Pollution,” http://www.pollutionissues.com/Te-Un/Thermal-Pollution.html; MSN Encarta. 2009. “Thermal Pollution,” http://encarta.msn.com/encyclopedia_1741500922/Thermal_Pollution.html

[9] Energy Information Administration (EIA). 2009. “U.S. Crude Oil Imported Acquisition Cost by Refiners (Dollars per Barrel),” http://tonto.eia.doe.gov/dnav/pet/hist/r1300____3A.htm

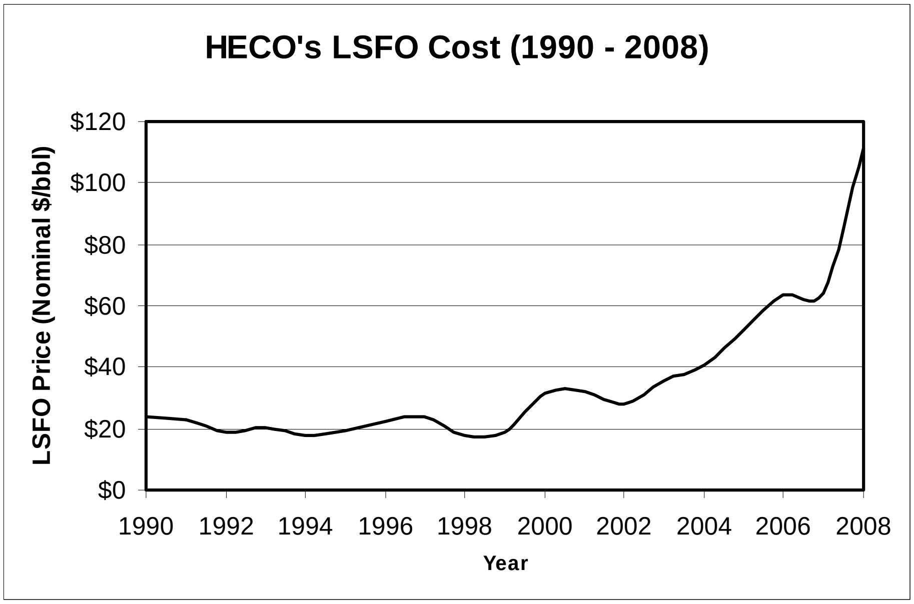

Figure 1-2: The Cost of Low Sulfur Fuel Oil (LSFO) Used by HECO to Generate Electricity (1990 – 2008 Nominal $)
(Source: Hawaiian Electric Industries, Inc. Annual Form 10-K reports)

LSFO prices were relatively stable throughout the 1990's. However, since 1998 they have increased by nearly 630% from $17.71/bbl in 1998 to $111.52/bbl in 2008. This is an average annual increase of more than 20% over this 10-year period.

1.1.3.1.3 Oil Price Trends

A number of factors affect the price of oil. These include: (1) global economy; (2) reserves (3) production capacity; (4) new discoveries; (5) geopolitical events; (6) terrorism, (7) weather, and (8) speculation.

- Demand for oil has risen steadily by 2% annually, while production from existing oil fields has been declining by 3 – 6% per year although recent economic events have halted this trend in the short run.
- Fifty-four of the 65 largest oil-producing countries in the world have passed their peak production and production is now in decline. Five years from now, five more of these producers will have reached their peak production.
- Global oil production is expected to peak early in the 21st century. The projected peak production is somewhere between 2003 and 2020, with an average estimated date around 2011 – only two years from now.
- Recent world excess capacity has increased from near record lows.
- Oil reserves have increased dramatically from earlier lows.
- Current demand is greater than 30 billion barrels/year. New discoveries are only about 4 billion barrels per year.
- There is only a finite amount of oil.
- There are a large number of trouble spots in the world, and many of these trouble spots are major oil producers. Trouble in any of these spots has the potential to disrupt supplies.
- Fears of terrorism have been fueled by attacks on oil personnel and facilities in Nigeria, Saudi Arabia, and Iraq.

- The Gulf of Mexico is the source of much of the U.S.'s oil supplies and the Gulf Coast the site of much of the U.S. refining industry. Supply increases have followed previous disruptions as a result of Hurricane Ivan and Katrina as platforms are able to increase production again.

All of these factors suggest that in the short term oil prices may decline until the global economy begins to expand once again. In the long term higher oil prices will be the result of increased scarcity of oil as producers pass their peak, while demand continues to grow as global economies continue to expand. These higher oil prices will severely impact Hawai'i if we do not use less oil and begin to use more renewable energy.

1.1.3.2 Cost of Electricity

Oil now represents about two-thirds of the cost of electricity on O'ahu. This fraction is expected to grow as the cost of oil increases. Figure 1-3 shows the impact of increasing oil prices on the cost of electricity on O'ahu. Electricity prices have increased by nearly 4.9%/yr over the period 1990 to 2008. Similar increases are expected in the future. This figure also shows that, while LSFO prices decreased slightly from 1990 to 1998, electricity prices continued to increase during this period. Since 1998, LSFO and electricity prices have both increased at alarming rates.

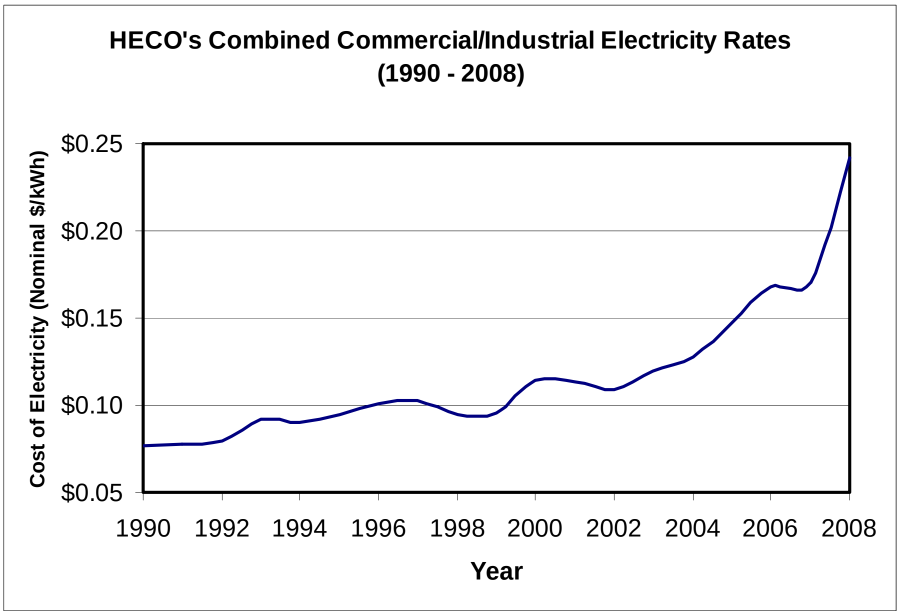

Figure 1-3: Weighted Average Cost of Electricity for HECO's Commercial and Industrial Customers (1990 – 2008 Nominal $)
(Source: Hawaiian Electric Industries, Inc. Annual Form 10-K Reports)

1.2 SWAC BENEFITS

SWAC systems have the potential to provide numerous benefits to many Hawai'i stakeholders. SWAC systems have significant environmental, energy, and economic benefits when compared with traditional electric air conditioning systems. The potential net public benefits of SWAC systems in general, and the HSWAC system in particular, greatly exceed any potential adverse effects.

1.2.1 Environmental Benefits

Reduced use of fossil fuels provides for significant reductions in greenhouse gas emissions and other air and water pollutants. SWAC systems also greatly reduce the use of harmful chemicals (refrigerants) used in conventional cooling systems.

1.2.1.1 Reduced Greenhouse Gases and Other Air and Water Pollutants

The 25,000-ton[10] HSWAC project would reduce the production of pollutants from fossil fuel combustion by up to the following amounts[11]:

- Carbon Dioxide (CO_2) Emissions - 84,000 tons/year
- Volatile Organic Compounds (VOC) Emissions - 5 tons/year
- Carbon Monoxide (CO) Emissions - 28 tons/year
- Particulate Matter under 10 microns (PM_{10}) Emissions - 19 tons/year
- Nitrogen Oxides (NO_x) Emissions - 169 tons/year
- Sulfur Oxides (SO_x) Emissions - 165 tons/year

Reducing the production of greenhouse gases (primarily CO_2), Hawai‘i’s contribution to global warming also would be reduced.

1.2.1.2 Reduced Potable Water Use

Cooling towers for conventional air conditioning systems require lots of potable water to make up for evaporation, drift, and blow down. SWAC systems eliminate the need for cooling towers and, as a result, reduce potable water use, toxic chemical use, and the production of sewage.

- The 25,000-ton HSWAC project would save up to 260 million gallons of potable water per year (see Appendix A for this calculation).
- This is equivalent to nearly two days of potable water use on O‘ahu.

1.2.1.3 Reduced Sewage Generation

Evaporation from cooling towers increases the concentration of dissolved substances present in the make-up water. Also, chemicals are added to cooling tower water to prevent corrosion and the growth of organisms. This contaminated water must periodically be discharged to the sewers (blow down) and replaced with fresh water. As stated previously, SWAC eliminates the need for cooling towers and reduces the production of sewage.

- The 25,000-ton HSWAC project would reduce sewage generation by up to 84 million gallons per year (see Appendix A for this calculation).
- This is equivalent to nearly one day’s generation of sewage on O‘ahu.

1.2.1.4 Reduced Use of Harmful Chemicals

SWAC systems greatly reduce the use of harmful chemicals (refrigerants) used in conventional cooling systems. Typical older air conditioning systems use chlorofluorocarbon (CFC), hydrochlorofluorocarbon (HCFC), or hydrofluorocarbon (HFC) refrigerants in chillers to cool water which is then used to cool the air that is circulated throughout the building.

CFCs are destructive to the ozone layer and are also powerful (i.e., very high CO_2 equivalence) greenhouse gases. The use of CFCs has been prohibited, but some may still exist in older chillers. HCFCs have been used as substitutes for CFCs and have only about 10% of the impact on ozone as do CFCs. HFCs contain no chlorine and have no known affect on the ozone layer. They can, however, have an even higher CO_2 equivalence than CFCs.

Water treatment chemicals for the cooling tower loop are consumed with the evaporation and blow down of the potable water. Handling and storage of hazardous chemicals used with cooling towers can be eliminated completely when a SWAC system is implemented.

[10] **Tons** is a unit of measure for the output of a heating or cooling system. One ton equals the amount of cooling that can be provided by one ton of ice melting over a 24-hour period, or 12,000 BTU/hr. One ton of cooling is roughly enough to cool one hotel room.

[11] Calculations of these amounts are described in Appendix A.

1.2.1.5 Reduced Thermal Pollution

SWAC reduces the amount of heat released to the environment (ocean and atmosphere). Electricity production is only about 32% efficient; the rest of the energy is rejected as waste heat (cooling water + stack gas losses + radiation and other minor losses). SWAC reduces thermal pollution of the environment by about 40% compared with conventional, electricity-powered air conditioning systems (see Appendix A for this calculation).

1.2.1.6 Reduced Noise from Cooling Towers

The mechanical components of cooling towers are quite noisy. Noise pollution emanating from buildings serviced by HSWAC would be reduced.

1.2.2 Energy and Demand Reduction Benefits

Building cooling (chillers, cooling towers, and chilled water circulation) is the largest single component of commercial and industrial electricity use. As a general rule-of-thumb, each ton of air conditioning provides energy and demand reduction benefits equivalent to one residential solar water heating system.

1.2.2.1 Increased Energy Efficiency

Conventional air conditioning systems rely on energy-intensive chillers. The cooling towers associated with these chillers also use significant amounts of electricity. On the other hand, SWAC systems basically involve less energy-intensive pumping of seawater and chilled water. A small amount of additional energy would be required for the very high efficiency auxiliary chillers used in the SWAC system to optimize the temperature of water delivered to customers. However, the return seawater from the heat exchangers would be used for condenser cooling of the auxiliary chillers, thereby substantially increasing their efficiency. Energy savings with SWAC systems are 75%, or more, compared to conventional air conditioning.

- Each ton of SWAC eliminates the need for about 2,000 kWh/year of energy use.
- The 25,000-ton HSWAC project would save more than 77.5 million kWh/year. This is equivalent to more than 27,000 residential solar water heating systems (see Appendix A for this calculation).

1.2.2.2 Reduced Demand for New (Likely-to-be-Fossil-Fueled) Power Plants

HECO’s daily peak power demand (MW) is caused primarily by air conditioning usage. For the first time in many years, HECO experienced a system peak demand during the daytime in August. On August 20, 2004, at about 1:30 p.m. a record system peak was observed.

HECO typically experiences its peak demand during a weekday evening in October. This system peak is primarily due to increased residential use after people get home from work and school. SWAC significantly reduces both the broad daytime peak, as well as the sharper evening peak shown in the following diagram (Figure 1-4).

- The 25,000-ton HSWAC project would eliminate the need for more than 14 megawatts of new generation. This is equivalent to more than 17,000 residential solar water heating systems (see Appendix A for this calculation).
- This reduced demand for new energy generation is equivalent to one year of HECO’s projected load growth (see Appendix A for this calculation).
- The reduced need for expensive new electricity generation capacity will help to keep O‘ahu’s electric rates lower for longer.

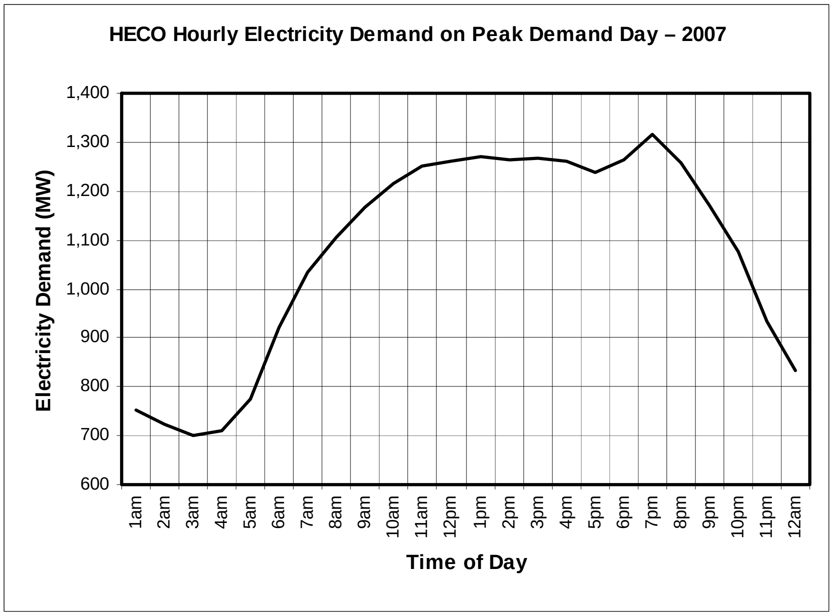

Figure 1-4: HECO Hourly Electricity Demand on Peak Demand Day – 2007
(Source: HECO, 2007)

1.2.2.3 Increased Use of Renewable Energy

SWAC uses a 100% renewable energy resource - cold, deep seawater.

- SWAC is able to use cold deep seawater at temperatures of 45°F, or less, to air condition buildings using a district cooling system. The average temperature of the ocean is about 39°F. One cubic mile of deep cold seawater can supply enough cold seawater to operate the HSWAC system for more than 69 years.
- SWAC will greatly help the State of Hawai‘i, and HECO, meet new Renewable Portfolio Standards.
- With limited land area and high electrical demand, O‘ahu will have the greatest challenge in meeting Hawai‘i’s RPS. SWAC is the renewable energy technology that can provide the greatest benefits to O‘ahu in the near term.
- The 25,000-ton HSWAC project would provide renewable energy benefits equal to:
  - 42 MW of photovoltaics (at a Capacity Factor[12] [CF] = 0.21);
  - 28 MW of wind (at a CF = 0.32); or
  - 14 MW of municipal solid waste (MSW) or biomass combustion (at a CF = 0.65).

1.2.2.4 Reduced Use of Fossil Fuels

Hawai‘i is more than 90% dependent on imported fossil fuels. About 96% of the electricity generated on O‘ahu comes from fossil fuels, and most of this is oil. A SWAC system can significantly reduce imports of crude oil.

- The 25,000-ton HSWAC project would reduce crude oil consumption by about 178,000 barrels per year (see Appendix A for this calculation).

[12] The **capacity factor** of a power plant is the ratio of the actual output of a power plant over a period of time to its output if it had operated at full capacity over that time period. This is calculated by totaling the energy the plant produced and dividing it by the energy it would have produced at full capacity.

1.2.2.5 Increased Energy Security

Hawai‘i’s great dependence on imported fossil fuels makes the State very vulnerable to supply disruptions. Reducing this dependence through increased energy efficiency and use of renewables will help to increase energy security.

1.2.2.6 Meet Government Energy Goals and Mandates

SWAC systems will help the State of Hawai‘i, the City and County of Honolulu, and the Federal government to meet goals and mandates for energy efficiency and renewable energy use.

Government buildings in the downtown Honolulu area would substantially be able to meet Federal mandates, address State requirements for energy efficiency and renewable energy use, and City and County of Honolulu sustainability objectives by connecting to the HSWAC system. They would also be able to further water conservation goals and reduce the use of ozone-depleting substances and other toxic and hazardous chemicals.

1.2.2.6.1 Hawai‘i State Energy Objectives

Hawai‘i’s energy objectives are described in Hawai‘i Revised Statutes (HRS), Chapter 226-18 §226-18 Objectives and policies for facility systems – energy. (a) Planning for the State's facility systems with regard to energy shall be directed toward the achievement of the following objectives, giving due consideration to all:

(1) Dependable, efficient, and economical statewide energy systems capable of supporting the needs of the people;
(2) Increased energy self-sufficiency where the ratio of indigenous to imported energy use is increased;
(3) Greater energy security in the face of threats to Hawai‘i's energy supplies and systems; and
(4) Reduction, avoidance, or sequestration of greenhouse gas emissions from energy supply and use.

HSWAC would help the State meet these objectives.

1.2.2.6.2 Hawai‘i’s Renewable Energy Portfolio Standard

On June 2, 2004, with the signing of Act 95, Session Laws of Hawai‘i 2004, Hawai‘i’s original Renewable Portfolio Standard (RPS) goal was replaced with an enforceable standard. Under the new standard, 20% of Hawai‘i’s electricity is to be generated from renewable resources by the end of 2020. Interim targets for renewables’ percentage of electricity sales are:

- 7% by December 31, 2003;
- 8% by December 31, 2005;
- 10% by December 31, 2010;
- 15% by December 31, 2015; and
- 20% by December 31, 2020.

Statewide, we are currently at about 8.5%; on O‘ahu we are at about 4%. The HSWAC Project would improve these percentages to 9.1 and 4.8, respectively.

1.2.2.6.3 Hawai‘i’s Greenhouse Gas Reduction Mandate

During the 2007 legislative session, the Hawai‘i State legislature passed, and the Governor signed, Act 234, which “establishes as state policy statewide greenhouse gas emissions limits at or below the statewide greenhouse gas emissions levels in 1990 to be achieved by January 1, 2020. The Act establishes a greenhouse gas emissions reduction task force to prepare a work plan and regulatory scheme to achieve the statewide greenhouse gas emissions limits.”

The purposes of this Act are to:

(1) Reduce, by January 1, 2020, greenhouse gas emissions in the State to levels at or below the best estimations and updates of the inventory of greenhouse gas emissions estimates for 1990; and

(2) Establish a greenhouse gas emissions reduction task force to prepare a work plan and regulatory scheme for implementing the maximum practically and technically feasible and cost-effective reductions in greenhouse gas emissions from sources or categories of sources of greenhouse gases to achieve the statewide greenhouse gas emissions limits by 2020.

1.2.2.6.4 State of Hawaiʻi "Lead by Example" Initiative

In 2006, the Governor of Hawaiʻi initiated an effort by State agencies to improve energy efficiency and the use of renewable energy in State operations and facilities. Each State agency is required to provide a summary of their actions each year.

An excerpt from the 2007 State report states:

> "The Lead by Example (LBE) initiative began in 2006 in response to legislative and executive mandates to change the way state executive agencies use energy in operations and facilities. These efforts acknowledge the high cost of electricity in Hawaiʻi, the energy security benefits of alternative fuel use, and the many opportunities for increasing energy efficiency in new and existing state offices, facilities and schools. The legislation also required incorporating environmentally preferable purchasing into state operations. Fully implemented, the LBE initiative represents an important step in achieving long-term economic and environmental benefits for the state."

1.2.2.6.5 Comprehensive Approach to Achieving Energy Self-sufficiency for the State

Act 96, enacted May 12, 2006, requires State facilities to improve their energy efficiency and to use renewable energy resources. Act 96 established "new planning and budget preparation goals for state agencies that incorporate green building practices; the installation of renewable energy resources such as cost-effective solar water heating systems; increased conservation, waste reduction, and pollution prevention directives; the procurement of environmentally preferable products, including fuel-efficient vehicles and alternative fuels; and the use of energy-savings contracts for the provision of energy services and equipment."

The purpose of this Act is to provide one segment of a larger comprehensive approach to achieving energy self-sufficiency for the state by:

(1) Authorizing the issuance of general obligation bonds to develop and implement a pilot project to install photovoltaic systems at public schools within the counties of Oʻahu, Hawaiʻi, Kauaʻi, and Maui;

(2) Establishing new planning and budget preparation goals for state agencies that incorporate green building practices; the installation of renewable energy resources such as cost-effective solar water heating systems; increased conservation, waste reduction, and pollution prevention directives; the procurement of environmentally preferable products, including fuel-efficient vehicles and alternative fuels; and the use of energy-savings contracts for the provision of energy services and equipment; and

(3) Promoting the use of green building practices by requiring each county agency that issues building, construction, or development-related permits to establish a procedure for priority processing of permit applications for construction projects incorporating energy and environmental design building standards.

1.2.2.6.6 City and County of Honolulu's Sustainability Initiative

Mayor's Energy and Sustainability Task Force
In September 2005, various city departments were convened to address the rising fuel oil prices and their impact on the city's operating budget and formed the Energy Issues Committee (EIC). The objective of the committee was to brainstorm energy reducing initiatives to offset the City's increasing energy costs. In early 2007, the EIC evolved into the Mayor's Energy and Sustainability Task Force to develop a 10-year plan to make the City even more energy efficient and sustainable (Mayor's Energy and Sustainability Task Force, 2008).

Objectives
The objectives of the Mayor's Energy and Sustainability Task Force are to:

1. Examine current technology and improve upon existing practices to make the City more energy efficient and sustainable.
2. Identify new technologies and practices that can be used to improve city operations by maximizing energy efficiency, reducing waste and protecting the environment.
3. Adhere to the Mayor's vision of the 21st Century Ahupuaʻa and its driving principles.
4. Align with the U.S. Conference of Mayor's Climate Control Agreement of 2004 advocating the reduction of greenhouse gas emissions.
5. Develop a 10-year plan with goals and benchmarks in the areas of:
    - Energy Conservation
    - Fuel and Transportation
    - Material Recovery and Recycling
    - Water Conservation
    - Watershed Protection and Management
    - Sustainable Agriculture
    - Innovative Urban Forestry
    - Education and Outreach

1.2.2.6.7 Federal Energy Efficiency and Renewable Energy Initiatives
On January 24, 2007, President Bush signed Executive Order (EO) 13423, "Strengthening Federal Environmental, Energy, and Transportation Management." This EO promotes energy efficiency, water conservation, and the use of renewable energy sources. It also promotes reduction of greenhouse gas emissions, along with the use and disposal of toxic and hazardous materials. The EO establishes goals for energy reduction in Federal facilities of 3% annually through 2015 or 30% by the end of 2015, relative to 2003. Beginning in 2008, each agency must reduce its water consumption by 2% annually through 2015 or 16% by the end of 2015 through life-cycle, cost-effective measures. It also requires Federal facilities to have at least half of the required renewable energy consumed in a fiscal year come from new renewable sources.

1.2.3 Local Economic Development Benefits

A SWAC project would generate millions of dollars in construction project spending. In addition to construction jobs, a significant number of long-term jobs also would be created directly and indirectly. Other local economic development benefits would accrue from money that stays in Hawaiʻi, and is not used to purchase fossil fuels.

1.2.3.1 Increased Local Spending, Output, Earnings, and Jobs Creation

During the lifetime of the HSWAC system, local spending would amount to more than $293 million. The calculated output based on this local spending is $484 million. This amount of local spending would also generate $166 million in earnings and 3,850 full-time-equivalent person-years (FTEPY) of jobs. This is equivalent to 145 full-time jobs for 26.5 years.

1.2.3.2 Increased State Revenues

During that same period, the HSWAC system would generate $24 million in new State taxes.

1.2.4 Other Benefits

SWAC systems also provide a number of other benefits, as described in the following sections.

1.2.4.1 Reliable Cooling

SWAC systems are simple and technically and economically feasible today. SWAC systems use industrial-grade, off-the-shelf components. Seawater supply systems have many years of use and demonstrated reliability in sometimes hostile environments. Deep water cooling systems have been successfully installed and operated in a number of areas worldwide from Stockholm, Sweden to the Natural Energy Laboratory of Hawai‘i (NELH) on the Big Island of Hawai‘i. Large-scale district cooling systems with, or without, thermal energy storage[13] are successful, low cost, energy efficient, environmentally friendly and have been used worldwide.

District cooling systems are very reliable. District cooling and heating provided by Ever-Green Energy Company, LLC (an HSWAC affiliate company) have a reliability record of 99.99%, much superior to the typical reliability of local electric utilities, or conventional, building on-site air conditioning. A similar reliability is anticipated for SWAC systems in Hawai‘i. HSWAC has a commitment to a rapid response on a 24/7 basis.

1.2.4.2 Stable Cooling Costs

Honolulu has some of the highest electricity costs in the nation and these costs have been increasing faster than the rate of inflation. SWAC systems provide customers with reduced and stable cooling costs.

- Average commercial electricity costs in Honolulu in 2008 were more than 24 cents/kWh.
- These costs have increased at a real (inflation-adjusted) rate of more than 2.7%/year over the period of 1990 to 2008. Annual increases, with inflation, are more than 5.0%/yr.
- At this rate, real electricity costs will increase by more than 96% over the 25-year book life of a SWAC project (with inflation, the cost increase is nearly 241%).
- Energy costs are a small fraction of total costs for a SWAC system and SWAC life cycle costs will, therefore, remain stable.

1.2.4.3 Simple Operating System

The operation of the HSWAC system is simple in the sense that the equipment mainly encompasses pipes, pumps, heat exchangers and chillers. Piping and heat exchangers need no direct operational considerations and the operation of pumps and chillers would be fully automated through a plant control system.

The plant would only be staffed during weekday office hours. During other periods, the staff would be on-call to respond to alarms generated by the plant control system or to phone calls from customers.

1.2.4.4 Reduced Operations and Maintenance Costs

Large-scale, district cooling systems have lower operating and maintenance costs than individual building air conditioning systems.

[13] **Thermal energy storage** can be used to increase the utilization of a district cooling system. A thermal energy storage system stores chilled water, or ice, in a tank. This chilled water or ice is generated during the utilities’ non-peak demand evening period (when electricity costs are lower) and is used during the utilities’ and customers’ peak demand period during the day to provide chilled water.

1.2.4.5 Secondary Use of Return Seawater and Return Chilled Water

There are a number of potential uses for the seawater that leaves a SWAC system. Among these are: (1) auxiliary cooling for power plants, industrial facilities, and cooling systems; (2) inlet air cooling for gas turbine power plants; (3) flushing of harbors and canals; (4) feed water for seawater desalination facilities; and (5) cold water agriculture and aquaculture.

Most of these potential uses are not suitable for the downtown HSWAC system due to its location, but may be suitable for other SWAC systems on O‘ahu, or elsewhere in Hawai‘i. For example, cold water agriculture and aquaculture are not feasible for HSWAC due to land limitations. Auxiliary cooling has been considered for HECO’s downtown power plant, but was rejected for other reasons. The return seawater from the HSWAC system is clean and free of pathogens and other organisms, and could be used as a source of feed water for a desalination facility.

Owing to the unique nature of the SWAC system, even return chilled water can be used for secondary purposes. As with return seawater, the return chilled water can be used for: (1) auxiliary cooling for power plants, industrial facilities, and cooling systems and (2) inlet air cooling for gas turbine power plants. Return chilled water can also be used for condenser cooling in buildings.

Unlike on-site cooling systems that use conventional chillers, chilled water return condenser cooling does not require additional energy to further cool the now warmer return chilled water. The cold seawater is able to remove this additional heat without any additional energy input (although additional heat exchanger surface may be required). This makes a better use of this valuable renewable energy resource.

Chilled water return condenser cooling uses return water from the chilled water distribution loop to provide condenser cooling. Chilled water return condenser cooling has a number of advantages: (1) it provides colder condenser water than is provided by cooling towers and further increases chiller efficiency; (2) it increases the number, and diversity of customers that SWAC systems can serve; and (3) it further enhances the benefits of SWAC.

Chilled water return condenser cooling can be used: (1) when the SWAC system has reached its maximum design capacity (i.e., when the total connected customer load reaches the maximum design capacity) or (2) for customers that have recently purchased new chillers and/or are committed to long-term system maintenance or performance contracts, and are therefore not able or willing to connect to a SWAC system in the near term.

CHAPTER 2. DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

2.1 INTRODUCTION

Federal and State regulations require analyses of all reasonable alternatives. The U.S. Army Corps of Engineers (ACOE) regulations clarify that reasonable means feasible in a geographic, functional or economic sense, and this is the basis for identification and analyses of alternatives in this EIS. The HSWAC project is a large, complex undertaking, and alternatives for each project component, large and small, have been fully analyzed and the most technically and economically feasible alternatives for those project components incorporated into the description of the Preferred Alternative[14] (Alternative 1) for the HSWAC system. Those evaluations were based on engineering and scientific analyses, geographic constraints, potential environmental impacts, the feasibility of mitigating potential impacts, relative benefits in terms of the project objectives, costs and other factors. Given the large number of potential variables, including distribution system routes, cooling station locations, seawater intake and return water depths, installation methodologies, etc., it would be possible to construct a nearly limitless number of potential system alternatives. In reality, four years of preliminary engineering analyses, public and agency coordination, impacts assessment, and site/route identification and evaluation have resulted in a Preferred Alternative optimized for constructability, cost and environmental impacts. In the descriptions of the system components below, the component alternatives considered are described and the rationale for selection of a preferred component alternative presented. The selected alternatives for each system component are assembled into the Preferred Alternative for the HSWAC system. A Second alternative (Alternative 2) was assessed to compare the impacts of a different set of assumptions about siting, construction/installation methods, and system operations. Both action alternatives are compared with the No Action Alternative to assess the net benefits and impacts of implementation.

In accordance with CEQ regulations, their derivative Federal agency guidelines and State regulations for EIS preparation, a summary of the potential environmental impacts of the alternatives is presented at the end of this chapter.

2.2 ALTERNATIVES TO THE PROPOSED ACTION

Three types of system alternatives were considered: alternative technologies, the required No Action Alternative, and the action alternatives.

2.2.1 Alternative Technologies

There are at least three ways other than SWAC in which a district cooling system for downtown Honolulu could be proposed, although none would achieve the HSWAC project purpose, satisfy the need for the project, or produce the net benefits of a SWAC system.

2.2.1.1 Deep Wells

The Honolulu Board of Water Supply has implemented a small district cooling system for the John A. Burns School of Medicine (JABSOM). The system uses cold water drawn from deep wells. However, the deep groundwater does not provide cold enough temperatures to use directly for air conditioning. The minimum temperature of the groundwater (i.e., 69°F) is cool enough to use for condenser cooling for conventional chillers, and thereby slightly increases the efficiency of the air conditioning system. Cooling

[14] The term **component alternative** is used here to indicate an alternative for a discrete element of the HSWAC system such as the seawater intake depth or the route of the distribution system. The **Preferred Alternative** for the entire HSWAC system is composed of each of the preferred component alternatives.

towers are eliminated, but chillers are still required and well water pumps are added. A larger-scale well-based condenser cooling system designed for downtown Honolulu would experience the same constraint, and many of the potential benefits associated with the HSWAC system would not be realized using groundwater condenser cooling.

2.2.1.2 District Cooling with Central Chillers

In areas without access to cold seawater or lake water, district cooling systems may still be practical. In such systems a few large central chillers replace many individual building chillers. Cooling towers are still required. While there are possible economic and environmental benefits to such systems, primarily resulting from slightly reduced energy consumption and other benefits of scale, there are no renewable energy components. Many of the benefits of the HSWAC system would not be realized with a conventionally-powered district cooling system.

2.2.1.3 District Cooling Using Ice-Making Chillers and Ice Storage

A district cooling system based on production of ice was proposed for the Downtown Honolulu area by a subsidiary of Hawaiian Electric Industries (HEI District Cooling) in 1999 (Dames & Moore, 1999). The concept was to produce ice at a central facility during nighttime hours when electricity rates are lower than during the daytime. The ice would be used to cool water, which would be pumped through a system of underground pipes to customer buildings throughout the Downtown area. The cool water would be used to chill water in a closed loop, and ultimately the air within each customer building. The benefits of such a system primarily stem from electricity rate savings rather than energy savings. In fact, ice storage systems can use more energy than conventional air conditioning or district energy systems; however, as with central chiller systems, there may also be energy savings related to economies of scale. Additionally, this type of system shifts electricity demand from peak hours to off-peak hours, deferring expansion of electricity generating capacity. As with central chiller-based systems, however, many of the benefits of the HSWAC system would not be realized with an ice storage system. An ice storage system would also require a significantly larger amount of floor space to accommodate the ice tanks and for larger chillers, as they would have to be upsized to accommodate their derating for making ice.

2.3 THE SEA WATER AIR CONDITIONING CONCEPT

SWAC uses renewable, deep cold seawater instead of electricity-intensive refrigeration systems to air condition one or more buildings. Typical large building air conditioning systems use refrigerant vapor compression cycle chillers to generate chilled water which is then used to cool the air that is circulated throughout the building. In a SWAC system, rather than cycling water through a chiller, the water is routed through a heat exchanger. Fresh water circulates through one side of a system of titanium (or other corrosion-resistant alloy) plates, transferring its heat to the cold seawater on the other side of the plates. The fresh water loop is closed, that is, the water circulates around and around from connected buildings to the heat exchanger, while the cold seawater passes through the heat exchanger only once before being returned to the sea. A small portion of the cold seawater would also be used a condenser water to cool the auxiliary chillers.

The main components of a basic seawater air conditioning system are a seawater circulation system including the supply pipe, pumps, and return pipe; a fresh water circulation network, including pumps that provide chilled water to each connected building; heat exchangers that transfer heat from the fresh water loop to the seawater; and auxiliary chillers to optimize the distribution water temperature.

2.4 WORLDWIDE SEAWATER AND LAKE WATER COOLING SYSTEMS

The feasibility of using cold seawater or lake water to cool buildings has been studied and analyzed for many years. A number of such systems are now in operation around the world. In 1975, the U.S. Department of Energy funded a program entitled "Feasibility of a District Cooling System Utilizing Cold Seawater" (Hirshman et al., 1975). Several locations were studied and the two most favorable sites were

Miami/Ft. Lauderdale and Honolulu. The study, however, noted that one of the limiting technical factors was the inability to deploy large diameter pipelines to depths of 1,500 feet (ft) and more. This technical challenge has since been addressed and successfully overcome with a number of large diameter deep-water pipelines being deployed at the Natural Energy Laboratory of Hawaiʻi at Keāhole Point, Hawaiʻi. Water pumped from 2,200 ft deep has been used to air condition buildings there since 1986, and plans have recently been approved to provide cold deep seawater air conditioning to the adjoining Keāhole International Airport.

In 1995, Stockholm Energy (now called Fortum) started supplying properties in central Stockholm, Sweden with cooling from a district cooling system. Most of the cooling is produced by using cold water from the Baltic Sea. There are at present more than 65,000 tons of load connected to the district cooling system in Stockholm, and Sweden currently has more than 80,000 tons of combined SWAC and lake cooling.

Several large-scale lake water cooling projects have come on line in recent years. In 1999, a 63-inch diameter, 10,000-foot long pipeline was installed to link Cornell University and nearby Lake Cayuga. The pipeline accesses cold water at a depth of 250 ft. The system, which can provide 20,000 tons of cooling, is supplying air conditioning to the Cornell University campus and the Ithaca City Schools.

More recently, Enwave in Toronto, Canada completed Phase I of a district cooling system that utilizes cold water from Lake Ontario to provide air conditioning to buildings in Toronto. The lake water is initially brought to a cooling station through three 63-inch pipes where it is used to cool a fresh water distribution system that provides air conditioning to downtown buildings. After the coldness of lake water has been used for air conditioning, the water is used in the city's potable water system. The system is designed for 58,000 tons -- the equivalent of 32 million square feet of building space. Compared to traditional air conditioning, this system reduces electricity use by 75% and eliminates 40,000 tons of carbon dioxide production annually, the equivalent of taking 8,000 cars off the streets.

The Intercontinental Resort and Thalasso Spa Bora Bora opened May 1, 2006 and features a number of unique, innovative, eco-friendly attributes. Their SWAC system uses a 7,874-foot pipe extending to a depth of 3,000 feet off the reef of Bora Bora. The system pumps cold, deep seawater through a titanium heat exchanger, cooling a freshwater circuit that then provides air conditioning throughout the hotel.

A number of other seawater and lake water district cooling systems are now under study or in design, including systems in Miami, Hong Kong, Guam and elsewhere. The engineering design and deep water pipeline installation challenges have been met, and SWAC systems today are feasible, reliable and economical.

2.5 ALTERNATIVE 1: THE PROPOSED HSWAC PROJECT (PREFERRED ALTERNATIVE)

This section describes the Preferred Alternative, including aspects or components for which there are no economically feasible or environmentally acceptable options. The considerations and analyses of the planning, engineering, and environmental studies that eliminated alternatives to these system aspects or components are presented in this section, as are the preferred alternatives for certain aspects or compounds for which there are alternatives, including cooling station locations, distribution piping installation method, seawater piping route, return seawater discharge depth, and intake pipe screening.

The overall capacity of the proposed HSWAC system was established in consideration of the potentially available cooling load in downtown Honolulu, the costs to connect buildings of various sizes and locations, system capital and operating costs, the availability of appropriate equipment, and the offshore bathymetry and seawater characteristics. The proposed system capacity, in turn, determined the sizes of the major system components. Component sizes, their respective operating environments, and life-cycle costs determined component materials, for example, high density polyethylene (HDPE) is specified for the seawater pipes because of its strength, flexibility, inertness in seawater, and good thermal insulating properties. Similarly, system component size, material composition, and environmental constraints drove selection of construction methodologies.

Although a wide range of alternative equipment types was evaluated, there would be little or no differences in their respective environmental impacts and they are not considered alternatives for purposes of this assessment. The equipment selected for use in the project is described below.

Where system requirements did not allow for alternatives, the respective potential environmental impacts of their installation or operation are considered unavoidable, although mitigation measures may be employed to reduce impact intensity, duration or extent.

2.5.1 Project Setting and Use of Public Lands

The HSWAC project is proposed for the downtown area of Honolulu, on the leeward shores of O‘ahu. The island of O‘ahu is part of the City and County of Honolulu. Four areas near downtown Honolulu (Figure 2-1) would be used in four discrete functions associated with construction and operation of the HSWAC system:

- Seawater intake and return pipes would be deployed offshore of Honolulu in the area between Honolulu Harbor and Kewalo Basin;
- A cooling station would be built on a site in the Makai District of the Kaka‘ako Community Development Area;
- Freshwater distribution pipes would be installed beneath streets in the downtown Honolulu area; and
- A shoreline site on Sand Island would be temporarily used for materials staging and pipeline assembly.

Use of public lands would include State and Federal submerged lands where the seawater pipes would be installed, State highways and city streets where the distribution system pipes would be installed, and State lands where the seawater pipelines would be assembled.

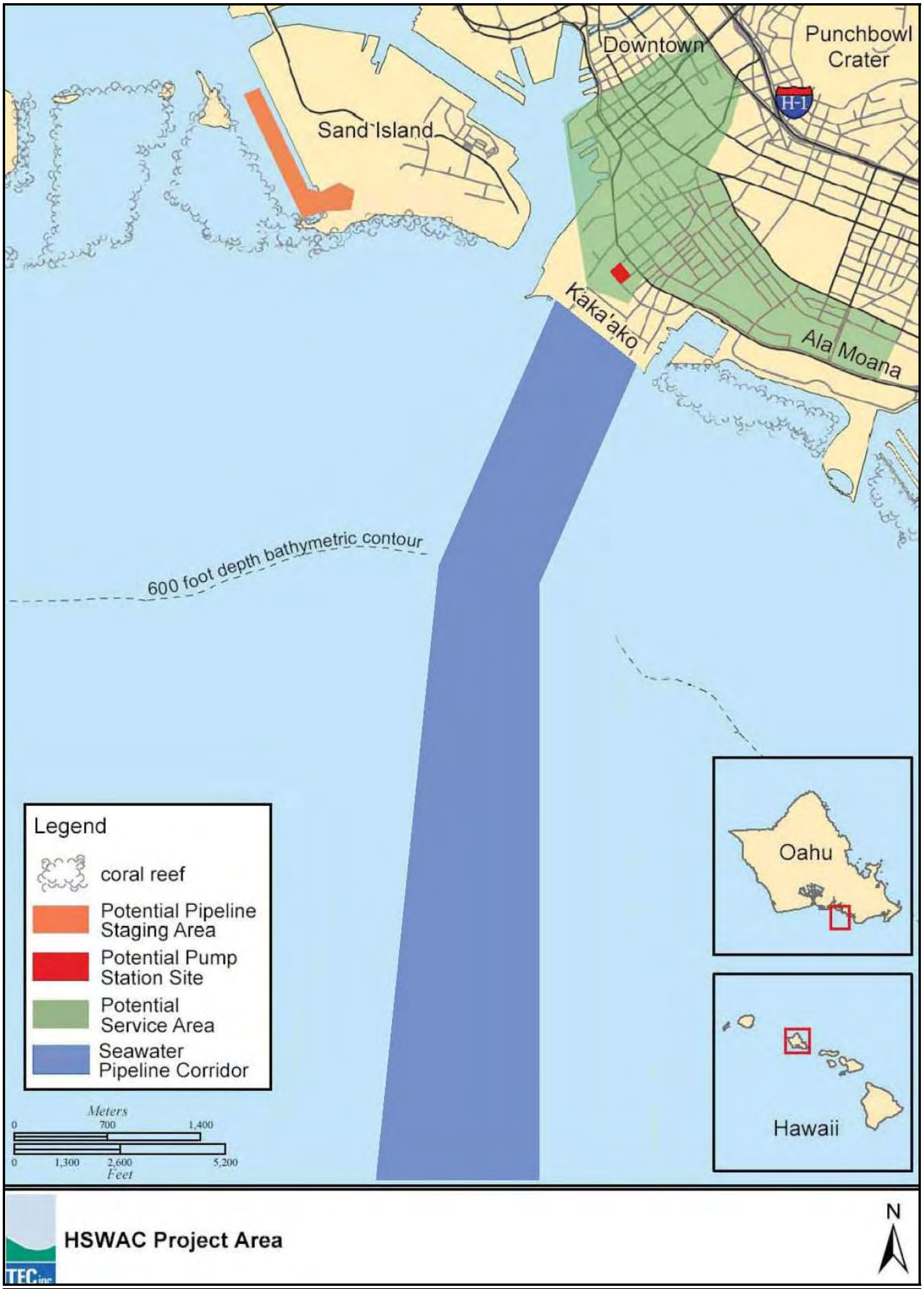

Figure 2-1: HSWAC Project Area

2.5.2 Project Overview

The HSWAC project would be owned by HSWAC, and provide 25,000 tons of centralized air conditioning for downtown Honolulu. The primary means of cooling would be through the use of deep, cold seawater accessed through a long offshore intake pipeline. The system is shown conceptually in Figure 2-2. The primary system components are as follows:

- Seawater intake and return pipes;
- A seawater cooling station containing:
  - Seawater pumps;
  - Fresh water pumps;
  - Heat exchangers;
  - Auxiliary chillers; and
- A chilled (fresh) water distribution system.

Each of these components is described further below. A staging area would be required for materials storage and pipeline assembly and testing. This area is described below as well.

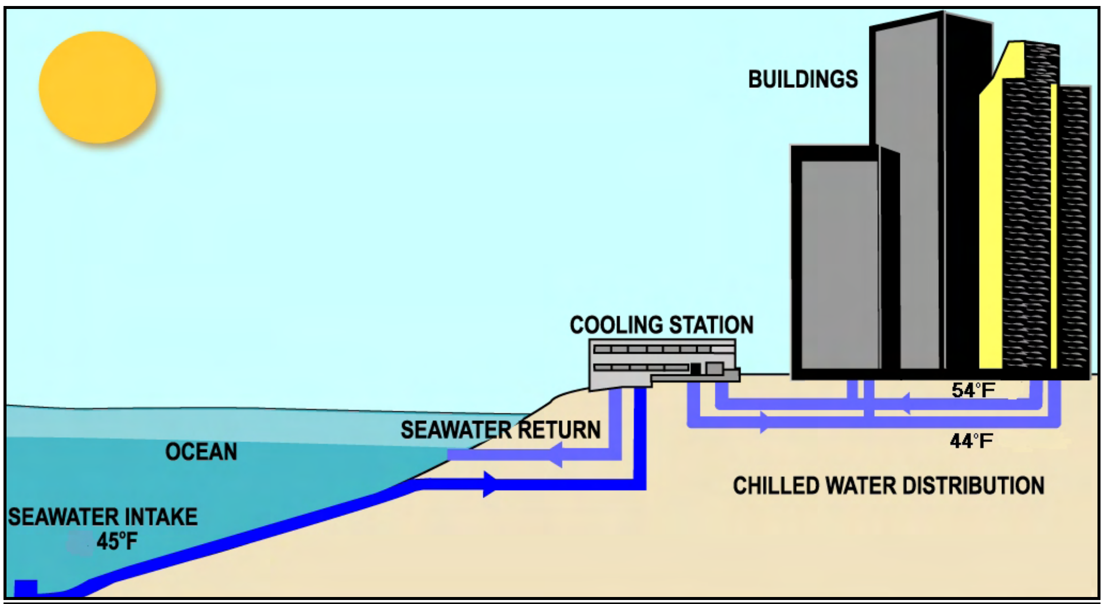

Figure 2-2: Conceptual Drawing of Major Components of the HSWAC System
(Source: HSWAC)

Figure 2-3 is a schematic drawing of HSWAC system operations. Cold seawater would be pumped through heat exchangers and then through condensers in auxiliary chillers before being returned to the sea. Freshwater would circulate through the heat exchangers and the auxiliary chillers before returning to the connected buildings.

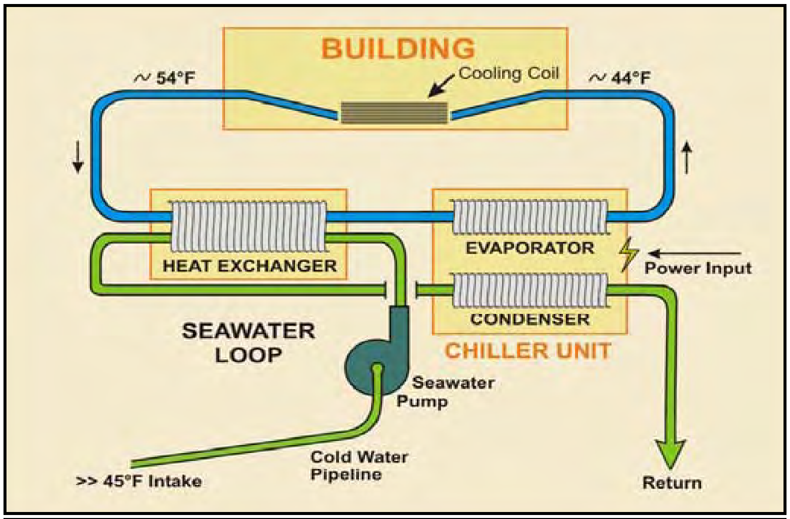

Figure 2-3: Schematic Drawing of the HSWAC System with Chiller Enhancement
(Source: Makai Ocean Engineering, 2005a)

2.5.3 Seawater Circulation System

2.5.3.1 Description

The seawater circulation system would consist of parallel seawater intake (supply) and seawater return pipelines extending from the cooling station to their respective terminal points offshore. Because of limitations inherent in the available construction/installation methodologies and the pipe materials themselves, and because of environmental considerations, in particular the presence of corals, various combinations of construction/installation methodologies and pipe types were considered for different segments of the intake and return routes. In particular, the available trenchless technologies for pipeline installation were thoroughly evaluated for potential use in installing the two pipes underground from the cooling station to a breakout point offshore where living corals give way to coral rubble and sand. Trenchless technologies evaluated included horizontal directional drilling, microtunneling and conventional tunneling. Seaward of the breakout point, the seawater intake and return pipes would be surface-mounted. The discrete segments of the intake and return seawater pipelines are: (1) from the cooling station to the offshore breakout point; (2) from the breakout point to the return seawater diffuser; and (3) from the diffuser to the intake. The following paragraphs describe these segments in greater detail, including materials, construction and alternatives considered.

2.5.3.2 Cooling Station to Breakout Point

To minimize potential environmental impacts, reduce the seawater intake and return pipelines' exposures to wave loads, and avoid existing utility installations in the vicinity of the cooling station, it was decided to use a trenchless technology for routing the seawater pipes from the cooling station to an offshore breakout point at a depth in the range of 20-40 feet in an area where corals are largely absent. Three trenchless pipeline installation methods were considered:

- Horizontal directional drilling (HDD) methods (drill pilot hole, ream/enlarge drill hole and pull back pipeline/casing),
- Microtunneling (remote control pipe jacking), and
- Tunneling (man entry tunneling using a tunnel boring machine and reinforced concrete segmental liner).

Trenchless design considerations included existing geological and geotechnical information, interpretation of the nearshore geology from aerial photographs, underwater reconnaissance at and near the proposed offshore breakout point, and geotechnical field investigations. The potential trenchless corridor was evaluated for the potential to encounter very soft or loose lagoonal deposits, or very hard basalt lava flows. Either of these conditions would create problems for trenchless technologies. Basalt was found to occur at approximately 120 feet below the existing ground surface, or on the order of approximately 115 feet to 150 feet below mean sea level (MSL). It was determined that the objectives of the trenchless installation could be met by installing the pipes at approximately 40 feet or deeper below sea level. The subsurface in that depth range consists of coralline silts, sands, gravel, cobbles, boulders (detritus), and reef limestone ledges, layers and masses, with and without voids and cavities.

While the breakout point and offshore pipeline routes were being investigated, detailed bathymetric surveys and sub-bottom profiling was completed. A buried ancient alluvial channel was discovered near the Honolulu Harbor entrance channel and several mounds of dredge spoils were also found further to the east. In combination, these features suggested that the safest pipeline route would be to the east of the spoil mounds. Review of the DEIS by University of Hawaiʻi's (UH) marine scientists, however, revealed potential conflicts between construction and operation of the HSWAC seawater system along this route and the facilities and operations of the Kilo Nalu Observatory, a system of cabled sensors arrayed on the seafloor. Further geotechnical studies were conducted and a suitable route to the west was defined that was acceptable and would not interfere with the Kilo Nalu Observatory. This western route was adopted as part of the Preferred Alternative.

Additional considerations in planning for a trenchless installation for the on-land portions of the distribution system included the presence of other buried utility installations along the proposed route and the availability of work space.

The next three subsections describe the trench technologies evaluated, potential offshore routes considered for them, and conclusions as to the applicability of those technologies and routes to the HSWCA project.

2.5.3.2.1 Horizontal Directional Drilling

HDD has been used for over 15 years to complete pipeline installations beneath rivers and other waterways, and also to construct ocean outfalls. Recently, several HDD projects staged over water have also been completed. Important design considerations for HDD applications include geotechnical conditions, the horizontal and vertical alignment, pipe materials, pipe stresses during installation, constructability, construction staging, spoil, drilling mud disposal, and construction cost. In general, pipelines from 2,900 feet to as long as 8,400 feet and ranging in outer diameter from 10-inch to 56-inch have been constructed using HDD methods. It is important to note that the longest HDD installed pipelines tend to be smaller diameter, generally less than 30-inch, and tend to be steel pipes.

HDD methods for the construction of pipelines involve using sophisticated drilling techniques to drill a pilot hole, which is subsequently enlarged by reaming with various reaming tools to obtain a hole of the desired size. Drilling mud is used to flush the cuttings from the hole and to stabilize the hole to reduce the potential for significant cave in. When the hole has reached the required size, the pipeline (or a casing) is pulled back into the hole in a single operation. An HDD drill rig can be staged on land or over water, and for this project, if HDD were the selected technology, most likely both on land and over water staging would be necessary.

Over water, the HDD drill rig would need to be mounted on pile-supported steel platforms or large spud barges. A spud barge is a vessel that uses heavy timber or pipe as a means by which to moor. The timber or pipe is located in a well at the bottom of the boat, and acts in the same manner as would an anchor. Spud barges are riverboats that are most commonly used as work barges, or as a loading or unloading platform. An example of over water HDD pipeline (HDPE) pull back and under water connection of a spool segment is shown on Figure 2-4.

Figure 2-4: Over Water HDD Pipeline Pull Back (HDPE Pipe) in Pearl Harbor
(Source: Yogi Kwong Engineers, Inc.)

Due to the open ocean conditions offshore of Kakaʻako, the use of spuds to stabilize barges or a platform in 40 feet or deeper water may not be cost effective. Alternatively, barges may be moored to pre-installed underwater mooring anchor piles. Steel pipe piles, for example from 20 to 30 inches diameter, could be used to reduce potential barge anchor impact to corals, if present. A similar underwater mooring was provided for mooring of the sunken *Ehime Maru.* The underwater steel piles would be abandoned in place, and may protrude a few feet above the sea floor.

In evaluating HDD for this application, it became apparent that there were several serious constraints to use of that technology for the HSWAC application. These constraints are related to the maximum pipe sizes that can be installed with this technology and the volumes of water required for the HSWAC project. In the U.S. to date, the largest HDD installed pipe size is 48-inch OD steel. However, steel will corrode in seawater. HDPE pipes, such as those proposed for the offshore portions of the HSWAC seawater system, as large as 42-inch have been installed directly, but not at the lengths that would be required in this application. HDPE pipes do not have the tensile strength to withstand the pipeline pulling stress that would be exerted during the installation. The conclusion was that HDD cannot be used to directly install pipes of the diameter required by the HSWAC system, and HDPE pipes cannot withstand the stress of direct installation for the required pipe lengths.

In order to use HDD for the HSWAC system, a series of smaller diameter steel pipes would have to be installed in separate tunnels, and then a smaller, non-corrosive pipe such as HDPE or fusible PVC (FPVC) installed inside the steel casing and the annulus between them grouted to provide support for the suction forces on the interior pipe. To handle the volume of water required for the HSWAC system, five tunnels would be required. The seawater intake would consist of three tunnels, each holding a 42-inch OD steel casing with a 36-inch FPVC pipe inside. The seawater return would consist of two 36-inch FPVC pipes, with or without a larger casing.

The necessity to install five pipes to complete the system would create two other problems. First, because of the inherent limitations in steering the HDD machine underground and the characteristics of the soils, the individual pipes would have to be separated by at least 20 feet to avoid the possibility of the tunnels affecting one another. Second, because of this requirement for separation of the pipes, the entry and exit pits would be wide. On the shore end there are right-of-way constraints that would make it difficult to acquire an adequate work area and on the seaward end this would create a much larger excavation at the breakout point than would be the case with fewer pipes.

Nevertheless, four HDD alternative routes were investigated to compare with the other trenchless technologies. These routes are shown in Figure 2-5. Three of the potential routes pass ‘ewa of the Kaka‘ako Waterfront Park and the landfill buried beneath it. The fourth alternative, going beneath the park at a more Diamond Head location could combine microtunneling and HDD technologies. As noted above, however, routes to the east of the area, in addition to having to pass beneath an unlined landfill, would interfere with UH’s Kilo Nalu Observatory, and were subsequently eliminated from consideration.

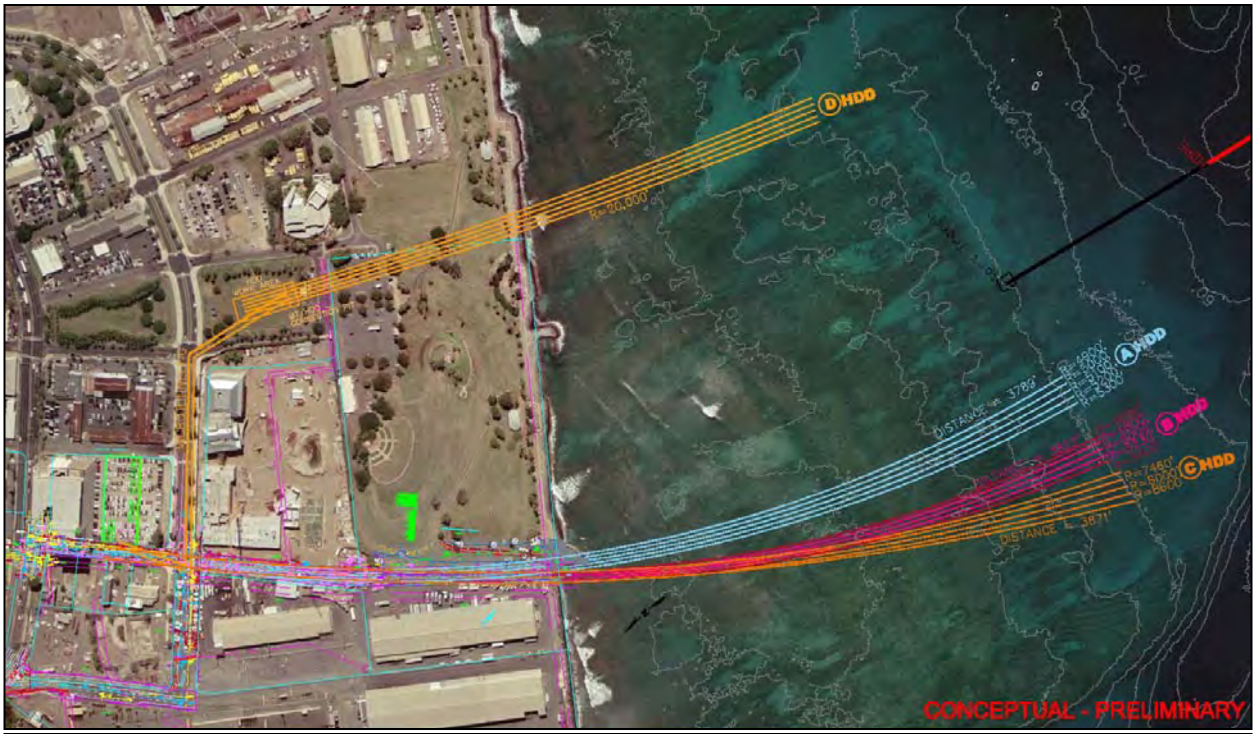

Figure 2-5: Potential Horizontal Directional Drilling Routes to Breakout Depth
(Source: Yogi Kwong Engineers, Inc.)

Staging of the HDD entry point from behind the shore line was found to be impractical due to the lack of available easements and work areas on the ‘ewa side of this potential corridor (HDOT Harbors yard) and the Kaka‘ako Waterfront Park and buried landfill on the Diamond Head side. In addition, there is only an approximately 20-foot wide space between major sewer lines under Keawe Street from outside the proposed cooling station. Consequently, the entry location would have to be in a large, deep pit dug and dewatered just offshore of the existing drainage canal. From that point to the cooling station, tunneling or microtunneling methods would be required to install fewer, larger diameter pipes in the available space.

The section of Keawe Street between 677 Ala Moana Boulevard’s Keawe Street driveway entrance and the driveway entrance to the Ala Moana Wastewater Pump Station (WWPS) near Ilalo Street would have to be closed to through traffic throughout the HDD and related operations – a period of 6 to 12 months.

In addition, up to 3,800 linear feet of steel casing and HDPE or FPVC pipe would have to be floated offshore during pipeline pull back, an operation estimated to require approximately 30 days for each of the five pipelines required. This would require boat and ship traffic to be re-routed around the over water work zone.

In general, the minimum work area for HDD methods at the entry and exit locations is an area approximately 200 ft by 200 ft. Additional staging area is required for pipe storage, spoil handling with dewatering, and for laying-out the pipe when the pipe string is assembled for pull back. Additional off-site staging areas for materials and equipment storage and handling of construction spoils, etc., are required. For previous trenchless projects on O'ahu, yard spaces on Sand Island and in Campbell Industrial Park were used.

For on-land disposal of spoils, a temporary spoil stockpiling and dewatering area would be needed during construction to allow spoils separated from the drilling fluids (or mud) to be stockpiled, inspected, sampled and tested prior to disposal. In addition, some space to allow the drilling fluids to be dewatered to separate the spoil from the drilling fluids would be desirable, as there would be a considerable volume of drilling fluids. A minimum 200 ft by 200 ft area for processing of drilling fluids would probably be needed. The dewatering basin would have a plastic liner to prevent infiltration of the drilling fluids into the ground. Typically, the plastic liner is covered by a layer of sand to protect the liner.

Detailed bathymetric surveys conducted to better define potential offshore routes identified two areas of constraint that further discounted use of HDD in favor of microtunneling. First, to the west, near the entrance to Honolulu Harbor, there is a probable buried ancient alluvial channel with a probable area of submarine landslide further offshore. Alluvium would not support HDD methods and the submarine landslide area would put the pipes at risk. Further to the east are several significant mounds of dredge spoils that must also be avoided in pipe laying. The result is that the pipeline alignment would have to go farther to the east than would be possible with all but the eastern-most HDD alternative which, as noted above, is unacceptable due to the potential interferences with the Kilo Nalu Observatory. In conclusion, HDD technology was eliminated from further consideration.

2.5.3.2.2 Microtunneling

Microtunneling is a specialized form of pipe jacking used to install pipelines without the need for personnel to enter the pipe. It is therefore conducive to small diameter pipes (e.g., internal diameters less than 36 to 48 inches) but is by no means restricted to these diameters. Jacking of 60-inch to 120-inch diameter reinforced concrete pipes is not uncommon. Microtunnel construction techniques may be used to install a carrier pipe by direct jacking or to install a casing into which the carrier pipe is installed. The microtunnel boring machine (MTBM) is a specialized tunnel boring machine with the following general components:

1. It is operated by remote control.
2. The front of the MTBM consists of a cutterhead, which must be designed and equipped to mine through the range of anticipated ground conditions.
3. It controls the soil at the face by use of an earth pressure balance technique and counterbalances the groundwater by a slurry pressure technique.
4. Soil cuttings are removed from the face of the machine by use of a slurry system or an auger system. For this project, an auger system would not be appropriate.
5. It is steerable and generally laser guided.
6. The tunnel lining installed by pipe jacking can be a larger diameter casing (steel, reinforced concrete pipe, composite, or concrete-polymer pipe). Based on the project considerations and anticipated mixed subsurface conditions, a steel or reinforced concrete casing can be considered for straight drives, and reinforced concrete casing pipe should be considered for curved drives. In the U.S., microtunneling drives completed to date are generally straight drives. Many curved drives from 650 feet to over 1000 feet bend radius have been completed in Western Europe and some Asian countries.

Microtunneling methods require jacking shafts and receiving shafts. Jacking shafts are required to launch the MTBM, and the construction staging area is generally located at the jacking shaft and/or reception shaft. Receiving shafts are required to remove the MTBM upon completion of each drive. Selecting the location of jacking and receiving shafts is based on the evaluation of a number of factors, such as identifying acceptable staging areas and maintaining feasible drive lengths. In order to minimize the number of jacking sites required, each jacking pit can be utilized for installing pipe in both directions. Figure 2-6 provides an example of microtunnel shaft construction on a narrow public roadway in Kailua, O‘ahu.

Figure 2-6: Microtunnel Shaft Construction on a Narrow Public Roadway in Kailua, O‘ahu
(Source: Yogi Kwong Engineers, Inc.)

The following three figures show aspects of microtunneling over water. Figure 2-7 shows a microtunneling rig near the Pearl Harbor entrance channel. Figure 2-10 shows the inside of the microtunnel shaft in the ocean off Pearl Harbor, and Figure 2-8 shows wet retrieval of the microtunnel machine.

Figure 2-7: Microtunnel Rig off Pearl Harbor
(Source: Yogi Kwong Engineers, Inc.)

Figure 2-8: Forty-foot Deep Microtunnel Shaft off Pearl Harbor
(Source: Yogi Kwong Engineers, Inc.)

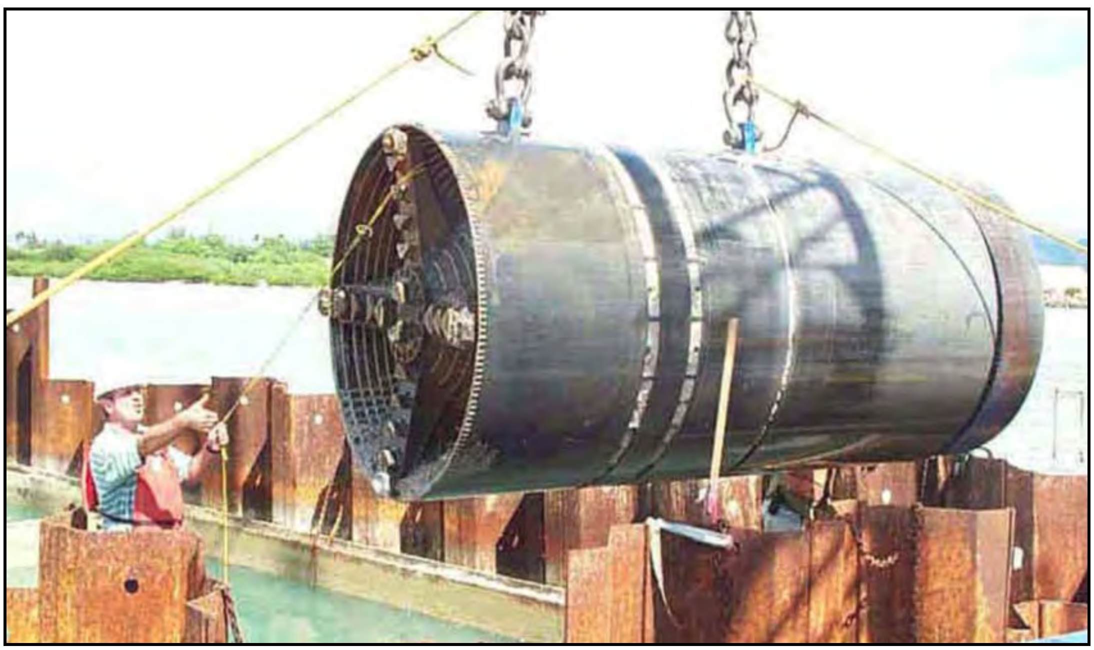

Figure 2-9: Wet Retrieval of Microtunnel Machine
(Source: Yogi Kwong Engineers, Inc.)

Based on the available geotechnical data, the shoreline crossing could be constructed using microtunneling methods and that would require a narrower easement corridor than HDD. However, along the Keawe Street - drainage culvert alignment corridor, the approximately 3,600 linear feet shore crossing far exceeds the single drive jacking distance previously attempted by US contractors. Therefore, a jacking shaft would be required close to the shoreline, either on shore (Preferred Alternative) or offshore, to break the route into two sections of approximately 1,600 to 1,700 lineal feet each (Figure 2-10). The Preferred Alternative route is shown on Figure 2-10. The cooling station location and the preferred jacking pit location are outlined in green. The coordinates at the center of the jacking pit are 157°51.985' N, 21°17.676' W. In plan view it would be a polygon with approximate maximum dimensions of 45 feet by 65 feet. The offshore receiving pit would be at 157°51.985' N and 21°17.395' W. Its dimensions would be approximately 30 feet by 40 feet.

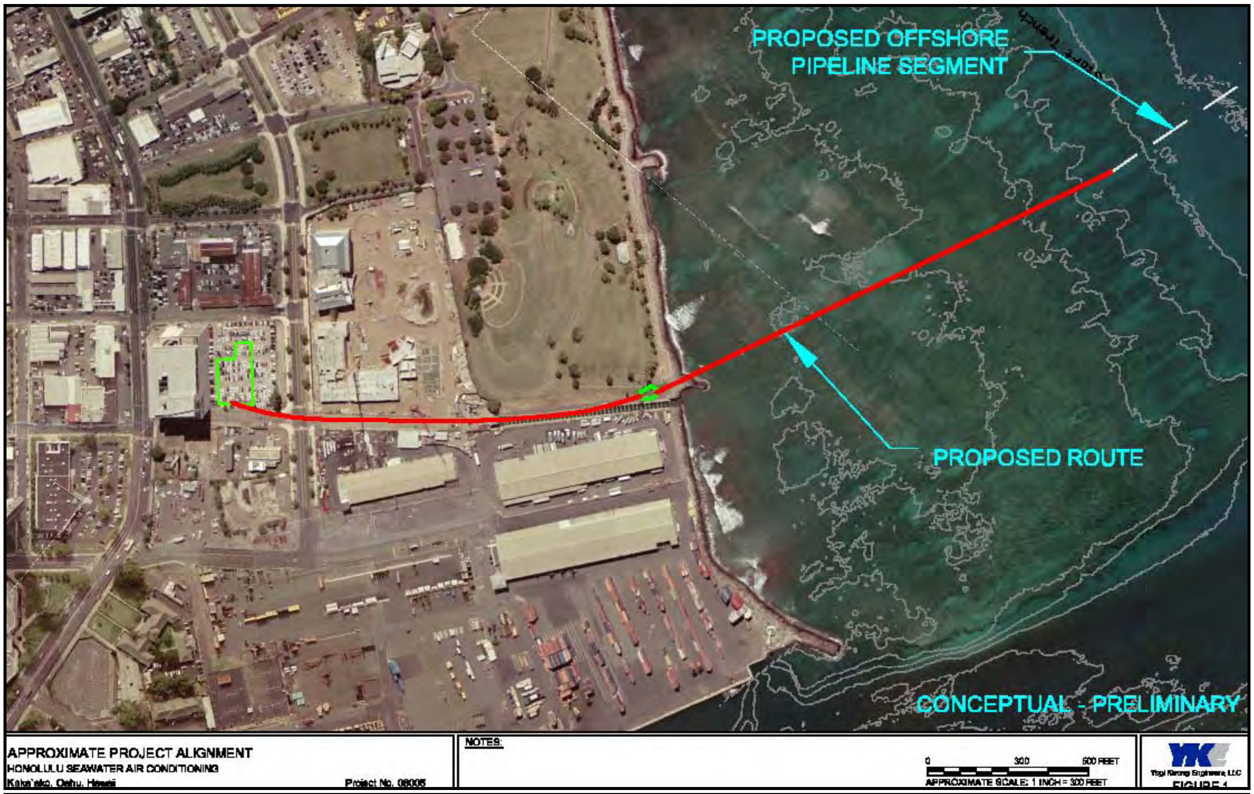

Figure 2-10: Preferred Microtunneling Route to Breakout Depth
(Source: Yogi Kwong Engineers, Inc.)

Use of microtunneling would substantially reduce both the required over water and on land work areas compared to HDD, however, the cost may be somewhat higher and it would likely take longer, due to the need to construct an offshore receiving pit from which to recover the microtunneling machine and a deep jacking shaft at the cooling plant site (probably to -50 feet MSL). Using microtunneling technology, only two jacked pipelines would need to be installed:

- For the cold sea water intake pipeline, a minimum 72-inch internal diameter (ID) reinforced concrete pipe (RCP) casing for the required curve drive into the cooling station jacking/receiving pit from the shoreline jacking/receiving pit, and a similar size RCP or steel casing jacked from the shoreline to the breakout point for connection to the offshore pipelines. A nominal 54-inch (ID) diameter composite or concrete-polymer pipe or 63-inch (OD) HDPE pipe with stiffeners would be installed inside the jacked casing and the annulus space between the casing and the carrier pipe grouted.
- For the return seawater discharge pipeline, a 54-inch (ID) RCP pipe would be jacked from the same pits described above.

The eastern alignment would pass beneath the unlined but capped landfill beneath the Kakaʻako Waterfront Park. Although the trenchless shafts would be on the order of 40 feet below the ground surface, it is unknown if significant contamination exists at that depth. If the soil is contaminated, the cost of disposal could be a significant factor. These uncertainties combined to eliminate its alignment from further consideration.

The preferred alternative would require construction access through and staging and work areas near the ʻewa corner of Kakaʻako Waterfront Park between the old landfill and the open drainage culvert. Microtunneling and installation of the casings would be expected to take 6 to 7 months, and installation of the carrier pipelines and annulus grouting an additional 1 to 2 months.

All soil removed from the tunnel, jacking pits, would pass beneath the unlined but capped landfill beneath the Kakaʻako Waterfront Park. Although the trenchless shafts would be on the order of 40 feet below the ground surface, it is unknown if significant contamination exists at that depth. If the soil is contaminated, the cost of disposal could be a significant factor. and receiving pit would be disposed of on land. The spoil would be processed by a solids separation plant at the jacking pits (at the cooling station and just behind the shoreline in the Preferred Alternative). The solids and slurry would be transported in lined dump trucks to the contractor's own yard for drying and then disposed of properly, likely at the construction waste landfill. Assuming a cooling station jacking pit size of 40 ft by 40 ft by 60 ft deep would yield 96,000 cubic feet or 3,600 cubic yards. Spoil from the offshore receiving pit would be barged and then hauled to the contractor's yard. This pit would be about 40 ft by 40 ft and 15 ft deep, yielding about 24,000 cubic ft or about 900 cubic yards. The tunnel itself would generate about 9,000 cubic yards. Sand and gravel from the receiving pit and microtunneling would likely be washed and made available as backfill materials.

2.5.3.2.3 Tunneling

Conventional tunneling methods (man entry) involve the use of a tunnel shield or tunnel boring machine (TBM), the installation of an initial support system to support the surrounding ground, and then placement or installation of a final lining or carrier pipes. TBMs utilize a full-face rotating cutterhead to excavate tunnels at a higher advance rate. There are open TBMs and shielded TBMs. Open TBMs are used mainly for excavating hard rock formations with no or minor ground water inflow. The cutterhead of the open or main beam machine is thrust forward with hydraulic rams supported by grippers, which are mounted on each side of the main beam of the machine and bear against the tunnel walls. In soft ground, the material is not strong enough to withstand the bearing pressure of the grippers and a shielded TBM with thrust jacks would normally be used.

In general, a shielded TBM has a full circular shield that provides temporary ground support while the initial support system (usually cast steel liner plates, or precast concrete segments) is erected within the tail of the shield. Shielded TBMs advance by thrusting against the tunnel's initial support system with hydraulic jacks. Such an approach requires an initial support system that can withstand ground loads, the TBM thrust forces, and hydrostatic pressures, if present. Closed face and more sophisticated pressurized face shields can be used for tunnel excavation below the groundwater level. The cutterhead of either type of TBM can be equipped with disc cutters for excavating rock or drag teeth for excavating soil and soft rocks. A slurry TBM would be the appropriate choice for the anticipated subsurface conditions in the HSWAC project area. An example of a tunnel lined by precast reinforced concrete segments is shown on Figure 2-11.

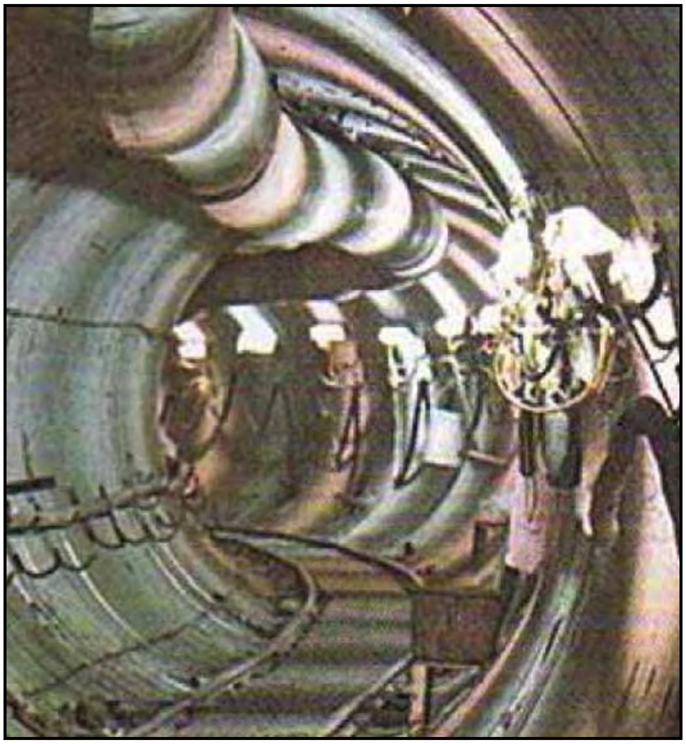

Figure 2-11: Tunnel Lined with Precast Reinforced Concrete Segments
(Source: Yogi Kwong Engineers, Inc.)

The potential use of man-entry conventional tunneling methods using a closed face slurry tunnel boring machine (slurry TBM) was evaluated for installation of the HSWAC seawater pipes from the cooling station to the breakout point. The tunneling option would reduce the excavations of pits to two: a large entry shaft at the cooling station and an underwater TBM retrieval pit at the breakout point. Only one route was examined as the most direct route could be employed using this technology (Figure 2-12).

Figure 2-12: Potential Tunneling Route to Breakout Depth
(Source: Yogi Kwong Engineers, Inc.)

The tunnel itself would mostly likely be lined with a minimum 11 to 12 feet inside diameter pre-cast reinforced concrete segmental liner, due to the tunnel length and slurry TBM equipment and other tunneling needs, such as the space necessary to provide a compressed air chamber at the front of the TBM to allow for man-entry intervention to the TBM cutter head to replace worn cutter discs periodically during the underwater tunneling operation. The required 63-inch diameter HDPE seawater intake pipeline and 54-inch diameter HDPE seawater return pipeline would be installed inside the tunnel liner. The pipelines would be secured inside the liner and the annulus between the casing and the intake and return pipelines grouted. The construction cost estimate would be expected to be significantly higher than HDD or microtunneling installations. Tunneling would be expected to take 9 to 11 months; installation of the carrier pipelines and annulus grouting would be expected to take an additional 1 to 2 months.

2.5.3.3 Breakout Point to Diffuser

At the breakout point of the microtunneled shafts, a pit of about 30 feet by 40 feet in plan view and 20 feet deep would be excavated and contained by sheet piles extending about 10 ft above the seafloor. This pit would be used to recover the MTBM and connect the microtunneled pipes to the surface-mounted pipes extending seaward. The plan for connecting the two segments of pipes is shown on Figure 2-13.

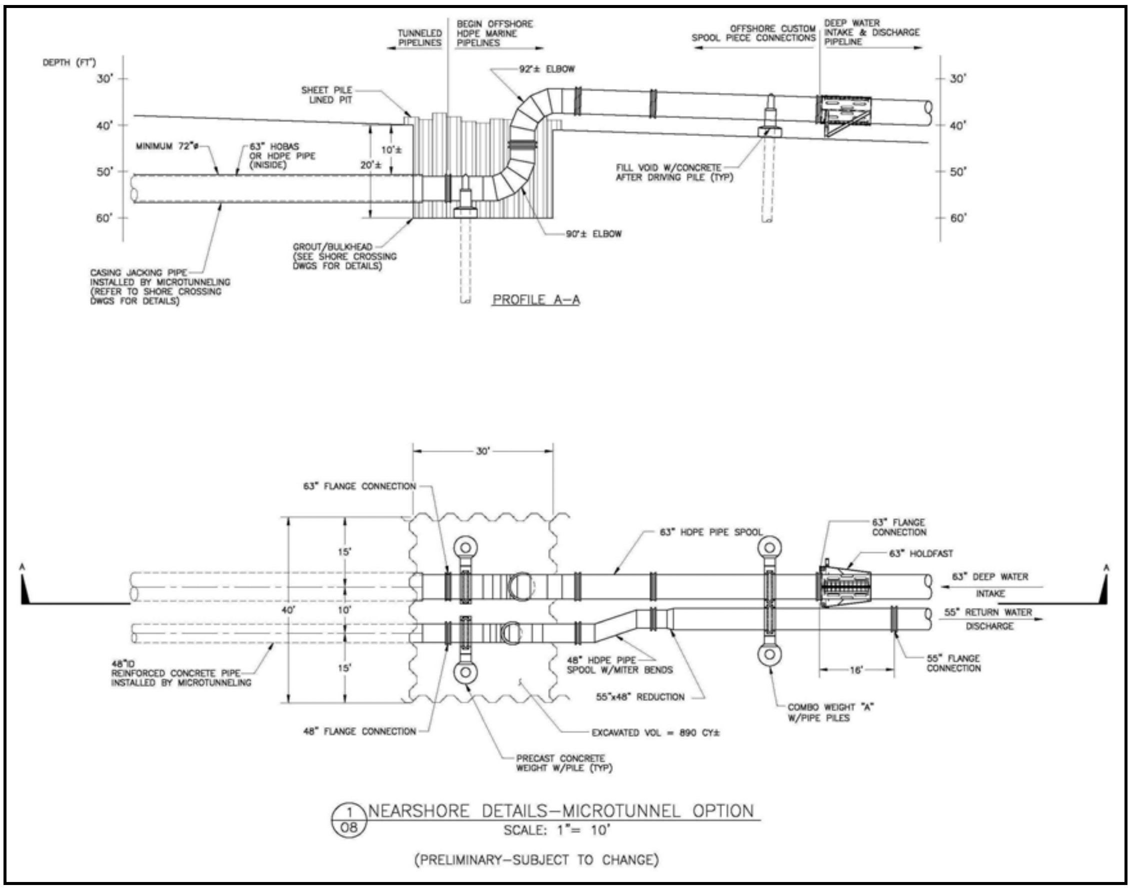

Figure 2-13: Details of Connection Between Microtunneled and Surface-mounted Segments of Seawater Pipes
(Source: Makai Ocean Engineering, Inc.)

The feasibility of employing silt screens around the receiving pit in this open water environment will be evaluated during permitting. Such screens would have to be designed by an expert familiar with the currents and waves at the site to maximize the chances of success.

After completion of the connections, the pit would be backfilled and covered with a concrete cap. The backfill would be crushed basalt gravel graded between 3/8-inch and 2-inch size and pre-washed to remove any fines. The sheet piles would be removed or cut off at least 2 feet below the existing seafloor grade.

The offshore segments of the seawater pipe would be fabricated from high density polyethylene (HDPE). The seawater intake pipe would be 63-inch diameter and the seawater return pipe would be 54-inch diameter. Long sections of these pipes would be assembled from shorter segments in a pipeline staging and assembly area (see section 2.5.3.6). Individual pipe segments would be heat-fused to form longer segments and these longer segments would be flanged together to form a single pipe. Joining hardware would be fabricated from steel bolts and fittings that have been galvanized in zinc, with additional zinc anodes to extend life in seawater. The design life of the pipeline would be 75 years.

To protect the pipes from the effects of large storm waves, especially in the shallower reaches of the route down to about 150 feet, several options were evaluated, including trenching and burying, installing anchor piles, attaching additional gravity anchors or a combination of these methods. Initial considerations indicated that trenching and burying the pipes from the breakout point to a depth of about 80 feet and then surface mounting the pipes with steel pipe piles driven through concrete collars in the depth range from 80 feet to 150 feet would provide the protection required. In subsequent evaluations, including analysis of effectiveness, logistics, costs, and environmental impacts, it became clear that excavating a trench on the order of 1,000 feet long and 20 feet wide, with gradually sloping sides to avoid slumping of sediments back into the trench, sidecasting and stockpiling the excavated material, and burying the pipes could cause unacceptable turbidity in the water column. In addition, the necessity to mobilize the equipment to excavate the trench and then mobilize different equipment to drive piles would unnecessarily inflate construction costs. The conclusion reached was that securing the pipes to the bottom using piles and gravity anchors would cost-effectively provide the necessary protection while minimizing environmental impacts.

Seaward of the breakout point, the seawater intake and return pipes would parallel one another to the end of the diffuser at 150 feet deep. Both pipelines would begin at approximately 1,800 feet offshore at a water depth of 31 feet (MLLW). The return seawater pipeline would run an additional 1,700 feet offshore (approximately 3,500 feet from the shoreline) and terminate in a 25 port diffuser extending from 120 to 150 feet deep. With a nominal intake depth of 1,770 feet, the seawater intake pipe would extend to a point approximately 23,000 feet from shore and terminate at 1,784 feet deep (see Figure 2-17). The precise depth of the intake is currently unresolved, but would be within the depth range of 1,600 to 1,800 feet.

The pipes would be fitted with concrete collars, or gravity anchors, of three types, depending on depth. From the breakout point to the end of the diffuser, combination collars (Figure 2-14), which would hold both pipes, would be used, and most of these would be further secured to the bottom with piles. Steel pipe piles would be driven through sleeves in the collars using a percussion hammer. Sand from inside the pipe would be removed, probably with an airlift siphon system, to a level about 6 ft below the original seafloor. The amount excavated from each pile would be about 1 cubic ft. This material would be side cast near the pile. Tremie concrete would be used to fill and cap the piles. There would be a total of 89 of these "combo" weights, but only about 51 of them would have two piles driven through. Ten others would have one anchor pile, giving a total of 112 piles from the breakout point to the end of the diffuser. Collars without piles (28) would serve only as gravity anchors.

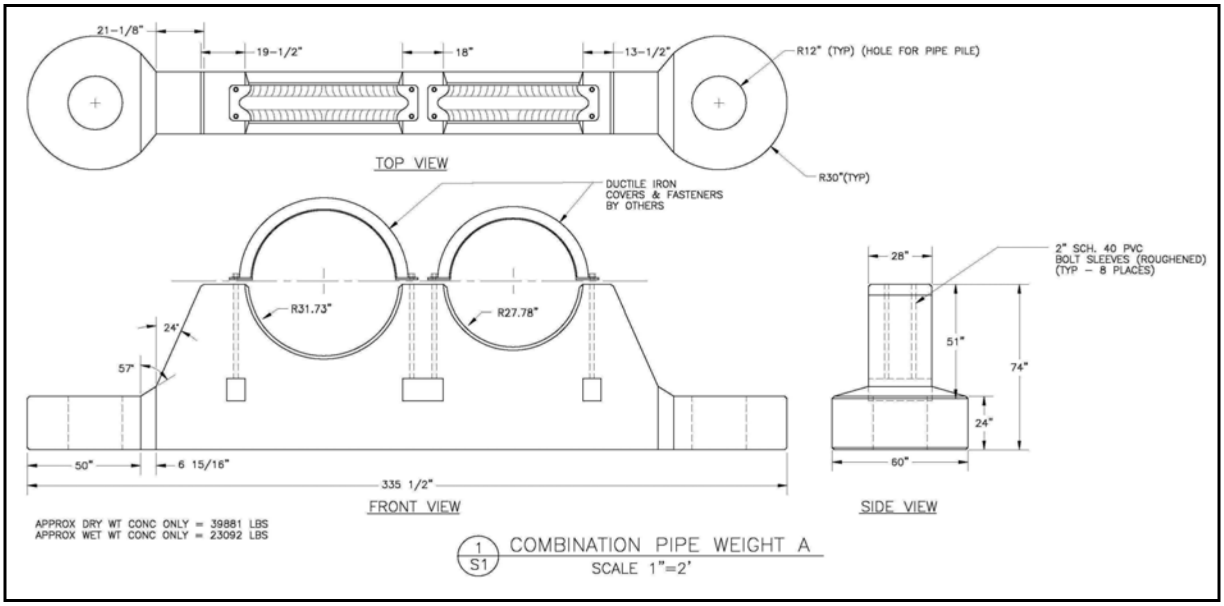

Figure 2-14: Design of Shallow Water Combination Collars
(Source: Makai Ocean Engineering, Inc.)

As can be calculated from Figure 2-14, the footprint of the combination collars is about 76 square feet per collar. Thus, the 89 combination collars between the breakout point and the end of the diffuser would cover approximately 6,788 square feet of substratum.

Beyond the end of the diffuser, shallow water single pipe collars would be used (Figure 2-15). These weights are designed to shed lines or chains such as barge tow cables. From 150 ft deep to 700 feet deep, 155 of these weights would be used. The footprint of these weights is about 31.7 square feet. The area covered from 150 feet to 300 feet deep would be 3,265 square feet (103 collars). The total area covered by these weights would be about 4,913 square feet.

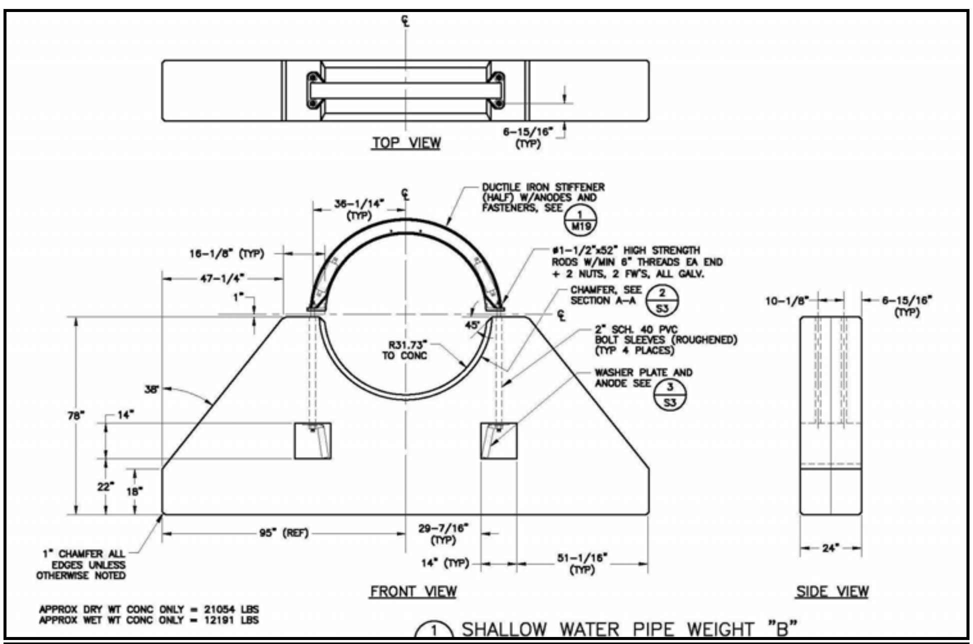

Figure 2-15: Shallow Water Pipe Weight B
(Source: Makai Ocean Engineering, Inc.)

Beyond 700 feet deep a third type of collar would be used (Figure 2-16). From 700 feet deep to 1,780 feet deep, 761 of these collars would be used. The footprint of these collars is about 8.9 square feet. The bottom area covered by these collars would be about 6,773 square feet. Several special collars would be used at the extreme terminal end of the pipe.

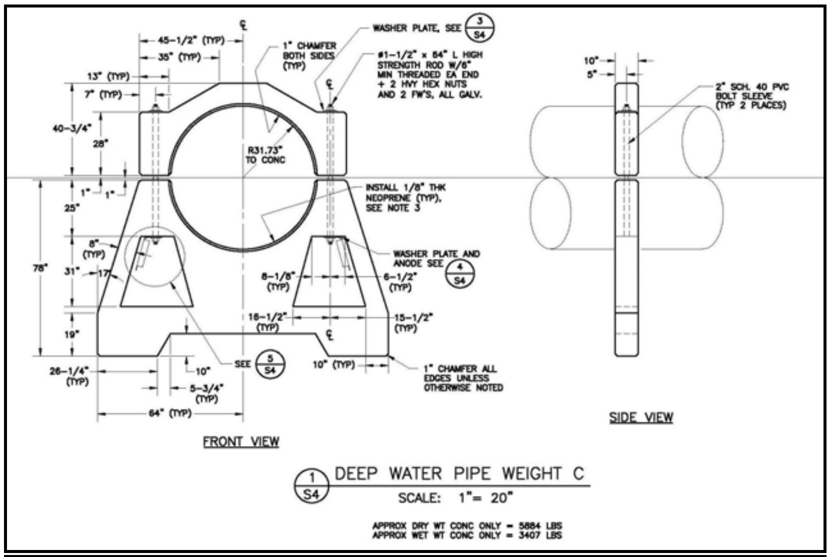

Figure 2-16: Deep Water Pipe Weight C
(Source: Makai Ocean Engineering, Inc.)

2.5.3.4 Diffuser Location and Depth

Three alternative locations for return water discharge were evaluated: Honolulu Harbor, shallow coastal waters and deep coastal waters.

2.5.3.4.1 Honolulu Harbor

Located on Māmala Bay, Honolulu Harbor is Hawai‘i's major port facility. The harbor was created by freshwater flows from Nu‘uanu Valley which inhibited coral growth within a small reef basin and cut several channels through the surrounding reef. The main channel, which was the deepest, was flanked to the west by shallower outlets. Between these outflows rose occasional spots of earth and coral - the beginnings of Sand Island. Of significance, the harbor water is used by HECO as a heat sink for condenser cooling of its Honolulu Generating Station, as well as waste discharges. The Honolulu Generating Station is permitted (NPDES clean water permit #HI0000027) to discharge effluent in the quantities shown in Table 2-1.

Table 2-1: Hawaiian Electric Company Honolulu Generating Station Permitted Discharges to Honolulu Harbor

Operation	***Average Flow***	***Description***
Condenser Cooling	187 MGD	Ocean Discharge
Turbine Condensate	20,000 GPD	Neutralization
Boiler Blowdown	15,000 GPD	Neutralization
Misc. Low Volume Waste (intermittent)	24,000 GPD	Neutralization

Operation	Average Flow	Description
Treated Metal Cleaning Waste (intermittent)	65,000 GPD	Chemical Precipitation and Neutralization
Stormwater (intermittent)	36,000 GPD	---

(Source: DOH Permit Files)

At 44,000 GPM, or about 63 MGD, the HSWAC return seawater flow would be about one-third the volume of the HECO discharge to Honolulu Harbor. Discharge of HSWAC return seawater into Honolulu Harbor would be most convenient, and would have the potential for considerable system cost savings, if adequate dilution of the return water was possible.

Two approaches, flux analysis and temperature analysis, were taken in order to estimate the achievable dilution in the harbor. Considering Honolulu Harbor as a discrete water body, estimates of the significant fluxes were made (tidal flush and streamflow) and achievable dilution implied. The expected level of dilution was found to be 6.2.

Using technical data and permit compliance records available for the aforementioned HECO discharge, an approximation of the achievable dilution was deduced. Specifically, temperature measurements distributed spatially within the zone of mixing were used in conjunction with ambient values and discharge values to derive a relationship in terms of mixing. From the data analyzed, the lower and upper bounds of dilution were 2.9 and 21, respectively.

The results of the two initial mixing analysis methods are in close agreement; an approximation of the achievable dilution within the harbor is likely to be in the bounds 2.9 to 21. This implies discharge into the harbor could result in exceedances of water quality standards for nitrate + nitrite, ammonia, dissolved oxygen and potentially for temperature. Initial analysis, therefore, indicates the dilution requirement cannot be met and therefore returning seawater to Honolulu Harbor is not considered feasible.

2.5.3.4.2 Shallow Coastal Waters

Corals cannot tolerate temperatures of less than 64°F for extended periods of time. The temperature of the return seawater will be <58°F under most operating conditions. Owing to the potential impacts of this cold discharge water on coral (and other marine organisms), return seawater discharge into shallow coastal waters was eliminated from further consideration.

2.5.3.4.3 Deep Coastal Waters

The return seawater, while warmed somewhat from its temperature at the intake location, would still be relatively low in temperature and dissolved oxygen content and high in dissolved macronutrient concentrations compared with coastal waters. A zone of mixing would be required to permit discharge of waters not complying with ambient water quality standards. The Preferred Alternative is to discharge the return seawater through a diffuser situated at 120-150 feet deep. To optimize the diffuser design and understand how the plume of returned seawater would behave, two computer models were used. The assumptions used in the modeling were:

- a 54-inch return seawater pipe would extend from the tunnel breakout point to 150 feet deep;
- the flow rate from the diffuser would be 44,000 gallons per minute (gpm);
- the lowest return temperature (worst case) would be 53°F;
- the ambient temperature of the receiving water would be 77°F;
- the density of the return water would be 64.09 lb/ft^3 and that of the receiving water 63.88 lb/ft^3;
- the roughness factor of the bottom would be 0.05;
- the ambient wind speed would be 11mph;

- a 25-port diffuser section would extend from 120-150 feet deep (a diffuser length of approximately 400 feet);
- the diffuser would be oriented parallel to the intake pipe (i.e., perpendicular to shore);
- the diffuser ports would be vertically facing and equally spaced (approximately 15 feet on centers); and
- the diffuser ports would be basic orifices (rounded) in the pipe wall and 8 inches in diameter.

The first modeling effort used CORHYD[15] to optimize the diffuser design. It was determined that the flows through the diffuser as specified above would be quite well balanced; only about a 10% variation in flow rate would be experienced along the diffuser. The greatest port velocity, 11.7 feet per second (fps), would be at the port farthest from shore, and the smallest port velocity, 10.5 fps, would occur at the port nearest shore. The design of the diffuser is shown on Figure 2-17.

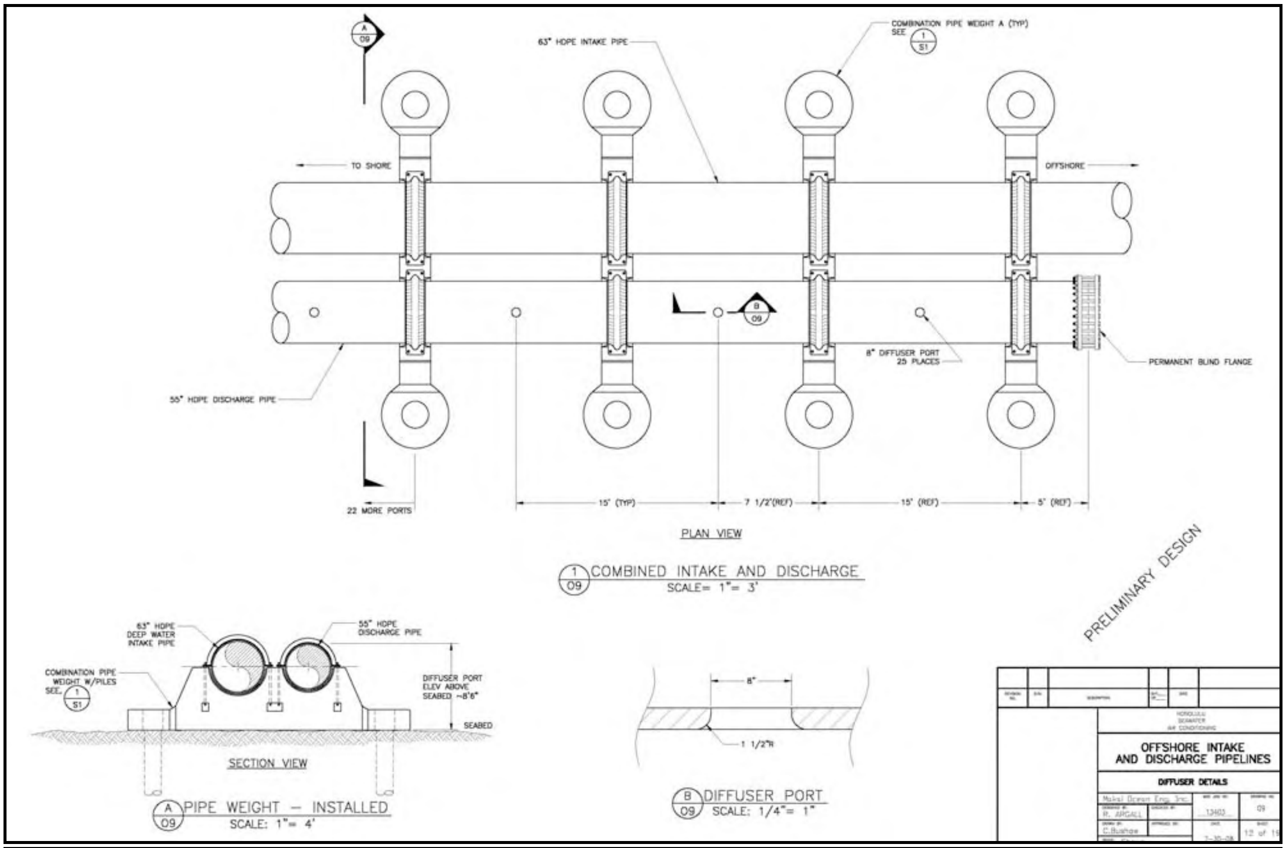

Figure 2-17: Diffuser Design
(Source: Makai Ocean Engineering, Inc.)

The differences between the ambient water quality at the preferred diffuser location and that of the return seawater were compared in light of the water quality standards in HRS Chapter 54 for wet open coastal waters to determine how much dilution would be required in the zone of mixing. Interestingly, the parameter that requires the greatest dilution is not temperature, which requires a dilution of only 18, but nitrate+nitrite, which requires a dilution of 100.

[15] The CORHYD computer program has been developed for the calculation of velocities, pressures, head losses and flow rates inside the diffuser pipe and, especially, at the diffuser port orifices to analyze and optimize diffuser design alternatives as well as existing diffuser configurations for different and varying discharge and ambient conditions.

The second modeling effort used CORMIX[16] to analyze the plume of return seawater from the discharge diffuser. Three different current regimes were modeled: low current (0.16 fps), mean current (0.46 fps), and high current (2.0 fps). The conclusions were as follows:

- The design of the diffuser facilitates significant near-field initial mixing of the return water for all current cases considered.
- The discharge near-field behavior is dominated by the negative buoyancy of the plume. Surfacing of the plume (at a low dilution) is not anticipated; after initial mixing, the plume will have a tendency to sink.
- Some plume-seabed interaction is anticipated in the immediate vicinity of the diffuser, however, significant initial dilution implies plume properties would be close to ambient when the seabed is encountered by the plume. Within a few meters from the centerline of the diffuser the dilution would be sufficient to meet water quality standards for temperature, a characteristic of the return seawater that may affect benthic communities.
- Under low current conditions, port velocity of the diffuser would provide good initial mixing, but the weak ambient flow would allow significant upstream intrusion of the plume. This is presumed to be acceptable, as the zone of mixing would not be directionally restricted. The required dilution of 100 would be reached within 148 feet of the diffuser centerline.
- Under high current conditions, the initially mixed plume would be rapidly advected away from the diffuser, and the plume dispersed rapidly by the turbulent energy associated with the high flow. The required dilution of 100 would be achieved within 59 feet of the diffuser centerline.
- Under mean current conditions the required dilution would be reached within 128 feet of the diffuser centerline.

2.5.3.5 Diffuser to Intake

Beyond the end of the diffuser, the deep seawater intake pipeline would be installed along a carefully selected route and terminate with an elbow fitting at a water depth between 1,600 and 1,800 feet. Figure 2-18 shows the nominal route with an intake depth of 1,770 feet.

[16] CORMIX (Cornell Mixing Zone Expert System) is a USEPA-supported mixing zone model and decision support system for environmental impact assessment of regulatory mixing zones resulting from continuous point source discharges.

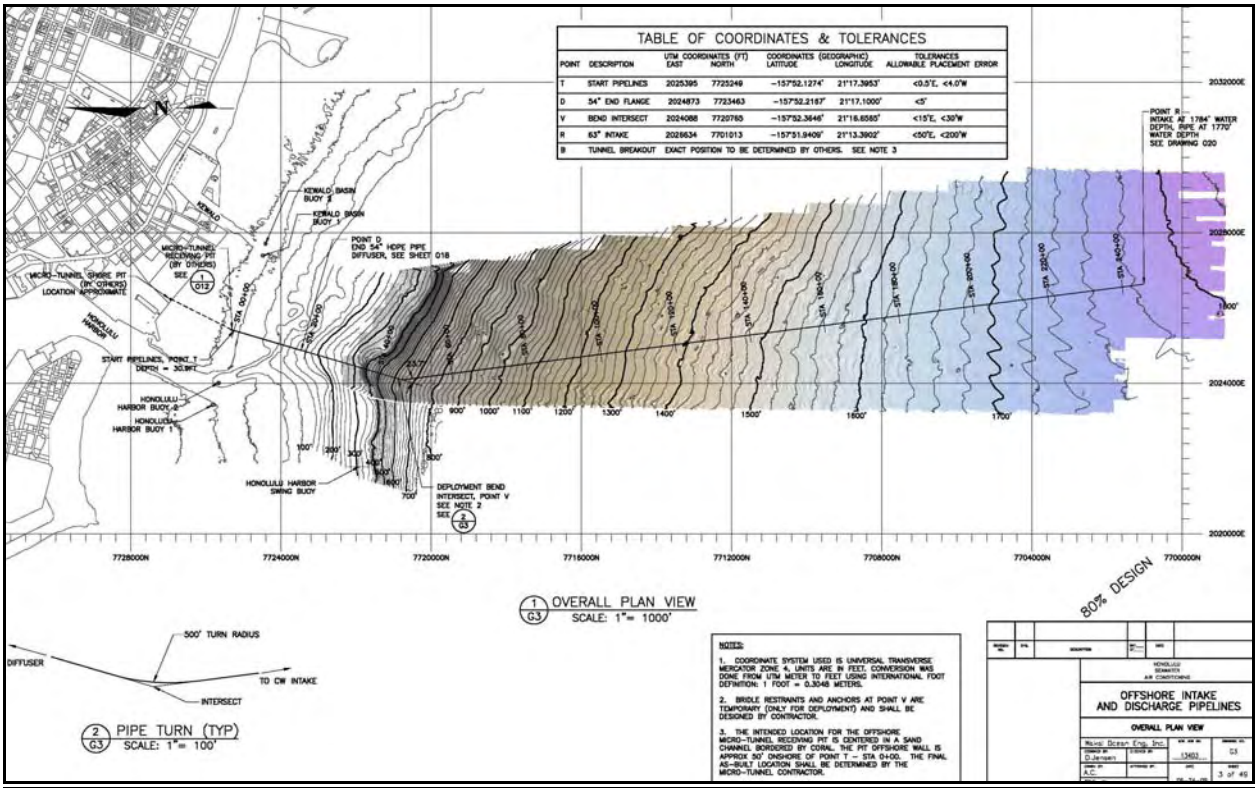

Figure 2-18: Offshore Pipelines Route
(Source: Makai Ocean Engineering, Inc.)

The selection of the terminal depth was a critical system criterion. The economic feasibility of the project depends on providing seawater cold enough to necessitate little if any supplemental chilling of the distribution water. Ideally this temperature would be approximately 42°F, or less, for a chilled water delivery temperature of 44°F, however, there is an economic trade-off between installing a longer, deeper pipe to access colder seawater and providing some supplemental chilling of the distribution water. Further, owing to friction losses, a longer pipe also provides less seawater flow due to suction pressure limitations of the HDPE pipe, and could thereby provide less cooling capacity although colder water could be reached. For the HSWAC project, this decision was driven substantially by the bathymetry offshore of Honolulu and the unit cost of fabrication and deployment of the intake pipe. Beyond about 1,000 feet deep, the bottom slope flattens considerably compared with the relatively steep slopes seen at shallower depths. Additionally, it was desirable to minimize temperature fluctuations associated with tidally-driven internal waves in Māmala Bay. Preliminary system analysis and optimizations by Makai Ocean Engineering (2004, 2005a, 2005b) based on levelized lifetime costs showed a relatively flat optimum for intake depths between 1,600 feet and 1,800 feet with average seawater temperatures varying between 44°F and 45°F. Initially an intake depth of 1,600 feet with an average seawater temperature of 45°F was selected. Subsequent evaluations have shown that a deeper intake depth may be operationally desirable. The final depth of the intake remains unresolved. It is primarily an economic choice; the environmental impacts would not be significantly different for any intake within this depth range. The economic trade-off is that a deeper intake would increase capital costs for additional pipe lengths and installation, while a shallower intake would increase operational costs because additional supplemental cooling of the slightly warmer water would be required. The benthic conditions are not significantly different between 1,600 and 1,800 feet deep.

Below depths where cables could snag the anchors, a different design would be used. In this version, the concrete collar is split allowing the two halves to be bolted onto the pipeline. The heavier bottom would keep the pipeline stable during deployment and help to prevent any roll during installation. The anchors would support the pipeline above the seabed to reduce the hydrodynamic forces on it.HDPE pipelines are limited in maximum suction. Over time, pipelines can oval and eventually collapse if too high a suction pressure is applied. In order to increase the suction capability of this pipeline, ductile iron stiffeners would be added to the outside of the pipeline. Each stiffener would be coated and additionally protected with zinc anodes. Figure 2-19 illustrates similar stiffeners and anchor collars in place on a floating pipeline.

Figure 2-19: A 63-inch Pipeline with Ductile Iron Stiffeners and Anchor Collars
(Source: _Makai Ocean Engineering, 2005a)

2.5.3.6 Staging and Assembly of Offshore HDPE Pipelines

The HDPE pipes (intake and return) would be constructed on-shore from 40 to 80 feet long segments. A staging area of approximately 18 acres near the shore would be temporarily required to store pipe, concrete anchor blocks and other components, and to fuse the pipe lengths into longer segments.

The pipe segments would be fused together into longer (~3,300-feet) segments, and launched directly as fused. Concrete anchors and stiffening rings would be added to the pipe from a barge while the pipe sections float in the staging area. These floating segments would be stored (moored) in the water pending completion of all segments. Final assembly of the pipe would be done by connecting the segments by lifting the ends slightly above the water, removing the blind flanges, and bolting the flanged ends together.

Several potential locations for the staging area were investigated, including Kalaeloa Harbor (Barbers Point), Ke‘ehi Lagoon, Kaneohe Bay, and Moloka‘i Harbor. The latter two locations were evaluated and rejected for the following reasons:

- Kaneohe Bay: This large bay on the windward side of O‘ahu is well protected, but is an intensively used recreation area, typically has many recreational vessels present, is a popular dive location, has many shallow patch reefs, and is the home of the Hawai‘i Institute of Marine Biology. Using this bay could inconvenience users and is not likely to get community acceptance.

Furthermore, access to an appropriate shoreside staging area might be difficult and maneuvering the fully-assembled pipeline could also be difficult.

- Kaunakakai Harbor: The harbor on Molokaʻi was considered but is too small for the staging equipment. In addition, it is far from the final deployment area, which would significantly increase costs and risks related to towing the pipeline.

Use of an area within Kalaeloa Harbor or Keʻehi Lagoon was discussed with representatives of the Harbors Division of the State Department of Transportation. Each of these sites has the advantage of being very close to the heaviest industrial infrastructure in the Hawaiian Islands on the south side of Oʻahu. The curved northern shoreline of Kalaeloa Harbor was evaluated for suitability for pipe assembly and mooring. This area would allow assembly of pipe sections, each of which is approximately 3,300 ft long. About five to eight such pipe sections would be necessary to complete the deep water pipe assembly. The subject area is currently unused. Shore protection has been installed in the northern corner of the harbor to protect it from surge motion during the winter months. Further discussions with the Harbors Division, however, indicated that placing obstructions, such as pipeline sections, in this harbor could constrain the movement of large ships, and its use for pipeline staging would be incompatible with its primary function.

The best location for the staging area would be along the shore of Keʻehi Lagoon, with completed sections of the pipeline stored in the adjoining channel. Figure 2-20 illustrates the channels in Keʻehi Lagoon that could be used for pipeline assembly and storage. Four channels have been dredged in the lagoon and each has a different level of existing use. The characteristics and uses of each channel are listed below:

- Channel A: parallels Lagoon Drive, roughly 1.55 miles long, dredged to 12 ft, used by a single seaplane. Very few moored vessels.
- Channel B: approximately parallels the Reef Runway, roughly 1.46 miles long, dredged to 12 ft, used by jet skis. Could also be used by the seaplane. Very few moored vessels.
- Channel C: parallels Sand Island Access Road, roughly 0.92 miles long, dredged to 12 ft, widely used for small boat mooring, Keʻehi Marine Center located on shore here.
- Channel D: parallels western shore of Sand Island, roughly 0.75 miles long, dredged to 12 ft, lightly used for small boat moorings, channel at southern end is closed off - no access to ocean.

HSWAC's preferred location for a staging area would be in and adjacent to Keʻehi Lagoon Channel D. Five to eight sections of pipeline easily could be stored in this region. As the pipeline is towed out of the harbor for deployment, sections would be added and it would be maneuvered out the Kalihi channel.

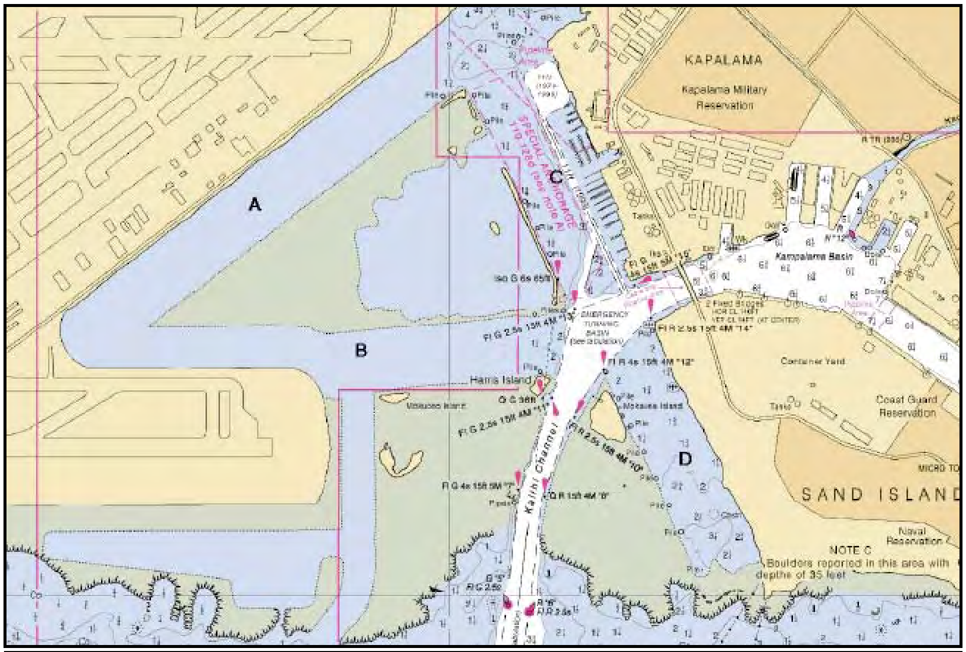

Figure 2-20: Possible Pipeline Assembly Areas in Ke'ehi Lagoon
(Source: Makai Ocean Engineering, 2005b)

Channel D would be an ideal location for pipeline assembly for several reasons:

- The area is long and, because there is no direct passage to the ocean, vessel traffic is minimal.
- There is sufficient room that the entire pipeline could be assembled from 5-8 sections.
- The deployment site may be accessed easily with a short towing distance.
- Assembly and towing out of the lagoon can be reasonably accomplished by the marine contractor.
- There is excellent access to the major center of marine construction equipment in the Hawaiian Islands.
- There is adjacent land available on Sand Island for fusing and launching the pipe sections.

A proposal has been submitted to the Land Division of DLNR for temporary (10 month) use of land on Sand Island and adjoining waters of Ke'ehi Lagoon. These sites include:

- an on-land pipe storage and assembly site on the southwestern corner of Sand Island currently occupied by four condemned baseball fields,
- an offshore pipe assembly and preparation site which would occupy what was originally a seaplane runway that extends along the western shore of Sand Island,
- and an existing unimproved access roadway that runs from Sand Island Access Road around the Sand Island Wastewater Treatment Plant to the baseball park site.

An aerial photo of the proposed staging sites identifying the primary features is shown on Figure 2-21.

Figure 2-21: Proposed Sand Island and Ke'ehi Lagoon Staging Areas
(Source: Makai Ocean Engineering, Inc.)

The boundary of the site proposed for temporary HSWAC contractor use as an on-land pipe storage and assembly area is shown in Figure 2-22. This is an area of approximately 17.7 acres and it includes the entire baseball park area with its adjoining parking lot, the improved and unimproved roadways around the baseball park, the area between the park and the water and an almost 400' long frontage on the water. According to the DLNR State Parks Division, the baseball park has not been in use for its originally intended purpose for many years. Originally, the baseball fields were supposed to be maintained by a group of volunteers from the Little League that used the fields. This arrangement did not last, and the fields fell into disrepair. Subsequently, copper wires from the sprinkler system valves were stolen, so it will take some effort now to re-establish these fields. The infield areas are grown over with weeds, and it appears that homeless people now sleep in the dugouts.

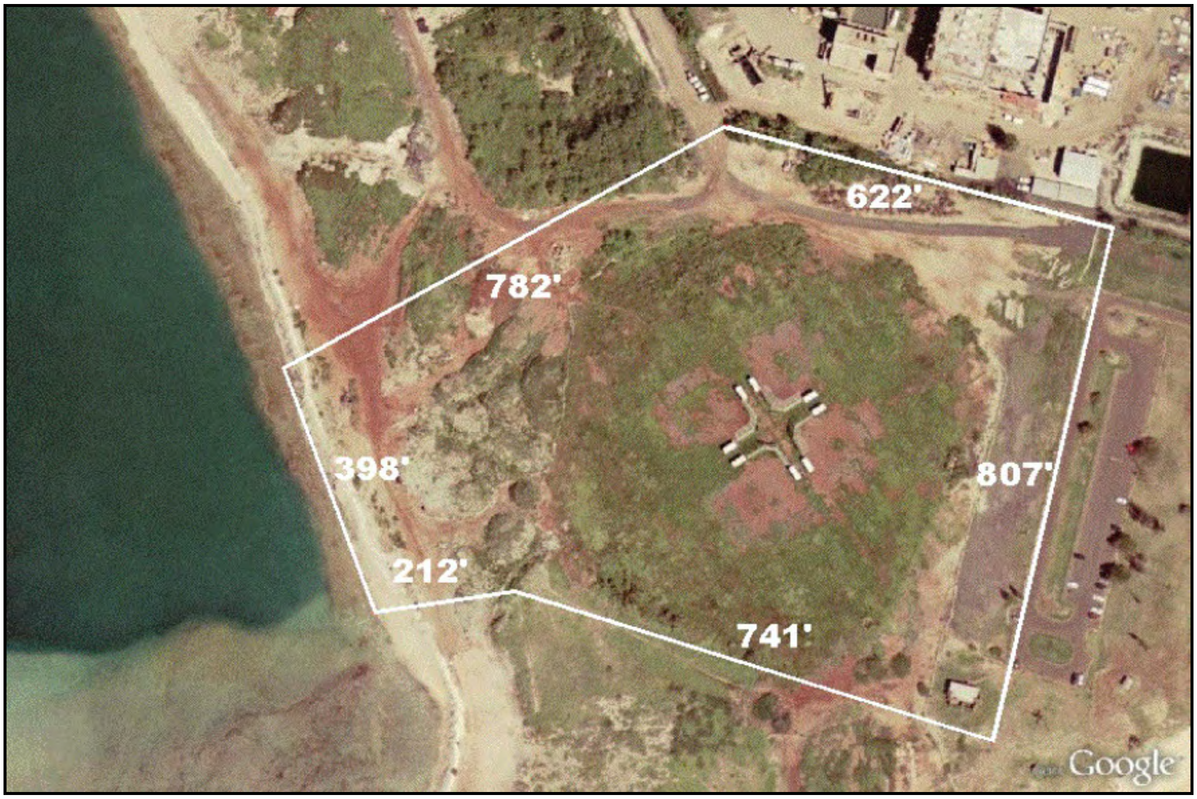

Figure 2-22: Boundaries of Proposed Sand Island Staging Area
(Source: Makai Ocean Engineering, Inc.)

In September 2006 the area between the baseball parks and the water front was the subject of a lease agreement between DLNR and the Sand Island Off-Highway Vehicle (OHV) Association. This area is one portion of a larger area that extends along the western shoreline of Sand Island and that was proposed for use as an OHV park to serve all-terrain vehicles, 4x4's and motorcycles. This group's plan was approved by DLNR, and they have been steadily progressing through their permit and environmental obligations prior to finalizing their lease with DLNR. The OHV project area abuts and overlaps the planned staging area desired by HSWAC.

As a result of the potential conflict in uses for this site, HSWAC representatives coordinated this request for a temporary staging site with Dan Quinn, State Parks Administrator, Curt Cottrell of the State Division of Forestry and Wildlife, who has worked closely with the OHV Association to establish the Sand Island OHV Park, and with Reid Shimabukuro, President, Sand Island Off Highway Vehicle Association. The OHV group has indicated that they do not have immediate plans to develop the "OHV 4x4 & ATV Sand Course." Their immediate development plans will end at the "OHV 4x4 Road Course. " Therefore, they do not have any objection to HSWAC's marine contractor temporarily using the area and cutting passages through the existing dredge spoil mounds for access to the waterfront with the understanding that the site will be re-established in equal or better condition upon the demobilization of HSWAC's contractor.

The proposed offshore staging area consists of one portion of the Ke'ehi Lagoon seaplane runway channels dredged many years ago. To our knowledge the particular portion of the runway system that is proposed for use as an in-water staging area has not been used by seaplanes at any time in the last 30+ years. Other uses of this particular seaplane runway section have developed over the years. The area mainly serves as a practice area for outrigger and one man canoe paddlers as well as for some small sail boats. At the northern end there are several individual residences that have been built near the vertex of the coral shelf where this seaplane runway meets the Kalihi Channel. To accommodate the boat traffic to and from these residences, HSWAC proposes to set back the in water staging area from the western shoreline by about 200 feet and by at least 150 feet from the eastern shoreline. This would allow adequate space for small boats to easily access the small docks built in front of the residences on the western side of the channel. The overall in-water staging zone with approximate dimensions is shown in Figure 2-23. The area inside the yellow bordered zone equals about 49.9 acres.

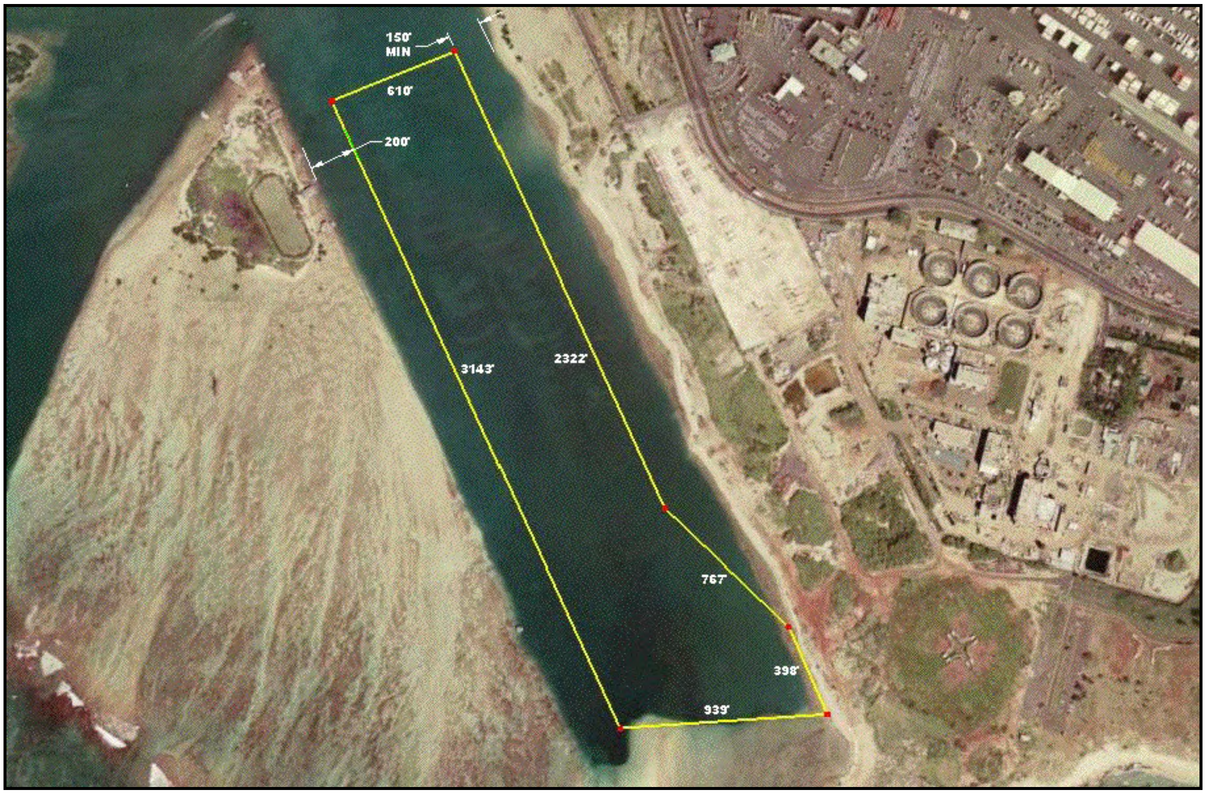

Figure 2-23: Boundaries of Proposed Ke'ehi Lagoon Staging Area
(Source: Makai Ocean Engineering Inc.)

In order to access the baseball park staging area with large trucks and other contractor equipment, it would be necessary to have a roadway to the site other than the vehicle entrance through the Sand Island State Park. An unimproved roadway already exists that leads from the northwest corner of the baseball fields around the Sand Island Wastewater Treatment Plant to an established entry onto Sand Island Access Road.

This road has apparently been used for contractor ingress and egress in the past, and the open space on either side of this road near the entry to Sand Island Access Road is currently used by a microtunneling contractor, Frank Coluccio Construction Company (FCC). FCC has stockpiled pipe and unused equipment on either side of this road over about the first 500 feet of the roadway closest to Sand Island Access Road. Figure 2-24 shows the approximate zones where FCC equipment is stored and that the overall length of this access road is about 1,576 ft. An approximately 20-ft wide roadway would be needed by the HSWAC contractor to provide adequate room for large trucks and equipment to pass safely from the park to Sand Island Access Road. It is not anticipated that this would significantly impact FCC's current use of the sites adjacent to this access roadway.

Figure 2-24: Access Road Requested from Sand Island Access Road to Staging Area
(Source: Makai Ocean Engineering, Inc.)

The exact use of the proposed staging site would be determined by the marine contractor who is hired to carry out the assembly and installation of the marine pipelines. However, from past deep water pipeline projects of a very similar nature, it is possible to define and describe the range of activities that would take place on land and in the adjacent waterway. These activities in roughly chronological order are summarized as follows:

1. 63" and 54" HDPE pipe in 50' lengths would be stored on the baseball field areas where the ground is flat and has been previously graded. Pipe would most likely be trucked in from one of the commercial piers in Honolulu Harbor. The access road shown in Figure 2-24 would be used for truck traffic to and from the staging site. Pipe would be stored in tightly spaced rows taking up much of the open baseball park surface. Figure 2-25 shows a similar pipe being unloaded and stored.
2. The Contractor would set up a mobile office trailer on the site to use as his base for construction operations.
3. Various containers of tools and equipment needed to carry out his work would be brought to the site.
4. The Contractor would have to widen the existing passages in the dredge spoils that separate the baseball park from the shoreline in order to allow pipe transport to the water from the park. This would most likely be done by a front end loader and/or bulldozer. This would probably involve movement of less than 50 cubic yards of material as existing passages exist between the mounds down to the water (see Figure 2-26).

Figure 2-25: Large Diameter HDPE Pipe Being Unloaded and Stored at Kawaihae Harbor
(Source: Makai Ocean Engineering Inc.)

Figure 2-26: Proposed Truck Circulation Routes Within Staging Area
(Source: Makai Ocean Engineering, Inc.)

5. An area between the shoreline and the spoil mounds would be cleared of old concrete piles and debris, and an HDPE fusion machine together with pipe support rollers would be set up in this area. The fusion machine would be used to join the HDPE pipe sections into continuous lengths. Figure 2-27 and Figure 2-28, respectively, show pictures of a fusion machine set up to fuse 63-inch diameter pipe for another deep water pipeline project and the roller bed that is set in place to guide the air filled pipe into the water. The air-filled pipe with ends closed by flange plates would float very high in the water.

Figure 2-27: HDPE Pipe Fusion Operation
(Source: Makai Ocean Engineering, Inc.)

Figure 2-28: Roller Bed to Launch HDPE Pipe into Water
(Source: Makai Ocean Engineering, Inc.)

6. HDPE pipe would be transported from the ball park down to the fusion machine. Pipe would be fused into lengths up to approximately 3,000 feet long and pulled out onto the waterway as they are fused. The exact length of fused segments would be a function of the contractor's plan and lengths permitted by State DOT authorities.
7. Floating sections of pipe would be temporarily moored in the seaplane runway. Moorings would be formed using steel pipe piles temporarily driven into the bottom or with anchors and lines. Traffic by public boaters would need to be restricted on this waterway during pipe assembly operations (see Figure 2-29).

Figure 2-29: Stored Floating Pipeline with Stiffeners and Anchor Weights Being Attached
(Source: Makai Ocean Engineering, Inc.)

8. Assembled pipe segments would be hydrostatically tested while floating on the waterway. This would be done before pipe ballast weights are clamped onto the pipe segments, so pipe segments would continue to float even when filled with water.
9. Using a crane barge, pipe ballast weights and stiffeners would be mounted on the pipe while it is stored in the waterway. Precast concrete ballast weights would either be loaded on barges and towed in from Barber's Point Harbor, or trucked in and loaded onto barges from a crane at the site. To mount the pipe weights and stiffeners onto the pipes, the lower halves of pipe weights and stiffeners would be lowered into the water and then lifted up from below the pipe. The top half then would be lowered down from above and the pieces bolted together. This work would be done from a crane barge with an elevator assembly mounted on one side. The air filled pipe can support all the weights and stiffeners when floating on the waterway.
10. Weights and stiffener bolts would be re-tightened several times before deployment. This would be accomplished from a small boat or by walking down the length of the floating pipe segments.
11. Other pipe attachments and end flange preparations would be installed while the pipelines are floating in the waterway. Several crane barges, flat barges and work boats would be moored in the waterway during staging operations, especially as final preparations commence.
12. The final task before deployment would be assembly of the floating pipe segments into one continuous length. A representation of this process is shown in Figure 2-30. This would occupy a continuous period of 36-48 hours and would involve mooring a barge on one side of the Kalihi Channel and pulling the pipe segments into a large arc in order to join the flange joints at this barge (see Figure 2-31). Multiple barges and work boats would be used to hold the pipe into the bent shape and to restrain the offshore pipe that would lengthen as each new segment is joined. The offshore end of the pipeline would extend out the channel into the open ocean (see Figure 2-32).

Figure 2-30: Plan for Connecting Pipe Segments and Towing From Ke'ehi Lagoon
(Source: Makai Ocean Engineering, Inc.)

Two weeks prior to initiation of the deployment activities, notices of the operations would be given to the harbormasters to post or distribute, and a Notice to Mariners published. During the deployment, contractor supplied escort (picket) boats would be on site throughout the pipe joining and towing operations to divert boaters who are curious or are entering or leaving the harbor via the Kalihi Channel. Escort boats would have a large sign notifying boaters to tune to VHF channel 72 or 16 for instructions. Escort boats would guide boaters safely around the marine operations.

Figure 2-31: Assembling Flange Joints on Elevator Platform on Crane Barge
(Source: Makai Ocean Engineering, Inc.)

Figure 2-32: Fully Assembled NELHA 55-inch Pipe Being Towed From Kawaihae Harbor
(Source: Makai Ocean Engineering, Inc.)

2.5.3.7 Installation of Offshore HDPE Pipelines

The deployment methodology for the offshore portions of the HDPE pipeline has been developed and tested in previous projects and is specific to the nature of the HDPE pipe and available handling equipment. All but a small length of the intake and return seawater pipes seaward of the breakout point (the spool sections connecting them to the microtunneled segments) would be deployed using the following methodology.

Deployment of the pipes would be done once all the segments are assembled. The pipelines, with weights and stiffeners attached, would be towed into place, the near shore ends temporarily secured to allow the pipelines to be put under tension, and the pipelines sunk in a controlled manner from shallow to deep water by controlled flooding. At least three tugs would be used to maneuver the pipelines to their final position. As the pipelines would be deployed off the south side of O‘ahu, deployment would ideally be scheduled during the winter or early spring, when large southern swells are absent. The pipes would be pulled into place in a single day and sunk at night to take advantage of the HDPE pipe's superior strength properties when it is cool and not exposed to the sun.

The deployment process is illustrated in Figure 2-33. The air-filled and anchor-weighted HDPE pipelines would be floated on the surface of the ocean and controllably submerged by flooding from the shore end and venting air on the offshore end. At all times, the pipeline configuration would be in equilibrium with the air-filled portion supporting the flooded section. To avoid kinking the pipelines at the two bends, the seaward ends would be pulled (90 to 100 tons tension) by a tug boat during deployment, while the landward ends would be held in place by attachment to anchors or piles driven closer to shore. The positions of these anchors or piles would be along predetermined angles from the pipe ends, and at least 100 feet shoreward of the pipe ends. The precise location of the anchors or piles would be adjusted to avoid corals or other significant biota. A remotely operated vehicle (ROV) would be used to monitor the deployment.

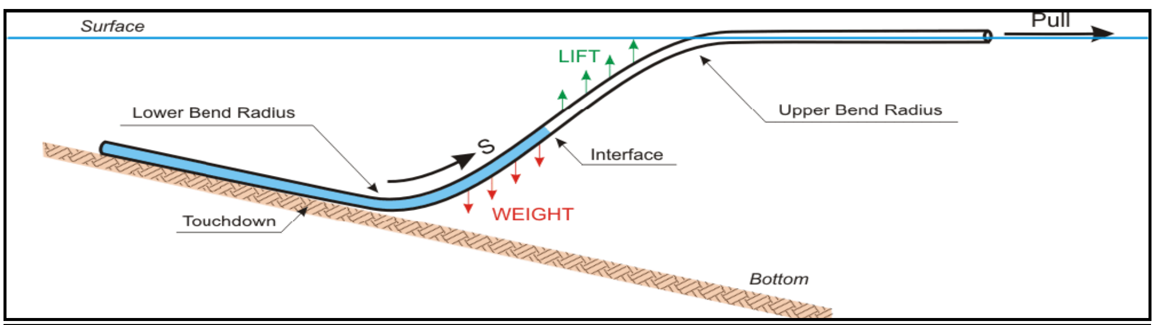

Figure 2-33: Controlled Submergence of an HDPE Pipeline
(Source: Makai Ocean Engineering, 2005a)

Because of the size of the intake pipe (length and diameter), the volume of water to initially fill it would be very large. At a deployment flow of 5,000 gpm, the total flooding would take eight hours. At least another eight hours would be required for contingency delays and lowering the end of the pipe. Once the pipeline is completely flooded, the blind flange would be removed from the end of the pipeline and the end would be lowered to the seafloor at the full intake depth. The ROV would inspect the location and condition of the pipeline prior to release of the lowering cable.

The nearshore ends of the pipelines would be close to but not connected to the end of the microtunneled segment of the route. A spool piece would be prepared to fill the gap and flange bolted in place by divers.

Once the pipelines are in place, their location would be added to the appropriate nautical charts of the area. Large ocean-going vessels would be prohibited from anchoring on the pipelines, but there would be no restrictions on recreational uses of overlying waters. Small boat anchors would not harm the pipelines.

2.5.3.8 Operation

The cold seawater from the intake pipe would pass through the cooling station and, in the heat exchangers, receive heat from the fresh water distribution loop. Warmed water would be returned to the ocean through a diffuser. A description of the modeling that was done to optimize the design of the diffuser and the characteristics of the resultant return seawater plume are provided in Section 4.7.2. A negatively buoyant plume would be formed at the discharge depth. The maximum flow rate through the intake pipe would be 44,000 gpm. The average temperature of the intake water would be approximately 44-45°F. The return mass would equal the intake mass in this open loop system. (Small changes in volume would occur as a result of differences in density at different temperatures and pressures.) The temperature of the return seawater would be approximately 58°F at peak demand, but this may vary with system demand, customer installations, and distribution pipe insulation.

2.5.3.9 Repair

The economical service life of the pipelines is minimally 25 years. By incorporating appropriate safety factors into the pipe design, installing pipe stiffeners, and by maintaining operating flow rates (pressure losses) below design guidelines, the useful service life of these pipes is expected to be in excess of 75 years. HDPE pipe is used in marine applications due to its strength, ruggedness, ductility, abrasion resistance, impact resistance, corrosion resistance and biofouling resistance. These qualities make it possible to install a marine HDPE pipe by the controlled submergence process described above. During this installation process the pipe would experience combined pressurization, tensioning and bending that would constitute the most extreme loads the pipe would see at any time during its entire service life. Therefore, if the pipe survives the deployment process, the chance of pipe failure while in service is very low.

While the loads on the pipe are very low during operation, as an exposed submarine pipeline there is always the chance that a large vessel anchor could make contact with the pipeline and cause damage. Also the manufactured fittings in shallow water that are used to make the final connection between the offshore pipe and the tunnel shore crossing pipes are generally more susceptible to damage due to the large miter bends involved in their fabrication. In general, both of these types of damage are repairable and the repair process for each is discussed below.

Anchor Damage: Small vessel anchors generally do not have the weight nor does the vessel have the power to damage the pipeline. A large anchor (from a freighter or large Navy Vessel – Destroyer or larger) contacting the pipeline will not necessarily damage it, but the types of damage it could do include: puncture damage or point load damage (crimping or over bending) from catching on the pipe and then dragging it to one side. The chance of such damage causing the pipe to part is extremely small, as the force needed to shear the very heavy wall HDPE pipe is beyond the capacity of most ships. If the pipe were damaged, steps involved in the repair include:

1. *Inspection:* If the damage is at diver depth (150 feet deep or less), a diver would be used to survey the damaged portion of the pipe and provide photographic or video documentation. If the damage is deeper than diver depth, a remotely operated vehicle (ROV) would provide the same inspection service. Locally operated ROV's are available for work down to 300 ft depth (it is unlikely that anchor damage would occur deeper than that) or an inspection class ROV could be air freighted in from the West Coast on short notice.
2. *Puncture Damage:* If some form of cut or puncture occurred in the pipe wall from a sharp high force contact with an anchor, the repair would generally involve installation of a repair coupling. Large repair couplings are fabricated by several major mainland manufacturers and could be special ordered for delivery within a week or two. While the coupling is on order, it may be possible to temporarily plug the damaged area by winding sheet metal and/or neoprene around the damage and tensioning it with wide polyester slings. Thus, the intake pipeline could continue to be pumped until the proper repair parts are brought in.

3. *Point Load Damage:* If the pipe were dragged to one side with a very large point load, this could cause the pipe to crimp or buckle locally. Such damage would require inspection as discussed above. In all likelihood the repair would involve correcting any remaining misalignment of the pipe and then reinforcing the damaged portion of the pipe to allow full design flows through the pipe once again. Correcting the misalignment would be accomplished by installation of slings (diver depth) or use of a specially designed grapnel to make an attachment to the pipe and pull it back to its original alignment. An ROV or diver would help guide this process. This would only be done if it was essential to repair the damaged portion of the pipe. Once the pipe was realigned, reinforcement of the damaged portion of the pipe could be done by external stiffeners bolted onto the outside of the pipe. These would be the same type of stiffeners that are applied to the pipe to allow greater long term suction loads to be applied. During the repair process, intake water flows may have to be reduced, but would probably not have to be shut down altogether.
4. *Installation of Repair Hardware:* If the repair is deeper than divers can work while breathing compressed air, it is likely that diving operations on mixed gases (Helium-Oxygen) would be needed to complete the final repairs. Divers and equipment from the West Coast may have to be flown in if local dive contractors cannot work at such depths. If the repairs are done in shallower waters local divers can be used to install the repair coupling or the stiffener rings as needed. Dive times for installation of either type of hardware would be relatively short as the pipeline is held off the bottom by its pipe weights, so full access to all sides of the pipeline is possible.
5. *Environmental Interaction:* Neither of the above types of repairs would involve significant environmental impacts. There would be some contact made with the seafloor by divers, their tools and repair parts, and there may be some dragging of pipe weights along the bottom, but this would produce little in the way of sediment plumes as the weights would slide or be lifted across the bottom. As mentioned above, these repairs could probably be conducted while the intake pipeline continues to operate, perhaps at somewhat reduced flows.
6. *Time Required:* The time required to achieve the above described repairs would probably be a week or so for initial inspection and temporary patch, then two months to allow parts to be flown in, exact work scope defined, contractors hired, and work performed. Actual time on the water to perform these repairs would be a week or less.

Miter Fitting Damage: During the 2006 earthquakes that occurred in waters off the Big Island, two of the NELHA HDPE pipelines (40-inch and 18-inch) experienced miter elbow damage in shallow near shore waters. In both cases the damage was repaired by simple replacement of the flanged mitered joint with a replacement unit of the same dimensions. Replacement was accomplished by divers breathing compressed air.

1. *Mitered Fitting Improvements:* The HSWAC pipelines would have no mitered fittings at depths deeper than diver depths. The mitered fitting damage on the NELHA pipelines occurred on pipelines that were installed over 20 years ago. Since that time the HDPE industry has developed new standards for mitered fittings that require heavier wall pipe segments and improved manufacturing and testing techniques to be used. This makes it more unlikely that such damage would occur on the HSWAC pipelines. As evidence of this, the 55-inch NELHA intake pipeline installed in 2001 also uses shallow offshore mitered fittings, and none of these were damaged by the earthquake. These fittings were fabricated in accordance with the new standards.
2. *Repair of Miter Fittings:* If damage to a mitered fitting did occur, this would be repaired by divers using primarily hand tools, pneumatic tools, underwater lift bags and perhaps a winch or crane off a barge or workboat. The replacement of a fitting would have to be carefully planned to minimize the pipeline's operational downtime. As with puncture damage discussed above, it is very likely that some form of temporary patch could be applied to the pipe until the replacement fitting is manufactured and brought in. This was done on the NELHA 40-inch pipe, which continued to

operate except during the actual fitting replacement operation. There would be very little disturbance of the seafloor during this operation with the exception of some contact made with the seafloor by divers, their tools and repair parts.

3. *Time Required:* The time required to achieve the mitered fitting repairs would probably be a week or so for an initial inspection and temporary patch, then two months to allow parts to be flow in, exact work scope defined, contractors hired, and work performed. Actual time on the water to perform these repairs would be a week or less.

2.5.4 Cooling Station

The seawater circulation system and the fresh water distribution system would come together in a cooling station where the heat exchangers, seawater and fresh water pumps, and auxiliary chillers would be housed.

2.5.4.1 Cooling Station Type

A sump is needed for the seawater pumps to draw from. Two alternative types of sumps were considered: wet sump and dry sump. The design of the cooling station, its layout and footprint, is determined in large measure by the type of sump employed because of the very different land requirements of the two types of sumps, the wet sump requiring much more land area. The subsections below summarize the evaluation of sump types and the rationale for selection of the dry sump as the Preferred Alternative for the HSWAC project.

2.5.4.1.1 Wet Sump Cooling Station

Wet sumps involve excavation of some form of deep open well or pit which is subsequently filled with water. Various pump styles can be used to draw the water from the sump: vertical style well pumps can be mounted over it; submersible pumps can be lowered into it on a fixed rail system; dry-style centrifugal pumps can be mounted in a dry sump alongside the wet well. In all cases, for a wet well serving a large diameter deep water intake pipe, some form of screen or strainer box at the connection of the intake pipe in the well is needed to catch and eliminate fish or other relatively large marine organisms before they can enter the sump. It is desirable for the intake pipe to follow a slight uphill grade in its attachment to the wet sump to allow any entrained air to be naturally vented into the sump. The advantages and disadvantages of a wet sump cooling station are as follows.

Advantages of a Wet Sump Cooling Station

- Screening of large marine organisms - a single strainer box can be mounted on vertical rails to allow removal and cleaning without closing valves or shutting down pumps. A flat screen strainer can be temporarily installed during cleaning of the box.
- The wet sump lends itself to the use of any one of several pump styles: horizontal shaft centrifugal pumps, vertical well style pumps or submersible pumps.
- If the intake pipe slopes up to the wet sump, any air that comes out of solution in the long intake pipe is naturally vented.
- The wet sump may provide some flexibility in an emergency, e.g., in the event of a pump failure, a submersible pump could be temporarily installed in the sump.
- The wet sump provides easy access to the cold water for sampling, testing, and impressed current corrosion protection systems.

Disadvantages of a Wet Sump Cooling Station

- The wet sump must be deep and large, e.g., a big concrete box or large cylinder set deep in the ground. It is expensive to construct and dewater such a structure or to construct a prefabricated sump that can be installed in a wet pit.
- In addition to the construction costs, the footprint of the sump may be very large, which imposes a further cost penalty on this style cooling station.

- Because a sudden pump shutdown would not immediately stop the cold water flow in the intake pipe, a wet sump cooling station must be designed to handle the overflow water. This requires an extra large sump or some way to safely discharge this water to avoid inundation. This has substantial economic and operational impacts on the cooling station.
- The depth of the wet sump limits suction pressure on the intake pipeline; pumps can only drain the sump down to the depth of the pipe connection into the sump or to their submergence limit if the pump head is in the sump.
- A wet sump would allow a free surface whereby noncondensible gases would come out of solution (i.e., CO,) due to pressure changes from deep water to atmospheric. This previously sequestered CO, would reduce the positive carbon footprint attributed to the SWAC system.

2.5.4.1.2 Dry Sump Cooling Station

The second type of cooling station is a dry sump – direct connect type. A dry sump cooling station is constructed inside a room that is located adequately below mean sea level to allow the Net Positive Suction Head[17] (NPSH) requirements of the selected pumps to be satisfied. Therefore, like the wet sump, the exterior of the dry sump would have to provide a waterproof barrier to the entry of groundwater into the room. With direct connection to the intake pipeline, the cooling station assembly must include a suction strainer to remove fish and other marine organisms before they can enter a pump. Each seawater pump would be fitted with a strainer inside the pump room.

The intake pipe would terminate in a suction manifold that may be located inside or outside of the dry sump. This manifold would provide a fixed number and size of flanged pipe stubs for pump attachments. The direct connect pumps are usually horizontal shaft centrifugal style pumps, although custom arrangements have been devised to use submersible pumps for such a cooling station. Isolation valves are located on either side of the pump to allow removal, and check valves are located on the discharge side to allow parallel pump operation. Another pipe manifold is provided on the discharge side of the pumps and from this manifold on, the dry sump, and direct connect type cooling station is identical to the wet sump type cooling station.

For long intake pipe applications, the pipeline should be installed with a gradual upward slope to the dry sump cooling station. A vacuum pump system is needed to remove air that comes out of solution during the water's long transit up the intake pipeline. The suction headers are a convenient place to isolate and remove this air from the pipeline. The advantages and disadvantages for HSWAC of such a dry sump system are as follows.

Advantages of a Dry Sump Cooling Station

- The dry sump would require a much smaller physical plant than the wet sump, as the intake manifold and suction strainers replace the large sump.
- The depth of the dry sump only needs to be enough to meet NPSH requirements; this is less than is needed for a wet sump which must have adequate depth to draw the water down to match the losses in the intake pipe.
- No special arrangements would be necessary to accommodate water flow for a sudden sump shutdown. Water would gradually slow due to friction, and due to the greater density of the deep seawater, may reverse flow which would close the pump manifold check valves.

There are no significant disadvantages to a dry sump cooling station. Given the proposed location of the HSWAC cooling station and the limited space available at the site, a dry sump - direct connect pump arrangement would be most practical and economical for this cooling station. It would provide an overall

[17] **NPSH** for a pump is the difference between the suction pressure and the saturation pressure of the fluid being pumped. By maintaining the available NPSH at a level greater than the NPSH required by the pump, cavitation can be avoided.

lower cost and less flooding risk. Horizontal shaft centrifugal pumps with very high hydraulic efficiency are available in the sizes needed to power this type of cooling station.

2.5.4.2 Cooling Station Footprint and Layout

Given a dry-sump type of cooling station, a variety of potential layouts for the cooling station were evaluated (Makai Ocean Engineering, 2005b). To allow efficient operations, maintenance, and equipment replacement, the cooling station would have to be designed with certain physical requirements in mind, including:

- Adequate space, both horizontal and vertical, for all pumps, heat exchangers, chillers, electrical distribution panels and controls to allow easy accessibility and convenience in repair/replacement of each component;
- A means to move equipment in and out of the cooling station, heat exchanger, and chiller rooms;
- A location that allows construction of a dry sump slab about 20-feet below MLLW (pump centerline about -17 MLLW to satisfy pump NPSH requirements); and
- Avoidance of flooding due to failure of a pipe fitting or manifold or potential tsunami inundation.

A variety of cooling station layouts would satisfy most of the above stated criteria. The simplest arrangement would be on a site large enough to allow all components to be installed on one level. However, flooding would be an issue if all components were located at the level of the pumps (below mean sea level). Therefore, a single level arrangement is not feasible.

A multi-story arrangement is more practical. A two or three-story structure with pumps in the basement is the most workable. A two-story facility with pumps in the basement (30-feet below ground level) is proposed for the cooling station. Heat exchangers and chillers would be located on the ground floor. The overall space required is 30,400 square feet; 5,100 square feet in the basement and 25,300 square feet at grade if the principal electrical equipment (transformers and switchgear) is contained in the building.

Construction of the cooling station would require excavation and dewatering because the seawater pump room must extend below sea level to allow for sufficient pump suction head.

At a conceptual level, other features of this building would be:

- Electrical panels and controls could be distributed on all floors in accordance with convenience and need, or alternatively they could be located in an adjacent electrical building, lot space permitting. Flooding is an important issue relative to electrical equipment placement.
- The building would be designed to allow delivery and removal of large, heavy equipment. (Pumps weigh over 8 tons each.)
- The building floors would have high unit load ratings and would be planned assuming flooding. Incidental water would be directed to integral drainage trenches and a floor sump for removal.
- The pipelines, manifolds, and heat exchangers would accumulate condensate unless the building is air-conditioned and maintained at a low relative humidity. Pipes inside the cooling station would probably be insulated.

The design life of the cooling station is estimated at 75 years for the structure, and 25 years for most of the mechanical and electrical equipment.

2.5.4.3 Equipment

Alternative designs for the cooling station equipment, such as pumps, heat exchangers, chillers, piping, electrical gear, control system, etc., have been evaluated. These considerations are summarized in this section and the selected alternatives identified. Equipment selection was based on equipment availability, engineering suitability including energy efficiency and economics.

2.5.4.3.1 Seawater Pumps

An array of three to four variable-speed pumps would draw cold seawater from a common intake manifold. At least one redundant pump would be installed. The seawater pumps used by HSWAC would be large, high-horsepower units made from corrosion resistant materials, and would be costly units to purchase and replace. Their long-term, reliable, and efficient operation would be critical to delivering chilled water to district cooling customers in Honolulu.

2.5.4.3.2 Manifolds and Control Valves

Extensive manifolds would be needed within the cooling station to distribute both seawater and chilled fresh water among the station components. These manifolds would provide efficient distribution in limited space without imposing significant head losses. The manifolds would be highly corrosion-resistant and safely resist the highest expected vacuum pressure and both negative and positive pressure surges.

Given the large manifolds and pump sizes in the HSWAC cooling station, isolation and control valves would represent a sizable capital investment. Requirements for these valves include low head loss, high corrosion resistance, tight shutoff and trouble free long-life operation. Various types of valves would be employed at different points in the system as required by engineering considerations.

2.5.4.3.3 Strainers

Because of the low density of fouling and other organisms at the intake depth, neither fouling nor impingement/entrainment of plankton or nekton is expected to be a problem. Such has been the experience at the NELH, where similar pipes draw water from about 2,200 ft deep for cooling, aquaculture, agriculture, alternative energy research, and recently, desalinated drinking water. Nevertheless, there would be strainers of ¾-inch to 1-inch mesh in line before the pumps to filter out larger organisms that may become entrained in the intake flow.

2.5.4.3.4 Heat Exchangers

The heat exchangers would be of the plate and frame type, with at least one spare heat exchanger frame installed for redundancy. The frames would be of carbon steel with plates of a corrosion-resistant alloy. A single plate heat exchanger unit consists of numerous closely spaced thin metal plates that have a hole near each corner and have been stamped with a corrugated pattern. The plates are suspended from a steel carrying bar and clamped between heavy steel flanges using long threaded rods. The gap between each plate is sealed with a narrow rubber gasket that is compressed as the rods are tightened. Each plate has inlet and outlet ports that lead to four flanged pipe connections on the frame. Figure 2-34 shows an exploded view of a typical heat exchanger.

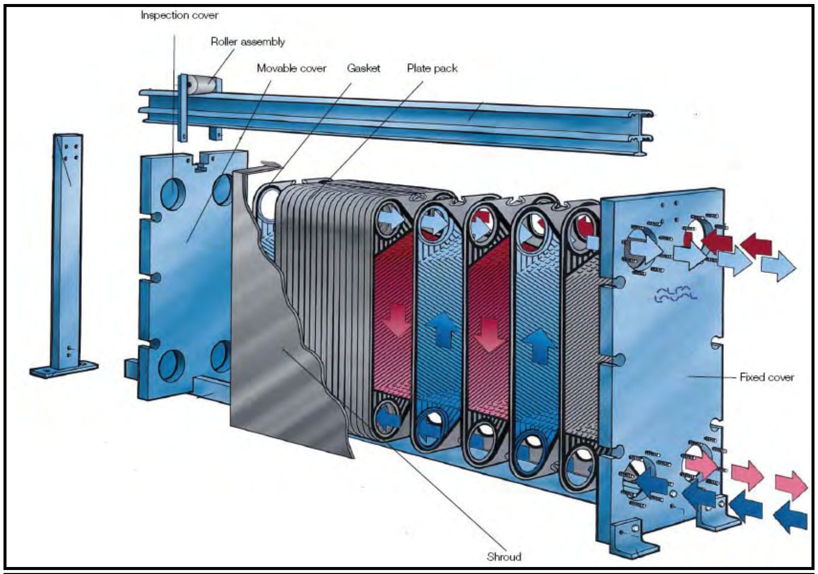

Figure 2-34: Exploded View of a Plate Heat Exchanger
(Courtesy of Alfa-Laval)

The HSWAC system would use from 6 to 18 large plate heat exchanger units to provide the bulk of the cooling capacity. The freshwater returning from the connected buildings would pass through the heat exchangers where it would transfuse heat into the cold 44-45°F seawater. The temperature of the return seawater from the heat exchangers at peak demand would be increased from approximately 53°F to 58°F after being used for condenser cooling of the chillers. The design life of the heat exchangers is estimated at a minimum of 25 years.

2.5.4.3.5 Auxiliary Chillers
The temperature of the seawater intake water would vary seasonally and with tidal influences. To maintain an optimum temperature in the fresh water distribution loop, auxiliary chillers would be available to provide supplemental chilling when necessary.

2.5.4.3.6 Backup Electrical Generators
HSWAC would have backup generators (two, 2,000 kW each) for seawater and chilled water pumps (but not for auxiliary chillers). There would also be a 5,000 gallon fuel storage tank. There is a concern about localized power outages that might affect the cooling station. With backup power for the pumps HSWAC would be able to provide ~46-47°F chilled water from seawater only. All engineering design and regulatory requirements for backup power units and fuel storage would be complied with.

2.5.4.4 Location

A number of candidate sites were evaluated for suitability for a cooling station in a comprehensive site selection process. Technical criteria evaluated for each site included:

- Size, configuration and existing structures;
- Soil conditions;
- Exposure to waves and tsunami run-up;
- Site contamination or presence of old buried utilities;
- Availability of access corridors for tunneling. It is higher risk to tunnel under adjacent sites (the contractor may not be able to retrieve his machine if it gets stuck), permission may not be granted, and there may be obstacles such as foundation piles; and
- Distances for tunneling both toward the sea and toward downtown so that energy consumption for pumping would be minimized to the extent possible.

State-owned and privately-owned sites were evaluated, and a preferred site identified. The sections below summarize the cooling station site selection process.

2.5.4.4.1 State-owned Sites Evaluated

A number of locations for the cooling station were evaluated. Exploratory efforts were made to coordinate development with the anticipated further development of the Aloha Tower area of the waterfront, but plans for that complex were too preliminary to allow the HSWAC project to proceed in a timely manner. Likewise, HECO was approached about the possibility of occupying an unused portion of their Honolulu Generating Station. This alternative had several interesting potential synergistic effects, including using SWAC water to cool the HECO generators thereby increasing their efficiency and reducing fuel use, and blending cool SWAC water with warm discharge water from the generating station to reduce potential thermal impacts of both. However, as noted above, the elevated nutrient concentrations in the HSWAC return seawater could not be adequately diluted in Honolulu Harbor, so this alternative was not pursued any further.

A number of potentially feasible sites for the cooling station were identified within the Makai District of the Kakaʻako Community Development District, administered by the Hawaiʻi Community Development Authority (HCDA). The Kakaʻako Community Development District is situated between Waikiki and Downtown Honolulu, and is divided into two separate districts. The Makai District extends southwest of Ala Moana Boulevard to the ocean and the Mauka District extends northeast of Ala Moana Boulevard to King Street. In preliminary discussions, HCDA identified several State-owned parcels under their control that might be available (Figure 2-35).

The first and perhaps the best overall sites investigated are shown under the red "X's" in Figure 2-35 (Piers 1 and 2 of Honolulu Harbor). This area had two underutilized warehouses set back from the pier, either of which could house the cooling station. The first warehouse (upper red X) was demolished to make way for the proposed Cancer Research Center. The second warehouse (lower red X) is currently being used for other purposes; however, discussions with HCDA and subsequently with the Office of Hawaiian Affairs (OHA), which is contemplating establishing a headquarters facility on the site, indicated that a portion of Pier 1 might be available for the HSWAC cooling station. This site was considered a viable option, and is described further as part of Alternative 2 in Section 2.6.4.

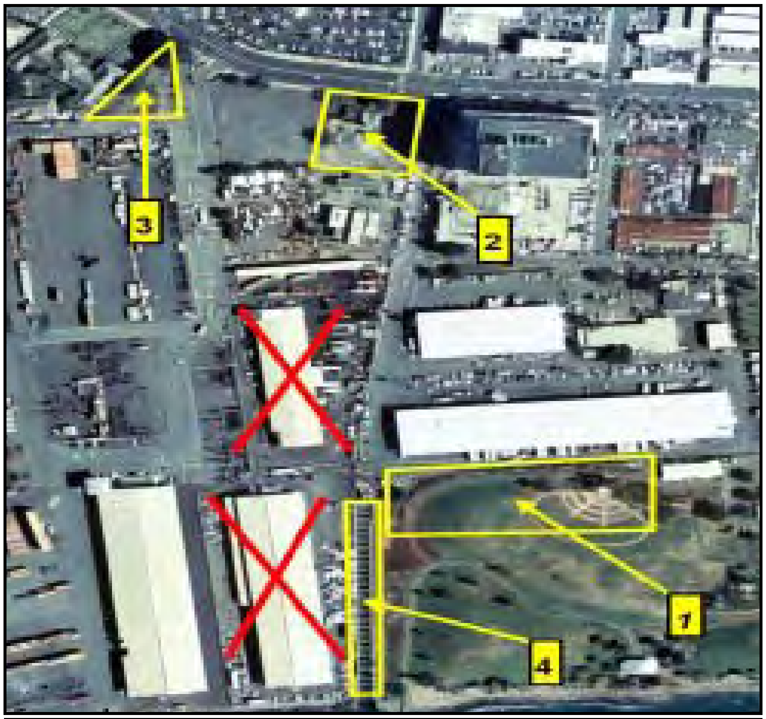

Figure 2-35: Potential Cooling Station Sites Proposed by HCDA
(Source: HSWAC)

HCDA subsequently suggested several other potential locations, shown outlined in yellow on Figure 2-35. Evaluations of these sites led to the following conclusions:

- *Site 1:* The cooling station could be located in the northwest corner of this large site. The site has good access to the ocean, and is sufficiently far from the shoreline to be protected from waves. The tunneling access corridors would probably be adequate. Most of this parcel is currently part of the Kakaʻako Waterfront Park; however, this area is little used and HCDA plans to develop it for other uses. The primary unknown is the nature of the soil, as it lies on the periphery of the former incinerator ash dump and the extent of subsurface contamination is unknown. It is possible that soil remediation work would be required by the regulatory agencies if excavation were undertaken, and excavation would be necessary to construct the cooling station. Of the four State-owned sites considered, this would be the best, although it is not ideal because of the potential soil contamination.
- *Site 2:* This site could be workable. The primary disadvantage is an existing historical building that takes up valuable real estate and would be costly to repair and maintain. The building would only be suitable for offices and the control system; it is too small to house any of the HSWAC machinery. It also has pipe access and increased pressure loss as negatives. The economic penalty and the cooling station layout constraints associated with maintaining the historic building argue against the feasibility of this site.
- *Site 3:* This triangular site is only 15,000 square feet in area and an odd shape. It would be difficult to design and relatively expensive to construct the cooling station on this site and within building codes, even with a three-story design having 10,000 square ft per floor. It also has increased pressure loss as a negative.
- *Site 4:* This site was initially attractive because there was no competitive use being considered by HCDA. However, there is an existing fresh water drainage canal through the site which could present costly issues relative to repair/stabilization of the walls of the drainage canal, tunneling, and building the deep pump room. Building over the canal could be attractive and economical if

not for the need to go deep for seawater pumping. In addition, this site could be inundated in a tsunami and protection from high waves (increasing the height of the rip rap breakwater) would be required.

In summary, only one of the State-owned sites offered by HCDA has the potential to meet all of the technical criteria for cooling station siting. The footprint for the cooling station at this alternative site would be essentially the same as for the Preferred Alternative. The orientation of the cooling station could vary.

2.5.4.4.2 Privately-owned Sites Evaluated

Several potentially available sites in the Makai District of Kaka'ako that are privately owned were evaluated using the same criteria as above. These included: (1) the parking lot adjacent to the Honolulu Generating Station; (2) the parking lot makai of 677 Ala Moana Blvd.; and (3) the parking lot Diamond Head of 677 Ala Moana Blvd. The first alternative above was eliminated because it would necessitate a longer intake pipeline and a difficult pipeline route through the Honolulu Harbor entrance channel. The third alternative above was eliminated because of future plans for the site by the landlord. That left the second alternative above as the preferred site for the cooling station.

2.5.4.4.3 HSWAC's Preferred Cooling Station Location and Building Configuration

Based on evaluation of the technical siting criteria and the receptiveness of the landowner to the intended use, the preferred location for the cooling station is on a parcel owned by The Estate of Bernice Pauahi Bishop (Kamehameha Schools) adjacent to and makai of the 677 Ala Moana Building (former the Gold Bond Building). The address of the parcel is 210 Coral Street and the tax map key (TMK) is 2-1-059:012 ("lot 12"). The parcel is bounded by Keawe Street, Ilalo Street, and Coral Street, and encompasses an area of 1.884 ac (0.762 hectares; 82,067 sf). Most of the site is paved concrete currently utilized for parking; there are no existing buildings. Figure 2-36 is a photograph of the site showing its current use as a parking lot and the 677 Ala Moana building in the background.

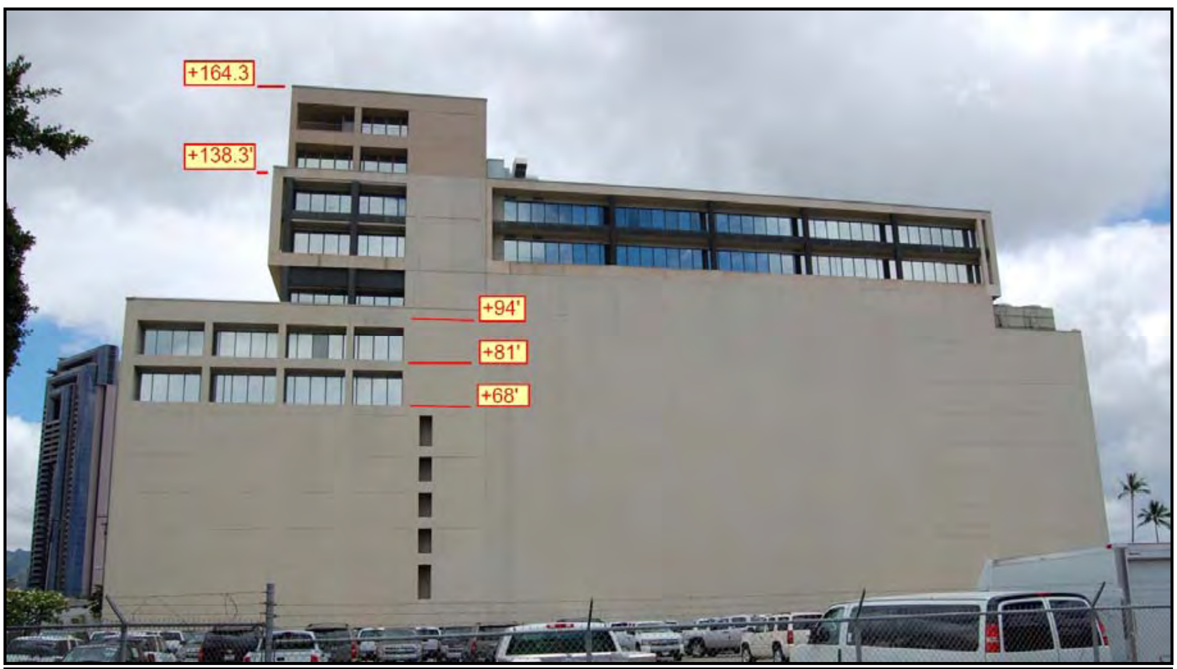

Figure 2-36: Cooling Station Site with 677 Ala Moana Building in Background
(Source: HSWAC)

The owner intends to subdivide this parcel into three smaller parcels, and the HSWAC cooling station would be located on a parcel makai of the existing building. The preliminary subdivision plan is shown on Figure 2-37. The proposed site plan is shown on Figure 2-38, and the building massing in Figure 2-39.

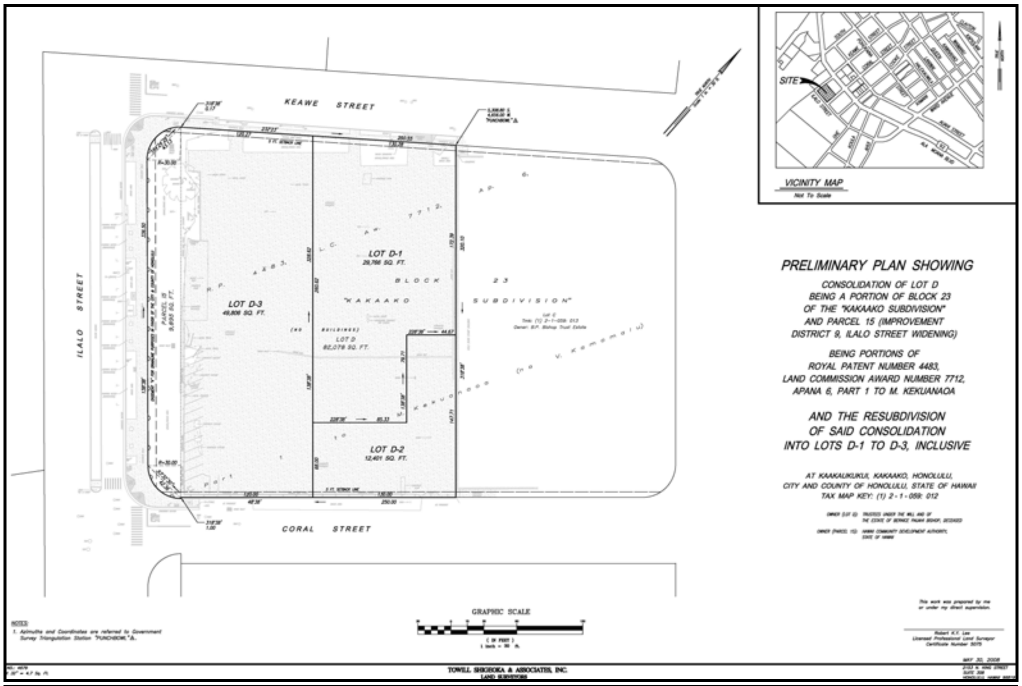

Figure 2-37: Preliminary Subdivision Plan for Preferred Cooling Station Site
(Source: HSWAC)

Figure 2-38: Proposed Site Plan
(Source: HSWAC)

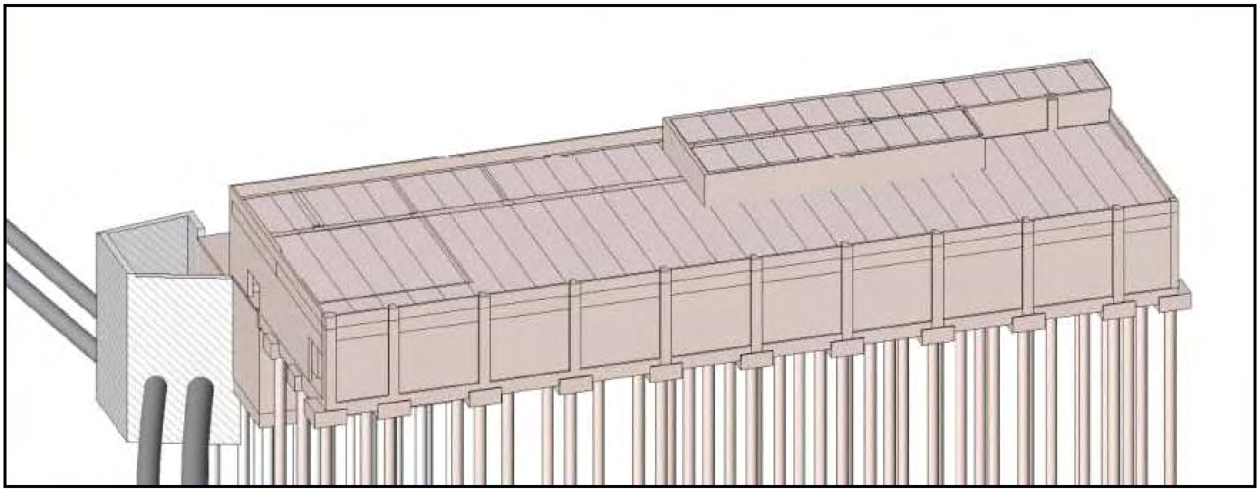

Figure 2-39: Proposed Cooling Station Building Massing
(Source: HSWAC)

The cooling station exterior elevations are shown in Figure 2-40 and Figure 2-41, cross sections in Figure 2-42, and longitudinal sections in Figure 2-43.

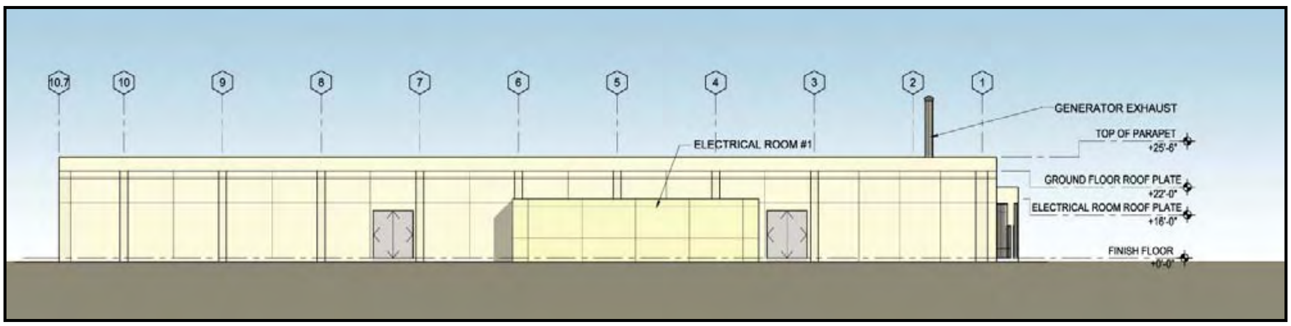

Figure 2-40: Proposed Cooling Station North Elevation
(Source: HSWAC)

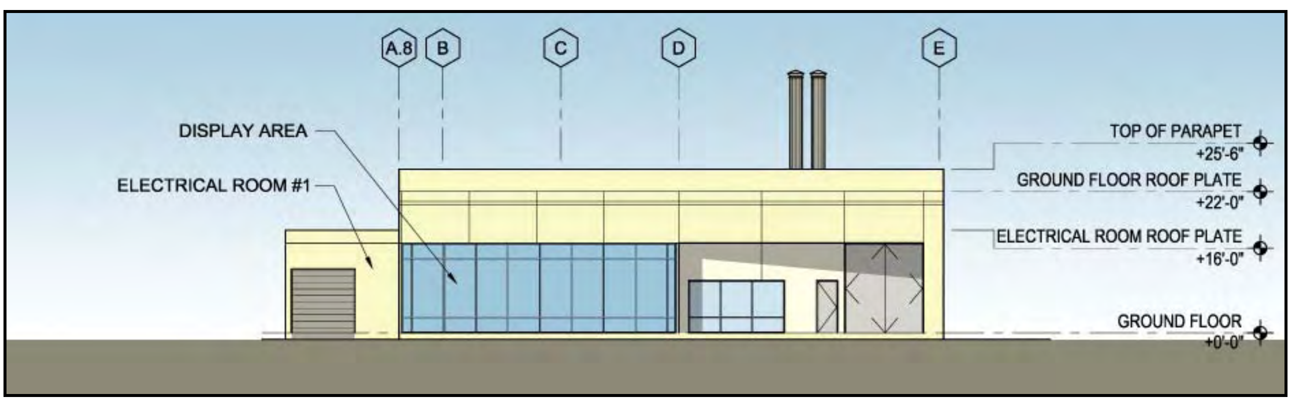

Figure 2-41: Proposed Cooling Station West Elevation
(Source: HSWAC)

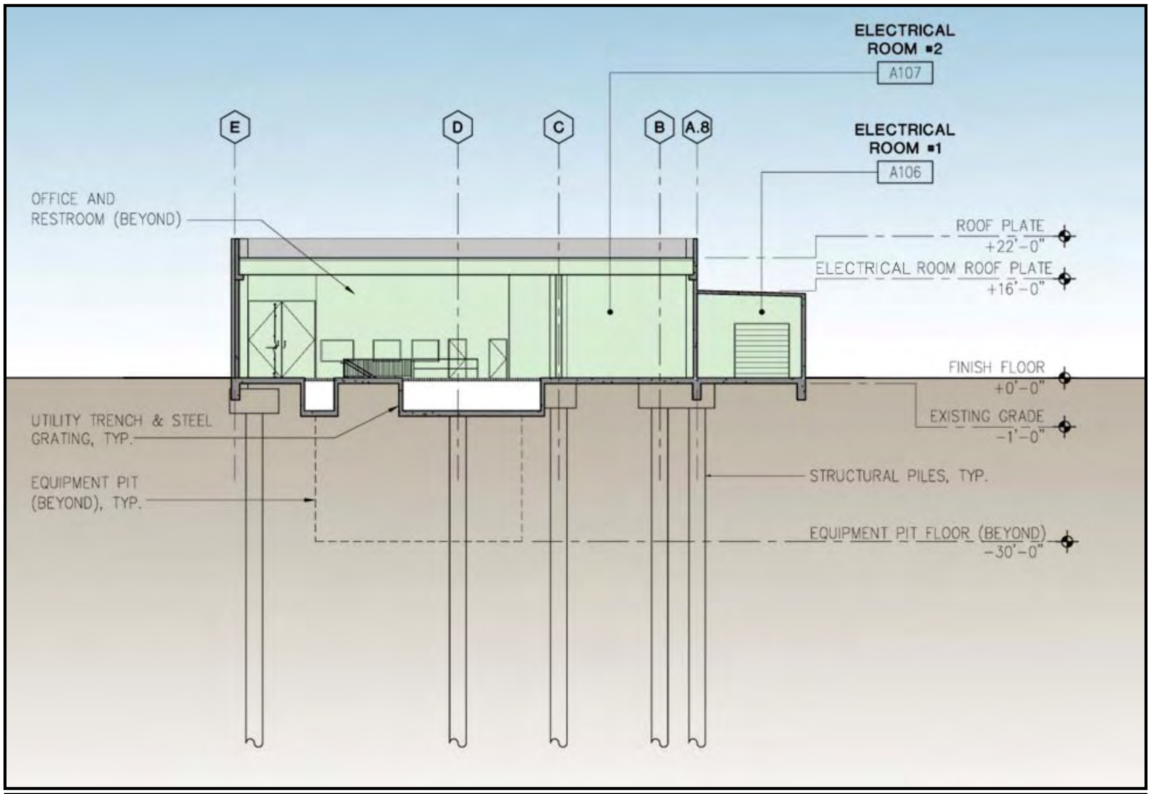

Figure 2-42: Proposed Cooling Station Cross Section
(Source: HSWAC)

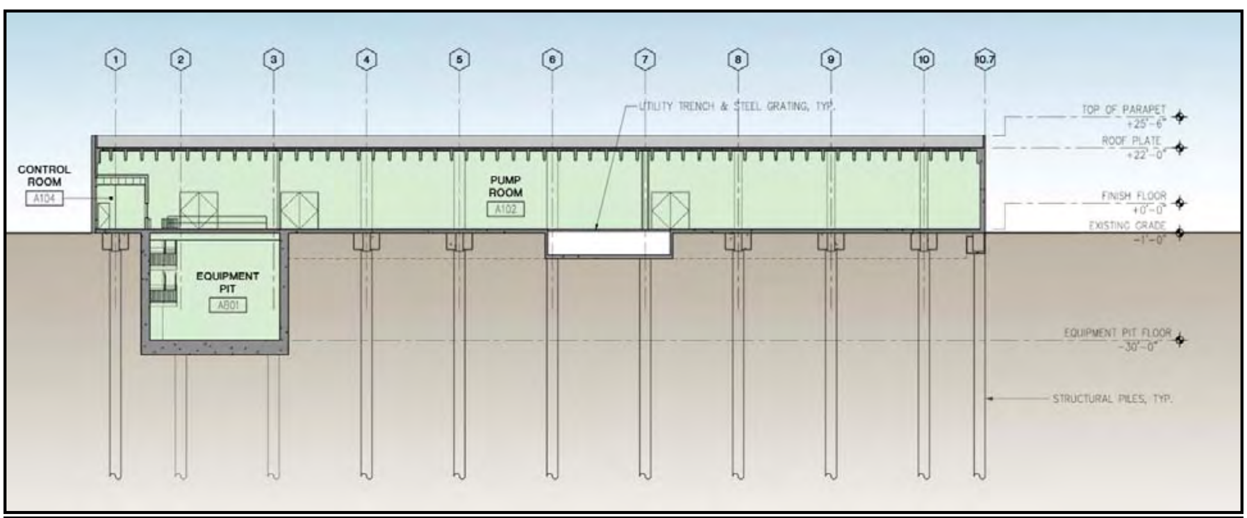

Figure 2-43: Proposed Cooling Station Longitudinal Section
(Source: HSWAC)

Kamehameha Schools has expressed an interest in developing a life sciences center and additional parking around the nearby medical school campus.

The substrata at the site consists of more than five feet of competent fill, with the groundwater table at about -5 ft below ground level. The site is located over a submerged alluvial channel, meaning that piles would be necessary to support more than a light structure. The depth to a coral surface is 58 to 68 ft below Mean Sea Level (MSL).

There is the potential for subsurface contamination to have migrated beneath the site from nearby underground storage tanks (USTs) on properties mauka of the site. Prior to initiation of construction, borings and soil sampling would be completed to determine the nature and extent of any contamination, and the potential remediation measures that would be required.

The parcel is in the State Land Use Urban District. It is zoned Commercial by HCDA, and HSWAC has obtained permission from HCDA to use the site for the cooling station. The maximum development density permitted by HCDA is calculated as a Floor Area Ratio (FAR)[18], and is equal to 3.5 for this parcel. The maximum floor area allowed for this parcel is 287,235 sf. The maximum height allowed is 200 ft. Yard setbacks are 15 ft at the front (any yard bounded by a street). Side and rear yards may have no setback where there are no windows or openings, or a setback of 10 ft where there are windows or openings. All yards must be landscaped. A height setback has been established at 45 ft at the front yard setback line. A tower footprint cannot exceed 16,000 sf, and the maximum tower width in the ‘ewa-Diamond Head direction is 110 ft.

Open space is defined as that portion of a development lot, exclusive of required yards, setback areas, or parking areas which is:

1. Open or unobstructed overhead;
2. Landscaped or maintained as a recreational or social facility;
3. Not to be used for driveways, loading purposes or storage or for the parking of vehicles; and
4. Visible and open to the public during normal business hours.

The minimum open space required at the preferred site is:

1. 15% of the development lot area (for a lot size less than 40,000 square feet).

The minimum required open space may include both of the following:

1. Up to 25% of an adjacent front yard provided that at least one-half of the open space is entirely in one location and proportioned to a maximum length–to-width ratio of 2:1; and
2. Up to 25% of any passageways or arcades.

Off-street parking for commercial parcels is one space per 400 sf of gross floor area. For a 23,500 sf cooling station, this equates to 59 parking stalls. The number of parking spaces actually needed at the cooling station for on-site employees is three. Administrative and customer service operations would be housed off-site. A modification from HCDA rules would be required for a reduced number of parking spaces.

2.5.4.5 Cooling Station Construction

Construction of the cooling station would require excavation and dewatering because the seawater pump room must extend below sea level to allow for sufficient pump suction head. All appropriate regulations would be complied with and permits acquired for grading, excavation, dewatering, etc. Recycling and use of recycled content products would be included in specifications for contractor bids. During final design of the cooling station, the feasibility of incorporating solar and/or photovoltaic systems would be evaluated.

[18] FAR x Lot Size = Maximum Floor Area Allowed.

2.5.4.6 Cooling Station Operation

The distribution system would be controlled from the cooling station. Most cooling station operations would be automated and manned during daytime working hours only. The distribution pumps would be variable-speed controlled based on maintaining a set differential pressure in the system. When the customer load increases, the distribution pump speed would increase. With increasing distribution pump speed the seawater pump speed would increase as would the load on the auxiliary chillers to maintain a maximum supply temperature of 44°F.

2.5.4.6.1 Infrastructure and Utilities Requirements

Utilities service for the HSWAC system would be required only at the cooling station site. Most of the water demand would be make-up water for the distribution system. Table 2-2 summarizes the utility demands at the cooling station. The cooling station would have only one bathroom and wash-down requirements would be minimal. The electrical demand arises from the seawater pumps, fresh water pumps, chillers and support equipment.

Table 2-2: Cooling Station Utility Demands

Utility	***Units***	***Demand***			
		Daily	***Monthly***	***Annual***	***Peak***
Water	Gallons	2,740	83,333	1,000,000	N/A
Sewer	Gallons	27	833	10,000	N/A
Electric	KWH	55,479	1,687,500	20,250,000	7,500

Existing capacities of all systems are adequate. The site is within the Kaka‘ako Community Development District Improvement District, which has undergone significant utility upgrades in recent years. Existing utilities at that site are described in Section 3.3.7.

New electrical utility service connections would be provided to the cooling station. New HECO feeders, from their nearby substations would provide electrical power to the project. These feeders would most likely be routed underground in ducts and manholes via two routes. The first route would start at the mauka side of the intersection of Ala Moana Boulevard and Ward Avenue and continue along Ilalo Street to the cooling station. A second route would begin near the intersection of Ala Moana Boulevard and South Street and continue along Ala Moana Boulevard and Keawe Street to the cooling station. Hawaiian Telcom would have to provide cabling to support the new facilities.

An existing 12-inch water main runs under Ilalo Street.Drainage improvements were made to Ilalo Street as part of the ID9 project.2.5.4.6.2 Personnel

The staffing of the HSWAC business would include the following nine positions:

- Manager;
- Office Assistant;
- Customer Service Representatives (2); and
- Plant and Distribution System Operators (5).

At any given time, the maximum number of on-site personnel would be three. Administrative and customer service functions would be done at an off-site office.

2.5.5 Chilled Water Distribution System

2.5.5.1 Distribution System Alternatives

A system of pipes would be installed beneath the streets of downtown Honolulu to provide chilled fresh water to customer buildings. Depending on the specific locations of HSWAC's customers, the total length of the distribution system may vary from approximately 16,000 to 19,000 linear ft. Distribution pipes would be larger in diameter closer to the cooling station and smaller at greater distances. Pipe sizes would vary between 8 inches and 42 inches, with a length-weighted average of about 26 inches. These pipes and fittings would be primarily HDPE. The total volume of fresh water in the distribution system would be close to one million gallons.

The chilled water would be maintained at a pH of about 10.1 and have added to it small amounts of molybdate[19] or other anti-corrosion agent and a biocide to control microbial activity. The biocide (bromine, chlorine/bleach, or a non-oxidizing biocide) would be selected based on what is determined to be most effective at the time with some variation in type and dose in order to stay ahead of the microbes' ability to become resistant to the effects of any one of the products.

Several criteria were used to identify potential routes through downtown Honolulu for the distribution system piping. Economy and efficiency would be best served by connecting the buildings with the largest air conditioning loads using the shortest system of pipes. However, as it is not known at this time which buildings would become customers of the HSWAC system, route optimization by customer distribution is not yet possible. Several other criteria were used to derive a preliminary preferred route for the distribution system:, including existing utility installations within the right-of-way, potential traffic (and bus transit) impacts during construction, the potential for unearthing cultural features including human remains, and other proposed major projects that would require use of street rights-of-ways, in particular, the City's proposed rapid transit project. The results of this screening analysis were used to construct the preferred distribution system route described below.

2.5.5.2 Description of Preferred Distribution Route

The optimum routing of the distribution system cannot be determined until major customer buildings are identified. Nevertheless, making some assumptions based on preliminary discussions with building owners and operators, streets in downtown Honolulu were evaluated for suitability for installation of the chilled water pipes.

To minimize potential traffic impacts and to avoid major utilities relocations, from the cooling station, an approximately 1,000-feet long trenchless segment under Keawe Street would be used to pass beneath Ala Moana Boulevard and daylight mauka of Auahi Street. Because of the limited and narrow public right-of-way, overhead power lines, potential traffic impacts, construction time, and lack of space for pipe fusion, stringing, and pullback during horizontal directional drilling, from a trenchless engineering standpoint, the dual pipelines along this alignment would probably be most efficiently installed using microtunneling methods. Composite or concrete-polymer pressure application pipelines would be direct-jacked. A tunneling option was evaluated, but considered less favorable due to higher costs and the very narrow and congested utility corridor.

To avoid installing a jacking/receiving shaft nearby or within the Keawe Street / Ala Moana Boulevard intersection, a curved microtunneling drive is proposed to install both of the chilled and return water pipelines. Based on a minimum radius of curvature of 1,000 feet in plan view and a spacing between outside diameters of 5 to 8 feet, the dual pipelines would need to be stacked on top of each other in order

[19] Molybdates are safe, environmentally-friendly alternatives to lead- and chromate-based corrosion-inhibiting pigments. They are regulated only as a nuisance dust material.

to fit within the right-of-way. The total length of the alignment in plan view is approximately 900 feet (Figure 2-44).

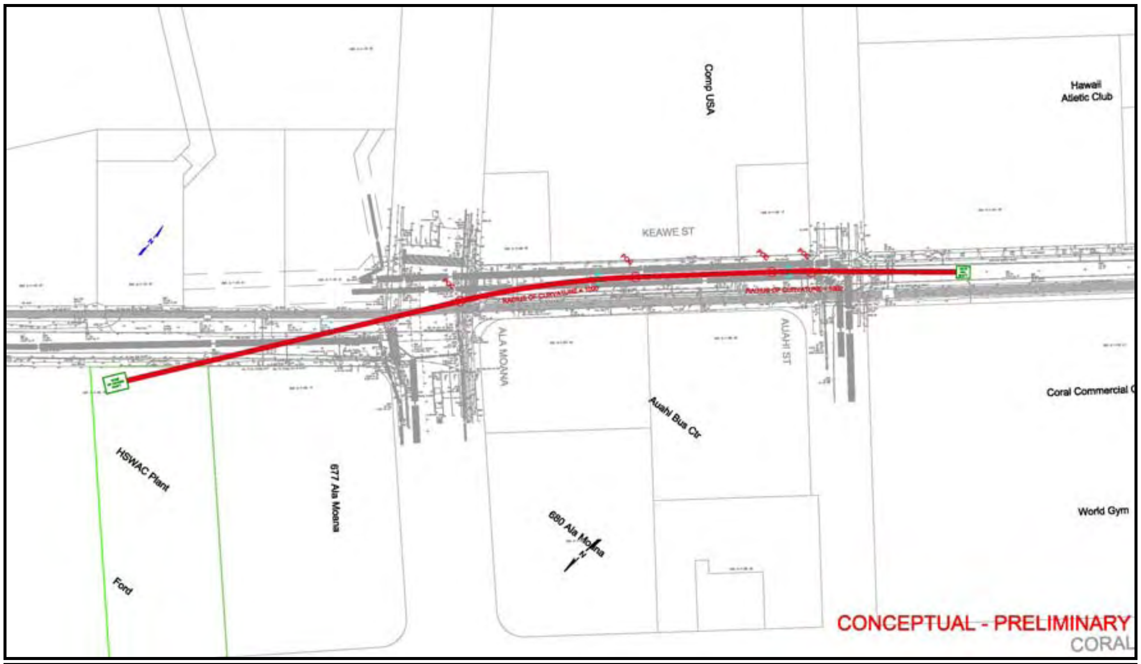

Figure 2-44: Microtunnel Route from Cooling Station Past Auahi Street
(Source: Yogi Kwong Engineers, LLC)

In profile, the upper pipe invert is proposed to be at approximately -27.5 feet MSL at the HSWAC pump station, and approximately -22.5 feet MSL in the vicinity of Auahi Street, in order to provide at least 5 feet of clearance from the crown of the upper pipe to the bottom of the lowest currently known existing utilities (about -12 to -15 feet MSL for the nearby 78-inch sewers). The lower pipe invert is proposed to be at approximately -41 feet MSL at the HSWAC pump station, and approximately -33 feet MSL in the vicinity of Auahi Street, in order to provide between 5 to 8 feet of clearance from the crown of the pipe to the bottom of the upper pipeline. If utilities or very soft soils are lower than the invert of the upper pipe, the alignment may need to be deeper.

The jacking and receiving pits would be covered and steel plated over and open to traffic after work hours or when not in use during construction. Typically work on the shaft would be conducted within the daytime hours of 8:30 am to 3:30 pm.

For this curved drive, the shaft constructed at the cooling station site for the shore crossing segment would be used for the jacking pit. Construction of the shaft for this trenchless segment is estimated to take two to three months; jacking the two drives would take at least 4 months. Installation of the carrier pipes would take one month.

Most of the remainder of the distribution system would be installed by cut and cover trenching. From the end of the microtunneled drive mauka of Auahi Street, the route would continue north on Keawe Street to Pohukaina Street.

At Pohukaina Street, the route would turn left and the 42-inch pipes would proceed to Punchbowl Street. Pohukaina Street has relatively low traffic volumes and limited existing utility installations. Along this reach, several smaller lateral lines would serve commercial and State buildings.

At Punchbowl Street, the route would turn right and the mains would turn left onto King Street and proceed down King Street to Bishop Street. A smaller diameter branch of the lines (30-inch) would continue north on Punchbowl Street, before splitting into two even smaller lines and entering the underground parking structures of the State Capitol and the Kalanimoku Building, respectively. The latter would proceed to the City's municipal center and serve several City buildings. The northern branch would pass through the State Capitol underground parking structure beneath Beretania Street and emerge on Miller Street. After a short trenched section, a trenchless (probably HDD) section would be used to access Queen's Hospital.

From the main lines heading west on King Street smaller pipelines would branch both north and south on Richards Street, and the mains themselves would be smaller diameter. The northern branch would turn left onto Hotel Street to serve several State buildings. Another branch would come off the main, turning left onto Alakea Street. At Bishop Street, the mains would split to run both north and south. The southern branch would have a spur west on Merchant Street.

Within a given roadway, the exact placement of the pipes would depend on constraints related to existing buried utilities, potential subsurface archaeological and cultural features, the location of customer buildings, potential construction impacts, and the availability of sites for jacking and receiving pits.

The proposed route is described as follows and shown on Figure 2-45, along with some of the alternative route segments that were not preferred for the various reasons described above.

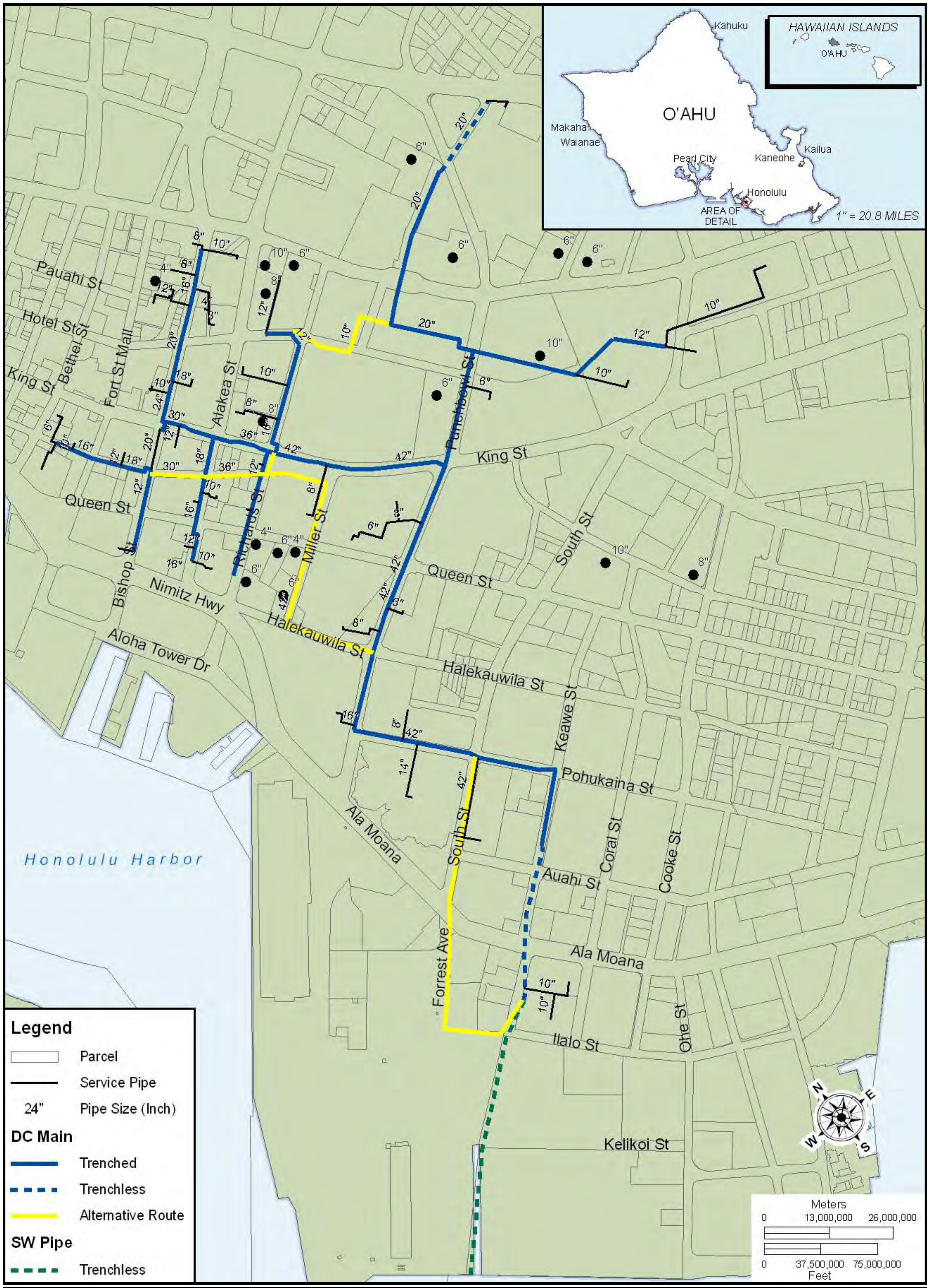

Figure 2-45: Distribution System Route and Pipe Sizes

2.5.5.3 Construction

In general, the distribution pipes would be buried in trenches dug in streets (Figure 2-46). All existing utility installations would be accurately mapped and agreements made for new or shared easements. In most cases, “cut and cover” trenching would be done. To the extent possible, routing would be done to minimize potential traffic impacts.

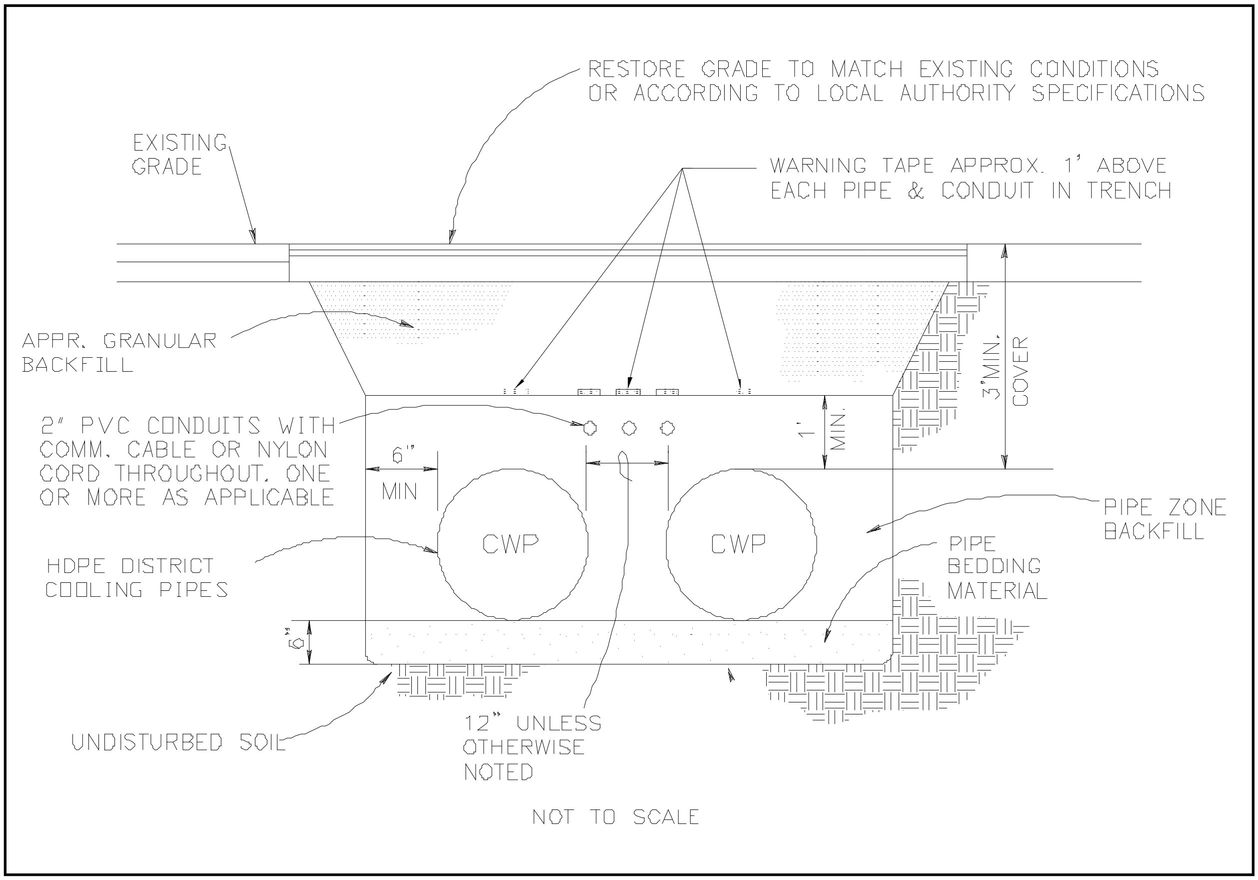

Figure 2-46: Typical Distribution Pipe Trench Section
(Source: HSWAC)

The intention is to work simultaneously in different areas to install the distribution pipes. In general, three blocks would be worked on at a time. Depending on the length and complexity of the specific segment, it would take from 3-4 weeks to 6-7 weeks for excavation, pipe installation, backfilling and street surfacing.

Where pipes would be installed by trenching, standard mitigation measures would be employed to minimize impacts to traffic and return the pavement surface to a condition equal to or better than what existed previously. HSWAC has been in discussion with City personnel regarding specific mitigation efforts which would be detailed in a construction management plan and a traffic management plan.

2.5.5.4 Customer Connections

Because each building is unique in its piping and chiller placement, connection points to the common chilled water loop and the amount of internal piping required to implement the conversion would be individually determined. A given building could be either indirectly connected, with a heat exchanger separating the building system and the distribution system, or directly connected (Figure 2-47). The decision between indirect or direct connection would be mainly based on distribution system pressure, building height, and building system design pressure.

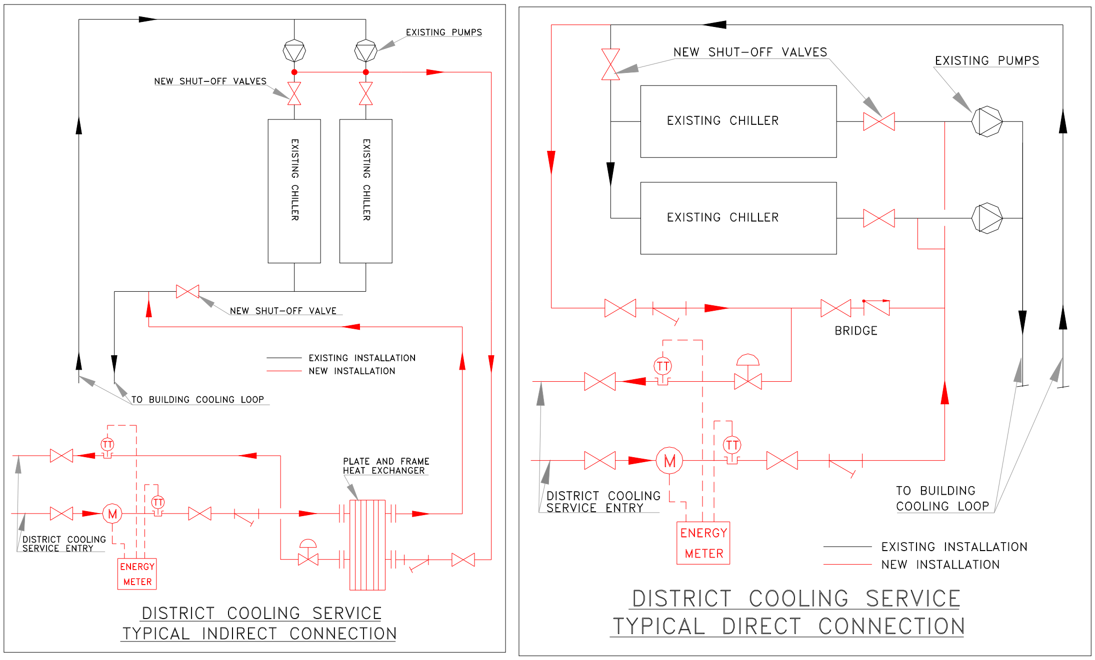

Figure 2-47: Typical Connections to Buildings
(Source: HSWAC)

2.5.6 Summary of the Preferred Alternative

This section summarizes the attributes of the Preferred Alternative.
The HSWAC seawater circulation system would consist of parallel seawater intake (supply) and seawater return pipelines extending from the cooling station to their respective terminal points offshore. The discrete segments of the intake and return seawater pipelines are: (1) from the cooling station to the offshore breakout point; (2) from the breakout point to the return seawater diffuser; and (3) from the diffuser to the intake. Microtunneling (remote control pipe jacking) would be used for the segment extending from the cooling station to the offshore breakout point at a depth of 31 ft MLLW.

A jacking pit would be required behind the shoreline to break the route into two sections of approximately 1,600 to 1,700 lineal feet each. The route of the Preferred Alternative and location of the jacking pit are shown on Figure 2-12. An offshore receiving pit from which to recover the microtunneling machine and a deep jacking shaft at the cooling plant site (probably to -50 feet MSL) would also be required. Two jacked pipelines would be installed:

- For the cold sea water intake pipeline, a minimum 72-inch internal diameter (ID) reinforced concrete pipe (RCP) casing for the required curve drive into the cooling station jacking/receiving pit from the shoreline jacking/receiving pit, and a similar size RCP or steel casing jacked from the shoreline to the breakout point for connection to the offshore pipelines. A nominal 54-inch diameter composite or concrete-polymer pipe or 63-inch (OD) HDPE pipe with stiffeners would be installed inside the jacked casing and the annulus space between the casing and the carrier pipe grouted.
- For the return seawater discharge pipeline, a 54-inch (ID) RCP pipe would be jacked from the same pits described above.

The Preferred Alternative would require construction access through and staging and work areas near the ʻewa side of Kakaʻako Waterfront Park between the old landfill and the open drainage culvert. Microtunneling and installation of the casings would be expected to take 6 to 7 months, and installation of the carrier pipelines and annulus grouting an additional 1 to 2 months.

At the breakout point of the microtunneled shafts, a pit of about 30 feet by 40 feet in plan view and 20 feet deep would be excavated and contained by sheet piles extending about 10 ft above the seafloor. This pit would be used to recover the MTBM and connect the microtunneled pipes to the (previously installed) surface-mounted pipes extending seaward.

After completion of the connections, the pit would be backfilled and covered with a concrete cap. The backfill would be crushed basalt gravel graded between 3/8-inch and 2-inch size and pre-washed to remove any fines. The sheet piles would be removed or cut off at least 2 feet below the existing seafloor grade.

The offshore segments of the seawater pipe would be fabricated from high density polyethylene (HDPE). The seawater intake pipe would be 63-inch diameter and the seawater return pipe would be 54-inch diameter. Long sections of these pipes would be assembled from shorter segments in a pipeline staging and assembly area. Individual pipe segments would be heat-fused to form longer segments and these longer segments would be flanged together to form a single pipe. Long sections of these pipes would be assembled from shorter segments in a pipeline staging and assembly area. Individual pipe segments would be heat-fused to form longer segments and these longer segments would be flanged together to form a single pipe.

Seaward of the breakout point, the seawater intake and return pipes would parallel one another to the end of a diffuser at 150 feet deep. Seaward of the breakout point, the seawater intake and return pipes would parallel one another to the end of a diffuser at 150 feet deep. Both pipelines would begin at approximately 1,800 feet offshore at a water depth of 31 feet (MLLW). The return seawater pipeline would run an additional 1,700 feet offshore (approximately 3,500 feet from the shoreline) and terminate in a 25 port diffuser extending from 120 to 150 feet deep.

The final depth of the seawater intake is unresolved. Preliminary system analysis and optimizations by Makai Ocean Engineering (2004, 2005a, 2005b) based on levelized lifetime costs showed a relatively flat optimum for intake depths between 1,600 feet and 1,800 feet with average seawater temperatures varying between 44°F and 45°F. Initially an intake depth of 1,600 feet with an average seawater temperature of 45°F was selected. Subsequent evaluations have shown that a deeper intake depth may be operationally desirable. The final depth of the intake remains unresolved. It is primarily an economic choice; the environmental impacts would not be significantly different for any intake within this depth range. The economic trade-off is that a deeper intake would increase capital costs for additional pipe lengths and installation, while a shallower intake would increase operational costs because additional supplemental cooling of the slightly warmer water would be required. The benthic conditions are not significantly different between 1,600 and 1,800 feet deep. For illustrative purposes, Figure 2-18 shows the seawater intake pipe extending to a point approximately 23,000 feet from shore, and terminating at 1,784 feet deep with an elbow fitting such that the actual intake depth would be at about 1,770 feet.

The exposed portions of the pipes from the breakout point to the end of the diffuser would be fastened to the bottom with concrete collars. Steel pipe piles would be driven through sleeves in the collars using a percussion hammer. Sand from inside the pipe would be removed to a level about 6 ft below the original seafloor. Tremie concrete would be used to fill and cap the piles. The exposed portions of the pipes from the breakout point to the end of the diffuser would be fastened to the bottom with concrete collars. Steel pipe piles would be driven through sleeves in the collars using a percussion hammer. Sand from inside the pipe would be removed to a level about 6 ft below the original seafloor. Tremie concrete would be used to fill and cap the piles. Figure 2-14 illustrates the design of these collars.

The seawater intake pipe from the diffuser at 150 feet deep down to a depth of 400-500 feet would be held in place by snag-resistant concrete gravity anchors attached to the pipe (Figure 2-15). This streamlined design would avoid entangling cables dragging from tugs or barges passing overhead. Joining hardware would be fabricated from steel bolts and fittings that have been galvanized in zinc, with additional zinc anodes to extend life in seawater. This streamlined design would avoid entangling cables dragging from tugs or barges passing overhead. Joining hardware would be fabricated from steel bolts and fittings that have been galvanized in zinc, with additional zinc anodes to extend life in seawater.

Below depths where cables could snag the anchors, a different design would be used. This design is shown in Figure 2-16. In this version, the concrete collar is split allowing the two halves to be bolted onto the pipeline. The heavier bottom would keep the pipeline stable during deployment and help to prevent any roll during installation. The anchors would support the pipeline above the seabed to reduce the hydrodynamic forces on it.

The spacing of concrete collars would vary as a function of depth. In the shallow region (to 150 foot depth) the collar spacing is minimized to maximize anchoring weight carried by the pipe. In deep water where loads are dramatically reduced, the weight spacing would be much greater, extending to as much as 100 feet between weights.

In order to increase the suction capability of this pipeline, ductile iron stiffeners would be added to the outside of the pipeline. Each stiffener would be coated and additionally protected with zinc anodes.

The HDPE pipes (intake and return) would be constructed on-shore from 40 to 80 feet long segments. A staging area of approximately 18 acres near the shore would be temporarily required to store pipe, concrete anchor blocks and other components, and to fuse the pipe lengths into longer segments.

The pipe segments would be fused together into longer (~3,300-feet) segments, and launched directly as fused. Concrete anchors and stiffening rings would be added to the pipe from a barge while the pipe sections float in the staging area. These floating segments would be stored (moored) in the water pending completion of all segments. Final assembly of the pipe would be done by connecting the segments by lifting the ends slightly above the water, removing the blind flanges, and bolting the flanged ends together. An aerial photo of the proposed staging sites identifying the primary features is shown on Figure 2-21.

The boundary of the site proposed for temporary HSWAC contractor use as an on-land pipe storage and assembly area is shown in Figure 2-22. This is an area of approximately 17.7 acres and it includes the entire baseball park area with its adjoining parking lot, the improved and unimproved roadways around the baseball park, the dredged material mound region between the park and the water and an almost 400' long frontage on the water.

The proposed offshore staging area consists of one portion of the Ke'ehi Lagoon seaplane runway channels. The overall in-water staging zone with approximate dimensions is shown in Figure 2-23. The area inside the yellow bordered zone equals about 49.9 acres.

It would be necessary to have an approximately 20-ft wide roadway to the site. An unimproved roadway already exists that leads from the northwest corner of the baseball fields around the Sand Island Wastewater Treatment Plant to an established entry onto Sand Island Access Road. Figure 2-24 shows the access road that would be needed by the HSWAC contractor to provide adequate room for large trucks and equipment to pass safely from the park to Sand Island Access Road.

The deployment methodology for the offshore portions of the HDPE pipeline has been developed and tested in previous projects and is specific to the nature of the HDPE pipe and available handling equipment. All but a small length of the intake and return seawater pipes seaward of the breakout point (the spool sections connecting them to the microtunneled segments) would be deployed using the following methodology.

Deployment of the pipes would be done once all the segments are assembled. The pipelines, with weights and stiffeners attached, would be towed into place, the near shore ends temporarily secured to allow the pipelines to be put under tension, and the pipelines sunk in a controlled manner from shallow to deep water by controlled flooding. At least three tugs would be used to maneuver the pipelines to their final position. A pipe would be pulled into place in a single day and sunk at night to take advantage of the HDPE pipe's superior strength properties when it is cool and not exposed to the sun. The deployment process is illustrated in Figure 2-33. The air-filled and anchor-weighted HDPE pipelines would be floated on the surface of the ocean and controllably submerged by flooding from the shore end and venting air on the offshore end. At all times, the pipeline configuration would be in equilibrium with the air-filled portion supporting the flooded section. To avoid kinking the pipelines at the two bends, the seaward ends would be pulled (90 to 100 tons tension) by a tug boat during deployment, while the landward ends would be held in place by attachment to anchors or piles driven closer to shore. The positions of these anchors or piles would be along predetermined angles from the pipe ends, and at least 100 feet shoreward of the pipe ends. The precise location of the anchors or piles would be adjusted to avoid corals or other significant biota. A remotely operated vehicle (ROV) would be used to monitor the deployment.

The nearshore ends of the pipelines would be close to but not connected to the end of the microtunneled segment of the route. A spool piece would be prepared to fill the gap and flange bolted in place by divers.

The seawater circulation system and the fresh water distribution system would come together in a cooling station where the heat exchangers, seawater and fresh water pumps, and auxiliary chillers would be housed. An array of three to four variable-speed pumps would draw cold seawater from a common intake manifold. At least one redundant pump would be installed. There would be strainers of ¾-inch to 1-inch mesh in line before the pumps to filter out larger organisms that may become entrained in the intake flow. The heat exchangers would be of the plate and frame type, with at least one spare heat exchanger frame installed for redundancy. The frames would be of carbon steel with plates of a corrosion-resistant alloy. The HSWAC system would use from 6 to 18 large plate heat exchanger units to provide the bulk of the cooling capacity. The freshwater returning from the connected buildings at 54°F would pass through the heat exchangers where it would transfuse heat into the cold 44-45°F seawater. The temperature of the return seawater from the heat exchangers at peak demand would be increased from approximately 53°F to 58°F after being used for condenser cooling of the chillers. The temperature of the seawater intake water would vary seasonally and with tidal influences. To maintain an optimum temperature in the fresh water distribution loop, auxiliary chillers would be available to provide supplemental chilling when necessary. The cooling station would have backup generators (two, 2,000 kW each) for seawater and chilled water pumps (but not for auxiliary chillers). There would also be a 5,000 gallon fuel storage tank.

The cold seawater from the intake pipe would pass through the cooling station and, in the heat exchangers, receive heat from the fresh water distribution loop. Warmed water would be returned to the ocean through a diffuser. A negatively buoyant plume would be formed at the discharge depth. The maximum flow rate through the intake pipe would be 44,000 gpm. The average temperature of the intake water would be approximately 44-45°F. The return mass would equal the intake mass in this open loop system. (Volume would vary slightly because of density changes with temperature and pressure.)

A two-story facility with pumps in the basement (about 25 feet below ground level) is proposed for the cooling station. Heat exchangers and chillers would be located on the ground floor. The required building footprint would be about 22,000 square feet at grade. The preferred location for the cooling station is on a parcel owned by The Estate of Bernice Pauahi Bishop (Kamehameha Schools) adjacent to and makai of the 677 Ala Moana Building (former the Gold Bond Building). The address of the parcel is 210 Coral Street and the tax map key (TMK) is 2-1-059:012 ("lot 12"). The parcel is bounded by Keawe Street, Ilalo Street, and Coral Street, and encompasses an area of 1.884 ac (0.762 hectares; 82,067 sf). Most of the site is paved concrete currently utilized for parking; there are no existing buildings. Figure 2-36 is a photograph of the site showing its current use as a parking lot and the 677 Ala Moana building in the background. The owner intends to subdivide this parcel into three smaller parcels, and the HSWAC cooling station would be located on a parcel immediately makai of the existing building. The proposed site plan is shown on Figure 2-40.

A system of pipes would be installed beneath the streets of downtown Honolulu to provide chilled freshwater to customer buildings. Depending on the specific locations of HSWAC's customers, the total length of the distribution system may vary from approximately 16,000 to 19,000 linear ft. The total volume of fresh water in the distribution system would be close to one million gallons. Distribution pipes would be larger in diameter closer to the cooling station and smaller at greater distances. Pipe sizes would vary between 8 inches and 42 inches, with a length-weighted average of about 26 inches. These pipes and fittings would be primarily HDPE.

From the cooling station, an approximately 1,000-feet long trenchless segment under Keawe Street would be used to pass beneath Ala Moana Boulevard and daylight mauka of Auahi Street. To avoid installing a jacking/receiving shaft nearby or within the Keawe Street / Ala Moana Boulevard intersection, a curved microtunneling drive is proposed to install both of the chilled and return water pipelines. The dual pipelines would be stacked on top of each other in order to fit within the City right-of-way. The total length of the alignment in plan view is approximately 900 feet (Figure 2-43). The proposed route is shown on Figure 2-44, and the remainder described as follows. The remainder of the distribution system would be installed by cut and cover trenching. From the end of the microtunneled drive mauka of Auahi Street, the route would continue north on Keawe Street to Pohukaina Street. At Pohukaina Street, the route would turn left and the 42-inch pipes would proceed to Punchbowl Street. At Punchbowl Street, the route would turn right and the mains would turn left onto King Street and proceed down King Street to Bishop Street. A smaller diameter branch of the lines (30-inch) would continue north on Punchbowl Street, before splitting into two even smaller lines and entering the underground parking structures of the State Capitol and the Kalanimoku Building, respectively. The latter would proceed to the City's municipal center and serve several City buildings. The northern branch would pass through the State Capitol underground parking structure beneath Beretania Street and emerge on Miller Street. After a short trenched section, a trenchless (probably HDD) section would be used to access Queen's Hospital. From the main lines heading west on King Street smaller pipelines would branch both north and south on Richards Street, and the mains themselves would be smaller diameter. The northern branch would turn left onto Hotel Street to serve several State buildings. Another branch would come off the main, turning left onto Alakea Street. At Bishop Street, the mains would split to run both north and south. The southern branch would have a spur west on Merchant Street.

2.5.7 Project Cost and Schedule

2.5.7.1 Cost and Use of Public Funds

The $200,000,000 HSWAC chilled water district cooling system would be funded with 80% debt and 20% equity. In December 2007, HSWAC closed on initial project funding of $10,750,000 to fund the design, engineering and development activities. The remaining project costs would be funded at the construction financing. At this closing, HSWAC would issue $145,000,000 in tax-exempt Special Purpose Revenue Bonds, $22,000,000 of taxable Revenue Bonds, and will secure additional equity for the total project funding requirements. HSWAC received authority to issue $145,000,000 in Special Purpose Revenue Bonds through three legislative actions passed in 2004, 2005 and 2007. The Revenue Bonds would be secured by a bank letter of credit that would have a rating of not less than A/A-1 and would be secured by the chilled water system and the long-term customer contracts. No public funds would be used for the project; however, HSWAC intends to seek federal grants and loan guarantees for the project.

2.5.7.2 Schedule

In 2004, planning and engineering design began. The final EIS is expected to be completed in 2009. The Conceptual Design (MOE, 2005a) is complete and preliminary design has begun. Final design is expected to be completed in 2009. Plans and specifications suitable for contractor bidding would be prepared and offered for bid in 2009. Construction is expected to begin in 2010. The system is expected to be on-line in 2011.

2.6 ALTERNATIVE 2

2.6.1 Setting and Use of Public Lands

The project setting for Alternative 2 would be very similar to that of Alternative 1, the Preferred Alternative, with the most significant change being in the location of the cooling station. In Alternative 2, the cooling station would be located on Pier 1 of Honolulu Harbor, as described more fully in Section 2.6.4. This would necessitate minor changes to the route of the microtunneled shaft from the cooling station to the proposed breakout point, and from the cooling station to the mauka side of Ala Moana Boulevard, as described in Section 2.6.5.

Under Alternative 2, the use of public lands would be similar to that under Alternative 1. Use of public lands would include State and Federal submerged lands where the seawater pipes would be installed, State highways and city streets where the distribution system pipes would be installed, and State lands where the seawater pipes would be assembled. In addition, the cooling station would be sited on State land, rather than on a privately-owned parcel as in Alternative 1.

2.6.2 Alternative 2 Overview

The components of the HSWAC system would be the same under either Alternative 1 or Alternative 2. Under Alternative 2, the system would still consist of:

- Seawater intake and return pipes;
- A seawater cooling station containing:
    - Seawater pumps;
    - Fresh water pumps;
    - Heat exchangers;
    - Auxiliary chillers; and
- A chilled (fresh) water distribution system.

Temporary use of a site on Sand Island and the adjoining submerged land would be required for staging and pipeline assembly.

2.6.3 Seawater Circulation System

Because under Alternative 2 the cooling station would be sited on Pier 1, the microtunnel drive length to the breakout point would be greatly reduced. The jacking pit between Kaka‘ako Park and the drainage canal ‘ewa of the park that would be required under Alternative 1 would not be required under Alternative 2. The microtunneled shaft would extend directly from the cooling station to the breakout point. The route of the shaft is shown in yellow on Figure 2-7. The breakout point for Alternative 2 would be in about 35 feet of water east of the breakout location for Alternative 1. This route would avoid the alluvial channel exiting Honolulu Harbor and the known mounds of dredged materials slightly east of that channel. Seaward of the breakout point, the seawater intake and return pipes would be installed as under Alternative 1; however, the return seawater diffuser would be deeper, between 210 and 240 feet deep, oriented perpendicular to the bottom contours. The effect of the deeper diffuser would be to place the return plume at a depth where its water quality characteristics are closer to those of the receiving water. On the other hand, a deeper diffuser position would require more of the larger combination-type collars and consequently more bottom surface area would be affected. The additional pipe length and combination weights would result in additional expense for this alternative.

Beyond the diffuser, the intake pipe would continue seaward and terminate at the same depth as under Alternative 1. In addition to the differences in breakout point location and seawater pipe routing, Alternative 2 would employ a grating over the mouth of the intake pipe. The purpose of this attachment would be to restrict entry into the pipe of protected species, especially the Hawaiian monk seal, and other large marine organisms. The design of this grate has not been done, but because the end of the intake pipe would be sealed with a blind flange during deployment, the grate would likely have to be installed after the pipe is laid. This would require a sophisticated ROV of the class used to inspect and maintain offshore oil rigs.

2.6.4 Cooling Station

The cooling station would be constructed on Pier 1 of Honolulu Harbor, where an existing warehouse (lower red "X" on Figure 2-35) would be partially or completely demolished. The site is controlled by HCDA and has been considered by the Office of Hawaiian Affairs as a potential site for their headquarters. HSWAC considered utilizing approximately 33,000 sf of the 5.266 acre site to build a 21,000 sf facility.

Siting of the cooling station on Pier 1under Alternative 2 would have economic, as well as design and construction differences from Alternative 1. As noted above, there would be no need for the intermediate jacking pit under Alternative 2. However, the cost savings that would be realized would be offset to some extent by the necessity to design and construct the building to standards appropriate to its location in Flood Zone A (flood fringe district). Additional costs would be incurred for waterproofing the structure up to the regulatory flood elevation and complying with structural requirements.

Additional challenges to development of this site for HSWAC included 1) crossing a 72-inch forced sewer main to access the site from the ocean and 2) existing tenancy in the warehouse. The presence of the sewer main adjacent to the parcel was a concern to both HSWAC and City officials. There would be a risk to the sewer main from vibrations associated with sheet pile driving and tunneling.

2.6.5 Chilled Water Distribution System

Because the cooling station would be on the ‘ewa side of the drainage canal, the initial segment of the distribution route would be routed under Forrest Avenue rather than under Keawe Street. With the cooling station closer to the ocean, the total trenchless distance would exceed the maximum run distance. Either open trenching or microtunneling could be employed to install the chilled water distribution piping to a point just makai of Ala Moana Boulevard. In either case, there would have to be a receiving and/or jacking pit at that location. A trenchless segment would, as in Alternative 1, pass beneath Ala Moana Boulevard and terminate mauka of Auahi Street. Instead of proceeding up Keawe Street, the route would use South Street to access Pohukaina Street. From Pohukaina Street the distribution system route would remain the same as under Alternative 1. Under this alternative there would be two sewer mains to cross with the above noted vibration risks.

2.6.6 Summary of Alternative 2

In Alternative 2, the cooling station would be located on Pier 1 of Honolulu Harbor. Use of public lands would include State and Federal submerged lands where the seawater pipes would be installed, State highways and city streets where the distribution system pipes would be installed, and State lands on and adjacent to Sand Island where the seawater pipes would be assembled. In addition, the cooling station would be sited on State land. Components of the system, including the seawater pipes, the cooling station and the distribution system would be the same as for the Alternative 1. The microtunneled shaft from the cooling station would emerge to the east of the breakout point for Alternative 1. The nearshore jacking pit required under Alternative 1 would not be required under Alternative 2. Seaward of the breakout point, the seawater intake and return pipes would be installed as under Alternative 1; however, under Alternative 2, the return seawater diffuser would be deeper, between 210 and 240 feet deep. Beyond the diffuser, the intake pipe would continue seaward and terminate at the same depth as under Alternative 1. In addition to the differences in breakout point location and seawater pipe routing, Alternative 2 would employ a grating over the mouth of the intake pipe.

The trenchless segment of the Alternative 2 distribution route would pass under Forrest Avenue rather than under Keawe Street. The trenchless segment would, as in Alternative 1, pass beneath Ala Moana Boulevard and terminate mauka of Auahi Street. There would be a receiving/jacking pit makai of Ala Moana Boulevard. Instead of proceeding up Keawe Street, the route would use South Street to access Pohukaina Street. The remainder of the distribution system route would remain the same as under Alternative 1.

2.6.7 Alternative 2 Cost and Schedule

The initial capital cost for the Alternative 2 system would be greater than that for Alternative 1 for several reasons, including: 1) additional return seawater pipe length; 2) additional combination collars; and, 3) additional costs for design, engineering and installation of the intake pipe grate. In addition, periodic maintenance of the intake grate would require mobilization of an appropriate ROV from the mainland, greatly increasing operating costs.

Financing methods and the debt to equity ratio would remain as for Alternative 1. The schedule presented for Alternative 1 would apply to Alternative 2 as well.

2.7 THE NO ACTION ALTERNATIVE

The No Action Alternative would not implement a seawater air conditioning system in downtown Honolulu. Buildings would continue to be independently cooled with on-site chillers. Large quantities of refrigerants and other chemicals would continue to be imported, stored, and used in downtown office buildings. Large quantities of potable water would continue to be used in cooling towers, and municipal treatment plants would continue to treat and dispose of the wastewater generated. Individual building’s mechanical systems would continue to be maintained and replaced.

Continuation of the status quo (No Action Alternative) would forgo the opportunity to realize the substantial benefits provided by the SWAC system (HSWAC’s Preferred Alternative). Potential savings of electricity, electrical demand, crude oil, potable water, and sewage generation would be foregone. Potential reductions in emissions of greenhouse gases (such as CO_2) and other air pollutants associated with burning fuel oil for electricity would not be realized. Significant economic development opportunities (i.e., increased local spending, output, earnings, jobs creation, and State tax revenue generation) would also be foregone.

Although the specific buildings to be connected to the HSWAC system are not known at this time, some generalizations may be made about the operations that would be curtailed by implementation of the

HSWAC system, or conversely, would continue under the No Action Alternative. Table 2-3 provides this summary.

Table 2-3: Comparison of Operating Parameters of HSWAC and the No Action Alternative

Parameter	***HSWAC's Preferred Alternative***	***No Action Alternative (Conventional Cooling)***	***Benefits with HSWAC's Preferred Alternative***
Energy Consumption (kWh/yr)	22,800,000	100,300,000	77,500,000
Electrical Demand (kW)	8,400	23,100	14,600
Crude Oil (bbl/yr)	52,600	231,600	179,000
Potable Water Consumption (gallons/yr)	1,000,000	261,000,000	260,000,000
Sewage Generation (gallons/yr)	10,000	84,100,000	84,090,000
CO_2 Emissions (tons/yr)	24,900	109,700	84,800
Class 1 Ozone-Depleting Substances in Use	TBD	TBD	TBD
Cooling Tower Treatment Chemicals Used	TBD	TBD	TBD
Local Spending (over 26.5 years)	$476,300,000	$183,500,000	$292,900,000
Output (over 26.5 years)	$806,700,000	$323,000,000	$483,700,000
Earnings (over 26.5 years)	$246,800,000	$80,800,000	$166,000,000
Jobs (full-time equivalent person-years over 26.5 years)	4,951	1,101	3,850
State Tax Revenues (over 26.5 years)	$39,000,000	$15,000,000	$24,000,000

2.8 COMPARISON OF THE ENVIRONMENTAL IMPACTS OF THE ALTERNATIVES

Table 2-4 summarizes the environmental impacts of alternatives for the HSWAC system as compared with the No Action Alternative. Both Federal and State impacts criteria are included in the comparison. The term "local" is intended to mean site-specific or of island-wide significance. The term "regional" is intended to mean of State-wide significance.

Table 2-4: Comparison of the Impacts of the Alternatives

Impact Criteria	*Alternative 1 (Preferred Alternative)*		*Alternative 2*		*No Action Alternative*	
	Context/Intensity	*Description*	*Context/Intensity*	*Description*	*Context/Intensity*	*Description*
Substantially Affects Public Health or Safety	Local, Long-term and Short-term, Direct and Indirect/Positive but Insignificant	Reduced noise from cooling towers and reduced air pollutants from fossil fuel consumption would have positive public health effects. Reduction of toxic chemical use in existing chiller systems would benefit public health and safety. During construction, public safety around work areas would be protected by implementing BMPs.	Local, Long-term and Short-term, Direct and Indirect/Positive but Insignificant	Reduced noise from cooling towers and reduced air pollutants from fossil fuel consumption would have positive public health effects. Reduction of toxic chemical use in existing chiller systems would benefit public health and safety. During construction, public safety around work areas would be protected by implementing BMPs.	Local, Long-term and Short-term, Indirect/Negative but Insignificant	Existing noise and air quality do not compromise public health or safety. Hawaiʻi is in an attainment area for air pollutants. In the long-term, additional generating capacity would increase air pollutant loading. Toxic chemicals used in chillers would continue to be used, stored and disposed of.
Irrevocable Commitment of Natural Resources	Local, Regional, National, Long-term, Direct/Not Significant	Deep, cold seawater is a renewable resource. Fossil fuel would be required for electricity, but there would be significant net savings. A small area of seafloor would be occupied by pipelines.	Local, Regional, National, Long-term, Direct/Not Significant	Deep, cold seawater is a renewable resource. Fossil fuel would be required for electricity, but there would be significant net savings. A slightly larger area of seafloor would be occupied than under Alternative 1.	Local, Regional, National, Long-term, Direct/ Significantly Negative	Substantial quantities of fossil fuels and potable water would be required.

Impact Criteria	***Alternative 1 (Preferred Alternative)***		***Alternative 2***		***No Action Alternative***	
	Context/Intensity	***Description***	***Context/Intensity***	***Description***	***Context/Intensity***	***Description***
Irrevocable Commitment of Cultural Resources	Local, Regional, Long-term, Direct/Not Significant	Mitigation measures to avoid adverse effects on cultural resources are incorporated in the Preferred Alternative.	Local, Regional, Long-term, Direct/Not Significant	Mitigation measures to avoid adverse effects on cultural resources are incorporated in Alternative 2.	Local, Regional, Long-term, Direct/ Not Significant	Cultural resources would not be affected.
Curtails the Range of Beneficial Uses of the Environment	Local, Regional, National, Long-term, Direct/ Significantly Positive	Beneficial uses of the environment would be expanded by use of seawater. Pipelines would provide complex habitat for marine life and recreational/fishing uses.	Local, Regional, National, Long-term, Direct/Significantly Positive	Beneficial uses of the environment would be expanded by use of seawater. Pipelines would provide complex habitat for marine life and recreational/fishing uses.	Local, Regional, National, Long-term, Indirect/ Insignificantly Negative	To the extent the (potentially avoided) burning of fossil fuels contributes to global warming and sea level rise, beneficial uses of the environment would be curtailed.
Violates Laws or Conflicts with Government Policies and Goals	Local, Regional, National, Short-term, Long-term, Direct/ Significantly Positive	All laws, regulations and ordinances would be complied with. Strongly advances energy policies, goals and objectives at all levels of government.	Local, Regional, National, Short-term, Long-term, Direct/ Significantly Positive	All laws, regulations and ordinances would be complied with. Strongly advances energy policies, goals and objectives at all levels of government.	Local, Regional, National, Short-term, Long-term, Direct/	All laws, regulations and ordinances would be complied with. Does not contribute to advancement of energy policies, goals or objectives of government agencies.

Impact Criteria	***Alternative 1 (Preferred Alternative)***		***Alternative 2***		***No Action Alternative***	
	Context/Intensity	***Description***	***Context/Intensity***	***Description***	***Context/Intensity***	***Description***
Substantially Affects Economic or Social Resources	Local, Regional, Short-term. Long-term, Direct, Indirect/ Significantly Positive	Construction expenditures and jobs would represent short-term benefits. System operation would create long-term jobs and economic benefits.	Local, Regional, Short-term. Long-term, Direct, Indirect/ Significantly Positive	Construction expenditures and jobs would represent short-term benefits. System operation would create long-term jobs and economic benefits.	Local, Regional, Short-term, Long-term, Direct, Indirect/ Significantly negative economic effects, but significantly positive social impacts in terms of jobs creation.	Expenditures for fossil fuel leak out of the State economy. Some of the other expenditures result in local economic benefits. Jobs are created directly and indirectly.
Involves Substantial Secondary Impacts such as Population Changes or Effects on Public Facilities	Local, Long-term, Indirect/ Insignificant	No induced secondary effects would result.	Local, Long-term, Indirect/ Insignificant	No induced secondary effects would result.	Local, Long-term, Indirect/ Insignificant	No induced secondary effects would result.

Impact Criteria	***Alternative 1 (Preferred Alternative)***		***Alternative 2***		***No Action Alternative***	
	Context/Intensity	***Description***	***Context/Intensity***	***Description***	***Context/Intensity***	***Description***
Results in a Substantial Degradation of Environmental Quality	Local, Short-term, Long-term, Direct, Indirect/ Insignificantly Negative	Temporary negative effects on traffic, air quality, water quality and noise would be unavoidable during construction. During operation there would be negative effects on water quality within a designated Zone of Mixing. A small quantity of marine organisms would be affected during construction and operation.	Local, Short-term, Long-term, Direct, Indirect/ Insignificantly Negative	Temporary negative effects on traffic, air quality, water quality and noise would be unavoidable during construction. During operation there would be negative effects on water quality within a designated Zone of Mixing. A small quantity of marine organisms would be affected during construction and operation.	Local, Short-term, Long-term, Direct, Indirect/ Significantly negative	Existing operations cause air pollution, water pollution, noise, and waste disposal issues. Marine communities and water quality within existing designated Zones of Mixing for power plant cooling water outfalls are impacted.
Represents a Commitment to a Larger Action	Local, Long-term, Direct/ Insignificant	HSWAC is an independent action.	Local, Long-term, Direct/ Insignificant	HSWAC is an independent action.	Local, Long-term, Indirect/ Significant	Increased demand for conventional air conditioning would eventually lead to a requirement for additional fossil-fueled generating capacity.

Impact Criteria	***Alternative 1 (Preferred Alternative)***		***Alternative 2***		***No Action Alternative***	
	Context/Intensity	***Description***	***Context/Intensity***	***Description***	***Context/Intensity***	***Description***
Substantially Affects a Rare, Threatened or Endangered Species or its Habitat	Local, Short-term, Direct/ Insignificant	No rare or protected species would be substantially affected during construction or operation of the HSWAC system. During construction, mitigation measures would be put into place to ensure no disturbance of white terns or impacts to sea turtles or marine mammals.	Local, Short-term, Direct/ Insignificant	No rare or protected species would be substantially affected during construction or operation of the HSWAC system. During construction, mitigation measures would be put into place to ensure no disturbance of white terns or impacts to sea turtles or marine mammals.	Local, Short-term, Direct/ Insignificant	No rare or protected species would be substantially affected.
Negatively Affects Air Quality, Water Quality or Noise	Local, Short-term, Long-term, Direct, Indirect/ Insignificantly Negative	Temporary negative effects on air quality, water quality and noise would be unavoidable during construction. During operation there would be negative effects on water quality within a designated Zone of Mixing. Noise and drift from cooling towers would be eliminated.	Local, Short-term, Long-term, Direct, Indirect/ Insignificantly Negative	Temporary negative effects on air quality, water quality and noise would be unavoidable during construction. During operation there would be negative effects on water quality within a designated Zone of Mixing. Noise and drift from cooling towers would be eliminated.	Local, Short-term, Long-term, Direct, Indirect/ Significantly negative	Existing operations cause air pollution, water pollution, and noise, Water quality within existing designated Zones of Mixing is impacted.

Impact Criteria	***Alternative 1 (Preferred Alternative)***		***Alternative 2***		***No Action Alternative***	
	Context/Intensity	***Description***	***Context/Intensity***	***Description***	***Context/Intensity***	***Description***
Affects or is Likely to Suffer Damage by Being in an Environmentally Sensitive Area	Local, Short-term, Long-term, Direct/ Insignificant	The cooling station and distribution piping would be outside a tsunami inundation or flood hazard zone. The seawater pipelines are in a vulnerable zone, but designed to withstand anticipated forces.	Local, Short-term, Long-term, Direct/ Insignificant	The cooling station and distribution piping would be outside a tsunami inundation or flood hazard zone. The seawater pipelines are in a vulnerable zone, but designed to withstand anticipated forces.	Local, Short-term, Long-term, Direct/ Insignificant	Existing facilities are sited and engineered to minimize potential outages.
Affects the Unique Character of an Area	Local, Long-term, Direct/ Insignificant	The only visible HSWAC facility would be the cooling station, which is proposed to be sited within a district undergoing redevelopment.	Local, Long-term, Direct/ Insignificant	The only visible HSWAC facility would be the cooling station, which is proposed to be sited within an industrial area undergoing redevelopment.	Local, Long-term, Direct/ Insignificant	No Action would accelerate the necessity for addition of electricity generating capacity. The location of any new facility is currently unknown.
Affects Scenic Vistas or Viewplanes	Local, Long-term, Direct/ Insignificant	The only visible HSWAC facility would be the cooling station, which would be invisible from mauka or makai vantage points.	Local, Long-term, Direct/ Insignificant	The only visible HSWAC facility would be the cooling station, which would be a low-rise building in an industrial waterfront setting.	Local, Long-term, Direct/ Insignificant	No Action would accelerate the necessity for addition of electricity generating capacity. The location of any new facility is currently unknown.

Impact Criteria	***Alternative 1 (Preferred Alternative)***		***Alternative 2***		***No Action Alternative***	
	Context/Intensity	***Description***	***Context/Intensity***	***Description***	***Context/Intensity***	***Description***
Requires Substantial Energy Consumption	Local, Regional, National, Long-term, Direct/ Significantly Positive	Pumps and other equipment in the cooling station would require relatively small amounts of electricity, but the major purpose of the project is to substitute renewable energy for fossil fuel derived energy.	Local, Regional, National, Long-term, Direct/ Significantly Positive	Pumps and other equipment in the cooling station would require relatively small amounts of electricity, but the major purpose of the project is to substitute renewable energy for fossil fuel derived energy.	Local, Regional, National, Long-term, Direct/ Significantly Negative	No Action would continue use of fossil fuel derived electricity for energy-intensive air conditioning in a significant number of buildings.
Affects a Historic Site	Local, Regional, National, Long-term, Direct/ Insignificant	Siting of the cooling station and routing of the distribution system were done with consideration of historic sites locations. Connections to historic buildings would not affect building character.	Local, Regional, National, Long-term, Direct/ Insignificant	Siting of the cooling station and routing of the distribution system were done with consideration of historic sites locations. Connections to historic buildings would not affect building character.	Local, Regional, National, Long-term, Direct/ Insignificant	Any potential modifications to historic buildings to install or modify air conditioning systems would not affect building character.
Has Considerable Cumulative Effects on the Environment	Local, Short-term, Long-term, Direct, Indirect/ Insignificant	Construction scheduling would be done to minimize any potential cumulative effects on traffic. In the long-term, the HSWAC system would have positive cumulative effects on air quality, water quality and noise.	Local, Short-term, Long-term, Direct, Indirect/ Insignificant	Construction scheduling would be done to minimize any potential cumulative effects on traffic. In the long-term, the HSWAC system would have positive cumulative effects on air quality, water quality and noise.	Local, Long-term, Indirect/ Significant	No Action would cumulatively increase demands for electricity, potable water and wastewater treatment.

Impact Criteria	Alternative 1 (Preferred Alternative)		Alternative 2		No Action Alternative	
	Context/Intensity	Description	Context/Intensity	Description	Context/Intensity	Description
Entails Unknown Risks	Local, Short-term, Long-term, Direct/ Insignificant	All risks associated with construction and operation of the HSWAC system are well understood.	Local, Short-term, Long-term, Direct/ Insignificant	All risks associated with construction and operation of the HSWAC system are well understood.	Local, Short-term, Long-term, Direct/ Insignificant	All risks associated with installation and operation of conventional air conditioning systems are well understood.
Is Controversial	Local, Short-term, Direct/ Insignificant	An aggressive public involvement program has to date not surfaced controversy. Issues raised thus far can be mitigated.	Local, Short-term, Direct/ Insignificant	An aggressive public involvement program has to date not surfaced controversy. Issues raised thus far can be mitigated.	Local, Short-term, Direct/ Insignificant	No Action is the accepted method for providing air conditioning. It is not controversial.

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CHAPTER 3.
AFFECTED ENVIRONMENT

3.1 INTRODUCTION

This chapter describes the environmental setting of the proposed action. The potential direct, indirect, and cumulative impacts of project alternatives on those environmental resources are presented in Chapter 4. Mitigation measures are also described in Chapter 4.

A very extensive public involvement program was undertaken for this project. The length and analytical depth of the various sections in this chapter reflect the relative importance of the respective issues as determined in the public involvement process. Where agency personnel or members of the community have expressed concern about potential impacts to environmental resources, those resources are described in detail and potential impacts of the HSWAC system analyzed accordingly. Other environmental resources are described and analyzed in less detail. Issues that were identified as potentially significant in scoping include: archaeological and historic resources, conformance with land use plans and policies, impacts on the built environment, economic effects, the effects of natural hazards on the HSWAC system, impacts on marine organisms and habitat, and impacts on water quality.

3.2 ARCHAEOLOGICAL, HISTORIC AND CULTURAL RESOURCES

Three concerns were raised in scoping with respect to archaeological, historic and cultural resources: (1) the possibility of uncovering archaeological or cultural remains including human burials in excavations for HSWAC system components, (2) use of or impacts to historic structures in downtown Honolulu, and (3) impacts to traditional Hawaiian cultural activities. The sections below provide the background information for evaluating these potential effects. Assessment of the potential significance of impacts to these resources and potential mitigation measures to minimize their significance are described in the next chapter. This information is summarized from an archaeological and cultural impact study conducted by Pacific Consulting Services, Inc. prepared for the HSWAC project and included in its entirety in Appendix B.

3.2.1 Previous Archaeological Work in the Vicinity of the APE

The Area of Potential Effect (APE) lies mostly within the Downtown and Kakaʻako sections of modern-day Honolulu. Although the Downtown and Kakaʻako sections are extensively developed and undergoing continuous development the areas are rich in historic and cultural resources. Appendix B lists and reviews 72 prior studies in the vicinity of the APE. Of most concern is the potential to uncover human remains in trenching for the distribution system. Figure 3-1 plots the locations of previous burial finds in and near the APE.

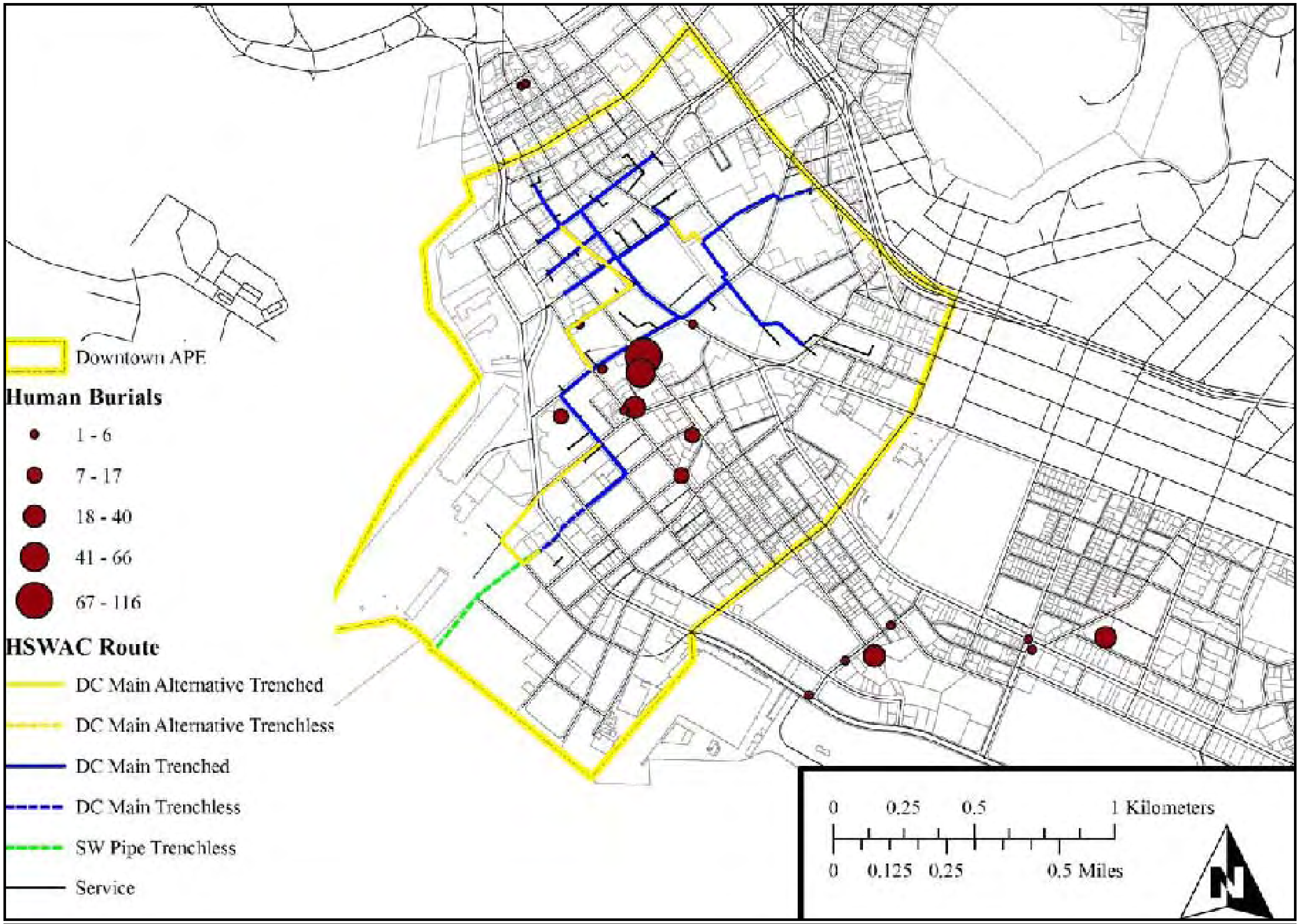


Figure 3-1: Location of Previous Burial Finds Within and Near the APE

3.2.2 Historic Sites

3.2.2.1 Architectural Properties - Overview

Many of the most distinctive and significant historic architectural properties in Hawai‘i are found in downtown Honolulu. The buildings exemplify a range of architectural styles and periods, and, in the case of register districts, preserve remnant portions of former architectural landscapes. The APE for the HSWAC system encompasses a number of historic architectural properties that are classified as follows:

- Individual ***sites*** that are ***currently listed*** on the Hawai‘i Register of Historic Places (HRHP) and/or National Register of Historic Places (NRHP);
- Register ***districts currently listed*** on the HRHP or NRHP that include multiple contributing properties;
- Sites that have been formally deemed ***eligible for listing*** on the NRHP by the Keeper of the National Register;
- Buildings and structures that are ***historic*** in age (50 years old or more) that were identified by participants in the cultural impact statement (CIA), but are not currently listed on the HRHP or NRHP; and
- Buildings and structures that are not historic in age but were identified as ***culturally significant*** by participants in the CIA.

Sites listed on the HRHP or NRHP are protected by State and Federal laws designed to avoid or minimize any impact on them by proposed development or construction activities. Under State law (Chapter 6E-10, Hawai‘i Revised Statutes), any project that may affect a historic site on the HRHP must be reviewed by the State Historic Preservation Division (SHPD) before it takes place in order for the SHPD to assess the effects, if any, and recommend needed mitigation. Figure 3-2 shows the locations of sites listed on the HRHP or NRHP in the APE.

3.2.2.2 Individual Architectural Properties within the APE on the HRHP and/or NRHP

Table 3-1 lists individual architectural properties placed on the HRHP or NRHP, and that are located within the overall boundaries of the APE for the underground distribution system for the HSWAC system. With the exception of the Falls of Clyde – a historic sailing vessel moored at Pier 7 -- the listed properties include buildings with a range of public and private functions from commerce to religion. Although all listed properties provide information on Honolulu’s and Hawai‘i’s past, some also exemplify specific building styles or techniques.

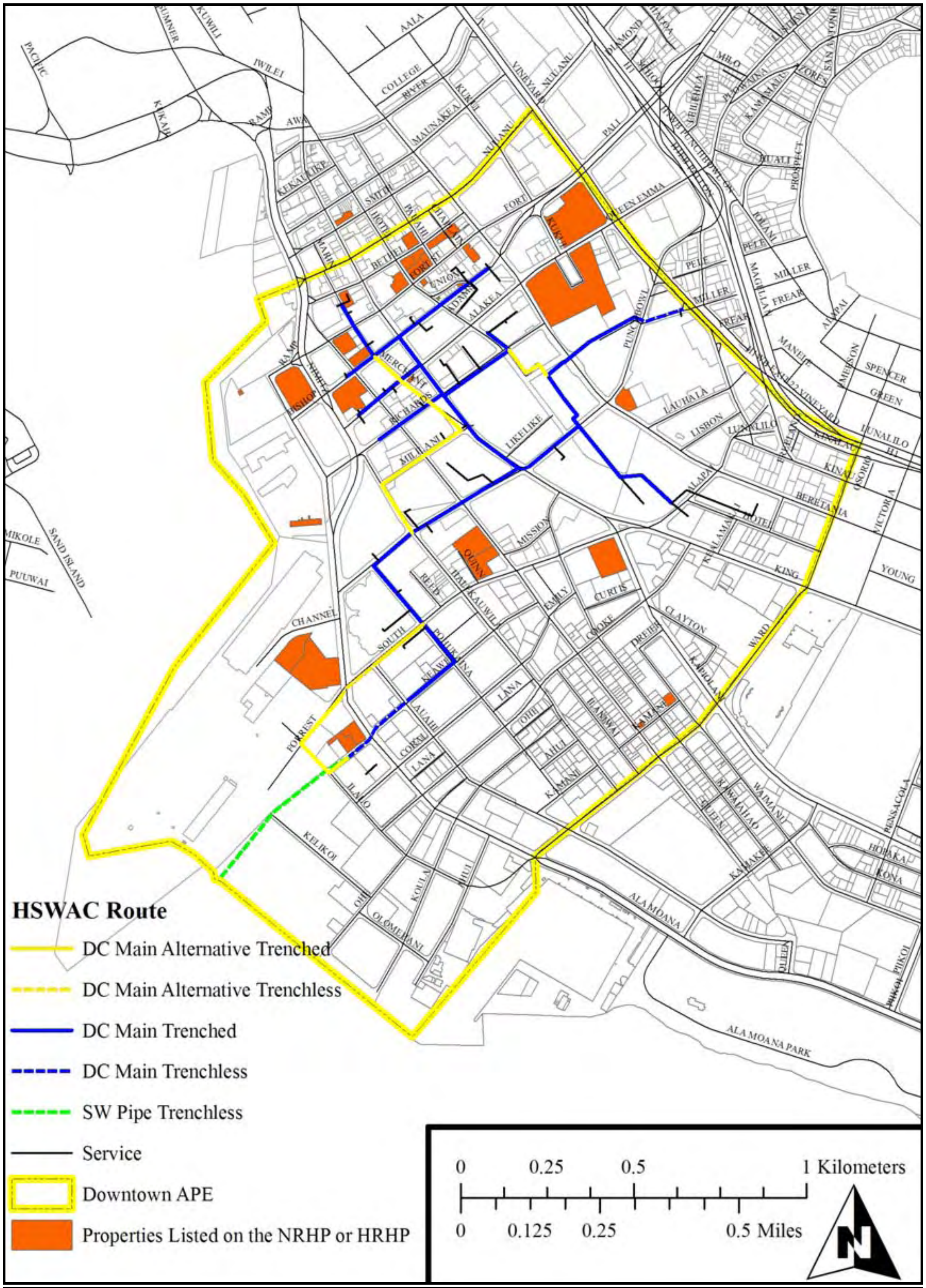


Figure 3-2: Locations of Historic Properties Listed on the State or National Registers of Historic Places in the Area of Potential Effect

Table 3-1: Individual Architectural Properties in the APE That Are Listed on the Hawai‘i and/or National Register of Historic Places

Name of Property	*Year Built*	*SIHP[1] No.*	*TMK*	*HRHP[2]*	*NRHP[3]*	*Adjacent to Pipelines*
The Hawai‘i Theatre	1922	-1332	2-1-03:14	X	X	
Kaka‘ako Fire Station	1929	-1346	2-1-31:18	X		
Joseph W. Podmore Building	1905	-1357	2-1-16:04	X	X	X
Emerald Building	1941	-1379	2-1-10:41	X		X
Falls of Clyde	1878	-9700	2-1-01:60		X	
Kaka‘ako Pumping Station	1900	-9710	2-1-15: 43, 44	X	X	X
Yee/Kobayashi Store	1918	-9739	2-1-49:08	X		
Saint Peter’s Church	1914	-9740	2-1-18:02	X		
Mabel Smyth Memorial Building	1941	-9765	2-1-35:01	X	X	
Central Intermediate School	1926	-9774	2-1-09:01	X	X	
Irwin Memorial Park	1930	-9829	2-1-13:07	X		
Dillingham Transportation Building	1929	-9900	2-1-14:03		X	
Our Lady of Peace Cathedral	1843	-9906	2-1-10:14	X	X	X
Royal Brewery	1900	-9917	2-1-31:21		X	
Alexander & Baldwin Building	1929	-9925	2-1-13:01	X	X	X
Aloha Tower	1926	-9929	2-1-01:13	X	X	
C. Brewer Building	1930	-9938	2-1-13:03	X	X	
US Immigration Office	1934	-9964	2-1-15:18,19		X	

[1] Statewide Inventory of Historic Places;[2] Hawai‘i Register of Historic Places;[3] National Register of Historic Places

Of these 19 individual properties only five are immediately adjacent to the proposed pipeline system. Should any of these buildings be added as HSWAC customers, pipeline connections would be designed and installed so as not to affect a building’s appearance or structure.

3.2.2.3 Historic Districts within the APE on the Hawai‘i and/or National Register of Historic Places

Portions of several HRHP and/or NRHP districts are also found within the boundaries of the APE. Table 3-2 lists Districts within the HSWAC APE having one or more contributing properties and they are shown on Figure 3-3. Of the 40 architectural sites listed as contributing properties in Table 3-2, a total of 27 are generally adjacent to the proposed distribution pipelines but only three buildings are currently connected to the proposed distribution pipelines. The majority of these properties are within the Hawai‘i Capitol and Merchant Street Register Districts.

Table 3-2: Historic Districts Within the APE Listed on the Hawai‘i and/or National Register of Historic Places

District Name	*SIHP No.*[1]	*Contributing Properties Within the APE & Year(s) Built*[2]	*TMK*	*HRHP*[3]	*NRHP*[4]	*Adjacent (A) or Connected (C) to HSWAC*
Hawai‘i Capital District	-1321	State Capitol & Grounds (1969) YMCA (1928) YWCA (1927) Hawaiian Electric Company (1927) Territorial Office Building (1926) Hawai‘i State Library (1913) Honolulu Hale & Grounds (1929) Mission Memorial Building (1916) The Kamehameha Statue (1883) State Tax Office (1939) Washington Place and Grounds (1846) Ali‘iolani Hale (1874) ‘Iolani Palace & Grounds (1882), includes Old Archives Building (1906) & Old Mausoleum ‘Iolani Palace Bandstand (1883) ‘Iolani Barracks (1871) US Post Office, Custom House & Court House (1922) Kapuaiwa Building (1884) Kawaiaha‘o Church & Grounds (includes Lunalilo’s Tomb & Adobe Schoolhouse) (1835 & 1842) Mission Houses (1821 – 1831)	2-1-24:01 2-1- 17:01,02 2-1-17:09 2-1-16:01 2-1-25:03 2-1-25-01 2-1-33:07 2-1-33:07 2-1-25:03 2-1-26:22 2-1-18:01 2-1-25:03 2-1-25:02 2-1-25:02 2-1-25:02 2-1-25:04 2-1-25:03 2-1-32:17 2-1-32:02		X X X X X X X X X X X X NHL[5] X X NHL NHL	C A A A A A C A A A A A A A C A A A
Fire Stations of O‘ahu	-1346	Central Fire Station (1935) Old Kaka‘ako Fire Station (1929)	2-1-9:26 2-1-31:18	X X	X X	
City & County of Honolulu Art Deco Parks	-1388	Mother Waldron Neighborhood Park (1937)	2-1-51:05	X		
Merchant Street Historic District	-9905	Multiple Properties: T.R. Foster Building (1891)	 1-7-02:35		X	

Table 3-2: Historic Districts Within the APE Listed on the Hawai'i and/or National Register of Historic Places

District Name	*SIHP No.*[1]	*Contributing Properties Within the APE & Year(s) Built*[2]	*TMK*	*HRHP*[3]	*NRHP*[4]	*Adjacent (A) or Connected (C) to HSWAC*
		Royal Saloon (1890)	2-1-02:35			
		Waterhouse Building (1870)	2-1-02:34			
		Yokohama Specie Bank (1909)	2-1-02:33			A
		The Friend Building (1917)	2-1-02:32			
		Old Police Station (1931)	2-1-02:24			A
		Kamehameha V Post Office (1871)	2-1-02:12			A
		Melchers Building (1854)	2-1-02:20			
		Old Bishop Building (1878)	2-1-02:19			A
		Old Bishop Estate Office (1896)	2-1-02:19			A
		Judd Block (1898)	2-1-13:04			A
		Stangenwald Building (1901)	2-1-13:05			
Chinatown Historic District	-9986	Multiple Properties:			X	
		King's Court (1916)	2-1-02:42			
		McLean Block (1903)	2-1-03:16			
		Perry Block (1888)	2-1-03:17			
		Pantheon Bar (1911)	2-1-03:18			

SIHP = Statewide Inventory of Historic Places Number 50 (Hawai'i) – 80 (O'ahu) – 14 (Honolulu Quad) – XXXX (unique site number)
[2] APE = Area of Potential Effect
[3] HRHP = Hawai'i Register of Historic Places
[4] NRHP = National Register of Historic Places
[5] NHL = National Historic Landmark
[1]

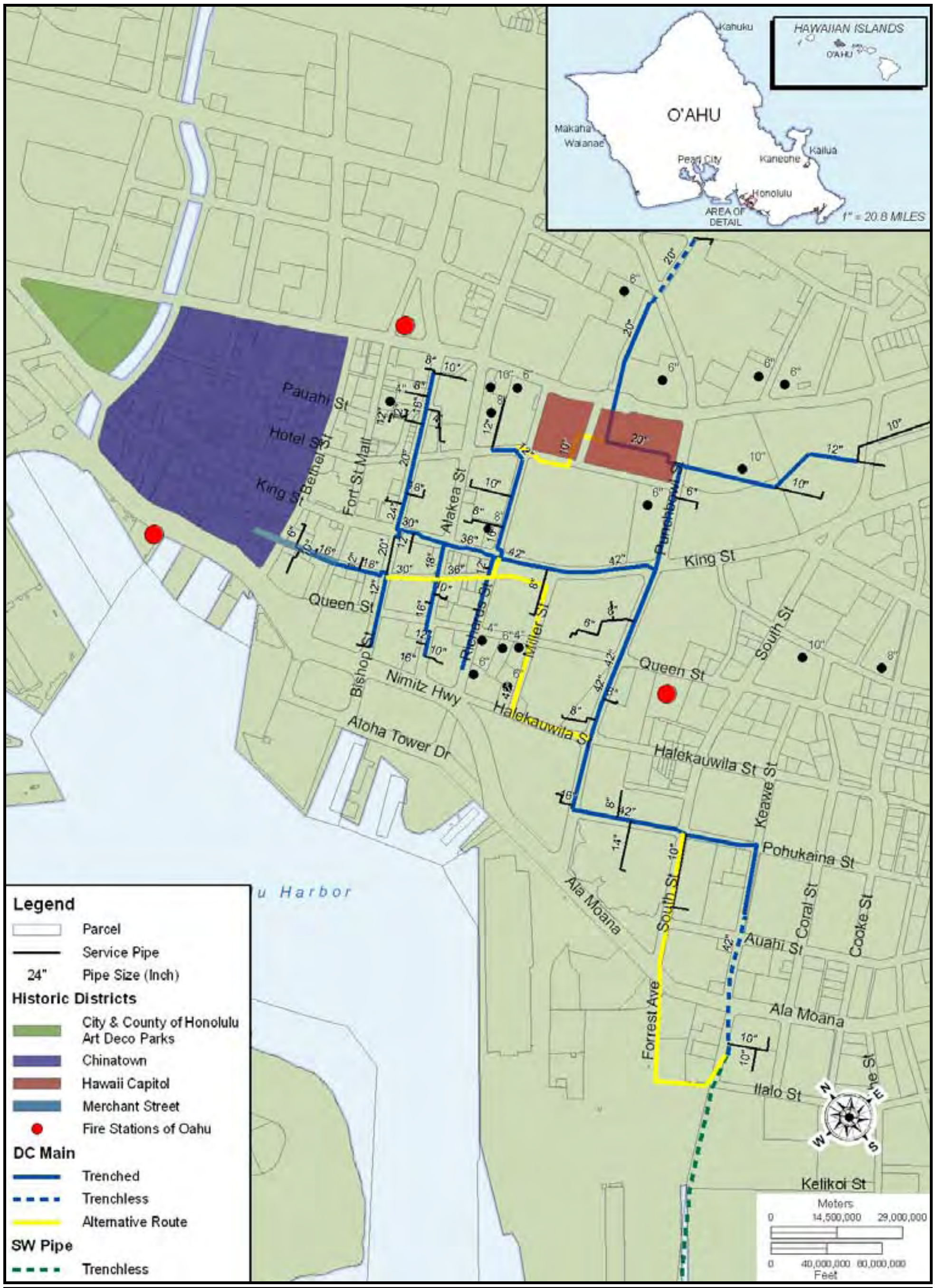


Figure 3-3: Historic Districts Within the APE Listed on the Hawai'i and/or National Register of Historic Places

As shown in Table 3-3, seven architectural properties that have been determined to be eligible for listing on the NRHP are within the APE. None are adjacent to or potentially affected by the proposed routing of the distribution pipelines for HSWAC.

Table 3-3: Historic Buildings & Structures within the APE That Have Been Deemed Eligible for Listing on the National Register of Historic Places

Name of Property	***Tax Map Key***	***Date of Eligibility Ruling***	***Adjacent or Connected to HSWAC***
Brass Foundry	2-1-49:54	1/24/1979	-
Hawai‘i Building	2-1-03: 12	1/11/1980	-
Hotel Street Sidewalk Features	1-7-03: various; 2-1-03: 10, 11, 12, 13, 14	1/11/1980	-
J. Campbell Building	2-1-02:01, Lots5, 7, 11, 12	1/11/1980	-
McCorriston Building	2-1-10:20	1/11/1980	-
Portland Building	2-1-10:13	1/24/1979	-
Advertiser Building	2-1-47:04	1/24/1979	-

Finally, participants in the CIA identified a number of buildings and structures of historic age (50 years to older) or of cultural significance during the interviews. Table 3-4 lists these architectural properties; in the interval since the CIA interviews were carried out, two of these buildings have been demolished. Furthermore, one of the buildings listed – the current church of Ho‘omana Naauao o Hawai‘i congregation – is less than 50 years old, having been built in 1969. The congregation, as seen in interviews conducted for the CIA, has long-term ties to the Kaka‘ako area though, and the current church is on the site of an earlier church structure.

In addition to the architectural properties discussed above, there is one other historic structure within the APE that has not been formally recorded. This is the historic seawall or dock structure that abuts the modern-day Pier 12 along its base and *makai* sides. Pier 12 lies *makai* of Nimitz Highway, between Bethel Street and Nu‘uanu Avenue. Current plans do not indicate that the structure would be affected in any way by project activities.

Table 3-4: Structures of Historic Age and/or Significance Identified During Oral History Interviews

TMK	*Street Address*	*Name of Property*	*Year(s) Built*	*Type of Structure(s)*	*Land Use*
2-1-049:079	505 Kamani Street	NA	1941	Quonset hut	Industrial
2-1-049:009	512 Kamani Street	NA	1920 1950	Residence Warehouse	Industrial
2-1-050:034	815 Queen Street	Church - Kewalo Holy Ghost	1958 2001	Church, Community Hall	Industrial (Religious Institution) Demolished 2006
2-1-050:040	871 Queen Street	NA	1915	Residence	Industrial – Demolished 2007
2-1-050:042	885 Queen Street	Hamada Store	1958	Warehouse	Industrial
2-1-050:049	901 Queen Street	Ching Store	1913 1912	Residence Apartments	Industrial
2-1-051: 001	640 Cooke Street	Aloha Theatre/Kewalo Theatre	1938	Theatre, Commercial	Industrial
2-1-046: 009	910 Cooke Street	Hoʻomana Naauao o Hawai`i	1969	Church, Shrine	Commercial (Religious Institution)
2-1-058: 041	59 Ahui Street	NA	1921 1936	Warehouse Frame Shed	Industrial

3.2.3 Cultural Impact Assessment

Appendix B also summarizes the results of a cultural impact assessment (CIA). The study consisted of three phases: (1) cultural and historical archival research (literature review); (2) ethnographic survey (oral history interviews), transcribing taped interviews, analysis of ethnographic data (oral histories) and (3) report writing. The cultural impact study/assessment was based on two guiding documents: Act 50 and the Office of Environmental Quality Control Guidelines, as well as the *Criteria for Historic Preservation*. The level of effort for the study included a broad archival research literature review and an ethnographic survey (11 interviews).

Material for the archival cultural and historical literature review was compiled. The majority of the primary source material came from the Hawaiian Collections of the University of Hawaiʻi Hamilton Library (Manoa Campus); the Bishop Museum Archives; Hawaiʻi Children's Mission House archives; Waihona ʻAina Corp.; State Historic Preservation Division library; information from State Bureau of Conveyances; personal library; and Internet searches. Primary source material included Land Court records, maps, newspapers, visitor journals, genealogies, oral histories and other studies. Secondary source material included translations of 19th century ethnographic works, historical texts, indexes, archaeological reports, and Hawaiian language resources (i.e., proverbs, place names and dictionary).

The ethnographic survey (oral history interviews) is an essential part of the CIA because it helps in the process of determining if an undertaking or development project would have an adverse impact on the cultural practices or access to cultural practices. The following are initial consultant selection criteria:

- Had/has Ties to Project Location(s);
- Known Hawaiian Cultural Resource Person;
- Known Hawaiian Traditional Practitioner; and/or
- Referred By Other Cultural Resource People.

The consultants for this CIA were selected because they met the following criteria: (1) consultant grew up or lived in Kakaʻako and vicinity; (2) consultant is familiar with the history and *moʻolelo* of Kakaʻako and vicinity; or (3) consultant referred by other people connected to Kakaʻako.

The ethnographic survey was designed so that information from ethnographic consultants interviewed would facilitate in determining if any cultural sites or practices or access to them would be impacted by the implementation of the HSWAC project. To this end the following basic research categories or themes were incorporated into the ethnographic instrument: Consultant Background, Land Resources and Use, Water Resources and Use, Marine Resources and Use, Cultural Resources and Use, Anecdotal Stories and Project Concerns. Except for the 'Consultant Background' category, all the other research categories have sub-categories or sub-themes that were developed based on the ethnographic raw data (oral histories) or responses of the consultants. These responses or clusters of information then become part of the supporting evidence for any determinations made regarding impacts on cultural resources and/or practices.

All of the information gathered in the CIA is included in Appendix B. The resulting recommendations are reproduced in Chapter 4.

3.3 BUILT RESOURCES AND HUMAN USES

3.3.1 Harbors and Shipping

The proposed area for installation of the HSWAC intake and return pipes is between the entrances of Honolulu Harbor and Kewalo Basin. Honolulu Harbor is the largest and most important of Oʻahu's three commercial harbors. It is the State's port-of-entry for nearly all imported goods. The harbor was created by freshwater flows from Nu‘uanu Valley, which inhibited coral growth within a small, reefed basin and cut several channels through the surrounding reef. The main channel, which was the deepest, was flanked to the west by shallower outlets. Between these outflows rose occasional spots of earth and coral – the beginnings of Sand Island. Use of the harbor by deep-draft vessels can be first traced to fur traders in 1794. The harbor and surrounding village grew with the ensuing sandlewood trade and then the arrival of whaling ships. The harbor was the center of community life in the 1800s and gave the city its name. By 1857, Honolulu Harbor had five wharves capable of handling ships of 1,500 gross tons, with a total berthing frontage of 600 ft. By 1870, an additional 2,000 ft of wharfage had been added by filling 22 acres of reef and tideland. Filling and dredging, including formation of Sand Island, accelerated with the rise of the sugar industry, and later pineapple, in the late 1800s and early 1900s. In 1907, the Corps of Engineers widened and deepened Kapalama Basin and Kapalama Channel. Today Honolulu Harbor has over 30 major berthing facilities with over five linear miles of mooring space, and is surrounded by over 200 acres of container yards. Harbor depths range from 40 to 45 ft. Anchorage for additional deep-draft vessels exists outside the harbor and Sand Island, west of the main entrance channel.

Kewalo Basin, O‘ahu’s smallest commercial harbor, was constructed in the 1920s to ease the congestion in Honolulu Harbor and provide docking for lumber schooners. It soon became a center of fishing operations. In 1955, approximately eight acres of filled land were added along the makai side of Kewalo Basin to form a peninsula protected by a rock revetment. Once used mainly by commercial fishing vessels, including the wooden sampans that supplied skipjack tuna (aku) to the now closed tuna cannery that occupied its western shore, Kewalo Basin in recent years has seen increasing use by tour boats offering whale watching and dinner cruises. Some smaller commercial fishing vessels still berth there, as do the majority of O‘ahu’s charter fishing boats. The Pacific Islands Fishery Science Center’s Kewalo Research Facility occupies about one acre near the terminal end of the seaward peninsula. Two saltwater wells provide almost 100,000 gallons per hour to tanks housing pelagic fish, marine mammals, sea turtles, and other marine organisms.

3.3.2 Pipelines, Outfalls and Dump Sites

Honolulu Harbor is ringed with industry; pineapple canneries, gas and oil storage, and numerous other industrial enterprises have operated, or are still operating, there. Pollution is well known in the harbor; poor conditions are described as early as 1920 in references cited by Cox and Gordon (1970). Several regulated and unregulated point sources of pollution discharge into Māmala Bay. Most prominent are the three wastewater treatment plant (WWTP) outfalls (Sand Island, Fort Kamehameha, and Honouliuli). Sewage has been pumped into the ocean offshore of Kewalo and Sand Island since the 1930s. The early inputs were all raw sewage released in shallow water (not exceeding 20 ft in depth). The actual points of release varied through time as different pipes were constructed and used. The multitude of perturbations that occurred in shallow water from these early sewage inputs continued until the construction of the present Sand Island deep-water outfall in 1978 (Brock, 1998).

Other notable discharges to Māmala Bay include the Ala Wai Canal (into which Manoa Stream discharges); Nu‘uanu, Kapalama, Kalihi, and Moanalua Streams; other small streams and drainage channels; and Pearl Harbor, which receives runoff from five perennial and three intermittent streams.

West of Kewalo Basin, on lands now occupied by the Kaka‘ako Waterfront Park, stood the former Honolulu incinerator and dump. While in operation, this dump received both burned and unmodified wastes from urban Honolulu at a period of time when concern over pollution from anthropogenic sources was less than now. Because the unlined dump filled in a section of old coastline in excess of 330 ft seaward, these materials along the seaward side are exposed to seawater and there is a potential for leaching of pollutants (Brock, 1998).

The diffuser for the Sand Island Deep Ocean WWTP Outfall lies about two miles west of the proposed site of the HSWAC seawater return diffuser.

Māmala Bay has been used as a dumping ground for dredged materials from both Pearl Harbor and Honolulu Harbor. Figure 3-4 shows the three main dump sites in Māmala Bay: the former Pearl Harbor site, the former Honolulu Harbor Site, and the active South Oʻahu Site, which was approved for use by the U.S. EPA in 1980. That site is approximately 1.5 miles west of the proposed HSWAC seawater intake site. An old 1972 disposal site is also shown along with two study sites evaluated during the South Oʻahu designation study.

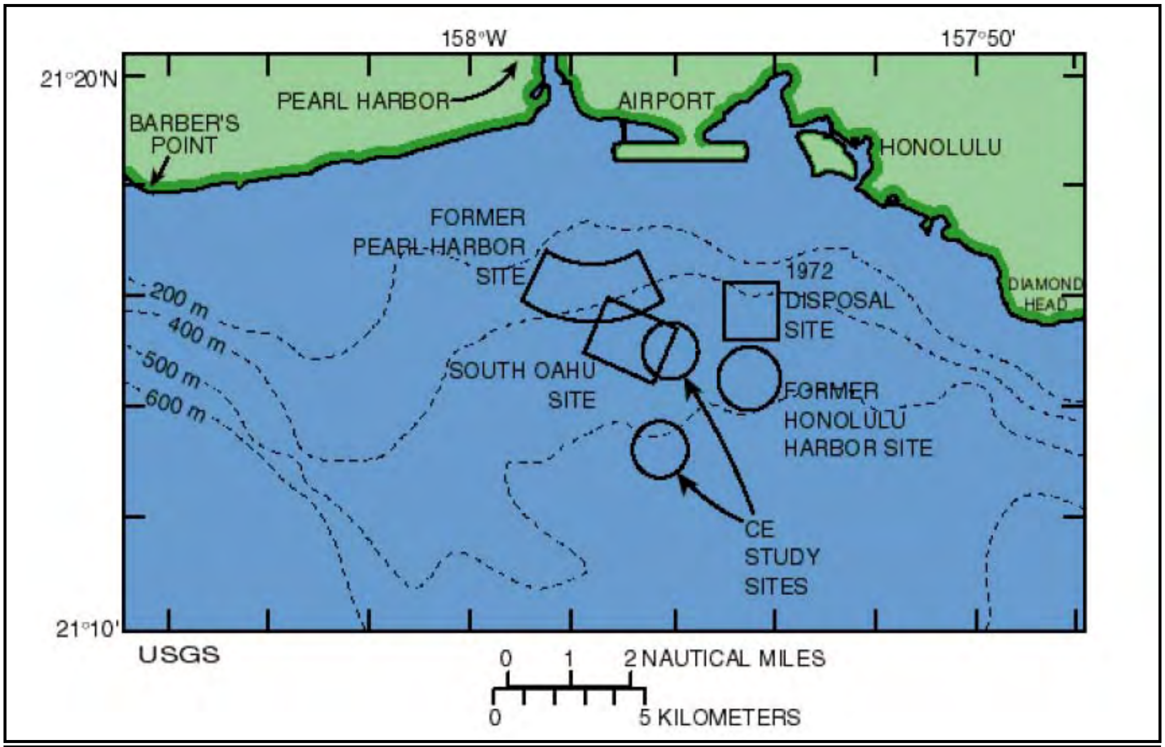


Figure 3-4: Dredged Material Disposal Sites in Māmala Bay
(Source: USGS, 2005)

3.3.3 Ocean Recreation

Recreational activities on the reef fronting Kakaʻako Park include swimming, surfing, snorkeling, diving, body boarding and various kinds of fishing. One of Oʻahu's best bodysurfing sites, Point Panic, is located at the east end of the park in front of the University of Hawaiʻi's Kewalo Marine Laboratory. Since 1994 this site has been off-limits to board surfers. Waters to the west of Point Panic are open to board surfers (Clark, 2005). Activities taking place farther offshore include sailing, paddling and other types of fishing.

Keʻehi Lagoon Beach Park, a seventy-two-acre park on the northern shore of the lagoon, is the site of outrigger canoe regattas. Facilities include canoe storage, a viewing stand and a man-made sand beach. While the waters of the lagoon are not highly regarded for swimming, they provide an excellent venue for canoe racing (Clark, 2005).

3.3.4 Commercial Fishing

In Hawaiʻi, anyone who sells part of their catch is classified a commercial fisherman. Commercial fisherman must be licensed by the State and submit catch reporting forms. Many recreational or subsistence fishermen sell portions of their catch to recover trip expenses, and thus are nominally commercial fishermen. Fishery resources in the project area are depleted as a result of habitat degradation and overfishing. Nevertheless, shore fishing is popular, and net and spear fishing are practiced near shore. Reef fishing from small boats takes place offshore and some of the charter boats from Kewalo Basin now offer night reef fishing.

Commercial catches are reported to the Hawaiʻi Division of Aquatic Resources (DAR) monthly by statistical area. Area 400 extends two miles offshore from the middle of the Reef Runway to Diamond Head. Area 420 extends seaward from 2 to 20 miles offshore. DAR's 2005 landings summary report (the latest year for which data are available on line) show that 46,428 pounds (including fish, shellfish, and seaweed) were landed from these two areas. That represents 0.02% of the Oʻahu landings. The report does not provide data on landings by each of these areas or on the species composition of those landings, but DAR kindly provided the 2007 data for these two areas (Table 3-5).

Landings in 2007 were nearly 27% less than in 2005. Landings in Area 400, nearest to shore, were 14,093 pounds, dominated by akule, a coastal schooling fish, taape, an introduced snapper, uhu (parrotfish), and heʻe (octopus). Akule is fished from a boat with nets or hook and line. Taape are usually taken on hooks. Parrotfish and octopus are usually taken by divers with spears.

Landings in Area 420 further offshore reflect the necessity to fish that area from a boat. A total of 19,878 pounds was landed, with the great majority being pelagic species typically caught by trolling including tunas, billfish, mahimahi and ono (wahoo). A small quantity of deep bottomfish was harvested, mostly onaga.

Table 3-5: Commercial Marine Landings off Kakaʻako in 2007

Species Group	***Species***	***Area***	
		400	***420***
		lbs. Landed	***lbs. Landed***
AKULE/OPEL	AKULE/HALALU	3,365	***
	OPELU	592	***
AKULE/OPEL	***SUBTOTAL***	***3,957***	*********
BILLFISHES	BLUE MARLIN	_	3002
	SHORT BILL SPEARFISH	_	180
	STRIPED MARLIN	_	622
	SWORDFISH	***	
BILLFISHES	***SUBTOTAL***	*********	***3804***
DEEPBOTTOM	HAPUUPUU	***	***
	KALEKALE	_	***
	OPAKAPAKA	***	***
	UKU	***	***
	EHU	44	44
	ONAGA	***	781
	LEHI	_	***
	GINDAI	_	***
	HOGO	_	***
	TAAPE	1358	_
DEEPBOTTOM	***SUBTOTAL***	***1402***	***825***

Species Group	Species	Area 400 lbs. Landed	Area 420 lbs. Landed
INSHORE	A'AWA	***	_
	AHA	***	_
	AWA	74	_
	HILU	***	_
	KALA	82	_
	KAWALEA	***	_
	KUMU	39	_
	LAENIHI	4	_
	MAIKO	***	_
	MA'O MA'O	***	_
	MANINI	385	_
	MOANA	83	_
	MU	***	_
	NAENEA	***	_
	NENUE	***	_
	NUNU	***	_
	OIO	***	_
	PALANI	776	_
	PANUHUNUHU	***	_
	PUALU	***	_
	PUHI (MISC.)	***	_
	PUHI (BLACK/BROWN)	***	_
	UHU (MISC.)	1,154	_
	MENPACHI	44	_
	MALU	***	_
	TOAU	***	_
	ROI	38	_
	POO PAA	***	_
	OPELU KALA	***	_
	KALALEI	***	_
	RED WEKE	405	_
	WEKE A'A (WHITE)	***	_
	MOANO KALE	***	_
INSHORE	***SUBTOTAL***	***3,084***	_
JACKS	OMILU	100	***
	KAGAMI	***	_
	DOBE	***	_
	SASA	***	_
	PAPA	13	_
	WHITE PAPIO/ULUA	522	_
	PAPIO, ULUA (MISC.)***	22	_
JACKS	***SUBTOTAL***	***657***	*********
MISC. PELAGIC	MAHIMAHI	393	6,473

Species Group	Species	Area	
		400	420
		lbs. Landed	lbs. Landed
	ONO	***	1,223
MISC. PELAGIC	***SUBTOTAL***	***393***	***7,696***
OTHER ANIMAL	SQUID	***	_
	HE'E (DAY TAKO)	2,744	_
	OPIHI 'ALINA	***	_
OTHER ANIMAL	***SUBTOTAL***	***2744***	_
SEAWEEDS	LIMU KOHU	***	_
	OGO	471	_
SEAWEEDS	***SUBTOTAL***	***471***	_
SHELLS	CONIDAE	na	_
	C. TIGRIS	na	_
	C. MARIAE	na	_
	MURICIDAE	na	_
	SPNDYLIDAE	na	_
	TEREBRIDAE	na	_
	ARCHITECTONICIDAE	na	_
SHELLS	***SUBTOTAL***	na	_
TUNA	AKU	75	753
	YELLOWFIN TUNA	***	5,704
	KAWAKAWA	_	46
TUNA	***SUBTOTAL***	***75***	***6,503***
UNCLASS/MISC.	UNKNOWN/MISC***	1,313	1,051
UNCLASS/MISC.	***UNKNOWN/MISC****	***1,313***	***,1051***
AREA	**TOTAL**	**14,096**	**19,879**
CY2007 for 400/420	**GRAND TOTAL**	**33,975**	

***Due to low level of fishermen reporting and to preserve confidentiality, data for these species are pooled under their respective species group unclassified miscellaneous or the Unclass./Misc. category.
Source: State of Hawai‘i, DLNR, Division of Aquatic Resources

3.3.5 Military Activities

The Pearl Harbor Entrance Channel is a Naval Defense Sea Area, and is closed to the public. This area begins about three miles west of the proposed HSWAC pipeline route, and extends about three to four miles offshore in the area fronting the Reef Runway of the Honolulu International Airport.

3.3.6 Parks and Recreational Facilities

Close to the proposed cooling station site is the Kaka‘ako Waterfront Park, built on an old solid and incinerator waste dump site. The waste has been capped, and fill added to limit exposure to toxics by park users. Mauka of Kaka‘ako Waterfront is the Makai Gateway Park, which affords a view from Ala Moana Boulevard to the ocean.

Along the proposed distribution line route is Mother Waldron Neighborhood Park, located east of Keawe Street between Auahi and Pohukaina Streets.

The proposed staging area on Sand Island is part of a large parcel that extends around the entire seaward margin of Sand Island from the northwest end of the Ke‘ehi Lagoon frontage, along the south-facing side of Sand Island, and extending around to the north fronting the interior of Honolulu Harbor. This parcel, at its eastern end, contains the Sand Island State Park. The proposed staging area, however, is more than a half mile from the developed park.

3.3.7 Utilities

Utilities service for the HSWAC system would be required only at the cooling station site. The site is within the Kaka‘ako Community Development District Improvement District, which has undergone significant utility upgrades in recent years. Existing utilities at that site are as follows. A 15-inch sewer main runs under Ilalo Street adjacent to the site. The line is enlarged to 21 inches at Keawe Street, just ‘ewa of the site. There is a six-inch lateral connection to the sewer line at the western corner of the parcel. Adequate sewer capacity would be available for the small number of on-site employees at the cooling station.

An existing 12-inch water main runs under Ilalo Street. An eight-inch lateral connection into the proposed cooling station site is in place. New fire hydrants were installed along Ilalo Street as part of the Improvement District 9 (ID9) project. It is expected that adequate water supply would be available at the site.

Drainage improvements were made to Ilalo Street as part of the ID9 project. There is a storm drain opening on Ilalo Street opposite the site which feeds a 11.5 ft x 9 ft box drain in Ilalo Street. At Keawe Street the storm drain turns makai and parallels an existing 8 ft x 4 ft box drain that runs makai on Keawe Street.

Fire hydrants are installed throughout the Kaka‘ako Makai District area. Data for the hydrants closest to the preferred site are as follows.

- FH 4075 located on Keawe Street between Ala Moana Boulevard and Ilalo Street
  - Static Pressure: 74 psi
  - Flow at 20 psi Residual Pressure: 4,000 gpm
- FH 1725 located on Ala Moana Boulevard between Coral Street and Cooke Street
  - Static Pressure: 74 psi
  - Flow at 20 psi Residual Pressure: 4,000 gpm
- FH 4864 located on Cooke Street between Ala Moana Boulevard and Ilalo Street
  - Static Pressure: 74 psi
  - Flow at 20 psi Residual Pressure: 4,000 gpm

Recently completed improvements to Ilalo Street include underground ducts for the electrical, telecommunications, and cable television systems. The improvements include provision of service conduit stubs into the preferred cooling station site. HECO’s primary electrical infrastructure on Ilalo Street consists of six six-inch conduits and related manholes. Service stubs for parcels along Ilalo Street consist of two four-inch conduits.

New electrical utility service connections would be provided to the cooling station. New HECO feeders, from their nearby substations would provide electrical power to the project. These feeders would most likely be routed underground in ducts and manholes via two routes. The first route would start at the mauka side of the intersection of Ala Moana Boulevard and Ward Avenue and continue along Ilalo Street

to the cooling station. A second route would begin near the intersection of Ala Moana Boulevard and South Street and continue along Ala Moana Boulevard and Keawe Street to the cooling station.
Hawaiian Telcom telecommunications system infrastructure on Ilalo Street consists of eight four-inch conduits and related manholes. Service stubs for the parcels along Ilalo consist of four four-inch conduits.

3.3.8 Roadways and Traffic

The distribution pipeline route through downtown Honolulu was optimized in consideration of: (1) density of other buried utilities, (2) potential traffic impacts, and (3) potential for buried cultural resources, including human remains and (4) potential cumulative impacts from other major proposed development, especially the City's proposed rail system. The construction crew would primarily use trenching to lay the distribution pipes.

Roadway intersections of interest are circled in Figure 3-5. Red circles indicate intersections where traffic studies have been performed in the past five years, and Table 3-6 shows AM/PM peak traffic hours at these intersections.

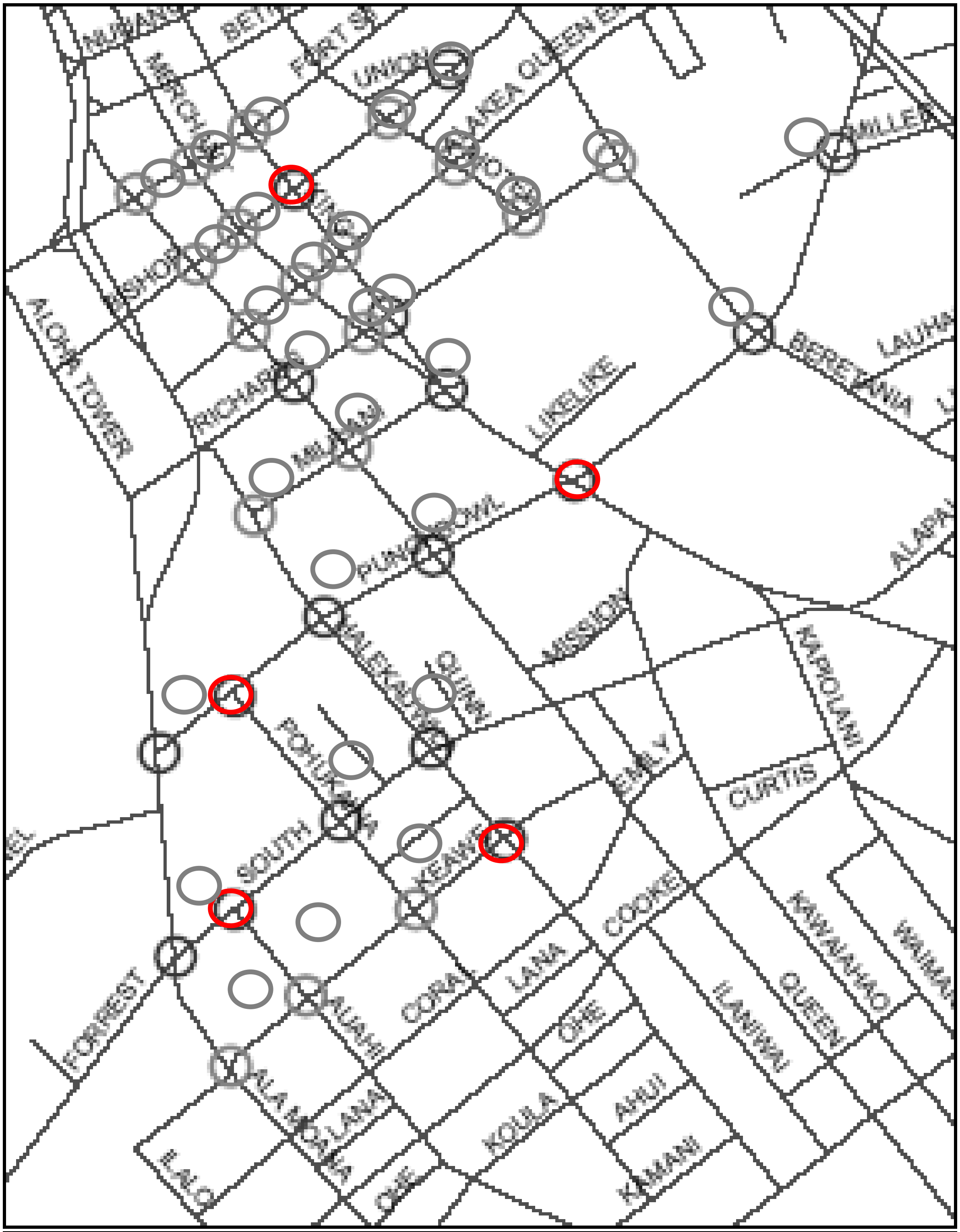


Figure 3-5: Roadway Intersections Potentially Affected by Distribution System Installation

Table 3-6: AM/PM Peak Hour Traffic at Selected Downtown and Kaka'ako Intersections

Location	*Direction*	*AM Peak Hour*	*AM Peak # of Vehicles*	*PM Peak Hour*	*PM Peak # of Vehicles*
South St. NE. of Auahi St.	NE BD (Depart)	7:00	444	3:00	443
	SW BD	11:00	175	4:00	284
Auahi St. SE of South St.	NW BD	7:00	125	3:00	126
	SE BD (Depart)	9:00	83	1:00/3:00	86
South St. SW of Auahi St	NE BD	7:00	403	3:00	429
	SW BD (Depart)	11:00	154	4:00	227
Punchbowl NE of Pohukaina	SW BD	7:00	990	4:00	945
Pohukaina SE of Punchbowl	NW BD	10:00	83	2:00	139
Halekauwila St. SE of Keawe St.	NW BD	7:00	273	1:00	268
	SE BD (Depart)	11:00	170	4:00	245
Halekauwila St. NW of Keawe St.	NE BD (Depart)	7:00	156	1:00	169
	SE BD	11:00	231	4:00	299
Keawe St. SW of Halekauwila St.	NE BD	11:00	76	4:00	109
	SW BD (Depart)	7:00	202	4:00	181
Keawe St. NE of Halekauwila St.	NE BD (Depart)	10:00	68	1:00	92
	SW BD	7:00	148	3:00	117
Punchbowl St. NE of King St.	SW LN 1,2,3	7:00	1,263	12:00	936
	SW LN 4	11:00	412	12:00	320
	SW BD (All Lanes)	7:00	1,579	12:00	1,256
	NE BD (Depart)	7:00	170	5:00	344
King St NW of Bishop St	SE BD	7:00	1,712	4:00	1,631
Bishop St. NE of King St.	LN 1,2,3,4 (Straight, Left Turn)	7:00	1,602	1:00	1,046
	LN 5 (Left Turn)	7:00	394	4:00/5:00	281
	SW BD (All Lanes)	7:00	1,996	1:00	1,318

Source: Department of Transportation Services, City and County of Honolulu
BD: Bound NE: Northeast SE: Southeast
SW: Southwest NW: Northwest LN: Lane

3.3.9 Ambient Noise

Ambient noise limits in the downtown area are 60 decibels (dB) from 7 a.m. until 10 p.m. and 50 dB at all other times. Noise in the Kaka'ako district was surveyed as part of the Kaka'ako Makai Waterfront Master Plan and the 1990 Supplemental EIS for the Kaka'ako Makai Area. The three main sources of noise in the Kaka'ako district are traffic, aircraft, and industrial equipment. Noise from industrial equipment was measured at between 72 and 80 dB.

The Day-Night Sound Level (L_{dn}) is more appropriate for describing noise from a source that generates noise both day and night. The Ldn is an average of noise levels over a 24-hour period. The average includes a penalty for noise generated between 10 pm and 7 am. The noise level from traffic on Ala Moana Blvd. to someone 50 ft from the street was 60 L_{dn}. Noise from aircraft in the area proposed for the cooling station was between 60 and 65 L_{dn}.

3.4 SOCIAL AND ECONOMIC RESOURCES

Hawaiʻi's economy is dominated by tourism and defense, with tourism being the leading industry in terms of employment and expenditures. The two represent approximately one quarter of Gross State Product (GSP) without consideration of ancillary services and also comprise the largest shares of "export" earnings. However, including retirement and disability payments, grants, contracts, other payments, and wages and salaries, total Federal expenditures in Hawaiʻi were $13.5 billion in 2006 (DBEDT, 2007), about 22% of GSP. Tables 3-7 and 3-8 summarize basic social and economic data for Hawaiʻi in 2007.

Table 3-7: 2007 Hawaiʻi Socio-economic Data

Year	*Gross State Product (million $)*	*Per Capita State Product*	*Resident Population*
2007	61,532	$47,945	1,283,388
Source: _DBEDT ,2007. Table 13.02			

Table 3-8: Hawaiʻi's Major "Export" Industries in 2005

Year	*Sugar (million $)*	*Pineapple (million $)*	*U.S. Military (million $)*	*Tourism (million $)*
2005[20]	92.5	113.4	5,015	11,904
Source: _DBEDT, 2007. Table 13.01				

Natural resource production remains important in Hawaiʻi, although its relative contribution to the economy has been greatly reduced compared to the period of the sugar and pineapple plantations throughout the first 60 or 70 years of the 20th century. Crop and livestock sales were $560.8 million in 2006, with the primary diversified agriculture crops being flower and nursery products, $100.7 million; seed crops, 98.6 million; vegetables and melons, $73.0 million; macadamia nuts, $38.9 million; and coffee, $37.0 million (DBEDT, 2007).

Until the recent economic downturn brought about by soaring oil prices and the housing crisis, Hawaiʻi had enjoyed a low unemployment rate (see Table 3-9) of 2.6 percent (DBEDT, 2007), which was among the lowest in the nation and less than half the U.S. average rate.

Table 3-9: Hawaiʻi Employment Statistics

Category	***2007***
Civilian labor force	649,100
Employed	631,900
Unemployment rate	2.6%
Payroll jobs	630,050
Real personal income ($ million)	50,359
Source: _DBEDT, 2007	

There were 7.5 million tourists in Hawaiʻi in 2007. This represents a daily rate of 185,412 tourists, 15 percent of the "de facto" population (resident, tourist, and military combined), indicating the weight of tourism in many sectors of Hawaiʻi's economy and society (DBEDT, 2007). Eighty percent of visitors are

[20] 2005 is the most recent year when complete industry statistics are available.

domestic, and 20% are international. The domestic visitor count has been rising for the past six years, while international visitors have declined since 2004.

Tourism is a service industry, and as such, tends to have lower wage levels than manufacturing. The dominance of tourism means that many workers in Hawaiʻi have to hold more than one job, with 16 percent of the workforce reporting they work 49 or more hours per week (DBEDT, 2007, Table 12.38). The benefits of the commercial economy are not spread evenly across either islands or ethnic groups in Hawaiʻi. In 2006, 9.2 percent of Hawaiʻi's population was below the poverty line (DBEDT, 2007, Table 13.22). The effect of these conditions is that the value of common-use resources, such as shorelines, forests, and the ocean, is high for both subsistence and recreational users.

Per-capita income ($39,239) and per-capita disposable income in Hawaiʻi ($29,174) are slightly above national averages, but Hawaiʻi's cost of living was 171% of the national average, averaged across income levels. Honolulu was the third most expensive major city in the country, behind only New York and San Francisco.

The State of Hawaiʻi has been attempting to diversify its economy for many years. Industries encouraged are science and technology, film and television production, sports, ocean research and development, health and education tourism, diversified agriculture, and floral and specialty food products (DBEDT, 2006). However, these remain a small percentage of the Hawaiʻi commercial economy at this time.
Bank of Hawaiʻi summarized the recent general trends as of August, 2008. At midyear, 2008, Hawaiʻi's economic growth had slowed to a crawl due to higher oil prices, falling tourism, and falling residential investment. The decrease in tourism was being fueled by both decreased domestic demand and a reduction in the number of trans-Pacific flights resulting from the shutdown of Aloha Airlines and ATA, which previously represented 15-20% of the available seats to Hawaiʻi.

Hawaiʻi's unemployment rate rose to 3.5% in June 2008 on a seasonally-adjusted basis, while job growth slowed to a few tenths of one percent, well below the rate necessary to generate enough labor force absorption to prevent the unemployment rate from rising.

Honolulu's inflation rate was 4.9 percent in first half 2008, up slightly from the 4.8 percent for all of 2007. While shelter costs began to moderate, energy costs rose significantly. Household fuels and utilities costs rose 36.4 percent, year-over-year.

3.5 VISUAL RESOURCES

Public views, as defined in the City and County of Honolulu's Development Plan (DP) Common Provisions, include "views along streets and highways, mauka-makai view corridors, panoramic and significant landmark views from public places, views of natural features, heritage resources, and other landmarks, and view corridors between significant landmarks (§24-1.4, Revised Ordinances of Honolulu.). Important views to be protected on Oʻahu, as identified in the Special Provisions for the Primary Urban Center DP, are "panoramic, mauka and makai and continuous views of the Koʻolau and Waiʻanae mountain ranges, ridges, valleys, and coastline and the sea," and "views of natural landmarks, such as Diamond Head, Punchbowl, Pearl Harbor, and major streams and forest areas." (§24-2.2(2)(A) and (B), Revised Ordinances of Honolulu).

3.6 NATURAL HAZARDS

Natural hazards are a fact of life on Hawaiʻi's coasts. Hazards that specifically impact coastal areas and that may affect the proposed action include tsunami waves, hurricanes, earthquakes, and other severe weather and ocean events. These hazards are described further in the following sections.

3.6.1 Tsunami Inundation

Tsunami are waves with very long wavelengths that are generated by seismic events such as earthquakes, landslides, or volcanism. The sudden ground movement typical of these kinds of events causes a rapid displacement of water, forming high-energy waves that can travel long distances while retaining most of that energy. Ships in the open ocean often do not notice tsunami waves because the amplitude of these waves is usually less than 3.3 ft when in water that is sufficiently deep. However, as the wave approaches land and water depth decreases, the wave's energy is translated into a higher amplitude resulting in a surge of fast moving water that can quickly inundate a coastline (Oʻahu Civil Defense, 2005).

The tsunami evacuation zone in Kakaʻako is shown on Figure 3-6. The Honolulu Harbor Channel, Kewalo Basin, Olomehani Street, and the waterfront form the boundaries of this tsunami evacuation zone (Oʻahu Civil Defense, 2005).

The Pacific Tsunami Warning Center in ʻEwa Beach monitors seismic events and ocean surface levels in the Pacific Region to detect when and where tsunamis are generated and whether warnings are needed. The Pacific Tsunami Warning Center is the operational center for the International Tsunami Warning System program (Pacific Tsunami Warning Center, 2005).

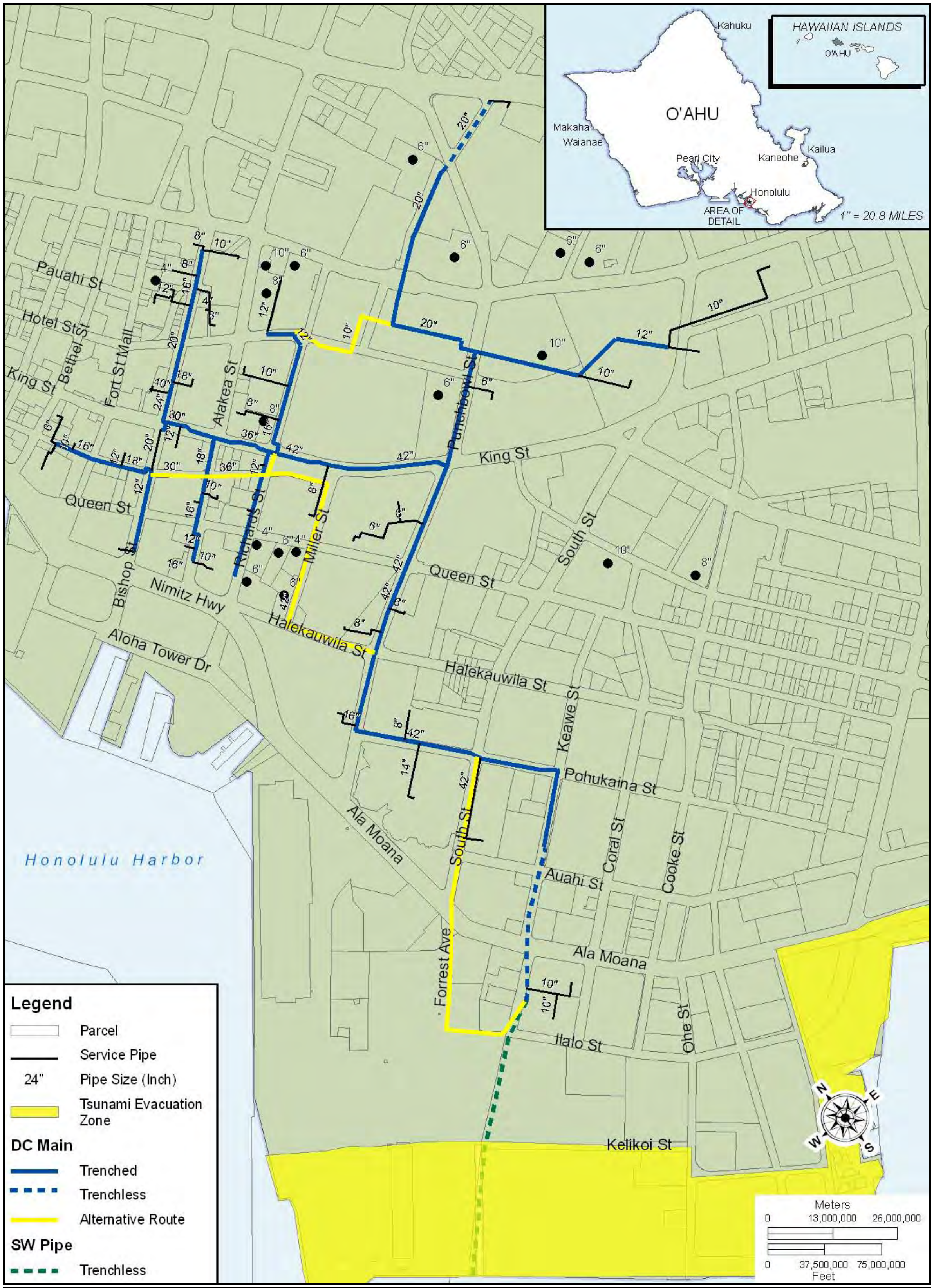


Figure 3-6: Tsunami Evacuation Zone

3.6.2 Flood Hazards

The Federal Emergency Management Agency (FEMA) assigns flood zones to areas based on the risk of flooding within that zone. These areas are indicated on Flood Insurance Rate Maps (FIRMs) as shown on Figure 3-7.

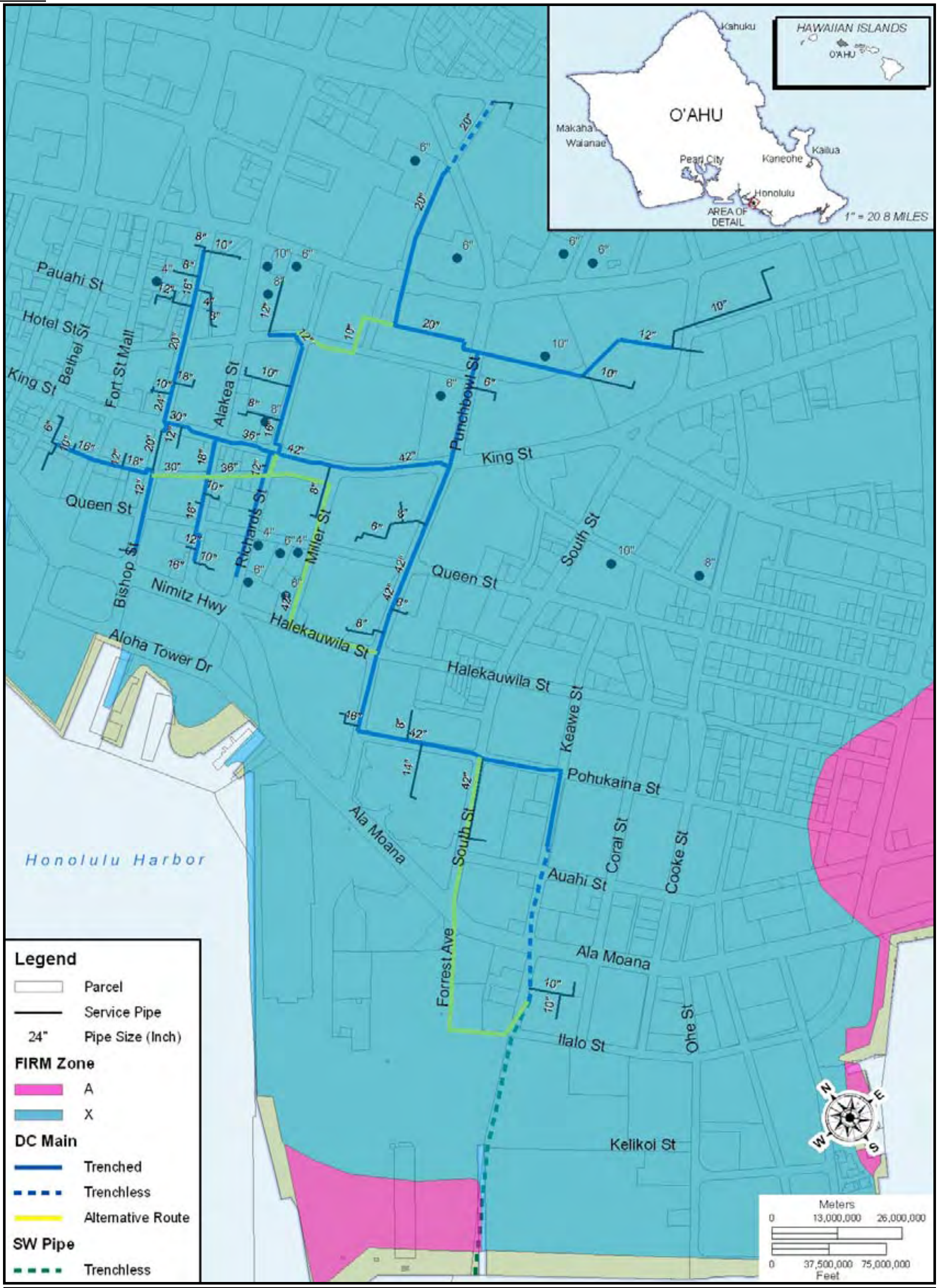


Figure 3-7: Flood Hazard Zones

3.6.3 Hurricanes and Other Severe Weather Events

Tropical cyclones include tropical depressions (wind speeds less than 39 mph), tropical storms (wind speeds between 39 and 73 mph), and hurricanes (wind speeds greater than 73 mph). Tropical cyclones periodically threaten the Hawaiian Islands. Such storms generate high winds and waves, heavy rains, marine storm surge, tornadoes, waterspouts, and small-scale, intense winds. Storm effects can be considerable even when a hurricane does not pass directly over an island. The Saffir/Simpson Scale classifies hurricanes into five categories according to wind speed and damage potential (Table 3-10).

Table 3-10: Saffir/Simpson Hurricane Scale

Category	*Description of Damage*	*Wind Speeds (mph)*	*Storm Surge (ft)*	*Examples*
1	Minimal	74 - 95	4 - 5	ʻIwa, 92 mph, Nov 1982
2	Moderate	96 - 110	6 - 8	None
3	Extensive	111 - 130	9 - 12	Uleki, 128 mph, Sep 1992
4	Extreme	131 - 155	13 - 18	Iniki, 145 mph, Sep 1992
5	Catastrophic	>155	>18	Emilia and Gilma, 161 mph, Jul 1994, John, 173 mph, Aug 1994
Source: Oʻahu Civil Defense Agency				

Hurricane season in Hawaiʻi begins in June and lasts through November. During the last 50 years many tropical storms and hurricanes have come close to the Hawaiian Islands, but there have been only three direct hits, all of which made first landfall on Kauaʻi (Figure 3-8).

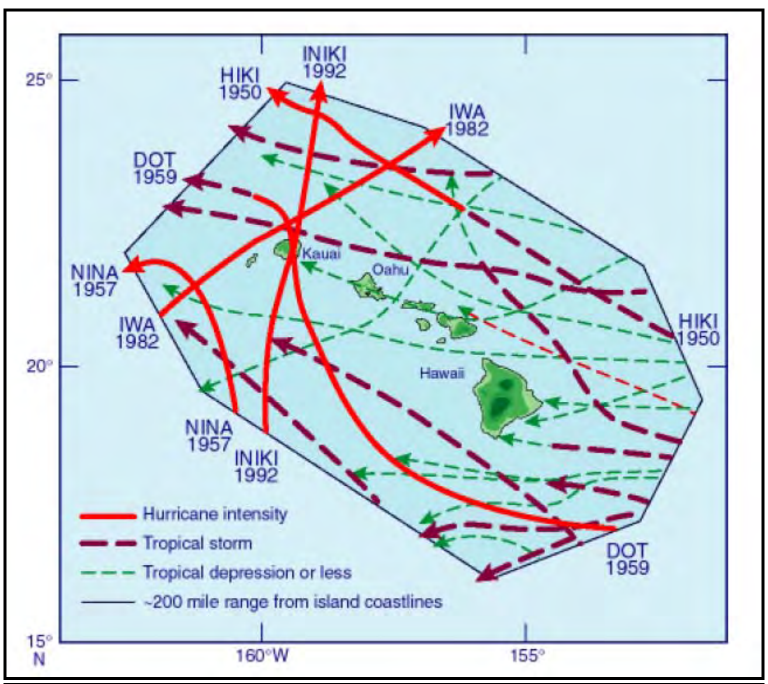


Figure 3-8: Hurricane and Tropical Storm Tracks Near the Main Hawaiian Islands
(Source: UH Manoa Storm Evolution and Energetics Research Group)

The south coast of Oʻahu is susceptible to damage from large ocean waves. Hurricane ʻIwa caused extensive damage, including inundation of the central sections of the coast southwest of the Waiʻanae

Range, as well as oceanfront areas on the south coast of Oʻahu from Sand Island to Diamond Head. A total of 421 acres of land flooded on Oʻahu.

The large waves generated by Hurricane ʻIwa caused extensive underwater damage, scouring coral and sand from the bottom. Large rocks and coral heads were moved about, some for great distances. A large pipeline (30-inch diameter with three-inch concrete coating) laid two nautical miles seaward off Barbers Point and weighted to the bottom by a series of 10-ton concrete blocks was moved sideways about 400 ft. At the same time, a "header unit" (a large assembly of pipes, valves and fittings), which was anchored by 30 ft steel pilings driven full length into the hard coral bottom was pulled out of the bottom and smashed aside. The HSWAC seawater pipe anchoring system has been designed with this knowledge in mind.

The major impact of Hurricane ʻIwa on Pearl Harbor was the hazards its waves posed to ships as they attempted to leave the harbor prior to the arrival of the storm's winds. Several ships reported waves (variously described by observers as surf, breakers, and waves) of heights ranging from 14 ft to 30 ft in the Pearl Harbor Entrance Channel between buoys 1 and 2 at its southeast end and in the channel approximately 1,500 yards northwest of buoys 1 and 2. The high waves caused several injuries, including one fatality, aboard departing ships as they attempted to sortie as ʻIwa approached. Damage was incurred within Honolulu Harbor, but was due to wind and wave driven debris and inadequate mooring of small vessels rather than high waves.

To put Hurricane ʻIwa in proper perspective, ʻIwa was not a major storm by hurricane standards. According to wind speeds estimated from satellite photographs, ʻIwa was a Category 1 hurricane (U.S. ACOE, 1983). The U.S. Department of Commerce (1993) classifies ʻIwa as a weak Category 2 hurricane.

Hurricane ʻIniki (1992) is considered the strongest hurricane to hit the Hawaiian Islands this century (U.S. Department of Commerce, 1993). Based on estimated peak sustained winds of between 130 and 160 mph, ʻIniki would be classified as a minimum Category 4 storm on the Saffir-Simpson Scale. If the classification were based on the last reconnaissance flight with sustained winds of 115 kt with gusts to 140 kt, ʻIniki would also be classified as a Category 4 storm. Despite the strength of the storm, ʻIniki did not cause as much damage on Oʻahu as ʻIwa did. Post-storm estimates of wave heights range from a maximum of 16 ft on the Waiʻanae Coast to 4 to 9 ft along the south coast of Oʻahu from Sand Island to Diamond Head.

Unfortunately, the factors that influence the severity of storm-surge flooding (such as coastal topography, tidal stage and height at the time of the storm, and location relative to the eye of the hurricane) cannot be predicted more than a few days in advance (Juvik and Juvik eds., 1998).

Seasonal Storm-Generated Waves

Sudden high waves and the strong currents they generate are probably the most consistent and predictable coastal hazards in Hawaiʻi. High surf is a condition of dangerous waves 10 to 20 ft high or more. On Oʻahu's southern coast, high surf usually forms during summer when storms in the southern hemisphere generate waves of 4 to 10 ft. Sets of large waves can develop suddenly, often doubling in size within a few seconds. The coastal water level increases under these conditions, and the seaward surge of excess water generates extremely dangerous rip currents (Juvik and Juvik eds., 1998).

Surface Wind-Generated Waves

Offshore of Oʻahu the seas are moderately rough, with wave heights of 3 to 14 ft. These vary seasonally with trade wind intensity. Between the islands, where the winds are funneled, the seas are intensified. The lee, shielded from the winds, is generally calmer. Along the shores waves become steeper and break as they enter the shallow water. The south shores of the Hawaiian Islands, shielded from northwesterly swells, are usually calm in winter. Breaking waves move water toward the shore where it escapes along shore. The water then returns to sea as narrow rip currents, generally located where the bottom is deepest. Although forecasts about general wave conditions can be made, the size or timing of individual waves cannot be predicted (Juvik and Juvik eds., 1998).

Regional Currents

The Hawaiian Islands affect the waters around the islands by interactions with large-scale ocean currents and wind speed variations in the lee of the islands. On the southern boundary of Oʻahu, for example, trade winds with speeds of 22 to 44 miles per hour are separated from the calmer lee by a narrow boundary area (wind shear line). Variations in winds have subtle effects on current patterns. Clockwise eddies can form under the southern shear lines. Off the southern coast of Oʻahu, surface currents average about 0.33 ft per second, but can vary by as much as 1.0 ft per second (Juvik and Juvik eds., 1998).

Tides

Local underwater surface contours affect the ranges and phases of tides along the shore as the tidal waves wrap around the Hawaiian Islands. Tidal currents result from tidal variations in sea level, and near shore they are often stronger than the large-scale offshore flow. The semi-daily and daily tidal currents tend to be aligned with the shoreline off Oʻahu. However, due to the variability of tidal currents around the island and other factors, they cannot be predicted as precisely as the general sea level. Strong swirls often result from tidal currents flowing around points, such as Barbers Point, and headlands and can be hazardous to divers (Juvik and Juvik eds., 1998). Of interest to the HSWAC project is the fact that tides in Māmala Bay generate internal waves that cause temperature variations of several degrees in the depth range of the proposed seawater intake. Additional information about tides and currents in Māmala Bay may be found in section 3.7.1.4, and additional information about tidal effects on water column temperatures may be found in Section 3.7.2.12.

3.6.4 Seismic Events

The USGS uses a computer model to estimate probabilities that an earthquake of a certain magnitude would occur within a certain time period. Table 3-11 summarizes the probability that an earthquake of 5.0 magnitude or greater would occur within 31 miles of Honolulu.

Table 3-11: Earthquake Probability

Time period (yrs)	*Probability of Occurrence (%)*
10	15
15	20
20	25
25	30
30	35

Source: USGS, 2005

To categorize the risk and establish appropriate building codes, in 1997 the U.S. Geological Survey (USGS) completed a seismic-hazards assessment for the counties of Hawaiʻi. Oʻahu was assigned to Seismic Zone 2A. The Uniform Building Code (UBC) projects that an area in Zone 2A could experience seismic activity between 0.075 and 0.10 g (the earth’s gravitational acceleration). In comparison, the island of Hawaiʻi is designated as Zone 4, the highest seismic zonation. Severe seismic activity with forces of 0.3-0.4 g could be experienced there.

3.7 MARINE RESOURCES

The shallow marine portion of the project area has been heavily impacted by past uses of the area including sewage and dredged material disposal, as well as hurricane storm surge and annual episodes of high surf conditions.

3.7.1 Bathymetry, Geology and Sediments

A shallow reef fronts the man-made boulder revetment (sea wall) between Fort Armstrong and Kewalo Basin along the seaward side of Kakaʻako Waterfront Park, which contains the former dump. The revetment was constructed on a limestone bench in 6 to 15 ft of water.

An underwater survey in depths of 40 to 80 ft in the vicinity of the locations of the microtunnel breakout points for the two alternatives was performed on January 6, 2005 using SCUBA gear, camera equipment, soil testing equipment, and general measuring tools. The survey consisted of two dives, and a period of underwater towing to capture video footage over a greater area offshore of Kakaʻako Waterfront Park bounded by the Honolulu Harbor entrance channel on the west and Kewalo Basin on the East (Makai Ocean Engineering, 2005a).

The bottom in the survey area generally consisted of variable grade, medium to coarse sands with broken coral. A loose sediment layer was observed to be at least six inches thick at all locations surveyed. The area proposed for pipeline installation was mostly coral rubble dredge spoils. The slopes encountered were variable, typically between one and nine degrees and never exceeded 15 degrees. There were no undesirable localized bathymetric or geotechnical conditions observed. Only a modest amount of biological productivity was noted across the survey area.

3.7.1.1 Dive Locations and Observations

The first dive was made at latitude 21-17.206°N, longitude 157-52.123°W. Depth of water at this position was approximately 80 ft, and the substratum was old coral rubble dredge spoil with little relief. A length of graduated ½-inch rebar could be pounded approximately eight inches into the ground using 20 blows with a two-pound hammer. The slope was approximately one degree. Closer to shore, sand and finer material was found at a depth of 70 ft. At a depth of 65 ft the conditions were sand with some rocky dead coral patches; the slope was eight degrees. The rebar penetrated the soil to a depth of 12 in with 20 blows (Figure 3-9).

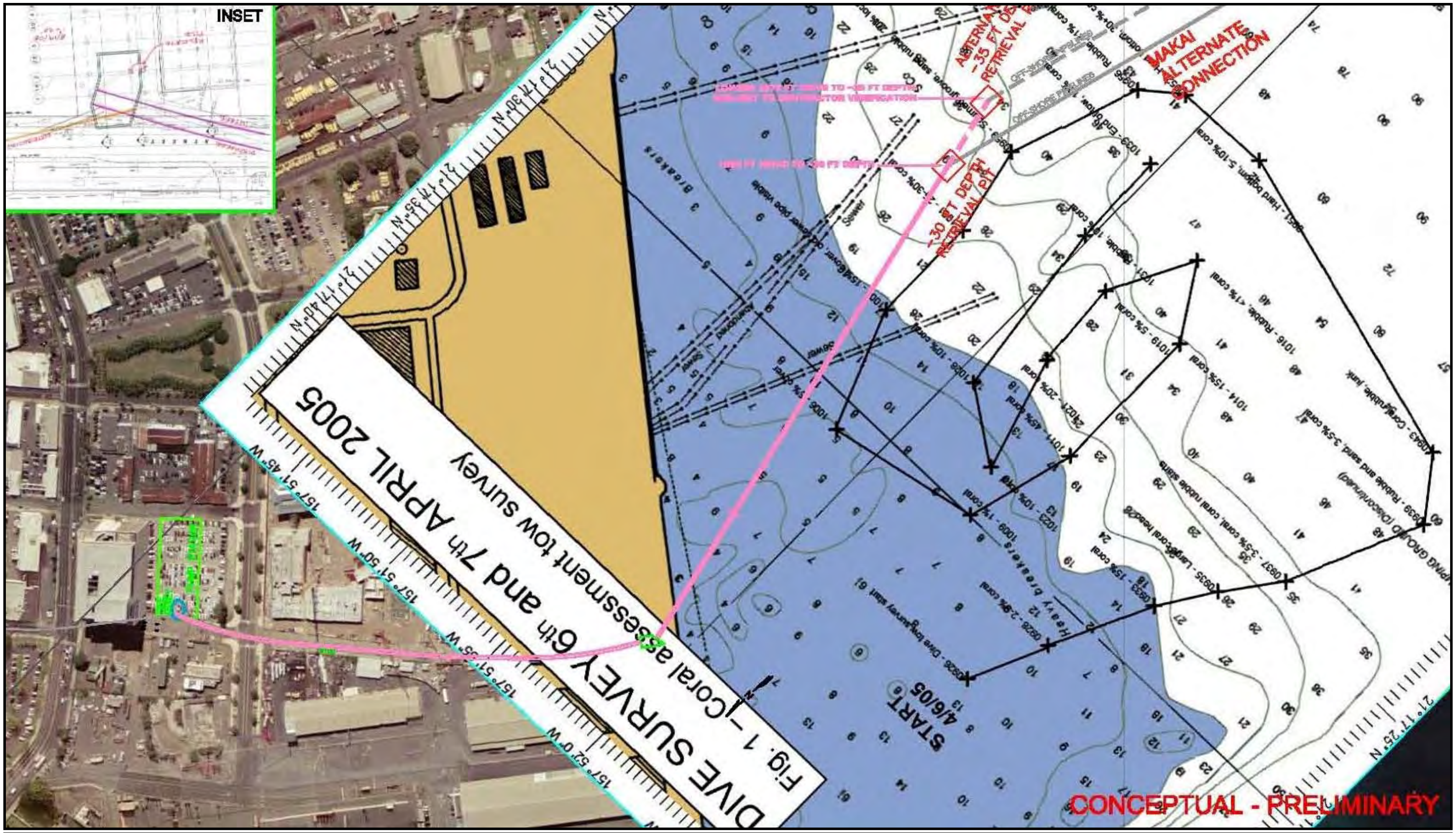


Figure 3-9: Dive Survey Area and Bathymetry with Proposed Directional Drilling Route

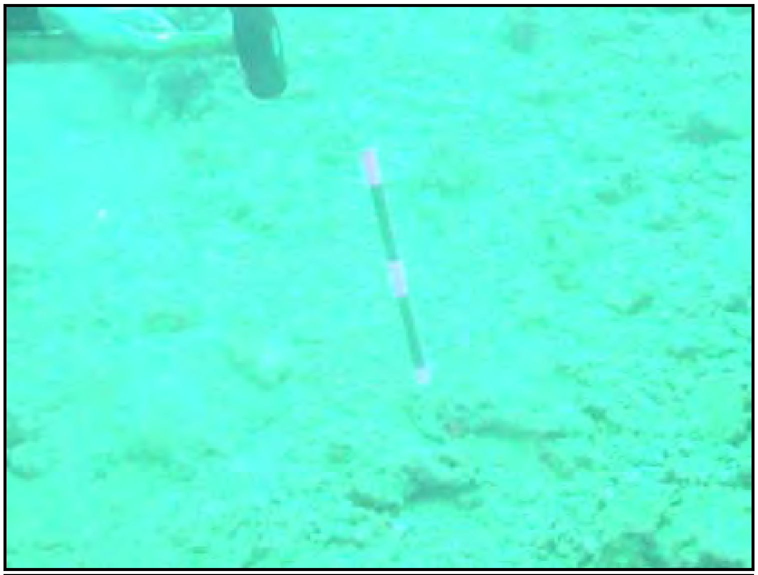


Figure 3-10: Soil Penetration Test on First Dive

The second dive was made at latitude 21-17.230°N, longitude 157- 52.255°W. The bottom conditions were sandy gravel and rocky dead coral. Rebar could be penetrated to approximately 12 in with 20 blows (Figure 3-11).

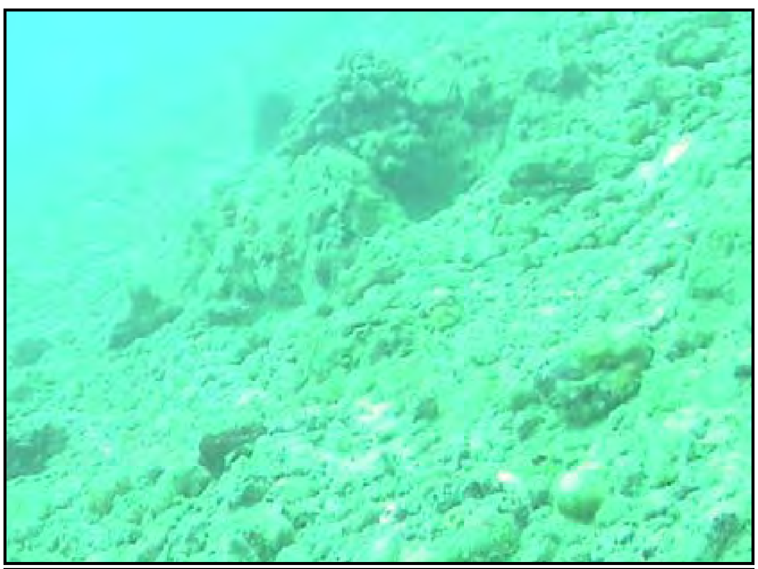


Figure 3-11: Second Dive - Typical Bottom

In summary, the observed substratum generally consisted of variable grade, medium to coarse sands with broken coral. The loose sediment layer was observed to be at least six inches thick at all locations surveyed. The proposed intake pipeline route was mostly coral rubble dredge spoils. The slopes encountered never exceeded 15 degrees and were typically between one and nine degrees. There were no undesirable localized bathymetric or geotechnical conditions (Appendix C).

3.7.1.2 Māmala Bay Bathymetry

Honolulu Harbor is the result of dredging what was originally the drainage basin of Nuʻuanu Stream. Dredging began before 1900, and periodic maintenance dredging still occurs. Until about 1960, spoils were dropped just outside of the harbor, generally to the east of the Sand Island Sewage Treatment Plant Ocean Outfall (Brock, 1998). The USGS, ACOE, and U.S. Environmental Protection Agency (USEPA) have been studying the dredged material and their impacts on the marine environment for decades. Figure 3-12 shows the locations of former (Old Pearl Harbor and Old Honolulu Harbor) and current (South Oʻahu) dredged material disposal sites. The narrow insular shelf adjacent to the island is bounded on its seaward side by an escarpment that drops off steeply from 160 to 820 ft depth. All of the disposal sites lie on the plain seaward of the escarpment.

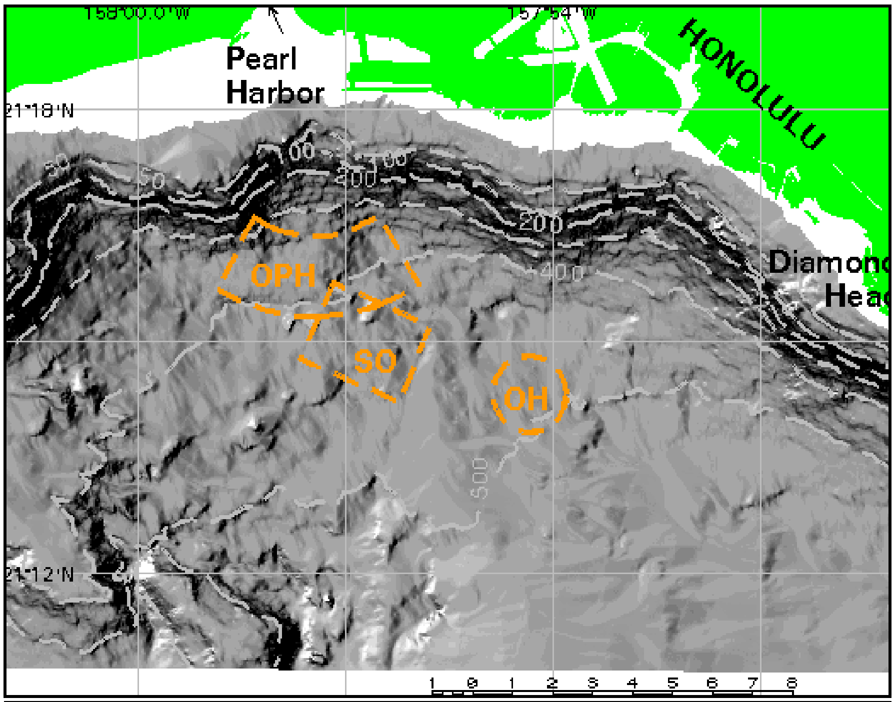


Figure 3-12: Shaded Relief Map of Māmala Bay Showing Designated Dredge Disposal Sites
(Old Pearl Harbor (OPH), South Oʻahu (SO), and Old Honolulu (OH)). (Bathymetry is in meters.)
(Source: Wong and others)

The bathymetic map presented in Figure 3-13 shows that the disposal sites are located in a broad southeast sloping trough having a slope of about two ft per 100 ft (1:50). Large pinnacles and canyons are absent, but several relatively small canyons and areas of irregular topography exist in the immediate vicinity of the disposal sites (Chase et al., 1995). The seafloor is naturally irregular in texture and slope.

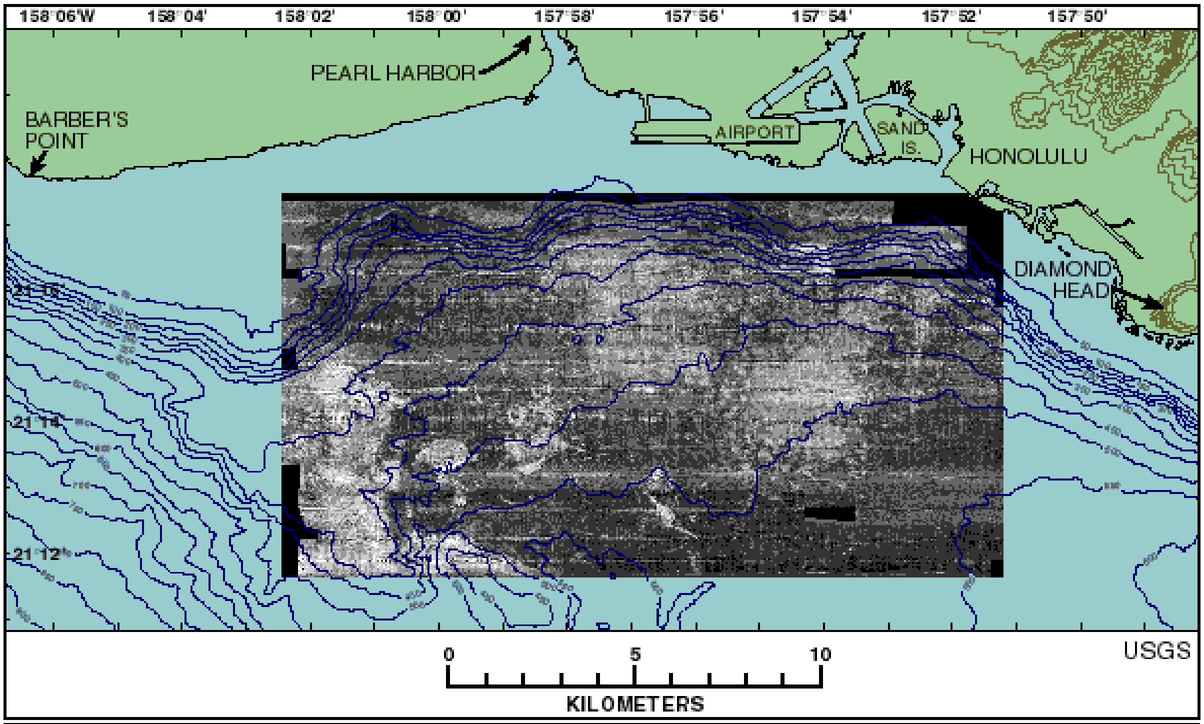


Figure 3-13: Generalized Māmala Bay Bathymetric Map Modified from Chase et al. (1995), Merged with the Sidescan Sonar Mosaic of the Seafloor
(Isobaths are in meters and a 50 m contour interval is used.)

3.7.1.3 Seafloor Sediment and Dredged Material

Some of the seafloor of Māmala Bay has bedforms visible on the sonar mosaic (Figure 3-14). Bedforms, structures that are molded on beds where deposition is taking place, also appear on bottom photographs collected during the USEPA dredged site designation studies (Chave and Miller, 1977a, 1977b, 1978; Neighbor Island Consultants, 1977; Tetra Tech, 1977; Goeggel, 1978; USEPA, 1980) The variety of bedforms common throughout the study area document active sediment movement, with the implied potential for the redistribution of dredged material beyond the original disposal site. USGS studies are now evaluating not only local and regional ocean circulation patterns, but the nature and characteristics of the dredged materials at their source (the harbors) and at the disposal sites.

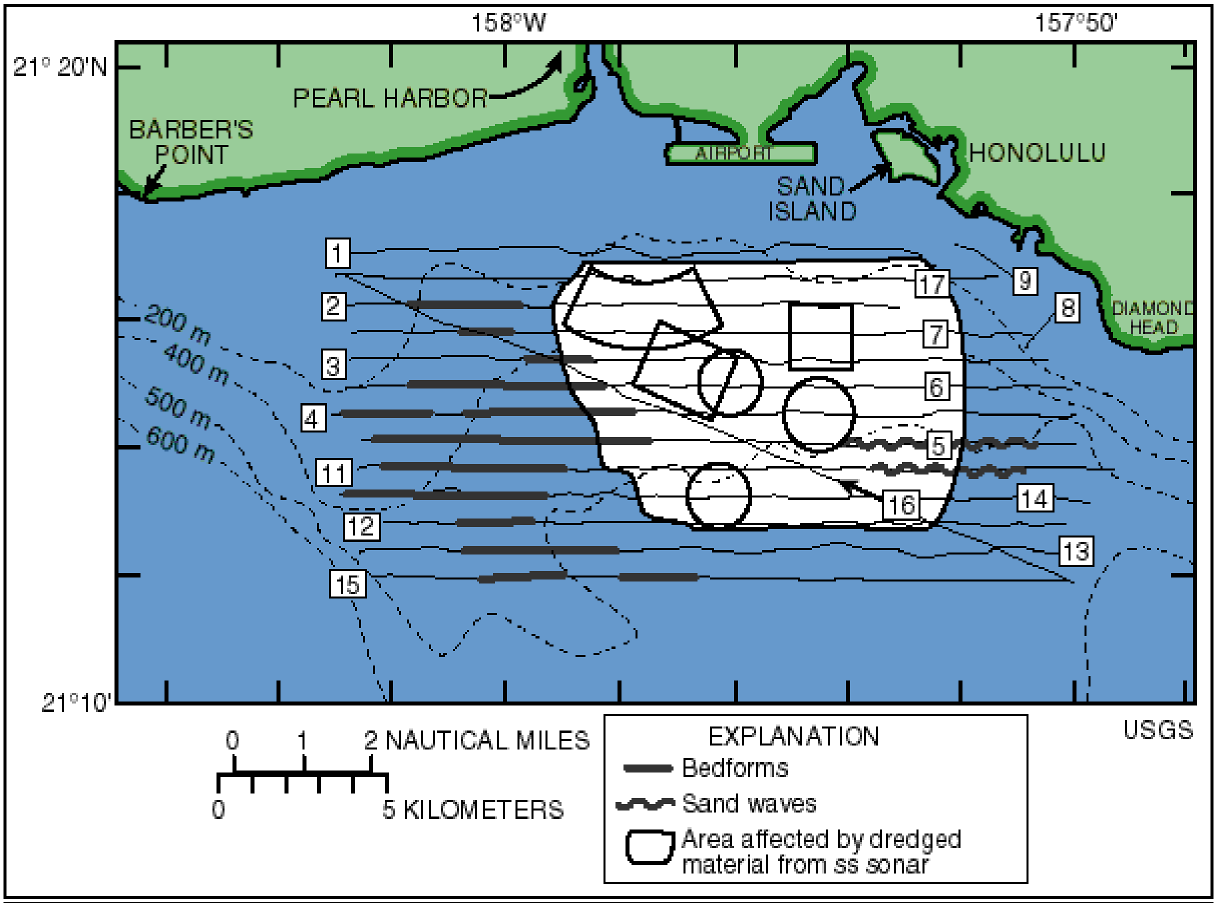


Figure 3-14: General Interpretive Geologic Map Based on 3.5kHz Acoustic Profiles and Sidescan Sonar
(Source: Wong, n.d.)

The results of the USGS 1993 acoustic survey and the subsequent May 1994 sampling program (Torresan et al., 1994a, 1994b) provide abundant evidence that the dredged material deposits are more extensive than the area defined by the official disposal site boundaries. Furthermore, preliminary interpretations of samples and photographic data collected in May 1994 indicate that the dredged material is more extensive than the area defined as dredged material deposits on the sidescan sonar mosaic and 3.5 kHz profiles (Torresan et al., 1994a and b).

Environmental studies show that the native seafloor sediment is primarily a muddy carbonate sand, with areas of outcrop and carbonate rubble that include shell, coral, and limestone (Chave and Miller, 1977a, 1977b, 1978; Tetra Tech, 1977; USEPA, 1980). Sediment sampling and bottom photography conducted during each phase of the 1977/1978 studies show that there is considerable variation in the composition of the seafloor in and around the disposal sites. Surficial sediment varies from primarily sand to sediment with substantial carbonate rubble (shell, coral and limestone), and the native seafloor sediment consists primarily of carbonate and basalt fragments that constitute about 90% and 10% of the sediment, respectively (Chave and Miller, 1977a, 1977b, 1978; Neighbor Island Consultants, 1977; Tetra Tech, 1977; Goeggel, 1978; USEPA, 1980).

The 1977/1978 site designation studies show that grain size distributions of sediment collected from the disposal sites during each phase of the study vary considerably from sample to sample, and range from sandy gravel to muddy sand. For example, pre-disposal sediment (Phase I) is poorly sorted, averaging

85% sand and 15% mud (silt and clay). Similarly, dredged material (Phase II) is also poorly sorted, but is substantially coarser, containing 49.3% pebbles, 13.8% granules and 36.9% sand. Grain size distributions of sediment collected after a disposal action varied considerably from sample to sample, and post-disposal (Phase III) samples lack mud, are poorly sorted, and vary from predominantly sand (about 80%) to predominantly gravel (about 75%) (Tetra Tech, 1977).

Bottom photography conducted during the 1977/1978 dredging cycle also shows that anthropogenic debris litters the seafloor of Māmala Bay (Chave and Miller, 1977a, 1977b, 1978; Tetra Tech, 1977). Video and still photography collected during a USGS survey conducted in May 1994 (Torresan et al., 1994b) documents the debris to include military ordnance, barrels, a variety of canisters, tires, and lengths of wire rope.

3.7.1.4 Tides and Currents

Ocean circulation in Māmala Bay is extremely complex, driven largely by tidal fluctuations with major components paralleling the shoreline, but influenced seasonally by thermal stratification, along with trade and Kona winds. Oceanographic processes that have significant effects on circulation in Māmala Bay can be divided into the following categories: (1) those caused by surface tides (semi-diurnal, with a period of 12.4 hours, and diurnal, with a period of 24.8 hours) and (2) those that result from other factors including wind forcing, propagation of long period waves and circulation in deep offshore coastal waters.

The semi-diurnal tidal wave moves in a southwesterly direction in the Pacific Ocean, and appears to split near the North Shore of Oʻahu. Two progressive tide waves are thus created; one propagating along the east side of the island and the other along the west side. Coastal trapping causes these two waves to curve around the headlands at Barbers Point and Diamond Head, and to merge within Māmala Bay before continuing toward the southwest. As a result, strong tidal velocities measured at Barbers Point and Diamond Head are oriented parallel to the depth contours and directed towards the middle of the bay. Weak currents result where the flows merge from opposite directions. Converging flows at flood tide cause a downwelling (downward flow) at the center of the bay, which reverses at ebb tide. Consequently, large changes in stratification occur over the tidal cycle, with the water column often becoming homogeneous at different sites.

Peak currents of about 20 inches per second were measured at the Sand Island Wastewater Treatment Plant outfall located about three miles southeast of the Reef Runway in approximately 250 ft of water. Figure 3-15 shows a schematic of the mean current circulation patterns in Māmala Bay (Colwell et al., 1996).

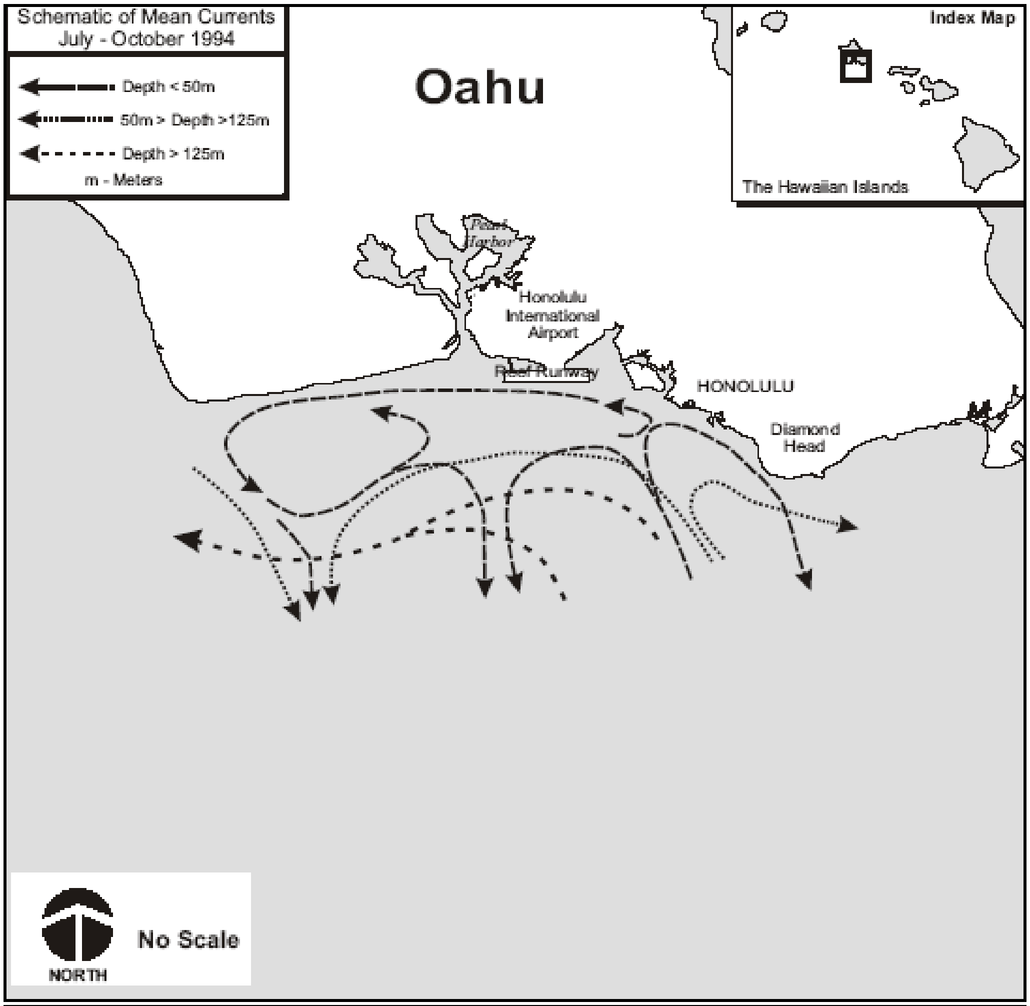


Figure 3-15: Schematic of Mean Circulation Patterns for Māmala Bay

Diurnal tides were observed to be relatively uniform in amplitude throughout the bay and propagated principally from west to east. Consequently, the combination of semi-diurnal and diurnal tides varied significantly at different sites in the bay, with semi-diurnal tides dominating at Barbers Point and Diamond Head, and diurnal tides dominating in the center of the bay. Both tidal components were generally directed parallel to the depth contours (Māmala Bay Study Commission, 1996a).

Analyses of sea level and currents revealed relatively weak local correlation with wind at sampling sites in the center of the bay. A general weakening of the westward flows on the shelf was observed with weakening of the trade winds from the northwest. There was little or no evidence of direct wind forcing effects in shallow near-shore areas. Instead, analysis of temperature fluctuations revealed a strong dependence of circulation within the bay on large-scale oceanographic processes in the ocean surrounding the island. General seasonal variations in mean flow patterns were apparent in the bay during the first year of the study. A branching of on shore flow was observed just east of Sand Island, resulting in eastward mean flow along the shore towards Diamond Head. It should be understood that these patterns were derived from a one-year record of investigations that, although representative of the general conditions during the Māmala Bay Study, may not include all phenomena that can affect circulation in the bay over a longer period (Māmala Bay Study Commission, 1996a).

Current research at the Kilo Nalu Observatory is exploring currents offshore of Kakaʻako (Pawlak and Merrifield, 2006). Baroclinic[21] motions in Māmala Bay offshore of Kilo Nalu have been observed to induce magnified isopycnal displacements as high as several hundred meters. The baroclinic motions associated with these displacements drive currents that are often several times greater than barotropic[22] tidal currents. In addition to significant forcing from baroclinic sources in Māmala Bay, Kilo Nalu is subject to seasonal surface wave forcing from distant southern hemisphere sources, northeast trade swell wrap and onshore 'Kona' storm winds.

3.7.2 Marine Water Quality

The HSWAC system would extract cold seawater from a depth of 1,600-1,800 ft, warm it in passage through heat exchangers, and return it to the sea at a depth of 120 to 150 ft. This section first provides a brief overview of seawater parameters of importance in assessing the impact of the HSWAC return flows. The applicable State of Hawaiʻi water quality standards are then presented. The ambient conditions at the proposed HSWAC intake and return sites are then described and compared with the State standards. Following that, the characteristics of the return flows are compared with ambient conditions at the proposed return site, potential exceedances of standards identified, and permitting requirements described.

3.7.2.1 Parameters of Interest

The ocean is a three-dimensional medium with many parameters varying greatly with depth. In sun-warmed surface waters where light penetrates, plants produce organic material and oxygen from inorganic nutrients and other materials. Organic matter and oxygen are consumed at higher trophic levels and waste products excreted, eventually sinking below the photic zone where bacterial decomposition reduces the organics back to inorganic forms. Mixing of near-surface waters by wind and waves creates a homogeneous surface layer characterized by relatively high temperatures, high dissolved oxygen concentrations, and low inorganic nutrient concentrations. Below this layer, temperatures decrease rapidly in the thermocline to deep waters characterized by low temperatures, low dissolved oxygen concentrations, and high inorganic nutrient concentrations. The HSWAC system would remove water from below the thermocline and return it somewhat warmed to depths in and above the thermocline. The return waters would differ from the receiving waters in temperature (and therefore density), dissolved oxygen concentrations, and dissolved inorganic nutrient concentrations. The following paragraphs briefly describe the importance and function of these parameters and others included below in the State's water quality standards.

3.7.2.2 Temperature

Water temperature is one of the most important physical factors of the marine environment. Temperature controls the rate at which chemical reactions and biological processes occur (Waller, 1996). In addition, most organisms have a distinct range of temperatures in which they thrive. A greater number of species live within the moderate temperature zones, with fewer species tolerant to extremes in temperature. Typically, the vast majority of organisms cannot survive dramatic temperature fluctuations.

Temperature gradients are created when warmer, lighter water floats above colder, denser water. A band of stable water called a thermocline separates the warm and cold layers of water. In Hawaiʻi, a wind-mixed turbulent layer varies from nearly 400 ft deep in winter to less than 100 ft deep in summer. Below this mixed layer there is a sharp decrease in temperature (the thermocline), from 77°F at the surface to

[21] In fluid dynamics, the **baroclinity** (sometimes called **baroclinicity**) is a measure of the stratification in a fluid. A baroclinic atmosphere is one for which the density depends on both the temperature and the pressure; contrast this with barotropic atmosphere, for which the density depends only on the pressure. In the ocean it generates a field of mesoscale (100 km or smaller) eddies that play various roles in oceanic dynamics.

[22] A *barotropic flow* is a flow in which the pressure is a function of the density only and vice versa. In other words, it is a flow in which isobaric surfaces are isopycnic surfaces and vice versa.

41°F at 2,300 ft depth, then a gradual decrease to 36°F at the bottom.[23] The thermocline acts as a barrier to many plants and animals and often represents the boundary between hospitable and inhospitable water masses for many species of organisms (Waller, 1996).

3.7.2.3 Salinity

Salinity refers to the salt content of sea water. For oceanic waters, the salinity is approximately 35 parts of salt per 1,000 parts of sea water. Variations in the salinity of ocean water are linked primarily to climatic conditions. Salinity variations are at their highest at the surface of the water. The salinity of surface water is increased by the removal of water through evaporation. Alternately, salinity decreases through dilution from the addition of fresh water (e.g., rain, runoff from fresh water sources such as streams, etc.). Estuaries represent transition zones from saltwater to fresh water. Seawater salinity has a profound effect on the concentration of salts in the tissues and body fluids of organisms. Slight shifts of salt concentrations in the bodies of animals can have stressful or even fatal consequences. Therefore, animals have either evolved mechanisms to control body salt levels, or they let them rise and fall with the levels of the sea water around them (Waller, 1996).

3.7.2.4 Density

Density (mass per unit volume) of sea water is dependent upon its composition and is a function of both temperature and salinity. Dissolved salts and other substances contribute to the higher density of sea water compared to fresh water. As temperatures increase, density decreases. Accordingly, water that is denser will sink, while water that is less dense will rise. Generally, the oceans can be thought of as having a three-layered system of water masses: the surface layer (0 to 550 ft), an intermediate layer (550 to 1,500 ft), and a deep-water layer (1,500 ft to the seafloor) (Waller, 1996).

3.7.2.5 pH

The measure of the acidity or alkalinity of a substance, known as the pH, is based on a scale ranging from 1.0 (highly acidic) to 14.0 (highly basic). A pH of 7.0 is considered neutral. Surface sea water often has a pH between 8.1 and 8.3 (slightly basic), but in deeper water the acidity of ocean water is very stable with a neutral pH. The very high concentration of carbonate ions in seawater give it a large buffering capacity and resistance to pH changes. Nevertheless, in shallow seas and coastal areas, the pH can be altered by plant and animal activities, pollution, and interaction with fresh water (Waller, 1996).

3.7.2.6 Dissolved Gases

Oxygen is not readily soluble in sea water. The amount of oxygen present in sea water will vary with the rate of production by plants, consumption by animals and plants, bacterial decomposition, and by surface interactions with the atmosphere. Most organisms require oxygen for their life processes. When surface water sinks to deeper levels, it retains its store of oxygen (Waller, 1996).

Carbon dioxide is a gas required by plants for photosynthetic production of new organic matter. Carbon dioxide is 60 times more concentrated in sea water than it is in the atmosphere. Sea water in tropical regions has lower levels of all dissolved gases in a given volume of water compared to sea water in high latitude areas (Waller, 1996).

3.7.2.7 Inorganic Macronutrients

Plants in the ocean form the base of the food web, producing the organic compounds that feed higher trophic levels. To do this they need, in addition to carbon dioxide and sunlight, nitrogen, phosphorus, other nutrients and trace elements. Primary production can proceed only until supplies of that substance which is in the shortest supply relative to the needs of the organism is exhausted (Liebig's "Law of the Minimum"). In freshwater, phosphorus is typically the limiting nutrient, but in seawater, nitrogen is generally the nutrient limiting primary productivity.

[23] http://www.satlab.hawaii.edu/atlas/

3.7.2.8 Applicable Standards

Hawai‘i's water quality standards (Chapter 11-54, HAR) are broadly based to protect both terrestrial (groundwater and surface waters) and marine waters. They consist of basic standards applicable to all waters, specific numerical standards for many toxic substances, and specific numerical standards for a number of classes of State waters. As there would be no discharge of toxic substances from the HSWAC system, those standards are not reiterated here. The paragraphs below describe the basic standards applicable to all State waters and the specific standards pertaining to the location of the proposed HSWAC return flows.

Basic water quality standards applicable to all waters in Hawai‘i are that they shall be free of substances attributable to domestic, industrial, or other controllable sources of pollutants, including the following (§11-54-4, HAR):

- Materials that will settle to form objectionable sludge or bottom deposits;
- Floating debris, oil, grease, scum, or other floating materials;
- Substances in amounts sufficient to produce taste in the water or detectable off-flavor in the flesh of fish, or in amounts sufficient to produce objectionable color, turbidity, or other conditions in the receiving waters;
- High or low temperatures, biocides, pathogenic organisms, toxic, radioactive, corrosive, or other deleterious substances at levels or in combinations sufficient to be toxic or harmful to human, animal, plant, or aquatic life, or in amounts sufficient to interfere with any beneficial use of the water;
- Substances or conditions or combinations thereof in concentrations which produce undesirable aquatic life; and
- Soil particles resulting from erosion on land involved in earthwork, such as the construction of public works; highways; subdivisions; recreational, commercial, or industrial developments; or the cultivation and management of agricultural lands.

With respect to the proposed HSWAC seawater return flows, potential issues are low temperatures and high macronutrient concentrations that could stimulate algal productivity.

The State of Hawai‘i classifies the marine waters of Māmala Bay as Class A. "It is the objective of Class A waters that their use for recreational purposes and aesthetic enjoyment be protected. Any other use shall be permitted as long as it is compatible with the protection and propagation of fish, shellfish, and wildlife, and with recreation in and on these waters. These waters shall not act as receiving waters for any discharge that has not received the best degree of treatment or control compatible with the criteria established for this class" (§11-54-3, HAR).

In addition to the basic standards applicable to all waters, each class of water has numerical standards for specific parameters. Generally, these standards are in the form of three numbers: 1) a value not to be exceeded by the geometric mean of the sample values, 2) a value not to be exceeded more than 10% of the time, and 3) a value not to be exceeded more than 2% of the time. Specific numerical standards have been promulgated for several types of marine waters, including embayments (including Honolulu Harbor and Kewalo Basin), open coastal waters (less than 100 fathoms deep) and oceanic waters (greater than 100 fathoms deep). These standards recognize that proximity to land affects ambient concentrations of many water quality parameters due to the effects of surface runoff, groundwater seepage, and pollutant discharges. Unfortunately, they do not recognize the three-dimensional stratification of ocean waters. Consequently, all State water quality standards are based on expected concentrations of parameters at the water's surface, even though natural, ambient, unpolluted conditions may exceed State standards in and below the thermocline.

The HSWAC system would draw water from "oceanic" waters, i.e., waters greater than 100 fathoms deep, and return the water to "coastal" waters, i.e., waters shallower than 100 fathoms deep. Coastal water standards would therefore apply to the receiving waters at the alternative diffuser locations. Coastal waters are further subdivided into "wet" areas, those receiving more than three million gallons per day of fresh water discharge per shoreline mile, and "dry" areas, those receiving less than three million gallons per day of fresh water discharge per shoreline mile. Māmala Bay is a "wet" open coastal area, and the standards in Table 3-5 apply at either alternative diffuser location.

A note on units is necessary here. Engineers and scientists often use different sets of units to describe concentrations of parameters in the sea. Engineering units stem from usage in wastewater applications, while scientific units reflect chemical precision. The standards in Table 3-12 from HAR Chapter 54 are given in engineering units. For comparison with the ambient data sets presented later, conversions to scientific units are shown in parentheses.[24]

Table 3-12: State Water Quality Standards Applicable to Wet Open Coastal Areas

Parameter	***Geometric Mean Not to Exceed***	***Not to Exceed More Than Ten % of the Time***	***Not to Exceed More Than Two % of the Time***
Total Nitrogen (µg N/l)	150.00 (10.71 µM/l)	250.00 (17.85 µM/l)	350.00 (24.99 µM/l)
Ammonia Nitrogen (µg NH_4-N/l)	3.5 (0.25 µM/l)	8.5 (0.61 µM/l)	15.00 (1.07 µM/l)
Nitrate + Nitrite Nitrogen (µg [NO_3 + NO_2] – N/l)	5.00 (0.36 µM/l)	14.00 (1.00 µM/l)	25.00 (1.78 µM/l)
Total Phosphorus (µg P/l)	20.00 (0.65 µM/l)	40.00 (1.29 µM/l)	60.00 (1.94 µM/l)
Light Extinction Coefficient (k units)	0.20	0.50	0.85
Chlorophyll a (µg/l)	0.30	0.90	1.75
Turbidity (N.T.U.)	0.50	1.25	2.00
pH	Shall not deviate more than 0.5 units from a value of 8.1, except at coastal locations where and when freshwater from stream, storm drain or groundwater discharge may depress the pH to a minimum level of 7.0.		
Dissolved Oxygen	Not less than 75% saturation, determined as a function of ambient water temperature and salinity.		
Temperature	Shall not vary more than one degree Celsius from ambient conditions.		
Salinity	Shall not vary more than 10% from natural or seasonal changes considering hydrologic input and oceanographic factors.		
Source: §11-54-6, HAR			

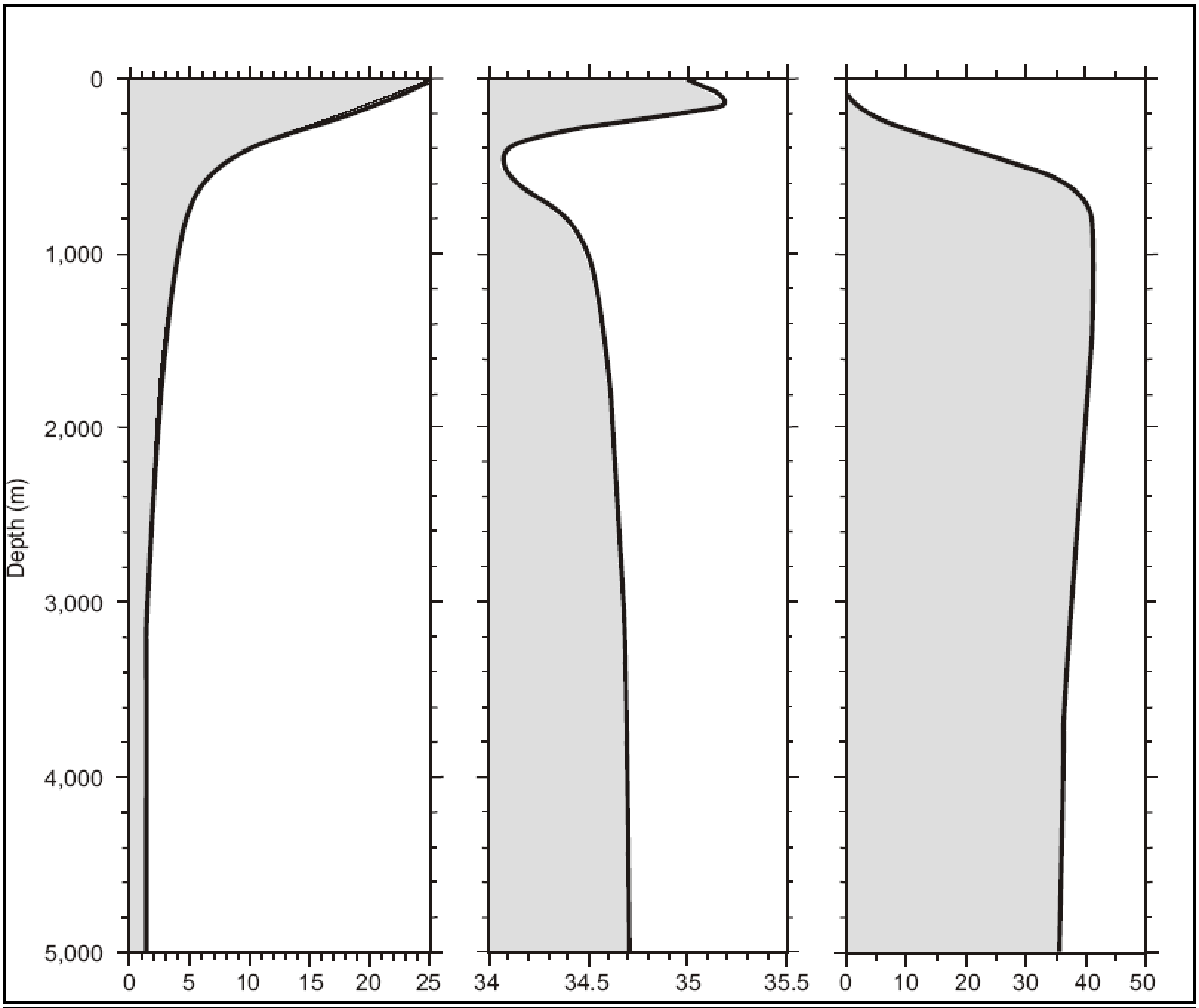
[24] Parts-per-million (ppm) is the same as milligrams per liter (mg/l); a micro-mole per liter (µM/l) is the same as a micro-gram-atom per liter (µg-at/l); and a value in micrograms per liter may be converted to micro-moles (or micro-gram-atoms) by dividing by the atomic weight of the constituent. For example, to convert a value in micrograms per liter of nitrogen, divide by the atomic weight of nitrogen, 14.0067 grams per mole.

3.7.2.9 Ambient Conditions

3.7.2.10 Depth Variability of Water Quality Parameters Near Oʻahu

Figure 3-16 depicts the average vertical profiles of temperature, salinity, and major nutrients computed from a series of monthly surface-to-bottom measurements made between 1988 and 1995 at Ocean Station Aloha located north of Oʻahu. Essentially the same conditions would be expected south of Oʻahu. Near the surface, the water column is mixed by wind and has uniform properties; the depth of the turbulent layer varies from nearly 400 ft in winter to less than 100 ft in summer. Below the mixed layer there is a sharp decrease in temperature (a thermocline), from 77 ˚F at the surface to 41˚F at 2,300 ft depth, then a gradual decrease to 36˚F at 16,400 ft depth. The salinity distribution reflects the sinking of water from the north: higher salinity water of 35.2 parts per thousand (ppt) at 500 ft depth, traceable to the high surface salinity water north of Hawaiʻi; and low salinity water of 34.1 ppt at 1,670 ft depth, traceable to low surface salinity water further to the northwest. Below this depth, salinity increases gradually to 34.7 ppt for abyssal waters. The concentrations of macronutrients are small at the surface, but increase to a maximum at about 2,600 ft depth (Flament, 1996).

Depth profiles for water quality parameters taken from a station in the Kauaʻi Channel west of Māmala Bay are shown in the following figures. Figure 3-16 shows the depth variability of nitrate-nitrogen. It can be seen that surface concentrations approach zero, while ambient concentrations at 1,640 ft (500 m) exceed 30 µM/L; nearly three times the State water quality standard. At all depths below 330 ft (100 m), State water quality standards are exceeded by ambient conditions.



Source: University of Hawaii
Legend: *C – Celsius; ppt – Parts per thousand; NO_2 – Nitrite; NO_3 – Nitrate; m – Meters*

Figure 3-16: Average Vertical Distribution of Temperature, Salinity, and Major Nutrients in Hawaiian Waters

Depth profiles for water quality parameters taken from a station in the Kaua'i Channel west of Māmala Bay are shown in the following figures. Figure 3-17 shows the depth variability of nitrate-nitrogen. It can be seen that surface concentrations approach zero, while ambient concentrations at 1,640 ft (500 m) exceed 30 µM/L, nearly three times the State water quality standard. At all depths below about 330 ft (100 m), State water quality standards are exceeded by ambient concentrations.

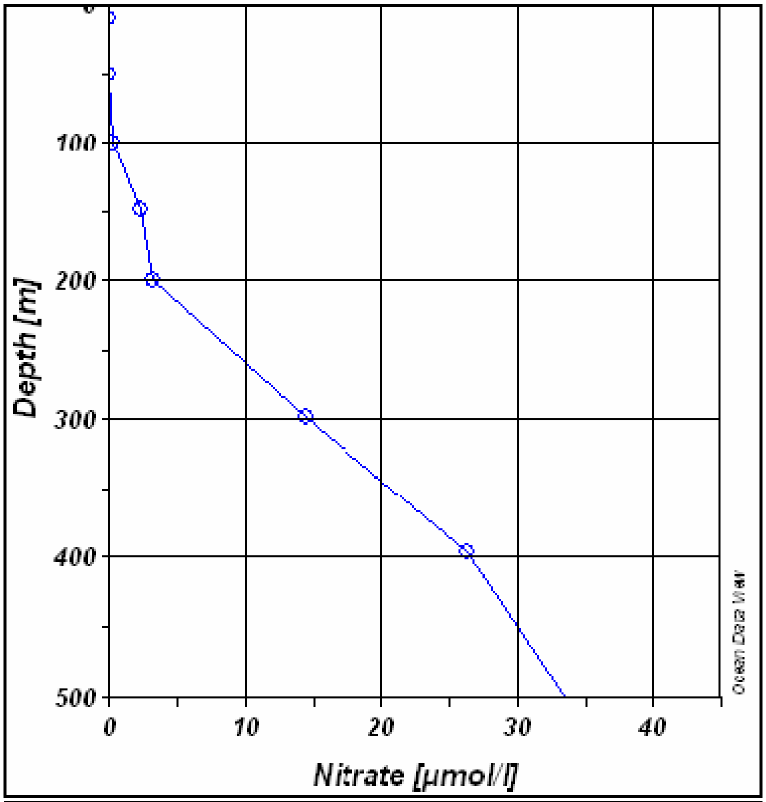


Figure 3-17: Nitrate Concentration as a Function of Depth at a Station West of O'ahu
(21.18°N, 158.55°W) (Source: Makai Ocean Engineering, 2005b)

Figure 3-18 shows a similar trend for phosphate-phosphorous. The relevant State water quality standard is given in terms of total phosphorous, which includes organic dissolved and particulate forms of phosphorous in addition to the inorganic orthophosphate plotted here. Thus, the total phosphorus concentration would be greater than the phosphate concentration alone. It can be seen from Figure 3-18 that State water quality standards for total phosphorous are exceeded by phosphate concentrations alone at depths below about 820 ft.

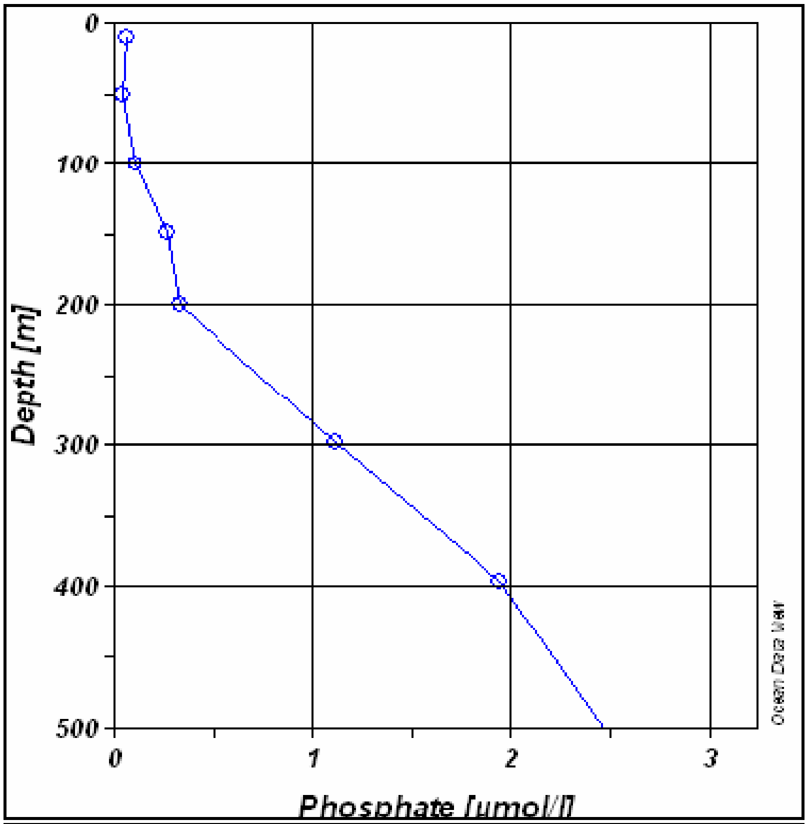


Figure 3-18: Phosphate Concentration as a Function of Depth at a Station West of O'ahu
(21.18°N, 158.55°W) (Source: _Makai Ocean Engineering, 2005b)

Figure 3-19 shows the corresponding depth profile for dissolved oxygen concentrations. Unlike the nutrient concentrations shown in the previous figures, oxygen concentrations are lower below the thermocline. The relevant State water quality standard for dissolved oxygen concentration is 75% saturation. Figure 3-20 shows a nomograph of oxygen saturation as a function of temperature and salinity (Strickland and Parsons, 1968). The saturation point for the receiving waters would be 6.63 mg/l. The measured concentration (Makai Ocean Engineering, 2005b) is 4.82 mg/l or 72.7% saturated. Thus, even the shallow receiving water is not in compliance with State water quality standards. The return flow would be 24.5% saturated at its discharge temperature, but as it warmed to ambient temperature in the receiving water its saturation would increase to 31.7% because warmer water can hold less dissolved oxygen.

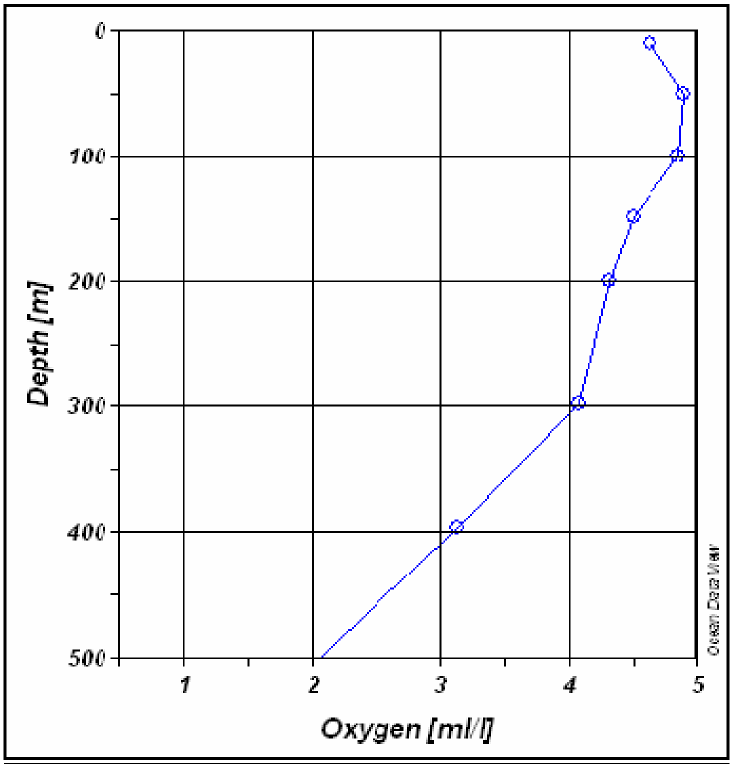


Figure 3-19: Dissolved Oxygen Concentration as a Function of Depth at a Station West of O'ahu
(21.18°N, 158.55°W) (Source: Makai Ocean Engineering, 2005b)

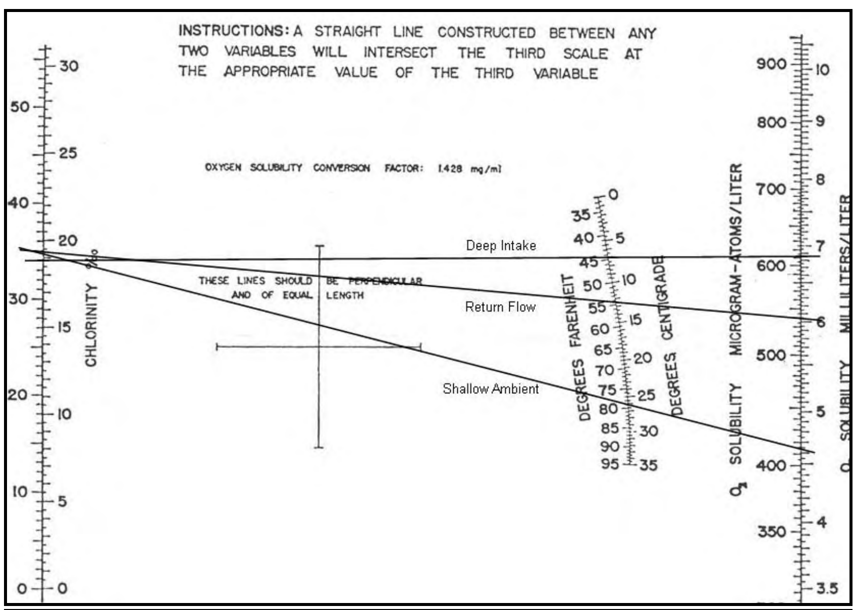


Figure 3-20: Dissolved Oxygen Saturation as a Function of Temperature and Salinity
(Source: Strickland and Parsons, 1968)

3.7.2.11 HSWAC Water Samples

While deploying the temperature sensors at the proposed HSWAC seawater intake site, water samples were collected from the proposed intake and discharge locations. The results of analyses of these samples were as shown in Table 3-13.

Table 3-13: Water Quality Data from Intake and Discharge Sites

Sample	*Dissolved Oxygen (mg/l)*	*Nitrate + Nitrite Nitrogen (µM/l)*	*Phosphate Phosphorus (µM/l)*
Intake Surface	8.27	<0.10	0.07
Intake Deep	4.88	40.27	2.40
Discharge Surface	7.98	<0.10	0.10
Discharge Deep	8.17	<0.10	0.08

The water column at the discharge site appears to be fairly well mixed, with near surface and near bottom samples having very similar characteristics. At the intake location, however, dissolved oxygen and nutrient concentrations of the near bottom sample reflect conditions below the thermocline. The concentration of phosphate phosphorous is nearly identical with what would be expected from the generalized profile in Figure 3-18. The concentration of nitrate + nitrite is somewhat higher than would be expected from its corresponding profile in Figure 3-16, indicative of deeper water. The dissolved oxygen concentration, however, at 4.88 mg/l is also somewhat higher than would be expected, indicative of water somewhat shallower than 1,600 ft. It is also possible that additional oxygen was introduced to this sample in the sampling process, as all of the near surface oxygen concentrations show apparent super-saturation.

3.7.2.12 Māmala Bay Studies

Past studies of Māmala Bay have shown that near-shore marine water quality degradation frequently occurs at the mouths of streams and storm-drain outfalls following substantial rainfall. This degradation can result from an influx of petroleum products and pathogenic organisms, the concentrations of which occasionally exceed State water quality standards (Teruya, 2001). Major sources of pollutants to Māmala Bay are industrial activities in the area of, and streams that flow into, Honolulu Harbor, Pearl Harbor, and Ke‘ehi Lagoon.

In the early 1990s, the City and County of Honolulu was mandated by the USEPA to conduct a comprehensive study of Māmala Bay and the effects of the Sand Island WWTP outfall on water quality and biota. During this study (Grigg, 1995), water quality sampling was performed for a year during baseline conditions (trade winds 10-20 mph, waves <6.3 ft, and rainfall <0.5 in/day). All measures of nutrients and other chemical parameters remained relatively constant at both surface and bottom (43 ft) stations (Table 3-14).

Even though sampling spanned an entire year, only small variations in all parameters were encountered. Salinity ranged between 34.5 and 34.6 ppt; phosphate, nitrate and ammonium concentrations ranged between undetectable levels and 0.15 µM/L; turbidity ranged between 0.25 and 0.37 ntu; and chlorophyll *a* ranged between 0.07 and 2.44 µg/L. Only silicate exhibited much variation and that was limited to the nearshore station near the Ala Wai Canal (Grigg, 1995).

Table 3-14: Baseline Values for Water Quality Parameters at Māmala Bay Study Offshore Stations

Baseline	*Surface*		*Bottom*	
Parameter	**Mean**	**Range**	**Mean**	**Range**
Salinity (ppt)	34.55 ± 0.03	34.48 - 34.60	34.55 ± 0.02	34.52 - 34.61
Phosphate (µM/l)	0.13 ± 0.01	0.11 - 0.15	0.13 ± 0.01	0.11 - 0.15
Nitrate (µM/l)	0.03 ± 0.02	0.01 - 0.07	0.04 ± 0.02	0.00 - 0.08
Ammonium (µM/l)	0.04 ± 0.02	0.00 - 0.07	0.05 ± 0.02	0.01 - 0.08

Baseline	*Surface*		*Bottom*	
Parameter	**Mean**	**Range**	**Mean**	**Range**
Silicate (µM/l)	1.87 ± 0.48	1.08 - 2.68	1.76 ± 0.46	1.04 - 2.25
Turbidity (ntu)	0.29 ± 0.03	0.25 - 0.37	0.28 ± 0.02	0.25 - 0.32
Chlorophyll *a* (µg/l)	0.16 ± 0.14	0.09 - 0.24	0.17 ± 0.06	0.07 - 0.24
Source: Grigg, 1995				

During significant wave events (height >6.3 ft, period >14 seconds) many chemical variables were unaffected by the waves and essentially remained baseline in character. This was true for salinity, silicate, chlorophyll *a* and turbidity, although turbidity increased slightly. The ranges for all variables are given in Table 3-15. Two notable exceptions to this pattern were observed. On one hand, phosphate decreased consistently and significantly at all stations, surface and bottom ($p < 0.01$), while on the other, nitrate and ammonium were both found to increase significantly over baseline values (t-test, $p<0.01$), and showed a slight increasing trend from east to west in the bay. Levels of nitrate increased exponentially with relative wave energy.

Table 3-15: Wave Event Values for Water Quality Parameters at Māmala Bay Study Offshore Stations

Wave Event	*Surface*		*Bottom*	
Parameter	**Mean**	**Range**	**Mean**	**Range**
Salinity (ppt)	34.70 ± 0.07	34.59 - 34.83	34.72 ± 0.06	34.63 - 34.83
Phosphate (µM/l)	0.09 ± 0.02	0.06 - 0.11	0.08 ± 0.01	0.06 - 0.10
Nitrate (µM/l)	**0.63 ± 0.86**	0.02 -3.38	**0.72 ± 1.04**	0.02 - 4.17
Ammonium (µM/l)	0.09 ± 0.05	0.01 - 0.22	0.10 ± 0.06	0.02 - 0.22
Silicate (µM/l)	2.30 ± 0.55	1.25 - 2.98	2.09 ± 0.45	1.28 - 2.75
Turbidity (ntu)	0.37 ± 0.10	0.27 - 0.70	0.34 ± 0.06	0.27 - 0.48
Chlorophyll *a* (µg/l)	0.18 ± 0.07	0.06 - 0.28	0.17 ± 0.07	0.01 - 0.30
Notes: Bolded values indicative of possible violations of water quality standards *Source: Grigg, 1995*				

Rainfall events produced the largest changes in water quality, particularly near non-point sources at Pearl Harbor and Ala Wai Canal and particularly at surface stations (Table 3-16). Changes were magnified (non-linear) by larger rainfall events. The greatest changes were surface salinity and silicate off Ala Wai Canal and Pearl Harbor. The nutrients nitrate and phosphate were also high at the surface off Ala Wai Canal, but interestingly this was not true at Pearl Harbor where they remained low. Conversely, chlorophyll *a* concentrations were very high at the surface off Pearl Harbor. Longshore gradients away from Pearl Harbor and the Ala Wai Canal for all chemical variables trended to the east along the shore toward Diamond Head. This was associated with strong westerly Kona winds, which accompanied all significant rainfall events studied (Grigg, 1995).

Table 3-16: Rain Event Values for Water Quality Parameters at Māmala Bay Study Offshore Stations

Rain Event	*Surface*		*Bottom*	
Parameter	**Mean**	**Range**	**Mean**	**Range**
Salinity (ppt)	34.13 ± 0.88	31.53 - 34.41	34.51 ± 0.21	33.97 - 34.60
Phosphate (µM)	0.15 ± 0.09	0.10 - 0.42	0.12 ± 0.02	0.10 - 0.17
Nitrate (µM)	**0.61 ± 1.36**	0.01 - 5.15	0.11 ± 0.13	0.01 - 0.53

Rain Event	***Surface***		***Bottom***	
Parameter	**Mean**	**Range**	**Mean**	**Range**
Ammonium (µM)	0.11 ± 0.05	0.04 - 0.24	0.11 ± 0.04	0.04 - 0.16
Silicate (µM)	3.51 ± 2.14	2.11 - 9.55	2.52 ± 0.30	2.13 - 3.35
Turbidity (ntu)	**0.93 ± 0.96**	0.28 - 3.20	0.39 ± 0.16	0.29 - 0.77
Chlorophyll *a* (µg/l)	**0.32 ± 0.34**	0.03 - 1.23	0.27 ± 0.20	0.13 - 0.89
Notes: Bolded values indicative of possible violations of water quality standards *Source: Grigg, 1995*				

Temperature Measurements

Because of the critical importance of the seawater intake temperature to HSWAC system engineering and economics, the temperature regime at the proposed intake location was exhaustively investigated. Existing data were analyzed, existing models were run, and sensors were deployed to collect new data. Some interesting relationships were seen between the water temperatures at 1,600 ft and tides and internal waves. Although reduction of temperature variability and its impact were important engineering considerations for HSWAC engineers, this temperature variability was not significant in terms of State water quality standards. Seawater temperature variations at 1,600 ft water depth in Māmala Bay were examined in four sources of data:

- The first data set (Hamilton et al., 1995) was collected as part of the Māmala Bay Study. This investigation consisted of deploying pressure sensors and thermistors at various depths and locations throughout Māmala Bay for a period of 1.5 years. The deepest and closest mooring relative to the preliminary proposed HSWAC intake location (named E4) was positioned approximately 3.7 nm southeast of that location in a water depth of 1,665 ft. The deepest thermistor attached to this mooring was at a water depth of 1,476 ft.
- The second source of data was a recent depth/pressure sensor deployment (named HSWAC1) in the general vicinity of the proposed HSWAC intake location at 1,600 ft water depth. The data were collected by Makai Ocean Engineering, Inc. (MOE), for a period of 11 days.
- The third source of data was based on a second deployment (named HSWAC2) that occurred immediately following the first MOE deployment and lasted for a period of 20 days.
- The fourth source of data was the Hawaiʻi Ocean Time-Series (HOT) project. The HOT data represents a long-term data set consisting of cruise averages spanning 19 years. The data are collected about 62 miles north of Oʻahu. A cruise average is generated from a series of expendable bathythermograph (XBT) casts. The casts collect instantaneous temperature data through the water column between the surface and 3,048 feet depth. Each cruise averages five days of data and the cruises are spaced about a month apart. The fact that the HOT data includes a wide range of depths means it includes data at the same depths as all the other data sets.

The locations of the first three stations are shown on Figure 3-21, and the results are discussed below.

Māmala Bay 1995 Study

The Māmala Bay study included 11 mooring stations positioned throughout Māmala Bay. Most sensors were deployed shallow (< 820 ft) with the exception of A4 and E4, which were deployed in 1,476 ft water depth (approximately 190 ft above the seafloor). The E4 sampling period was January 1994 to August 1995. The average temperature for this site was found to be 45.41^{o}F, with a standard deviation of 0.68^{o}F.

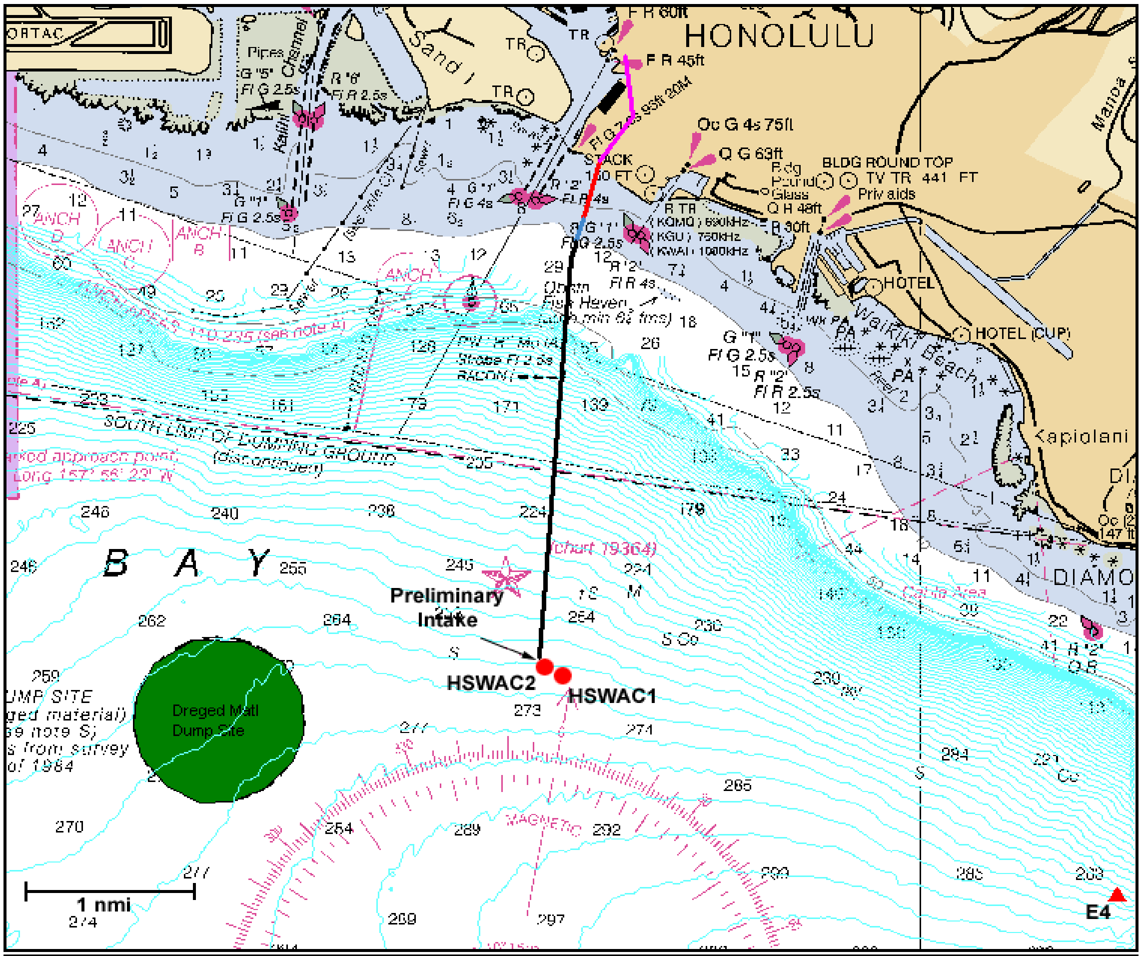


Figure 3-21: Temperature Time-Series Data Collection Sites in Māmala Bay
(Source: Makai Ocean Engineering, 2005a)

The preliminary HSWAC design intake temperature has been established at 45°F. Based on bathymetry and existing temperature profile data, this places the target intake at approximately 1,600 ft water depth. Using the data available from the Māmala Bay study (Hamilton et. al., 1995) and that of Noda (1982), the temperature at the 1,476 ft water depth was extrapolated to a depth of 1,600 ft. Taking the overall average for the Māmala Bay study data set gives an estimated average temperature at 1,600 ft water depth of 44.7°F.

MOE November 2004 11-Day Data Collection
In an attempt to gain a better understanding of the variation of subsurface water temperature at 1,600 ft in Māmala Bay, MOE deployed a temperature/pressure sensor approximately 3 nm seaward of Honolulu Harbor in 1,600 ft water depth (N21° 14.58276, W157° 52.20180). The deployment location is labeled HSWAC1 on Figure 3-19. The sensor was deployed on November 27th and retrieved 11 days later on December 8th, 2004.

Table 3-17 provides descriptive statistics from the 11-day sampling period. The mean water temperature (45.01°F) was 0.31°F warmer than what was predicted for the 1,600 ft depth at the E4 mooring (see Figure 3-21), as might be expected from sampling a much shorter time period than the 20-month time period for the E4 data.

Table 3-17: Descriptive Statistics for the HSWAC1 Sensor Located in 1,600 ft Water Depth at the Proposed HSWAC Seawater Intake Location

HSWAC1 Stats (11-Days) °F	
Mean	45.01
Standard Deviation	0.67
Range	3.22
Source: Makai Ocean Engineering, 2005a	

Making direct comparisons between the HSWAC1 data and those collected in 1995 (Hamilton et al., 1995) is difficult because of the differences in collection times and water depths. Further analysis of these temperature data suggests that the difference in temperature variation between the two data sets (HSWAC1 versus E4) may not simply be due to sampling error (difference in sample sizes).

When MOE plotted the entire HSWAC1 data series an obvious pattern of periodicity in temperature fluctuations is observed (Figure 3-22). Furthermore, a strong correlation between pressure (water depth) and temperature is apparent. The most likely explanation is that there is a correlation between water temperature and tides. An observed episodic temperature periodicity of 12 hours and in some cases 24 hours was noted.

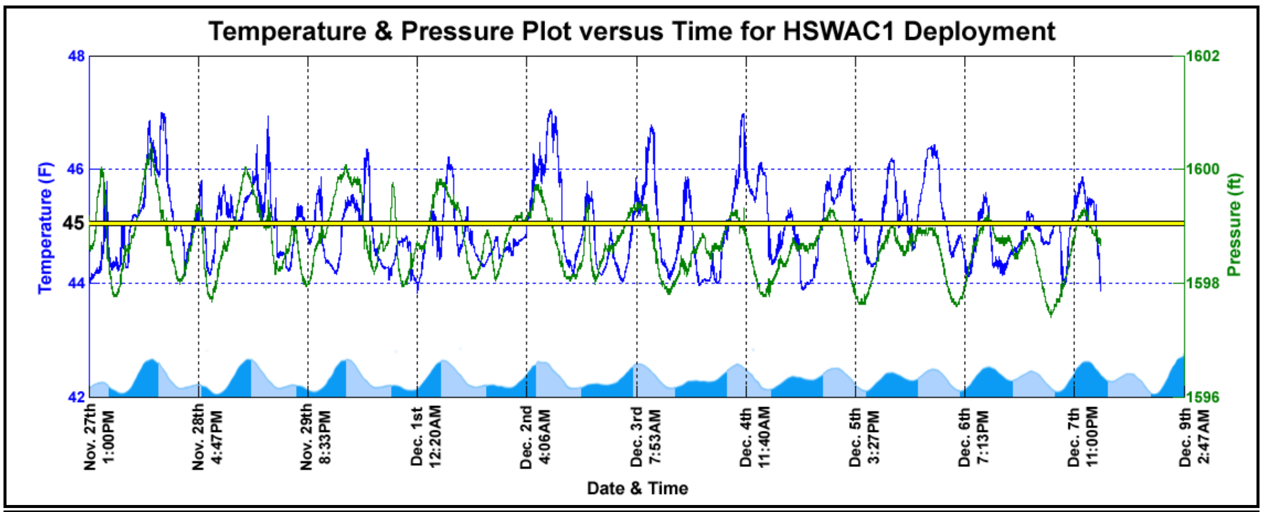


Figure 3-22: A Plot of the Temperature and Pressure Data Collected for an 11-day Period at the HSWAC1 Location

(The yellow bar represents the mean temperature, the blue line represents temperature and the green line represents pressure. Located just above the x-axis is the tidal profile for the periods identified.)

(Source: Makai Ocean Engineering, 2005a)

In addition to measuring the temperature variation at 1,600 ft, a water column profile was also collected (Figure 3-23). It can be seen that the mixed layer extends to well below 200 feet in this profile, at this time of year.

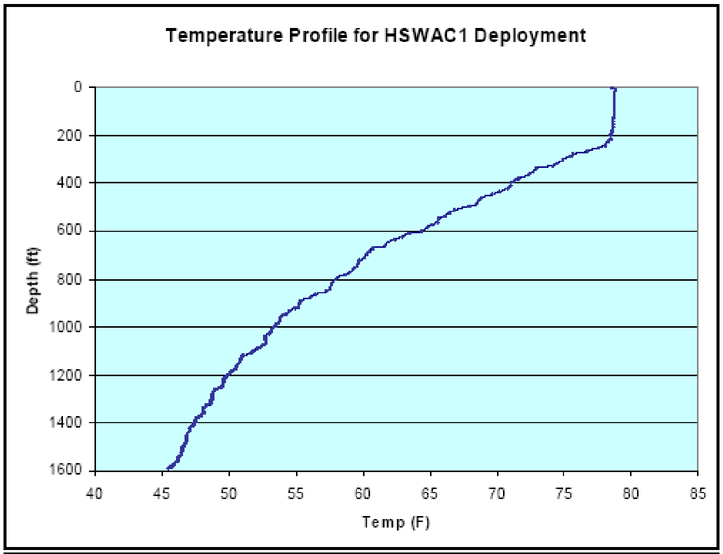


Figure 3-23: Temperature Profile for the HSWAC1 Deployment
(Source: _Makai Ocean Engineering, 2005a)

MOE December 2004 20-Day Data Collection
Immediately following the MOE 11-day HSWAC1 deployment, the sensor was redeployed for 20 days at roughly the same location; N21° 14.619, W157° 52.309 (HSWAC2 - see Figure 3-24). Table 3-18 provides descriptive statistics for the 20-day sampling period. The mean water temperature (45.2°F) was 0.19°F warmer than in the 11-day HSWAC1 deployment at essentially the same location.

Table 3-18: Descriptive Statistics for the HSWAC2 Sensor Located in 1,600 ft Water Depth at the Preliminary Intake Target

HSWAC2 Stats (20-Days) °F	
Mean	*45.20*
Standard Deviation	*0.59*
Range	*3.78*
Source: _Makai Ocean Engineering, 2005a	

The 20-day HSWAC2 sampling period resulted in minimum and maximum temperature values which were greater than the HSWAC1 11-day sampling period but less than the E4 monthly sampling period. Combined, the 20-day HSWAC2 and 11-day HSWAC1 are still within the E4 minimum and maximum temperature ranges recorded for the months of November and December 1994.

3.7.2.13 Analytical Modeling

To further examine potential variability in Māmala Bay water temperature modeling results were reviewed using two numerical oceanographic models that are designed to model Māmala Bay including the tides, internal waves, temperatures, salinity, and bathymetry. The University of Hawaiʻi – Mark Merrifield Model seemed to give more useful results.

3.7.2.14 University of Hawaiʻi – Mark Merrifield's Model

Dr. Mark Merrifield at the University of Hawaiʻi has published several papers on the dynamics of Māmala Bay. He also operates a Princeton-based model of the bay's dynamics including the tides, internal waves, temperatures, currents, etc. In general, his results show that Māmala Bay has large temperature excursions because of the tidal waves (not Tsunami) hitting the island daily from the northeast.

If the bottom of the ocean were flat there would be no vertical excursion near the seabed, and therefore no temperature variations. However, the bottom slope drives the vertical variations. Temperature excursions can be reduced by: (1) looking for the smallest cross-slope surge, (2) going deeper for a smaller temperature gradient, or (3) locating the intake at a low bottom slope.

Considering the bathymetry of Māmala Bay, there are potentially economically feasible opportunities for locating the seawater intake where the bottom slope is lower. For instance, in Figure 3-24, location C has a lower slope than location A where HSWAC1 and HSWAC2 measurements were made, so one would expect a significant lowering of the temperature fluctuations under the same surge conditions. Surge, however, increases toward Pearl Harbor, so the net effect of this possible move is unknown.

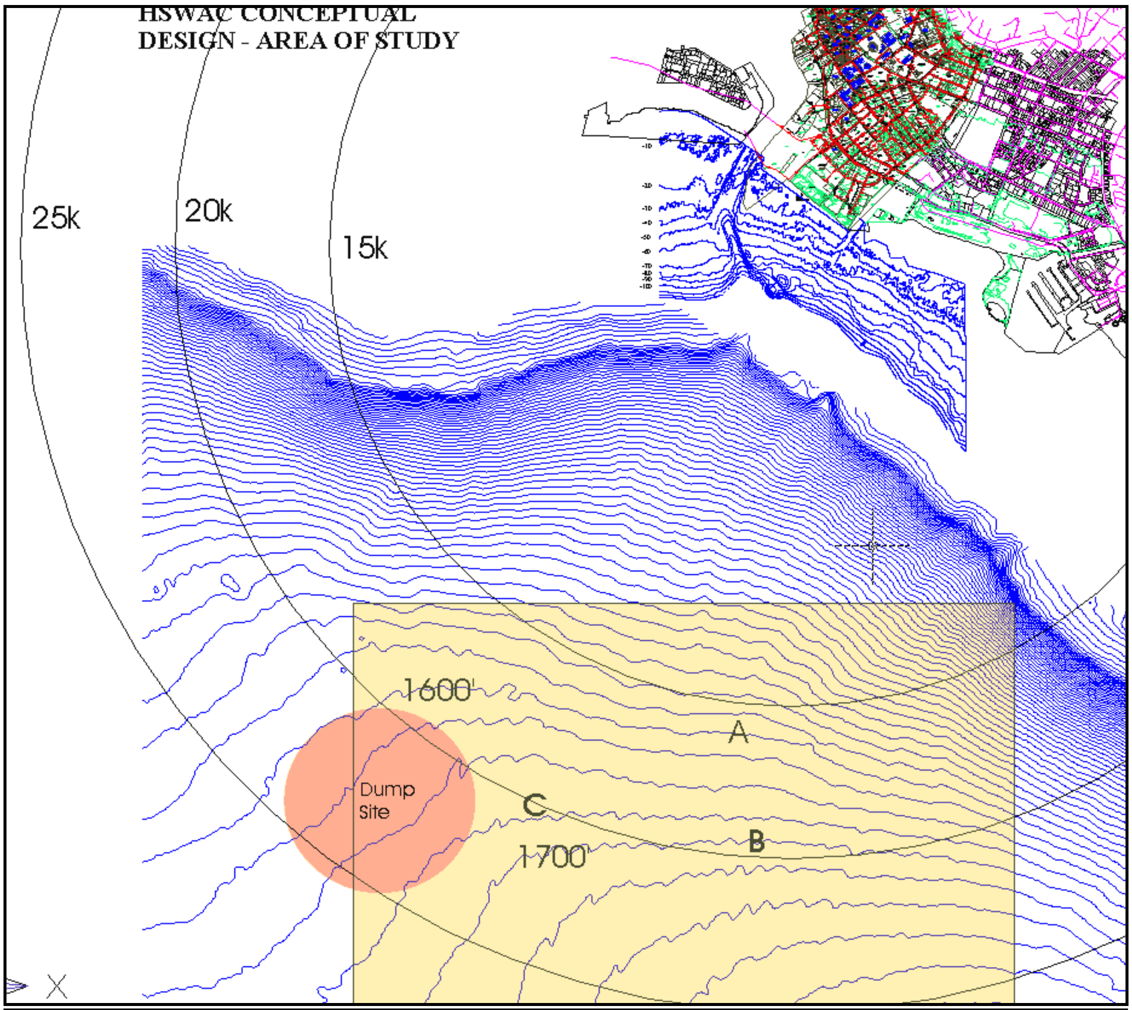


Figure 3-24: Alternative HSWAC Seawater Intake Locations Based on Bottom Slope

(Location C has a much lower slope than Location A where temperature data were collected. Location B is a possible 1,700 ft intake location. The radii are distances (in thousand [k] feet) from the assumed tunnel breakout location.) (Source: Makai Ocean Engineering, 2005a)

3.7.3 Marine Biota

Marine flora and fauna and certain marine habitats are protected by the Federal Endangered Species Act of 1973 (16 U.S.C. §§ 1531-1544, as amended) (ESA), Hawai‘i’s Endangered Species Law (Chapter 195D HRS), the Marine Mammal Protection Act (16 U.S.C. §§ 1361-1421h, as amended) (MMPA), and the Migratory Bird Treaty Act (16 U.S.C. §§ 703-712, as amended) (MBTA). Protection of certain habitats (essential fish habitat and coral reefs) is afforded by the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §§ 1801-1882, as amended) (Magnuson-Stevens Act or MSA) and Executive Order 13089 Coral Reef Protection, respectively.

Complex marine ecosystems occur in Hawaiian waters to depths of 16,500 ft and extend inland from the coasts to include coastal marine ponds. Several factors control the variety, distribution, and abundance of marine life, including geographic isolation, subtropical climate, storm waves, and human-caused pollution and development. This section describes the existing marine biological resources in the areas around the proposed seawater intake and return pipelines and in the proposed Ke‘ehi Lagoon staging area.

The marine areas in the proposed pipeline corridor are among the most historically degraded coastal habitats in the State, having been subjected to municipal waste dumping, sewage discharges, dredged material dumping, and other waste disposal activities. This area has limited marine biological resources. The nearshore area is maintained in an early successional stage by seasonal high surf events, occasional storm surge, and near the Honolulu Harbor entrance channel, dragging of barge tow cables on the bottom. Nevertheless, to avoid the existing zone of sparse coral formations (described below), microtunneling would be used to tunnel beneath the shoreline and nearshore reefs off Kaka‘ako Waterfront Park. Marine surveys have been done in the pipeline corridor and the results of these surveys are summarized below. Also described are: the benthic and pelagic communities in Māmala Bay, protected marine resources, including endangered and threatened species and their critical habitats, non-endangered or threatened marine mammals, seabirds and other migratory avifauna, and designated essential fish habitat (EFH) and habitat areas of particular concern (HAPC). Information is included for the proposed Ke‘ehi Lagoon staging area, although operations there would be temporary in nature.

3.7.3.1 Benthic Communities

Benthic communities, or the benthos, are made up of marine organisms that live on or near the seafloor. They may burrow in the seafloor, attach themselves to the bottom, or crawl or swim about within the bottom waters. Where sunlight reaches the seafloor, the benthos includes plants and plant-like organisms such as seaweeds, which become anchored to the bottom. Among the common animals that live on the seafloor are clams, crabs, lobsters, starfish, and worms. In tropical and subtropical waters, corals form an important part of the benthic community and provide habitat for other organisms. Bottomfish are fish that have adapted to life on and near the seafloor. Barnacles, clams, oysters, and various snails and worms are among the animals that begin life as zooplankton, but upon reaching maturity sink to the seafloor and become part of the benthos.

The greatest known diversity of marine species exists in benthic communities, especially in coral reefs. The benthic environment includes the intertidal shore; the shallow subtidal shelf; the deep abyssal plains; and isolated ecosystems such as coral reefs, seamounts, and deep-sea trenches. The substratum may vary considerably, with distinct differences between hard-bottom and soft-bottom communities. The type of bottom has a big effect on the nature of the community that lives there. Beyond that single physical factor, species diversity is maintained by biological mechanisms— competition, predation, larval recruitment, and biological structuring of the substrate—and/or physical mechanisms, such as nutrients, light, waves, and currents (Thorne-Miller and Catena, 1991).

The Māmala Bay study completed in the early 1990s looked at both water quality and benthic ecosystems in the bay. The historical account of major perturbations affecting the Māmala Bay benthos provided by Grigg (1995) is useful in understanding conditions in the bay today. The paragraphs below are excerpted from Grigg's report.

> *The effects of both point and non-point sources of pollution on coral reef ecosystems in Māmala Bay were studied at three levels of biological organization: the cell, the population and the community. The results show a uniform lack of negative environmental impact. Calcification and growth show no relation to point or non-point sources of pollution within the bay, nor do species abundance patterns, diversity or community structure. Changes in water quality caused by rainfall and wave events are too small and too short-lived to affect coral reef ecosystems in the bay.*
>
> *The lack of environmental impact of point and non-point pollution on coral reef ecosystems in Māmala Bay in 1993-94 has not always been the case. Prior to 1977, most of the sewage discharged into Māmala Bay was untreated. In that year, sewage treatment was upgraded from raw to advanced primary and the outfall terminus was moved from a depth of 13 m [43 ft] to a depth of 73 meters [240 ft], and 2,743 meters [9,000 ft] offshore. In 1975, an extensive survey was conducted that ranged between 4 km [2.5 mi] to the east of the outfall and 13 km[8 mi] to the west of the outfall at Sand Island at depths between 5 and 20 m [16 and 66 ft]. In 1975, a large zone of impact existed around the old outfall, extending 2 km [1.25 mi] to the east and 4 km [2.5 mi] to the west, in which corals were either absent or severely depressed in abundance. The bottom area within 1 km [0.6 mi] of the outfall was completely dominated by Chaetopterus, a tube building polychaete that built thick (up to 0.5 m [1.6 ft] high) mounds or bioherms. Within the mounds, up to 100,000 nematodes/m2 [9,300/ft2] were found. Other species favored within the zone of impact were the algae, Ulva sp., sponges and the urchins Echinothrix diadema and Tripneustes gratilla. The urchins were exceedingly abundant and succeeded in bioeroding and excavating virtually all living corals within the 6 km [3.7 mi] range. This accounts for the lack of old colonies of P. lobata noted in the survey conducted in Māmala Bay in 1993-94.*
>
> *By 1977, virtually the entire area within 6 km [3.7 mi] had been reduced to a flat hard plane of calcium carbonate with a benthic community dominated by species favored by the raw sewage. This community presumably replaced a normal coral reef ecosystem living in the area before the outfall was built in 1955. As such it represented a large scale phase shift in community structure (Hughes, 1994).*
>
> *In 1978, one year after the outfall had been diverted into deeper water, another survey of the area was made (R.W. Grigg, unpublished observations). At this time, all of the dominant species present in the zone of impact were now absent or very rare. The Chaetopterus bioherms had vanished. Urchins of both species were rare. Sponges and Ulva were absent. Another phase shift had occurred. The bottom was a hard pan barren limestone substratum with an abundance of cobbles and rubble and thin layers of sand. No coral recruitment was observed.*
>
> *Then in 1982, huge waves generated by Hurricane Iwa devastated the entire coast of Māmala Bay (Borg et al, 1992). Anecdotal observations by R.W. Grigg, Gordon Tribble, Roger Pfeffer and many others, revealed that most of the reefs all across the bay, particularly those dominated by Porites compressa, the finger coral, were heavily disturbed. Many reefs formerly supporting 60 to 100% coral cover were reduced to rubble. The only areas to "survive" were those where high relief existed and P. lobata was the dominant species. This explains the results of the 93-94 survey, that show that relative high coral cover exists only in high relief areas. By virtue of the*

complex morphology in high relief areas, they were little affected by scour and abrasion caused by transport and reworking of coralline rubble that occurs even during normal high waves every summer.

Then in 1992, Māmala Bay was again hit by hurricane force waves, this time produced by Hurricane Iniki. Like Hurricane Iwa, waves from this storm were reported to be 25 ft [7.6 m] or larger. In Hurricane Iwa, 30 foot [9.0 m] waves were reported by the missile destroyer Goldsborough as it was leaving Pearl Harbor on November 23, 1982. Five crewmen were injured, one fatally, by waves that hit the ship (Chiu et al, 1983). The effects of Iniki were similar to those of Iwa in terms of scour and abrasion, however, coral breakage was not nearly as severe as with Hurricane Iwa since much of the vulnerable coral had already been heavily disturbed and little recovery had occurred. The dominant species to "weather" both storms was P. lobata and did so most successfully in areas of high relief.

In low relief areas in 1992, scour and abrasion were severe and the successional process was set back (Dollar, 1993). Piles of rubble were transported and reworked along the bottom. Only in areas relatively free of carbonate rubble was there any evidence of substantial recovery and this was due to the recruitment and regrowth of P. meandrina since 1982. During the Māmala Bay 1993-94 survey, all low relief stations were dominated by this pioneer species.

In summary, a historical perspective is necessary to interpret and understand the existing patterns of distribution and abundance of coral ecosystems in Māmala Bay. At the present time (1993-94), these ecosystems are virtually unaffected by both point and non-point sources of pollution in the bay. Distribution patterns appear to be related primarily to the effects of past episodic and severe storm events in 1982 and 1992. Today, the effects of these past intense and short lived physical events override the cumulative effects of long-term but slow biological processes such as recruitment, regrowth and succession. However, in the absence of intense future storms, biological processes should eventually return the ecosystem to a more mature successional stage. Unless significant changes occur in the nature of existing sources of point and non-point source pollution, neither are expected to affect the long-term recovery of coral reefs in Māmala Bay (Grigg, 1995).

Since the 1993-94 surveys no major hurricanes have affected this coast, but the typically large surf experienced along this coast in summer months continues to inhibit coral recruitment by scour and abrasion. Figure 3-25 depicts the near-shore benthic habitat in the project area prepared by visual interpretation from remote sensing imagery collected by the National Oceanic and Atmospheric Administration (NOAA). While this map is coarse in scale, the general features agree well with dive surveys completed specifically for the HSWAC project. According to the NOAA interpretations, progressively seaward from shore are areas of macroalgae dominance, uncolonized pavement, scattered coral/rock in unconsolidated sediments, sand, and again macroalgae dominated habitat.

A marine biological survey of the general vicinity of the proposed breakout point was conducted. The results of this survey may be found in Appendix C and they are summarized below.

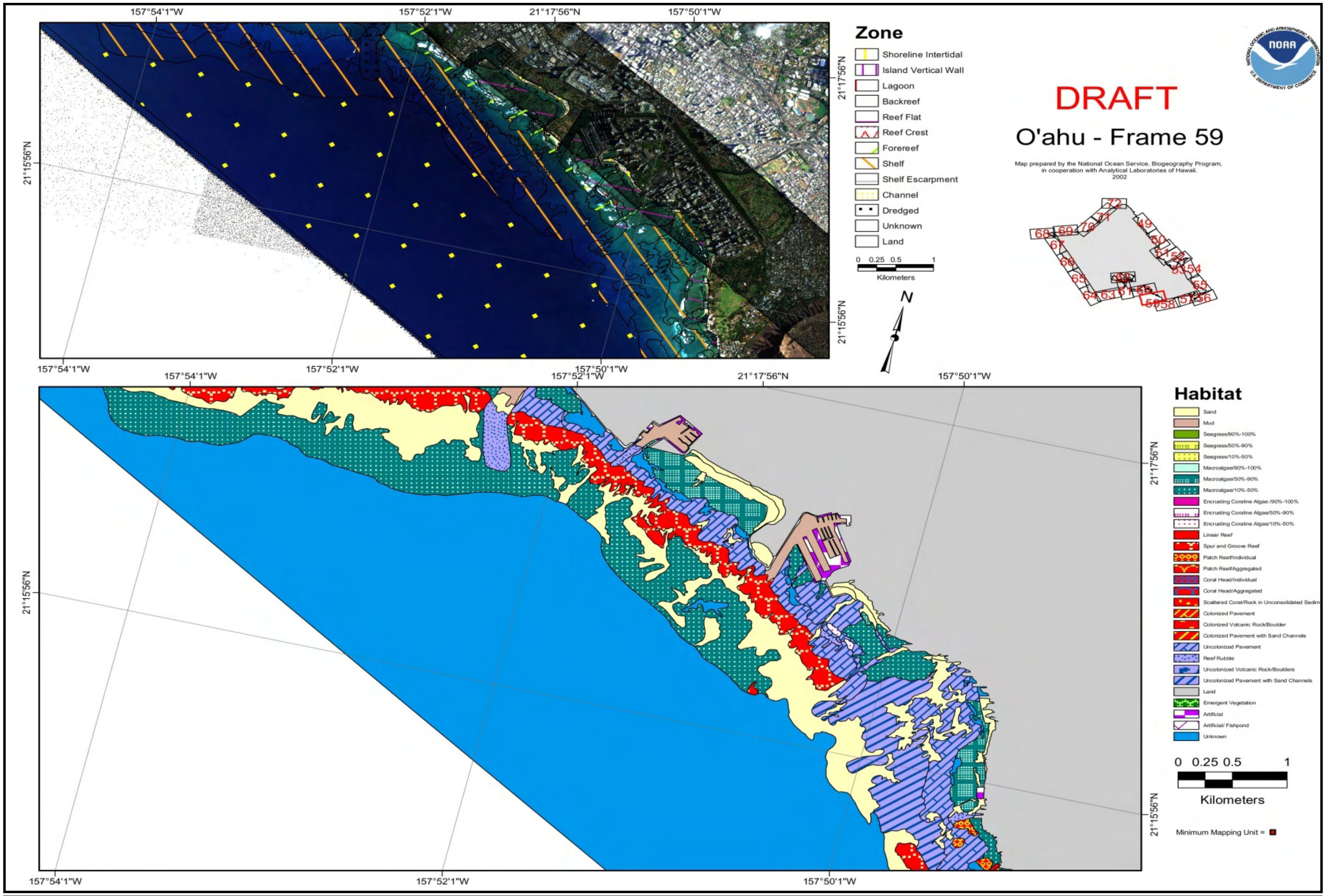


Figure 3-25: NOAA Interpretative Benthic Habitat Map for the HSWAC Project Area
(Source:_ NOAA, 2002)

Coral reef communities usually show some zonation that is related to physical characteristics of the given area. Some of the parameters that affect this zonation are exposure to wave energy, freshwater inputs, depth, substratum type, etc. The waters offshore of the Kaka'ako Waterfront Park have a typical zonation. Considerable effort was made to delineate the major ecological zones or biotopes present as well as determine the degree of development of coral communities in these biotopes. The zones or biotopes observed in the area include:

- the biotope of scoured limestone, which is located close to the boulder riprap shoreline,
- the biotope of scattered corals seaward of the biotope of scoured limestone (best developed in waters from about 13 to 40 ft depth),
- the biotope of dredged rubble, which is located seaward of the biotope of scattered corals and was created by the deposition of dredge spoils at depths from about 33 to 65 ft, and
- the biotope of deep sand which is seaward of the biotope of dredged rubble at depths generally greater than 65 ft.

Other than the biotope of dredged rubble these biotopes are also present in the waters fronting the Sand Island Beach Park, which is west of the entrance channel of Honolulu Harbor. The general characteristics of each biotope are described in more detail below.

The Biotope of Scoured Limestone

The biotope of scoured limestone is present along the entire length of the boulder riprap fronting Kaka'ako Waterfront Park and the commercial area to the west. The width of this biotope varies considerably from about 130 ft to more than 330 ft with the widest area being in the far western part of the Kaka'ako limestone platform. In the far west near shore area the scoured limestone is highly irregular comprising old spur and groove formations (Figure 3-26), which are typically found along the seaward side of the reef crest on most Hawaiian reefs. Other than this far western area the biotope of scoured limestone is relatively flat and smooth with little topographical relief present (Figure 3-27). Also present in this biotope are areas of sand and coralline rubble; these materials are moved about by impinging waves that create the scouring action, which inhibits the successful establishment and growth of corals. High surf is most common during the summer months when swells arrive from the south. In the biotope of scoured limestone, fish communities are best developed in the far western area probably due to the greater cover (shelter) afforded by the spur and groove formations. These fish communities are dominated by surgeonfishes (family Acanthuridae), triggerfishes (family Balistidae), and damselfishes (family Pomacentridae).

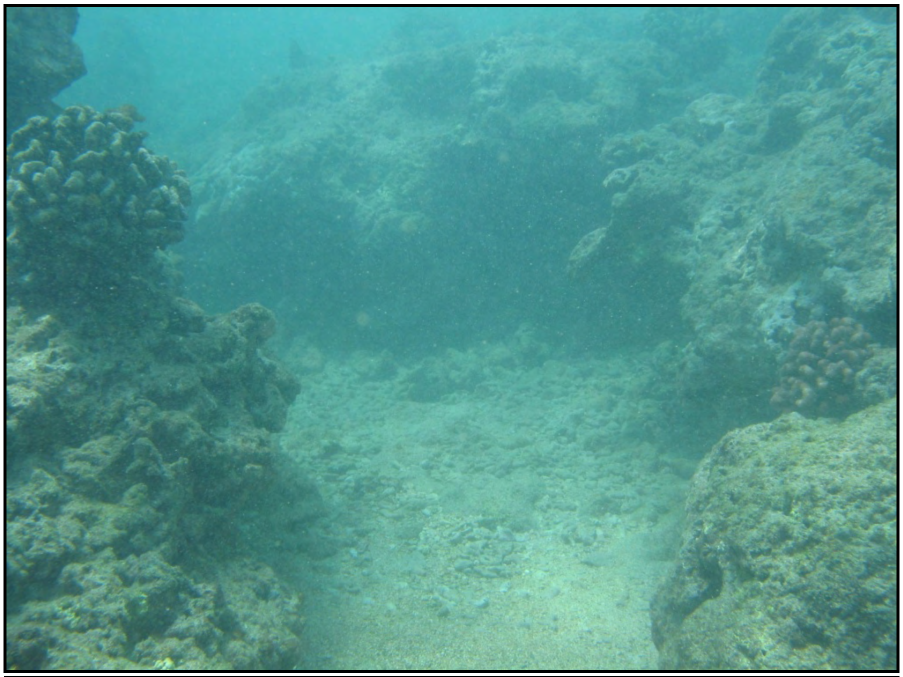


Figure 3-26: Example of Old Spur and Groove Formations Cut into the Limestone by Wave Action
(Channel bottoms typically are sand-filled and limestone ridges or spurs often rise 5 ft or more. Area is west of the proposed pipeline alignment; depth 15 ft.) (Source: Appendix C)

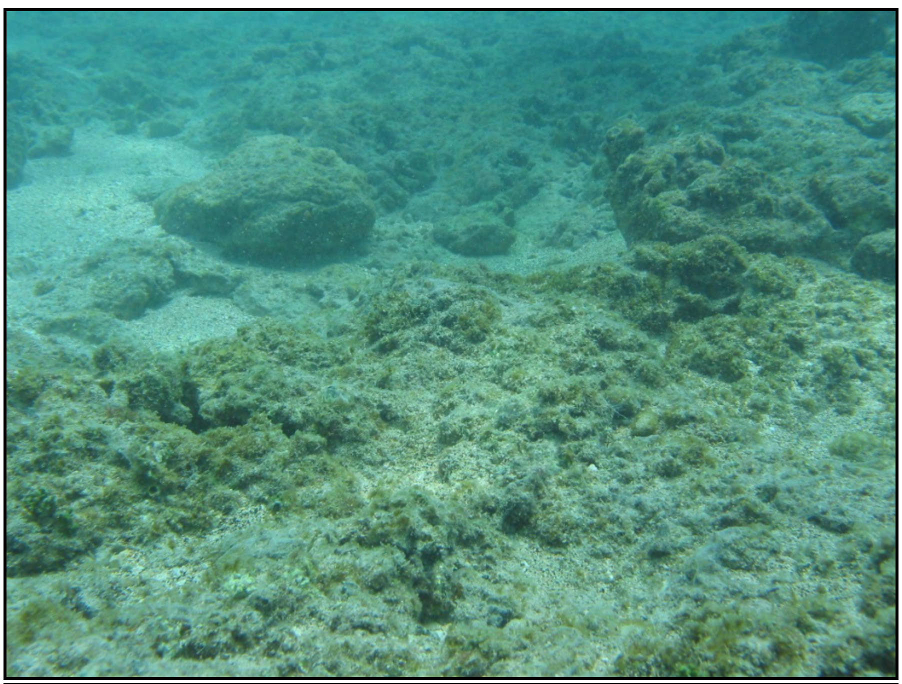


Figure 3-27: Flat Limestone with Rubble and Sand in the Biotope of Scoured Limestone West of the Pipeline Alignment
(Note the lack of corals; depth 13 ft.) (Source: Appendix C)

Coral cover is very low in the biotope of scoured limestone (much less than 0.1%), which as noted above, is probably due to the scouring created by occasional high surf events that commonly impact this coastline during the summer months. Coral species seen in this biotope include the cauliflower coral

(*Pocillopora meandrina*) and rarely, the lobate coral (*Porites lobata*). At the time of our survey, the edible seaweed limu kohu (*Asparagopsis taxiformis*) was seen in this biotope as were several small octopus or he‘e (*Octopus cyanea*). The diversity of diurnally-exposed macroscopic species (i.e., greater than 0.8 inches in some dimension) is low in this biotope. Probably the most common species include sea urchins (*Echinometra mathaei* and *Tripneustes gratilla*), sea cucumbers (*Holothuria atra*) and a few cone shell species (*Conus lividus*, *Conus ebreus*).

The Biotope of Scattered Corals

This biotope is situated seaward of the biotope of scoured limestone from about 160 ft to over 330 ft from the shoreline at depths commencing in 13 to 20 ft and ending in depths from about 40 to 60 ft. This biotope is the most common feature of the Kaka‘ako limestone platform and occupies a band about 1,100 ft in width, and about 3,000 ft in length between the Honolulu Harbor entrance channel and the abandoned sewer line near the Kewalo Basin entrance channel. Thus, the biotope encompasses about 75 acres.

The smooth limestone of the shallower, more inshore areas transitions to a series of limestone ridges (or spurs) separated by channels (or grooves). The spurs may rise as much as 5 ft above the general substratum and are separated by sand/coralline rubble-filled channels. These spurs and grooves have a general orientation that is perpendicular to shore and the ridges or “spurs” are from 6 to 49 ft in width and have lengths up to about 200 ft. Channels are from 3 to about 33 ft in width and are up to 130-160 ft in length (Figure 3-28).

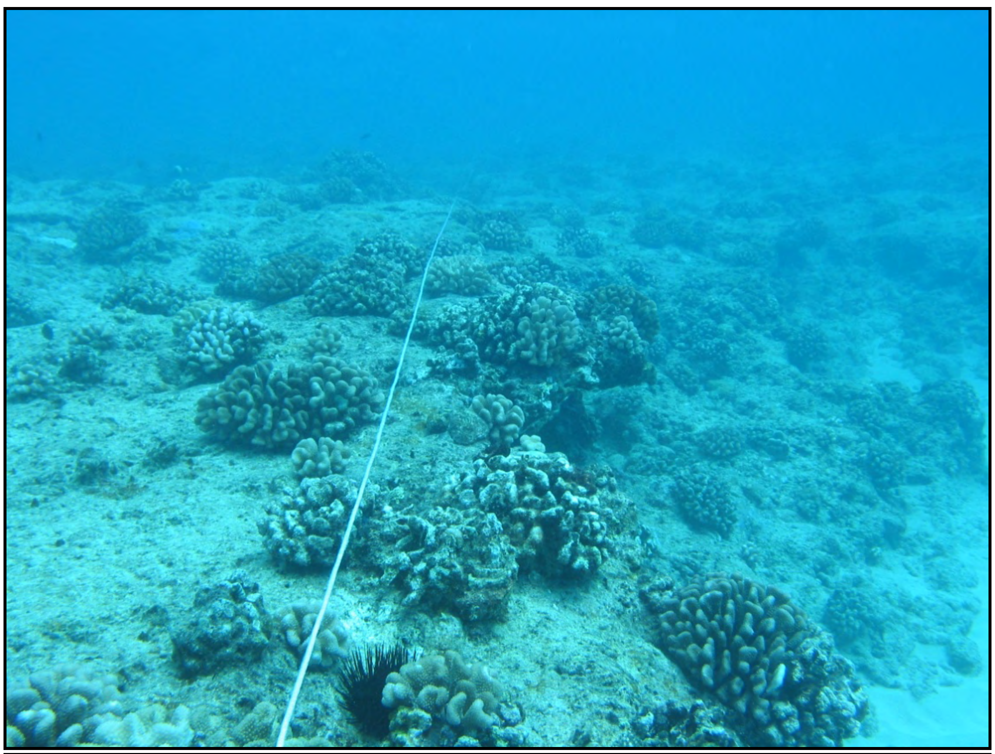


Figure 3-28: Edge of a Limestone Ridge or Spur on the Left with *Pocillopora meandrina* Colonies and on the Right Dropping Away into a Sand-filled Channel
(Depth 33 ft) (Source: Appendix C)

Along the shallower inner reaches of this biotope corals are scattered (Figure 3-29). With increasing depth (i.e., 26 to 40 ft) coral coverage increases, and in areas of 220 to 1,600 ft^2 coverage may approach 75%. A gross overall mean estimate of coral coverage in this biotope is 5%. Corals are commonly seen on the ridges that lie above the sand-scour that occurs during periods of high surf. Common species include the cauliflower coral (*Pocillopora meandrina*), lobate coral (*Porites lobata*), rice corals *(Montipora verrucosa, M. patula*), as well as other less dominant species (*Porites compressa, Monitpora verrilli, Pavona varians, Leptastrea purpurea, Porites rus,* etc.). Most of the other invertebrates and fishes seen in this area are all species common to Hawai'i's reefs. Diurnally-exposed macroinvertebrates seen include the pearl oyster or pa (*Pinctada margaritifera*, octopus or he'e (*Octopus cyanea*), sea cucumbers (*Holothuria atra, H. edulis, Actinopyge mauritana*), starfishes (*Linckia multifora, L. diplax, Acanthaster planci*), cone shells (*Cone imperialis, C. leopardus, C. lividus, C. ebraeus, C. miles* and *C. distans*), cowry (*Cypraea maculifera*), spindle shell (*Latirus nodus*), christmas tree worm (*Spirobranchus gigantea*), polychaete (*Loimia medusa*), boring bivalve (*Arca ventricosa*), mantis shrimp (*Gonodactylus* sp.), occasional ula'papa (*Paribaccus antarcticus*), and small xanthid crabs. Fishes commonly seen include surgeonfishes (manini - *Acanthurus triostegus,* na'ena'e - *A. olivaceus,* pualo - *A xanthopterus,* palani - *A. dussumieri,* maikoiko - *A leucoparieus,* ma'i'i'i - *A. nigrofuscus,*, kole - *Ctenochaetus strigosus,* lau'ipala - *Zebrasoma flavescens,* kala - *Naso unicornis*, umaumalei - *N. lituratus*, kihikihi - *Zanclus cornutus,* lauwiliwili - *Chaetodon miliaris, C. multicinctus, C. ornatissimus,* lauhau - *C. quadrimaculatus,* lauwiliwili nukunuku'oi'oi - *Forcipiger flavissimus*, mamo - *Abdufeduf abdominalis*, piliko'a - *Paracirrhites arcatus,* toby - *Canthigaster jactator* and damselfishes (*Chromis hanui, C. vanderbilti, C. agilis*). Fish species of commercial importance that are seen include moanos - *Parupeneus multifasciatus* and *P. pleurostigma,* weke - *Mulloidichthys flavolineatus,* roi - *Cephalopholis argus,* po'opa'a - *Cirrhitus pinnulatus,* rarely the omilu - *Caranx melampygus,* opelu - *Decapterus pinnulatus,* palukaluka - *Scarus rubroviolaceus,* and uhu - *Scarus sordidus.*

Figure 3-29: Photo Taken in the Shallow Portion (~23 ft) of the Biotope of Scattered Corals
Showing the Lower Density of Coral Colonies (Pocillopora meandrina) Across the Limestone.
(Source: Appendix C)

The Biotope of Dredged Rubble

Seaward, the spur and groove formations that are common elements of the scattered corals biotope become less obvious. Ridges or spurs often appear as relatively flat limestone with little coral present, and the intervening channels are filled in with coral rubble. Much of this rubble appears to be angular and ranges from two inches to about 2.5 ft in diameter, but the majority of it is small. This coral rubble remains from the dredging activities in Honolulu Harbor, and the tailings were deposited in the area (Figure 3-30) probably from 1920 through 1960. With time and sufficient material, the old seaward face of the limestone platform was extended seaward probably adding anywhere from 33 to 130 ft onto the outer edge of the platform. This biotope is recognizable at depths from about 30 to 40 ft, and extends seaward sometimes as a relatively steep slope or otherwise as a gentle slope from 65 to 200 ft in width. Its deepest point is about 80 to 95 ft where a sand/rubble bottom is encountered. The distance between the most obvious seaward spur and groove formations with reasonable coral coverage and the top of the more offshore rubble slope ranges from 65 to over 160 ft.

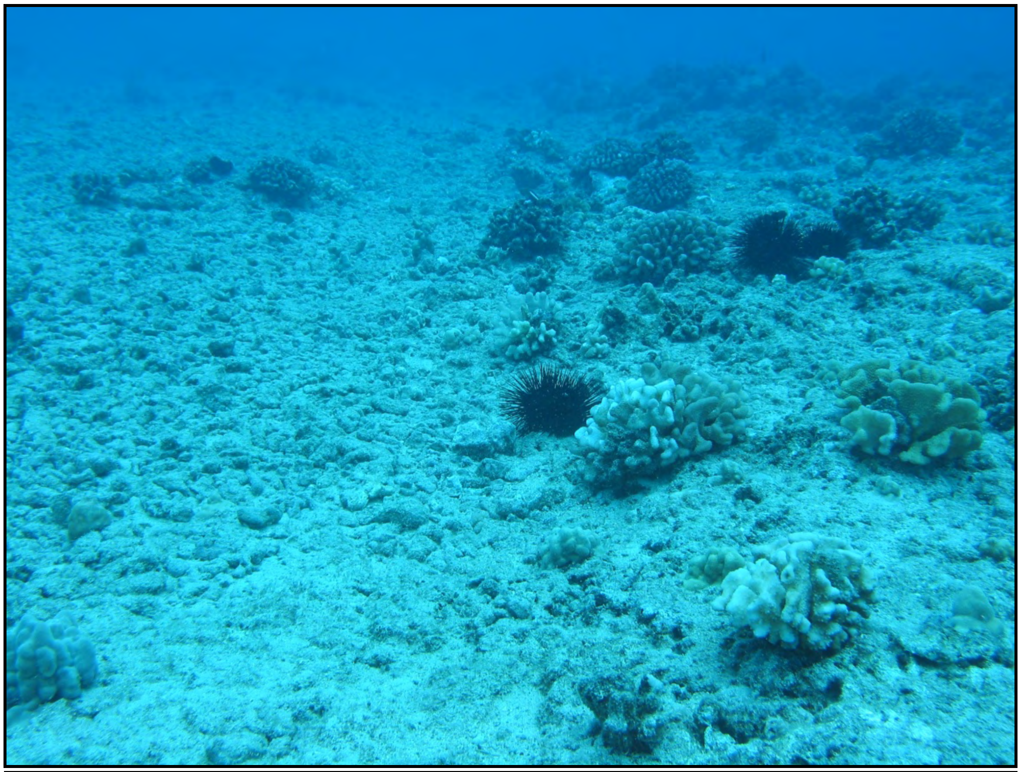


Figure 3-30: Zone of Transition (or Ecotone) Between the Biotope of Dredged Rubble (at Left) and the Biotope of Scattered Corals (on Limestone at the Right)
(Corals present are Pocillopora meandrina. Also present are black sea urchins or wana (Echinothrix diadema). Depth 36 ft) (Source: Appendix C)

In the zone of coral rubble and dredge tailings, benthic and fish communities are not well developed. The relatively unstable nature of the substratum does not promote coral growth; most corals seen in this biotope are small. Corals are best developed on the larger pieces of limestone. Mean coral coverage in this biotope is less than 0.1%, and species commonly seen include the cauliflower coral (*Pocillopora meandrina*), the lobate coral (*Porites lobata*), and rice corals (*Montipora verrucosa* and *M. patula*).

Fishes seen in this area are small (either juveniles) or species that do not attain large sizes (gobies, etc.), probably due to the lack of shelter. Where larger coral pieces or metal/concrete debris are found the fish communities are better developed, probably due to the shelter afforded by these materials. Most fishes encountered in this biotope are around available shelter; species commonly seen include the moano (*Parupeneus multifasciatus*), lauwiliwili (*Chaetodon miliaris*), butterfly fish (*Chaetodon kleini*), mamo (*Abudefduf abdominalis*), alo‘ilo‘i (*Dascyllus albisella*), dartfish (*Ptereleotris heteroptera*), piliko‘a (*Paracirrhites arcatus*), toby (*Canthigaster jactator*), puhi laumilo (*Gymnothorax undulatus*), ‘o‘opu hue

(*Arothron hispidus*), ala'ihi (*Sargocentron xantherythrum*), surgeonfishes (pualo - *Acanthurus blochii, A. xanthopterus*, palani - *A. dussumieri*), ma'i'i'i (*A. nigrofuscus*), kala holo (*Naso hexacanthus*), kala lolo (*Naso brevirostris*), humuhumu lei (*Sufflamen bursa*), humuhumu mimi (*Sufflamen fraenatus*) and wrasses, the a'awa - *Bodianus bilunulatus*, hinalea 'i'iwi - *Gomphosus varius*, small wrasses - *Macropharyngodon geoffroy, Pseudocheilinus octotaenia, Pseudocheilinus evanidus, Cheilinus bimaculata* as well as the 'omaka - *Stethojulis balteata*, and hinalea lauwili - *Thalassoma duperrey*.

Diurnally-exposed macroinvertebrates seen in this biotope include sea urchins (*Echinothrix diadema, E. calamaris, Diadema paucispinum, Tripneustes gratilla*), boring bivalve (*Arca ventricosa*), rock oyster (*Spondylus tenebrosus*), sponges including *Mycale armata, Suberites zeteki, Chondrosia chucalla, Spirastrella coccinea, Tethya diploderma, Mycale cecilia, Halichondria coerulea, Lotrochota protea, Halichondria dura* and *Tedania macrodactyla*, sea cucmbers (*Holothuria atra, H. hilla, H. verrucosa*) and the polychaete (*Loimia medusa*), he'e (*Octopus cyanea*), and cushion starfish (*Culcita novaeguineae*).

The Biotope of Sand

Below the rubble slope the substratum flattens and is comprised of sand and coral rubble. Offshore (within 330 ft of the rubble slope), there are several mounds of coral rubble that rise up to 16 ft above the surrounding substratum that probably represent one or more barge loads of dredge tailings. The diversity of marine life on the sand/rubble plain seaward of the 100 foot isobath is not well-developed, and was not examined in this study due to depth and bottom time constraints. Subsequently, however, the preferred route from the breakout point to the diffuser was photographically surveyed using divers and an ROV. Review of the resulting videotapes by the consulting marine biologist confirmed the descriptions of the biotopes and extension of the biotopes of sand to depths beyond 150 feet.

Coral Communities on the Western Side of Honolulu Harbor Entrance Channel

This area was investigated to compare the benthic communities east and west of the channel and provide a baseline for construction assessment. Alongside and within 260 ft of the western edge of the entrance channel to Honolulu Harbor there is a relatively well-developed coral community at depths from about 23 to 40 ft. This community is dominated by the cauliflower coral (*Pocillopora meandrina*). Mean coral coverage is about 25% through much of this area. Further west is a large barren area of limestone and sand flats, but about 660 ft west where the limestone is elevated, corals are again encountered. Common species in this area include *Porites lobata* and *Pocillopora meandrina* and local coverage (over areas from 110 to 1,100 ft^2 may be up to 30%. These more coral rich areas are broken by extensive sand flats so that overall mean coral coverage through much of the area is estimated to be less than 5%.

Resurvey of Proposed Breakout Point

Once the preferred breakout point was identified, a survey of that specific site was completed to confirm the general absence of corals. Visual observations of the various habitats present in the waters from the shoreline to a depth of 100 feet were made using SCUBA and either having the diver swim or be towed between points. Observations of substratum type (e.g., sand, coral rubble, coral or limestone), depth and biological diversity were noted and locations geo-referenced using a hand held global positioning system. The results of this survey generally confirm the conclusions from the first survey and may be found in Appendix D.

Ke'ehi Lagoon

The present shoreline and basins of Ke'ehi Lagoon represent perhaps the most altered marine area in Hawai'i. The perimeter of the lagoon is virtually all man-made, altered in this century by landfill of one sort or another. Material claimed from the lagoon was used to extend the shoreline and to reclaim shallow reef flats and marshy areas around the margin of the lagoon. Moanalua and Kalihi Streams empty into the northwest corner of the lagoon. Sediments from these streams are gradually filling the northern portion of the lagoon.

During World War II, the U.S. Navy dredged three intersecting basins across the fringing reef to create seaplane channels. The proposed staging area in Keʻehi Lagoon is within a previously dredged channel with a soft bottom invertebrate infaunal community with little cover or hard substrate to support corals or fish populations.

The Deep Benthos

The types of animals present and their abundance in the deep sea around Hawaiʻi are determined by Hawaiʻi's geographic isolation, water chemistry, temperature and pressure, current speeds, lack of light, and bottom habitat quality. In the deep sea around Hawaiʻi, only about 35% of the species seen from research submersibles are native to Hawaiʻi (Chave and Malahoff, 1998). Of the sponge, coral and echinoderm species present, 45% occur at depths of 15-400 meters, 15% at 400-800 meters, and 12% at 800-2,000 meters. Twenty-eight percent of these species range widely from depths of 40 to 2,000 meters. However, sessile benthic species are usually distributed in zones. Glass sponges, crinoids and most gorgonians are generally found at depths greater than 300 meters. The number of benthic fish species has been found to decrease logarithmically with depth. The greatest numbers of species inhabit depths between 15 and 200 meters, the fewest 2,000 meters. Crustaceans seem to follow the same distribution pattern (Chave and Malahoff, 1998).

Below 100 meters, only a few, if any, stony corals occur. Non-reef-building corals and other animals obtain their food from the plankton, smaller animals, or dead animal and plant material. Filter-feeding is a relatively common strategy, with areas swept by faster currents, such as ridges, banks and pinnacles, being favored. Because of low light intensity and limited food sources, depths below 500 meters are sparsely populated. Estimates of density are 0.05 animals per square meter (Chave and Malahoff, 1998).

At deep-sea depths, temperature is low, inhibiting metabolic processes. In addition, dissolved oxygen concentrations are low and pressures are high, further restricting life forms. Typical deep-sea animals include sponges, cnidarians including gorgonians, some of which are managed under the Precious Corals Fishery Management Plan, echinoderms including sea stars, deep-sea urchins, and sea cucumbers, brittle stars, basket stars, and crinoids (sea lilies), crustaceans including barnacles, crabs, and shrimp, and mollusks including sea snails and octopus. Typical fish include deep-sea sharks, rays, chimaeras, deep-sea mackerals and eels.

3.7.3.2 Pelagic Communities

The organisms living in pelagic communities may be drifters (plankton) or swimmers (nekton). The plankton includes larvae of benthic species, therefore a pelagic species in one ecosystem may be a benthic species in another. The plankton consists of plant-like organisms (phytoplankton) and animals (zooplankton) that drift with the ocean currents with little ability to move through the water on their own. The mostly one-celled phytoplankton float in the photic zone where they obtain sunlight and nutrients, and also serve as food for the zooplankton and some larger marine animals. Zooplankton consists of many kinds of animals, ranging from one-celled organisms to jellyfish up to 6 ft wide, which live in both surface and deep waters of the ocean. Crustaceans make up about 70% of all zooplankton. While some zooplankton float freely throughout their lives, many spend only the early part of their lives as plankton. As adults some become strong swimmers and join the nekton, while others settle to the seafloor, attach themselves, and become part of the benthos.

The nekton consists of animals that can swim freely and purposefully in the ocean. They are strong swimmers and include fish, squids, sea turtles, and marine mammals. Most species of nektonic animals live near the sea surface where food is plentiful, but others live in the deep ocean. Fish are the most important nekton, with over 13,000 kinds of fish living in the ocean. Squids are free-swimming mollusks that live in both surface and deep waters. Nektonic mammals, including porpoises and whales, remain in the ocean for their entire lives. Other marine mammals, such as the Hawaiian monk seal, spend time on land.

It is thought that pelagic systems are controlled primarily by physical factors, including temperature, nutrients, amount of light in the surface waters, and disturbances in the water structure. The latter occurs when winds and other atmospheric conditions drive changes in the circulation patterns of ocean waters. As a result, there are vertical changes in the temperature and nutrient distribution, which in turn affect the vertical distribution of species. There is no clear evidence of biological factors controlling species diversity in these ecosystems, but species interactions have not been well studied (Thorne-Miller and Catena, 1991).

Much of what is known about the biology of the deep ocean waters surrounding the Hawaiian Islands is based on limited information gleaned from studies on sport and commercial fisheries. Pelagic ocean and deep seafloor (benthic) ecosystems occur in the deep open waters beyond the neritic shallow-water zone around all the islands and on, and above, the seafloor at depths greater than 660 ft. Pelagic ocean waters are exposed to swells, currents, and winds from all directions, generally beyond the sheltering effects of the islands. Deep currents and eddies are also associated with this zone. Sunlight is absent on the deep seafloor. Basalt and carbonate rock substrates are common on slopes with sediments prevalent on flatter surfaces. Bottom sediments surrounding O‘ahu are composed largely of muds washed as organic matter (detritus) from the adjacent islands, and sand and gravel of shallow-water origin.

Phytoplankton are the only abundant plants in the pelagic zone; living plants are rare or absent on the deep seafloor. Zooplankton, fishes, squids, sea turtles, marine mammals, and various seabirds forage in neritic or pelagic waters. At depths in excess of 330 ft, many benthic organisms live where there is little or no light and maintain themselves on detritus and planktonic organisms in the water column.

3.7.3.3 Protected Species and Habitats

Protected species include those listed as endangered or threatened under the Endangered Species Act (ESA). In addition, all marine mammals are protected under the Marine Mammal Protection Act (MMPA), and migratory birds (including seabirds) are protected under the Migratory Bird Treaty Act (MBTA). Protected species of marine mammals, sea turtles, and migratory birds in Hawai‘i are identified below. Additional descriptions are provided for those species that could potentially interact with the HSWAC system.

<u>Marine Mammals</u>
Stock assessment information presented below for both listed and non-listed marine mammal species comes primarily from NOAA’s *U.S. Pacific Marine Mammal Stock Assessments: 2006* (Carretta et al., 2006) and the draft 2007 updates (Carretta et al., 2007) available on NMFS’ Office of Protected Resources web site. Information about the humpback whale comes primarily from NOAA’s *Alaska Marine Mammal Stock Assessments* (Angliss and Outlaw, 2007).

The most recent information on cetacean abundance in Hawaiian waters is the report by Barlow (2003) that summarizes the results of a NOAA survey conducted in August-November 2002. Two NOAA research vessels surveyed the entire EEZ around the Hawaiian Islands along parallel transects spaced 53 mi apart (outer EEZ stratum) and 26.4 mi apart within 87 mi of the main Hawaiian Islands (MHI) (main island stratum). Both visual observations and acoustic detections were employed. Twenty-four species of cetaceans were seen, including two species (Fraser’s dolphin and sei whale) that previously had not been documented to occur in Hawaiian waters. The most abundant large whales were sperm whales and Bryde’s whales. The most abundant delphinids were rough-toothed dolphins and Fraser’s dolphins. Dwarf and pygmy sperm whales and Cuvier’s beaked whales were estimated to be quite abundant. Accurate estimates of abundance for migrating whales were not possible as the survey did not take place during periods of their highest abundance in Hawaiian waters. Nevertheless, abundance estimates were possible for 21 other species. The overall density of cetaceans was low, especially for delphinids. The precision of density and abundance estimates was generally low for all species due to the small number of sightings. Table 3-19 summarizes the sightings data, calculated abundances and densities, and the coefficients of variation (CV) from Barlow (2003).

Table 3-19: Estimated Abundances of Cetaceans in the Hawai'i EEZ from 2002Research Cruises

Species	*Main Island Stratum*		*Outer EEZ Stratum*		*Overall*		
	#Sightings	*Abundance*	*#Sightings*	*Abundance*	*Abundance*	*Individuals /km^2*	*CV*
Offshore spotted dolphin	6	4931	2	5329	10260	0.0042	0.41
Striped dolphin	1	508	10	9877	10385	0.0042	0.48
Rough-toothed dolphin	7	3860	7	16044	19904	0.0081	0.52
Bottlenose dolphin	5	525	4	2738	3263	0.0013	0.6
Risso's dolphin	2	594	3	1757	2351	0.001	0.65
Fraser's dolphin	0	0	1	16836	16836	0.0069	1.11
Melon-headed whale	0	0	1	2947	2947	0.0012	1.1
Pygmy killer whale	1	817	0	0	817	0.0003	1.12
False killer whale	0	0	1	268	268	0.0001	1.08
Short-finned pilot whale	7	3131	7	5715	8846	0.0036	0.49
Killer whale	0	0	2	430	430	0.0002	0.72
Sperm whale	2	56	16	7026	7082	0.0029	0.3
Pygmy sperm whale	0	0	2	7251	7251	0.003	0.77
Dwarf sperm whale	0	0	3	19172	19172	0.0078	0.66
Unidentified beaked whale	1	330	0	0	330	0.0001	1.05
Blaineville's beaked whale	0	0	1	2138	2138	0.0009	0.77
Cuvier's beaked whale	0	0	2	12728	12728	0.0052	0.83
Longman's beaked whale	0	0	1	766	766	0.0003	1.05
Bryde's whale	0	0	8	493	493	0.0002	0.34
Sei whale	1	77	0	0	77	0	1.06
Fin whale	0	0	2	174	174	0.0001	0.72
Spinner dolphin	3	2036	1	768	2804	0.0011	0.66
Delphinids	32	16403	39	62709	79112	0.0323	
Beaked Whales	1	330	4	15632	15962	0.0065	
Source: Barlow 2003							

Endangered Marine Mammals

Endangered marine mammals in the Pacific Ocean include six cetaceans, two pinnipeds, and the dugong (*Dugon dugon*). The cetaceans include the humpback whale (*Megaptera novaeangliae*), the sperm whale (*Physeter macrocephalus*), the northern right whale (*Eubalaena glacialis*), the blue whale (*Balaenoptera musculus*), the fin whale (*B. physalus*), and the sei whale (*B. borealis*). The pinnipeds include the Hawaiian monk seal (*Monachus schauinslandi*), and the Steller sea lion (*Eumetopias jubatus*).

Most of these species occur very far offshore or in other habitats far from the proposed HSWAC project area. The listed marine mammals that could occur in the project area include the humpback whale, the sperm whale, and the Hawaiian monk seal. The sections below summarize available information on the biology and population status of these three species.

Humpback Whale *(Megaptera novaeangliae)*

The International Whaling Commission (IWC) first protected humpback whales in the North Pacific Ocean in 1965. Humpback whales were listed as endangered under the ESA in 1973, and are consequently considered “depleted” and “strategic” under the MMPA. Strategic stocks are those that have a level of human-induced mortality that exceeds the number of animals that can be safely removed from the stock without interfering with that stock’s ability to reach or maintain its optimum sustainable population level. Humpbacks are also protected by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Critical habitat has not been designated for this species, but some protections are afforded in Hawaiian waters by the Hawaiian Islands Humpback Whale National Marine Sanctuary. Recently the International Union for Conservation of Nature (IUCN) removed the humpback whale from its Red List of species at high risk of extinction due to its increased population, now estimated to be at least 60,000 and growing at 5% per year.

Humpback whales are found in all the world’s oceans. Photo-identification and genetic analysis show three separate stocks of humpbacks within the U.S. EEZ in the North Pacific Ocean that migrate annually (Calambokidis, et al., 1997). The Central North Pacific stock migrates between temperate/polar waters near British Columbia and southeast Alaska to warmer tropical waters around the Hawaiian Islands during the winter/spring months (November-April) to breed and calve. While in Hawaiʻi the whales favor shallow (~100 fathoms [fm]) nearshore areas. Humpback whales occur off all eight MHI, but are found in the highest density in the shallow waters of the “four-island” region of Kahoolawe, Molokaʻi, Lānaʻi, and Maui; the northwestern coast of the island of Hawaiʻi (Big Island), and the waters around Niʻihau, Kauaʻi, and Oʻahu (Wolman and Jurasz, 1977; Herman et al., 1980; Baker and Herman, 1981). The whales are generally found in shallow waters shoreward of the 600 ft depth contour (Herman and Antinoja, 1977), although Frankel et al. (1989) reported some vocalizing individuals up to 12.4 mi off South Kohala on the west coast of the Big Island over bottom depths of 4,593 ft. Typically mother and calf pairs prefer shallow water less than 600 ft deep (Glockner and Venus, 1983).

Little to no feeding occurs in the winter breeding grounds, and the whales live off blubber reserves and may lose up to 20% of their body weight during a winter fasting period. During the summer and fall, the whales frequent polar waters to feed on small schools of fish and krill (Caldwell and Caldwell, 1983).

The primary natural predators of humpback whales are killer whales, and large oceanic sharks. Anthropogenic sources, namely ship strikes, fishing gear (gillnets, purse seines), and high levels of sound, including that from the U.S. Navy’s Low Frequency Active (LFA) sonar program, also threaten humpbacks. Concern about habitat is growing due to the increasing number of whale watching boats observing humpbacks in Alaska and Hawaiʻi.

Sperm Whale (*Physeter macrocephalus)*
Sperm whales have been protected from commercial harvest by the IWC since 1981, although the Japanese continued to harvest sperm whales in the North Pacific Ocean until 1988 (Reeves and Whitehead, 1997). Sperm whales were listed as endangered under the ESA in 1973, and thus considered "depleted" and "strategic" under the MMPA. They are also protected by the CITES. Critical habitat has not been designated for sperm whales.

Sperm whales are found in tropical to polar waters throughout the world (Rice, 1989). They are among the most abundant large cetaceans in the western Pacific region, and were the most abundant large whale in the Hawaiʻi EEZ in the 2002 NOAA surveys (Barlow, 2003).

Sperm whales have been sighted around several of the Northwestern Hawaiian Islands (NWHI) (Rice, 1960) and off the MHI (Lee, 1993). Sperm whales have been sighted in the Kauaʻi Channel, the ʻAlenuihāhā Channel between Maui and the island of Hawaiʻi, and off the island of Hawaiʻi, and sperm whale sounds have been recorded throughout the year off Oʻahu (Lee, 1993; Mobley et al., 1999a; Thompson and Freidl, 1982). Twenty-one sperm whales were sighted during aerial surveys of nearshore Hawaiian waters conducted from 1993 through 1998. Sperm whales sighted during the survey tended to be on the outer edge of a 31 to 43 mi distance from the Hawaiian Islands, indicating that their presence may increase with distance from shore (Mobley et al, 2000). However, from the results of these surveys, NMFS has calculated a minimum abundance of 66 sperm whales within 29 mi of the MHI (Mobley et al., 2000). Sperm whales usually occupy areas with a water depth of 1,970 ft or more, and are not typically seen in waters less than 980 ft deep.

The sperm whale is the most easily recognizable whale with a darkish gray brown body and a wrinkled appearance. The head of the sperm whale comprises up to 40% of its total body length. The average size for male sperm whales is about 50 ft, while females reach up to 40 ft.

Sperm whales feed primarily on mesopelagic squid, but also consume octopus, other invertebrates, and fish (Tomilin, 1967; Tarasevich, 1968; Berzin, 1971).

Hawaiian Monk Seal *(Monachus schauinslandi)*
Hawaiian monk seals (HMS) comprise one of the two extant species of the genus *Monachus*, one of the most primitive genera of seals. The Mediterranean monk seal (*Monachus monachus*) is critically endangered with fewer than 600 individuals left in the wild. The Caribbean monk seal (*Monachus tropicalis*) was last seen in 1952 and declared officially extinct in 1996. The HMS was listed as endangered under the ESA in 1976, and is one of the most endangered marine mammal species in the U.S. The HMS is endemic to the Hawaiian Archipelago, and is the only endangered marine mammal that exists wholly within the jurisdiction of the United States. The HMS is characterized as a strategic stock under the MMPA.

The six major reproductive sites are French Frigate Shoals, Laysan Island, Lisianski Island, Pearl and Hermes Reef, Midway Atoll, and Kure Atoll. Small populations at Necker Island and Nihoa Island are maintained by immigration, and a growing number of seals are found throughout the MHI.

In 2006, the minimum population estimate for the HMS was 1,214 individuals (based on enumeration of individuals of the subpopulations in the NWHI, extrapolation of counts for Nihoa and Necker, and estimates of minimum abundance for the MHI) (Carretta et al., 2006). The best estimate of the total population size was 1,247.

The NMFS collects information and data for HMS sightings in the MHI, but the only complete systematic survey of seals in the MHI was performed in 2000 and 2001. Aerial surveys estimated a minimum abundance of 52 seals in the MHI but reports of seals have increased recently, and as of 2005 the total number of identifiable seals in the MHI was 77 (Baker and Johanos, 2004; Carretta et al., 2006).

Population trends for HMS are determined by the highly variable dynamics of the six main reproductive sub-populations in the NWHI. The sub-population of HMS on French Frigate Shoals has shown the most change in population size, increasing dramatically in the 1960s-1970s and declining in the late 1980s-1990s. From 1989-2005 beach counts at French Frigate Shoals declined 73%. In the 1960s-1970s the other five sub-populations experienced declines. However, during the last decade the number of HMSs increased at Kure Atoll, Midway Atoll, and Pearl and Hermes Reef, while the sub-populations at Laysan Island and Lisianski Island remained relatively stable. At the species level, however, demographic trends over the past decade have been driven primarily by the dynamics of the largest subpopulation at French Frigate Shoals. This population is experiencing an increasingly unstable age distribution resulting in an inverted age structure. This age structure indicates that recruitment of females and pup production is decreasing. In the near future, total population trends for the species will likely depend on the balance between continued losses at French Frigate Shoals, and gains at other breeding locations including the MHI. The recent sub-population decline at French Frigate Shoals is thought to have been caused by male aggression, shark attack, entanglement in marine debris, loss of habitat, and low juvenile survival rate due mainly to food limitation. The HMS is assumed to be far below its optimum sustainable population, and the overall population has declined approximately 3.8% per year since 1998 (Carretta et al., 2006).

HMS are brown or silver in color, depending upon age and molt status, and can weigh up to 600 lb. Adult females are slightly larger than adult males. It is thought that monk seals have a life expectancy of 30 years, but most do not reach their full life potential. HMS spend time in and out of the water, but stay on land for about two weeks during their annual molts. HMS are nonmigratory, but recent studies show that their home ranges may be extensive (Abernathy and Siniff, 1998). Counts of individuals on shore compared with enumerated sub-populations at some of the NWHI indicate that HMS spend about one-third of their time on land and about two thirds in the water (Forney et al., 2000). HMS feed on a wide variety of teleosts, cephalopods, and crustaceans indicating that they are highly opportunistic feeders (Rice, 1964; MacDonald, 1982; Goodman-Lowe et al., 1999).

The HMS population is influenced by human-caused mortality in the NWHI and to a larger extent in the MHI. The MHI is home to 1.2 million people, while the NWHI is inhabited by less than 100 people. Vessel grounding, damage or destruction of the reef, release of marine debris, and oil spills threaten the HMS habitat and have a higher chance of occurring in the MHI. Hookings of HMS by fisherman are also a cause of injury or death, as is vessel traffic, which is high in the MHI (Carretta et al., 2006).

Non-listed Marine Mammals

Marine mammals not listed as threatened or endangered under the ESA that have been observed in the central Pacific region are listed in Table 3-20. These species are protected under the MMPA.

Table 3-20: Marine Mammals Not Listed as Threatened or Endangered Under the ESA but Observed in the Central Pacific Ocean

Common Name	***Scientific Name***
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*
Rough-toothed dolphin	*Steno bredanensis*
Risso's dolphin	*Grampus griseus*
Bottlenose dolphin	*Tursiops truncatus*
Pantropical spotted dolphin	*Stenella attenuata*
Spinner dolphin	*Stenella longirostris*

Common Name	***Scientific Name***
Striped dolphin	*Stenella coeruleoalba*
Melon-headed whale	*Peponocephala electra*
Pygmy killer whale	*Feresa attenuata*
False killer whale	*Pseudorca crassidens*
Killer whale	*Orcinus orca*
Pilot whale, short-finned	*Globicephala macrorhynchus*
Blainsville's beaked whale	*Mesoplodon densirostris*
Cuvier's beaked whale	*Ziphius cavirostris*
Bryde's whale	*Balaenoptera edeni*
Pygmy sperm whale	*Kogia breviceps*
Dwarf sperm whale	*Kogia simus*
Minke whale	*Balaenoptera acutorostrata*
Dall's porpoise	*Phocoenoides dalli*
Fraser's dolphin	*Lagenodelphis hosei*
Longman's beaked whale	*Indopacetus pacificus*
Northern elephant seal	*Mirounga angustirostris*
Northern fur seal	*Callorhinus ursinus*

The Hawai‘i stock of the false killer whale is not considered endangered or threatened according to the ESA or "depleted" according to the MMPA, but owing to serious injuries documented in the Hawai‘i - based longline fishery is classified as "strategic" under the MMPA (Carretta et al., 2007).

Sea Turtles
In addition to endangered whales and the HMS, listed sea turtles occur in the project area. All species of sea turtles are listed under the ESA as either endangered or threatened, and five species of sea turtles occur in the region. Two are considered endangered: the leatherback (*Dermochelys coriacea*) and the hawksbill (*Eretmochelys imbricata*). The other three are considered threatened: the green (*Chelonia mydas*), the loggerhead (*Caretta caretta*) and the olive ridley (*Lepidochelys olivacea*), although the breeding populations of Mexico olive ridley turtles are currently listed as endangered. The green turtle is listed as threatened under the ESA throughout its Pacific range, except for an endangered population nesting on the Pacific coast of Mexico.

Leatherbacks have the most extensive range of any living reptile and have been reported circumglobally from latitudes 71°N to 42°S in the Pacific and in all other major oceans. The diet of the leatherback turtle generally consists of cnidarians (i.e., medusae and siphonophores) in the pelagic environment. They lead a completely pelagic existence, foraging widely in temperate waters except during the nesting season, when gravid females return to beaches to lay eggs. Typically, leatherbacks are found in convergence zones and upwelling areas in the open ocean, along continental margins, and in archipelagic waters.

The loggerhead turtle is a cosmopolitan species found in temperate and subtropical waters and inhabiting continental shelves, bays, estuaries, and lagoons. Major nesting grounds are generally located in warm temperate and subtropical regions, generally north of 25°N or south of 25°S latitude in the Pacific Ocean. For their first several years of life, loggerheads forage in open ocean pelagic habitats. Both juvenile and subadult loggerheads feed on pelagic crustaceans, mollusks, fish, and algae. As they age loggerheads begin to move into shallower waters, where, as adults, they forage over a variety of benthic hard and soft bottom habitats.

The olive ridley is one of the smallest living sea turtles (carapace length usually between 24 and 28 inches and is regarded as the most abundant sea turtle in the world. Since the directed take of sea turtles was stopped in the early 1990s, the nesting populations in Mexico seem to be recovering, with females nesting in record numbers in recent years. The olive ridley turtle is omnivorous, and identified prey include a variety of benthic and pelagic items such as shrimp, jellyfish, crabs, snails and fish, as well as algae and sea grass.

The hawksbill turtle is rapidly approaching extinction in the Pacific, primarily due to the harvesting of the species for its meat, eggs and shell, as well as the destruction of nesting habitat. Hawksbills have a relatively unique diet of sponges.

Green turtles in Hawaiʻi are genetically distinct and geographically isolated, which is uncharacteristic of other regional sea turtle populations. Both nesting and foraging populations of green turtles in Hawaiʻi appear to have increased over the last 20 years. In Hawaiʻi, green turtles nested historically on beaches throughout the archipelago, but now nesting is restricted for the most part to beaches in the NWHI. More than 90% of the Hawaiian population of the green turtle nests at French Frigate Shoals. Satellite tagging of these animals indicates that most of them migrate to the MHI to feed and then return to breed.

While hawksbill turtles are relatively rare, green turtles are very common in Māmala Bay, and despite the volume of vessel traffic are often seen close to shore and in harbors and marinas.

Migratory Birds

Thirty-nine species of migratory seabirds are known to occur in the Hawaiian Island chain (Table 4-14). Twenty-two of these species breed in Hawaiʻi. The foraging range of some of these species is estimated to be between 98 and 300 miles. Seabirds (e.g., red-footed boobies (*Sula sula*), masked boobies (*Sula dactylatra*), white-tailed tropicbirds (*Phaethon lepturus*), red-tailed tropicbirds (*Phaethon rubricauda*), sooty terns (*Sterna fuscata*), brown noddies (*Anous stolidus*), and others from the colonies located at Kaʻula, Niʻihau, Kauaʻi, and Oʻahu may be observed foraging in the coastal pelagic waters that surround all of these islands.

Migratory shorebirds and waterbirds are also relatively common (Table 3-21) in the Hawaiian Islands, although within the project area the number of species present is limited and appropriate nesting, foraging or other useful habitat is absent.

Table 3-21: Migratory Birds in the Hawaiian Islands

Scientific Name	***Common Name***	***Status***
Migratory Seabirds		
Phoebastria albatrus	Short-tailed Albatross	Vo E
Phoebastria nigripes	Black-footed Albatross	Bi
Phoebastria immutabilis	Laysan Albatross	Bi
Fulmarus glacialis	Northern Fulmar	Vo
Pterodroma phaeopygia	Hawaiian Petrel	Bes E
Pterodroma externa	Juan Fernandez Petrel	Vo
Pterodroma cervicalis	White-necked Petrel	Vo
Pterodroma inexpectata	Mottled Petrel	Vo
Pterodroma hypoleuca	Bonin Petrel	Bi
Pterodroma nigripennis	Black-winged Petrel	Vo
Bulweria bulwerii	Bulwer Petrel	Bi
Puffinus carneipes	Flesh-footed Shearwater	Vo
Puffinus pacificus	Wedge-tailed Shearwater	Bi

Scientific Name	Common Name	Status
Puffinus griseus	Sooty Shearwater	Vr
Puffinus tenuirostris	Short-tailed Shearwater	Vo
Puffinus nativitatis	Christmas Shearwater	Bi
Puffinus newelli	Newell's Shearwater	Be T
Oceanodroma leucorhoa	Leach Storm-Petrel	Vr
Oceanodroma castro	Band-rumped Storm-Petrel	Bi
Oceanodroma tristrami	Tristram Storm-Petrel	Bi
Phaethon lepturus	White-tailed Tropicbird	Ri
Phaethon rubricauda	Red-tailed Tropicbird	Bi
Sula dactylatra	Masked Booby	Ri
Sula leucogaster	Brown Booby	Ri
Sula sula	Red-footed Booby	Ri
Fregata minor	Great Frigatebird	Ri
Stercorarius pomarinus	Pomarine Jaeger	Vr
Larus atricilla	Laughing Gull	Vo
Larus Philadelphia	Bonaparte Gull	Vo
Larus delawarensis	Ring-billed Gull	Vo
Larus argentatus	Herring Gull	Vo
Larus glaucescens	Glaucous-winged Gull	Vo
Sterna antillarum	Least Tern	Vo
Sterna lunata	Gray-backed Tern	Bi
Sterna fuscata	Sooty Tern	Bi
Anous stolidus	Brown Noddy	Ri
Anous minutes	Black Noody	Res
Procelsterna cerulean	Blue-gray Noddy	Ri
Gygis alba	White Tern	Ri
Migratory Waterbirds		
Dendrocygna bicolor	Fulvous Whistling-Duck	Ri
Branta bernicla	Brant	Vo
Brantacanadensis	Canada Goose	Vo
Anas crecca	Green-winged Teal	Vr
Anas platyrhynchos	Mallard	Vo
Anas acuta	Northern Pintail	Vc
Anas querquedula	Garganey	Vo
Anas discors	Blue-winged Teal	Vo
Anas clypeata	Northern Shoveler	Vc
Anas americana	American Wigeon	Vr
Aythya collaris	Ring-necked Duck	Vo
Aythya afinis	Lesser Scaup	Vr
Gallinula chloropus sandvicensis	Hawaiian Moorhen	Be E
Anas uyvilliana	Hawaiian Duck	Be E
Himantopus mexicanus knudseni	Hawaiian Black-necked Stilt	Be E
Fulica alai	Hawaiian Coot	Be E
Migratory Shorebirds		
Egretta caerulea	Little Blue Heron	Vo
Nycticorax nycticorax	Black-crowned Night-Heron	Ri
Pluvialis squatarola	Blue-bellied Plover	Vr
Pluvialis dominica	Lesser Golden-Plover	Vc
Charadrius semipalmatus	Semipalmated Plover	Vo
Tringa flavipes	Lesser Yellowlegs	Vr
Heteroscelus incanus	Wandering Tattler	Vc

Scientific Name	*Common Name*	*Status*
Numenius tahitiensis	Bristle-thighed Curlew	Vr
Limosa lapponica	Bar-tailed Godwit	Vo
Arenaria interpres	Ruddy Turnstone	Vc
Calidris alba	Sanderling	Vc
Calidris mauri	Western Sandpiper	Vo
Calidris minutilla	Least Sandpiper	Vo
Calidris melanotos	Pectoral Sandpiper	Vr
Calidris acuminate	Sharp-tailed Sandpiper	Vr
Calidris alpine	Dunlin	Vr
Philomachus pugnax	Ruff	Vo
Limnodromus griseus	Short-billed Dowitcher	Vo
Limnodromus scolopaceus	Long-billed Dowitcher	Vr
Gallinago gallinago	Common Snipe	Vo
Phalaropus tricolor	Wilson Phalarope	Vo

Source:_ U.S. Fish and Wildlife Service 2001, unpublished tables
Symbols for Status:
E*=Endangered.* ***T****=Threatened.*
Be*=Breeder; species breeds only in Hawai'i.*
Bes*=Breeder; Species also breeds elsewhere; Hawaiian subspecies breeds only in Hawai'i.*
Bi*=Breeder; Hawaiian also breeds elsewhere.*
Res*=Resident; indigenous species; Hawaiian subspecies is endemic.*
Ri*=Resident; indigenous species; Hawaiian form is not endemic.*
Vo*=Visitor; occasional to frequent migrant to Hawai'i.*
Vr*=Visitor; regular migrant to Hawai'i in small numbers.*

Sea Birds
There are three listed species of seabirds that occur in the central Pacific region. The short-tailed albatross (*Phoebastria albatrus*) is an endangered species found primarily around the Pacific Rim. It is occasionally seen in the central Pacific on Midway Island at the northern end of the NWHI. It has never been sighted south of Kaua'i, and it would be a major ornithological event were it to be seen in Māmala Bay.

The second listed seabird species in Hawai'i is the endangered Hawaiian petrel (*Pterodroma phaeopygia*). The species is known to breed only within the MHI. Its nesting sites are currently restricted to elevations above 7,200 ft where vegetation is sparse and the climate is dry. Nesting colonies are found on Maui and Kaua'i, but there are no known nesting sites on O'ahu. Nesting takes place between March and November. During the remainder of the year these birds forage far out to sea. There is also one listed threatened seabird in Hawai'i: Newell's shearwater (*Puffinus auricularis newelli*). This species nests only in the MHI. It was once widespread, but is now reduced to a few remnant breeding colonies on Moloka'i, Hawai'i, and mainly on Kaua'i because of loss of nesting habitat and predation by introduced species. It does not currently nest on O'ahu and would not be expected to forage in Māmala Bay.

There are four endangered waterbirds that occur on O'ahu: Hawaiian moorhen (*Gallinula chloropus sanvicensus*), Hawaiian duck (*Anas wyvilliana*), Hawaiian coot (*Fulica alai*), and Hawaiian black-necked stilt (*Himantopus mexicanus knudseni*). These birds may overfly the project area, but their nesting and foraging areas are in wetlands. The closest waterbird habitat to the project area is in Pearl Harbor.

Essential Fish Habitat
The MSA defines essential fish habitat (EFH) as those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity. "Waters," when used for the purpose of defining

EFH, include aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include historical areas of use where appropriate. Substrate includes sediment, hard bottom, underlying structures, and associated biological communities. Regional Fishery Management Councils are responsible for identifying and describing EFH for each Federally-managed species, minimize to the extent practicable adverse effects on such habitat caused by fishing and non-fishing activities, and identify other actions to encourage the conservation and enhancement of such habitat.

The designation of EFH by the Western Pacific Regional Fishery Management Council (the Council), which has responsibility for the EEZ around Hawaiʻi and other U.S. flagged island areas in the Pacific, was based on groups of species managed under its five existing fishery management plans (FMP): pelagics, bottomfish and seamount groundfish, precious corals, crustaceans, and coral reef ecosystems.

In addition to EFH, the Council identified habitat areas of particular concern (HAPC) within EFH for all FMPs (Table 3-22). In determining whether a type or area of EFH should be designated as a HAPC, the area had to meet one or more of the following criteria:

- The ecological function provided by the habitat is important,
- The habitat is sensitive to human-induced environmental degradation,
- Development activities are or will be stressing the habitat type, or
- The habitat type is rare.

Table 3-22: Essential Fish Habitat (EFH) and Habitat Areas of Particular Concern (HAPC) for all Western Pacific FMPs

FMP	***EFH (Juveniles and Adults)***	***EFH (Eggs and Larvae)***	***HAPC***
Pelagics	Water column down to 3,300 ft	Water column down to 660 ft	Water column above seamounts and banks down to 3,300 ft
Bottomfish and Seamount Groundfish	Bottomfish: Water column and bottom habitat down to 1,320 ft Seamount Groundfish: (adults only) water column and bottom from 260 to 2,000 ft, bounded by 29°-35°N and 171°E-179°W	Bottomfish: Water column down to 1,320 ft Seamount Groundfish: (including juveniles) epipelagic zone (0 to 660 ft) bounded by 29°-35°N and 171°E-179°W	Bottomfish: All escarpments and slopes between 130 to 920 ft, and three known areas of juvenile opakapaka habitat Seamount Groundfish: not identified
Precious Corals	Keāhole Point, Makapuu, Kaena Point, Westpac, Brooks Bank, 180 Fathom Bank deep water precious corals (gold and red) beds and Milolii, Auau Channel and S. Kauaʻi black coral beds	Not applicable	Makapuu, Westpac, and Brooks Bank deep water precious corals beds and the Auau Channel black coral bed
Crustaceans	Bottom habitat from shoreline to a depth of 330 ft	Water column down to 500 ft	All banks within the NWHI with summits less than 100 ft
Coral Reef Ecosystems	Water column and benthic substrate to a depth of 330 ft	Water column and benthic substrate to a depth of 330 ft	All MPAs identified in FMP, all PRIAs, many specific areas of coral reef habitat (see FMP)

(Source:_ WPRFMC, 2004) Note: All areas are bounded by the shoreline and the outer boundary of the EEZ, unless otherwise indicated.

3.8 TERRESTRIAL RESOURCES

The HSWAC project may affect terrestrial resources at or around the cooling station site, the Ke‘ehi Lagoon staging area and along the distribution system route.

3.8.1 Topography, Geology and Soils

The Kaka‘ako Peninsula lies on the Honolulu coastal plain, an emerged fossil reef formed approximately 120,000 years ago (MacDonald and Abbott, 1970). Within the project area coral reefs and eroded volcanic material have formed a wedge of sedimentary rock and sediments, referred to as caprock, which rests on the underlying volcanic rock. Caprock is composed predominantly of coral-algal limestone interlaid with clays and muds. The downtown Honolulu area consists mainly of silty sand and coral gravel dredged from Honolulu Harbor that has been deposited on the caprock; it is unconsolidated, with high porosity and permeability. However, some other fill material of denser and stiffer consistency is also found in some areas. The ocean-side fronting Kaka‘ako Waterfront Park is underlain by a coral layer between 5 and 20 ft below mean sea level (MSL). Soft lagoonal deposits made up of sand, silt, and clay are found above the ancient reef, and are especially prominent in a buried stream channel which extends below Ala Moana Boulevard between Keawe and Ohe Streets to the ocean. Soft alluvial soils within the channel area extend to depths of 50 to 65 ft below sea level. These deposits are covered by 5 to 10 ft of dredged coral fill (Okamoto, 1998).

According to the soil survey maps published by the United States Department of Agriculture, Soil Conservation Service, surface soils in the Kaka‘ako area are described as fill land. Fill land generally consists of materials dredged from the ocean and from other sources.

The topography of the project area (cooling station and distribution route) is generally flat (less than 5% slope) with elevations 5 to 15 ft above MSL. An exception is the large mound located in Kaka‘ako Waterfront Park near the proposed cooling station. This mound was originally formed as a debris mound between 1927 and 1977 when the area was an incinerator landfill and was 400 ft wide by 1,700 ft long and 15 to 55 ft in elevation (Okamoto, 1998). The mound was resculptured in conjunction with the development of the park. At its highest point the mound is currently 53 ft in elevation (Okamoto, 1998).

According to a report of a 1989 investigation (Ecology and Environment, 1989), in addition to incinerator ash, the landfill received other wastes including unburned refuse, construction debris, household debris, drums of unknown liquids, automobile batteries and cans of paint thinner. Two incinerators, the first began operating in 1927 followed by the second in 1946, burned municipal refuse at the adjacent Kewalo Incinerator facility and transported the ash to Kewalo, which was located on a reclaimed area of near-shore reef and intertidal lands. A seawall was constructed in 1948 to contain the expanding ash area. From the late 1950s until the early 1960s, refuse which exceeded the incinerators’ 200 tons per day capacity was reportedly open-burned at Kewalo. During the mid-1960s, excess refuse was disposed of on site without burning. This practice was curtailed in 1979, with the site receiving only incinerator ash and slag until 1977.

An earlier 1989 study (Woodward-Clyde Consultants, 1989) included drilling four soil borings through the landfill and installing groundwater monitoring wells. That study found that refuse material in the landfill consisting of ash, glass, concrete blocks, scrap metal, wire and plastics was up to 45 feet thick, and capped with 12 to 25 feet of soil. Coral was found at 56 feet below grade or 6 feet below mean sea level. A number of hazardous contaminants were found including organochlorine pesticides, semivolatile organic compounds, benzene, lead, asbestos, and heavy metals.

A 1990 study (Harding Larson Associates, 1990) found methane gas being produced in the landfill and concentrations of arsenic, cadmium, copper, and lead above background levels. Chlordane and PCBs were also detected.

The alternative cooling station sites are located on the southern coastal plain of O‘ahu. Prior to being reclaimed in the late nineteenth and early twentieth centuries, the Kaka‘ako area consisted of mudflats and marshes adjacent to Honolulu Harbor. The general geology of the area, consisting of lagoonal deposits underlain by coralline sediments and alluvial deposits overlying basaltic bedrock, reflects changing depositional environments associated with rising and falling sea levels. During the Waipio stand of the Sea, sea level fell to 60 ft or more below the present level and streams flowed out of the Ko‘olau Mountains and into the Pacific carving out deep alluvial channels in the vicinity of Honolulu. One of these buried channels is likely present in the vicinity of the site. Based on readily available geologic information, a buried channel may run roughly from the corner of Keawe Street and Ala Moana Boulevard through the corner of Ilalo and Coral Streets and then continue south.

The anticipated subsurface conditions in the vicinity of the cooling station alternative sites are described as follows. The sites are located in a reclaimed area. Subsurface conditions in this area are generally anticipated to consist of variable amounts of fill material at the surface underlain by lagoonal deposits, coralline sediments, alluvial deposits, and basaltic bedrock. The lagoonal deposits are anticipated to consist of loose sandy silt, silty sand, and silty gravel. Coralline sediments underlying the lagoonal deposits are anticipated to consist of medium dense sand and gravel with layers of cemented coralline material and/or coral ledges. The coralline sediments are anticipated to be underlain by basaltic bedrock at depths of approximately 100 to 150 ft below existing grades. It is anticipated that variable amounts of alluvial deposits may be encountered. These alluvial deposits may be interbedded with, or be present in place of, the lagoonal deposits.

The proposed Sand Island staging area is on fill land reclaimed from the lagoon by dredging of the seaplane runways.

3.8.2 Climate and Air Quality

3.8.2.1 Climate

The climate of the project area is characterized by abundant sunshine, persistent tradewinds, and moderate and constant temperature and humidity. The average temperature recorded at the Honolulu International Airport ranges from 70°F in the coolest month to 84°F in the warmest month (with extremes of 52°F and 96°F). The average amount of annual rainfall varies greatly with location. For example, the yearly average is 18.3 inches at the airport but 152.1 inches in Manoa Valley (DBEDT, 2003). The project site is located in an area that would likely have a climate similar to that at the airport. Insolation (incoming solar radiation) in the project area is approximately 1,840 British thermal units (Btu)/ft^2-day (DBEDT, 2005).

3.8.2.2 Air Quality

Ambient concentrations of air pollutants are regulated by both national and state ambient air quality standards (AAQS) (Table 3-23). As shown in the table, national and state AAQS have been established for particulate matter (PM), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone, and lead. Particulate matter includes dust, soot, smoke, and liquid droplets. The State also has a standard for hydrogen sulfide.

Sulfur oxides, which include SO_2, are colorless gases emitted primarily by power plants, refineries and volcanic activity. Nitrogen dioxide is a brownish, highly corrosive gas with a pungent odor that is formed from nitrogen oxides emitted during combustion of fossil fuels by electric utilities, industrial boilers, and vehicles. Carbon monoxide is a colorless, odorless, and tasteless gas produced by the incomplete combustion of fossil fuels, primarily motor vehicles. Ozone is formed in the atmosphere by a chemical reaction of nitrogen oxides and volatile organic compounds in the presence of sunlight. Although an ozone layer in the upper atmosphere shields the earth from harmful ultraviolet radiation, high ozone levels at ground level can cause harmful effects to humans and plants. Lead is a naturally occurring substance that has been used extensively in paint and gasoline. Hydrogen sulfide is a colorless malodorous gas with the smell of rotten eggs, mainly associated with sewage or volcanic emissions.

Table 3-23: Summary of State of Hawai‘i and National Ambient Air Quality Standards

Pollutant (all units in $\mu g/m^3$)	***Averaging Time***	***Maximum Allowable Concentration***		
		National Primary [a]	***National Secondary*** [b]	***State of Hawai‘i*** [c]
Particulate Matter (≤10 microns)	Annual 24 Hours	50 150	50 150	50 150
Particulate Matter (≤2.5 microns)	Annual 24 Hours	15 65	15 65	- -
Sulfur Dioxide	Annual 24 Hours 3 Hours	80 365 -	- - 1300	80 365 1300
Nitrogen Dioxide	Annual	100	100	70
Carbon Monoxide	8 Hours 1 Hour	10,000 40,000	- -	5,000 10,000
Ozone	8 Hours 1 Hour	157 235	157 235	- 100
Lead	Calendar Quarter	1.5	1.5	1.5
Hydrogen Sulfide	1 Hour	-	-	35

[a] Designated to prevent adverse effects on public health. Source: 40CFR Part 50

[b] Designated to prevent adverse effects on public welfare, including effects on comfort, visibility, vegetation, animals, aesthetic values, and soiling and deterioration of materials. Source: 40CFR Part 50.

[c] Designated to protect public health and welfare and to prevent significant deterioration of air quality. Source: HAR 11-59-1

The national AAQS are stated in terms of primary and secondary standards for most of the regulated air pollutants. National primary standards are designed to protect public health with an "adequate margin of safety." National secondary standards define levels of air quality necessary to protect public welfare from "any known or anticipated adverse effects of a pollutant." The State AAQS are designed "to protect public health and welfare and to prevent the significant deterioration of air quality." The AAQS specify a maximum allowable concentration for a given air pollutant for one or more averaging times to prevent harmful effects. Averaging times vary from one hour to one year depending on the pollutant and type of exposure necessary to cause adverse effects.

The Hawai‘i State Department of Health (HDOH) operates a network of nine air quality monitoring stations at various locations on O‘ahu. Each station monitors certain air quality parameters. The closest monitoring station to the project area is located at 1250 Punchbowl Street, which is within the project area. An air pollutant emission summary for downtown Honolulu at this station for the years 2004 to 2006 is shown in Table 3-24. There were no exceedances of the standards for the measured parameters. The project area is an attainment area for all national and State AAQS. Although CO measurements taken at the monitoring stations suggest that concentrations are in compliance with the State standards, CO concentrations near congested intersections could exceed the State AAQS at times.

Table 3-24: Annual Summaries of Ambient Air Quality Measurements in Downtown Honolulu

Pollutant	Average Time	SAAQS (µg/m³)	NAAQS (µg/m³)	Maximum Concentration (µg/m³)			Number of Exceedances SAAQS			Number of Exceedances NAAQS		
				2004	2005	2006	2004	2005	2006	2004	2005	2006
CO	1 hr	10,000	40,000	2736	3876	2850	0	0	0	0	0	0
	8 hrs	5,000	10,000	1496	1610	1226	0	0	0	0	0	0
PM_{10}	24 hrs	150	150	36	64	25	0	0	0	0	0	0
	Annual	50	50	13	15	13	0	0	0	0	0	0
$PM_{2.5}$	24 hrs	---	65	10	45	10	---	---	---	---	---	0
	Annual	---	15	4	4	3	---	---	---	---	---	0
SO_2	3 hrs	1,300	1,300	56	75	43	0	0	0	0	0	0
	24 hrs	365	365	25	23	15	0	0	0	0	0	0
	Annual	80	80	1	1	1	0	0	0	0	0	0

Source: _HDOH, 2004-2006

3.8.3 Water Resources

The subsections below describe the surface water and groundwater resources in the project area.

3.8.3.1 Surface Waters

There are no streams within the downtown project area. The closest is Nuʻuanu Stream, approximately 1,000 ft from the nearest proposed segment of the distribution system. The runoff from the Kakaʻako Waterfront Park area is collected by a storm drain system and routed to the Keawe Street open channel or Kewalo Basin. Runoff from the downtown Honolulu portion of the proposed project is collected by a storm drain system and routed to Honolulu Harbor.

Coastal waters in the vicinity of the project site are Class A marine waters according to HDOH Water Quality Standards. Class A waters are to be protected for recreational and aesthetic enjoyment. Two streams, Kapalama and Nuʻuanu, and numerous ditches and storm drains discharge to the harbor, along with associated pollutants. Water quality in the Kapalama Basin portion of the harbor is particularly poor because of discharges from Kapalama Stream. The parameters of greatest concern in the Harbor are nutrients, metals, suspended solids, pathogens, and turbidity (HDOH, 1998). Coliform bacteria, nitrogen, phosphorus, and turbidity levels in the water regularly exceed State water quality standards. In 1978 and subsequent HDOH sampling, heavy metals, chlorinated pesticides, polychlorinated biphenyls (PCBs), chlordane, and dieldrin (a toxic chlorinated organic compound used in insecticides) have been identified in harbor waters.

3.8.3.2 Groundwater

Ground water is anticipated to be found at or near sea level. Because of the proximity of the sites to the ocean and harbors, it is anticipated that groundwater levels will fluctuate with tidal changes. Rainfall landward of the sites may also affect groundwater levels.

The project area is underlain by the Nuʻuanu Aquifer System, which is part of the Honolulu aquifer sector on the island of Oʻahu (Mink and Lau, 1990). This system includes an unconfined basal aquifer in sedimentary non-volcanic lithology. The groundwater in this aquifer is designated as currently used and has a moderate salinity (1,000 to 5,000 mg/l of chloride), and high total dissolved solids concentration. Close to the ocean the chloride level may reach 15,000 mg/l (equivalent to seawater). The groundwater is classified as neither drinking water nor ecologically important, replaceable, and with a high vulnerability to contamination. In the project area this aquifer is further underlain by a lower aquifer of the same system, the Honolulu Basal Aquifer, Nuʻuanu System. The aquifer is confined in flank compartments. The aquifer is currently being used as a drinking water source. The groundwater has a low salinity (250 to 1,000 mg/l chloride) and is classified as being irreplaceable with a low vulnerability to contamination.

In 1977, the Underground Injection Control (UIC) Line was established by the State of Hawaiʻi as part of the Federal Safe Drinking Water Act (SDWA) to protect the quality of the State's underground sources of drinking water from pollution by subsurface disposal of spent fluids. The UIC Line separates aquifers or portions of aquifers that supply public or private drinking water from exempt aquifers (aquifers or portions of aquifers that do not supply drinking water and can accept spent fluids). The UIC program established rules regulating the location, construction, and operation of all injection wells. Injection wells on Oʻahu are permitted only seaward of the UIC Line. The UIC line in the project vicinity runs along King Street (HDOH, 1984). There are numerous injection wells for waste discharge into the caprock in central Honolulu, including those for thermal effluent, car-wash return, and rainwater. Pollutants in these discharges do not reach the Southern Oʻahu Basal Aquifer due to upward artesian pressure in this aquifer.

3.8.4 Terrestrial Biota

Vegetation within the downtown project area consists of maintained plantings such as roadway medians, shoulders, and ruderal (weedy) patches. A few trees within the proposed project area meet the criteria for “Exceptional Trees,” which are defined as “a tree or grove of trees with historic or cultural value, or which by reason of its age, rarity, location, size, aesthetic quality, or endemic status has been designated by the City Council as worthy of preservation” (Revised Ordinances of Honolulu Section 41-13.7, June 3, 2003). Exceptional trees protected by this ordinance in the project area are as follows:

- [*]*Adansonia digitata*, Baobab Tree (Queen's Medical Center, 1301 Punchbowl Street, TMK: 2-1-35:3). [[*]"Champion Trees of Hawai‘i," in American Forests, May 1974.]
- *Agathis robusta*, Queensland Kauri Tree (Judiciary Building, ‘Ewa Courtyard, TMK: 2-1-25:3).
- *Canarium vulgare*, Pili Nut Tree (Washington Place, TMK: 2-1-18:1).
- *Ficus benghalensis*, Indian Banyan Tree (Iolani Palace grounds, TMK: 2-1-25:2).
- *Ficus benghalensis*, Indian Banyan Trees (two trees) (beside the Judiciary Building, TMK: 2-1-25:3).
- *Pseudobombax ellipticum*, Pink Bombax Tree (Queen's Medical Center, front lawn, TMK: 2-1-35:3).
- [*]*Sterculia urens*, Nawa Tree (Queen's Medical Center, TMK: 2-1-35:3). [[*]"Champion Trees of Hawai‘i," in American Forests, May 1974.]
- *Tamarindus indica*, Tamarind Tree (Judiciary Building, ‘Ewa Courtyard, TMK: 2-1-25:3).

In addition to these trees there are approximately 27 designated exceptional trees in Foster Botanical Garden (180 North Vineyard Boulevard), but the proposed distribution system is not expected to pass near that area. Several streets within the project area also contain mature vegetation within medians and streetscapes; particularly noteworthy is South King Street.

According to records maintained by the Hawai‘i Natural Heritage Program (NHP, 2003), two historical sightings of Federal and State threatened and endangered species have occurred in the proposed project service area:

- Hawaiian hoary bat or ‘ope‘ape‘a (*Lasiurus cinereus semotis*) – one sighting reported from 1990 at Queens Medical Center and one sighting reported from the 1890s at Beretania and Fort Streets.
- ‘Iwiwi (*Centaurium sabaeoides*), a vascular plant – one sighting reported from the 1800s near Pier 4 (Coast Guard Building).

White terns (fairy terns; *Gygis alba*) are also present in the proposed project area. The white tern population on O‘ahu was listed as threatened by the State of Hawai‘i in 1986 (Hawai‘i Administrative Rules, Title 13, Part 2, Chapter 124). This listing was presumably based on its limited distribution and small population size. Although the white tern is a common seabird that nests on many islands throughout the tropical and subtropical Pacific, Atlantic, and Indian Oceans (Harrison et al., 1983), including the Northwestern Hawaiian Islands, white terns were first documented on O‘ahu in 1961 according to Vanderwerf (2003).

White terns are found scattered throughout urban and suburban areas of Honolulu on the southern shore of O‘ahu where a total of 694 adult white terns and 221 nests were observed from October 2001 through January 2003 (Vanderwerf, 2003).

3.9 LAND USE PLANS, POLICIES AND CONTROLS

Components of the proposed HSWAC system would be constructed or installed in areas under Federal, State, and county jurisdictions. The cooling station would be built within the Makai Area of the Kakaʻako Community Development District, administered by the State's Hawaiʻi Community Development Authority. The seawater pipelines would be installed on and under the seabed, mostly in the State's Conservation District, administered by the State Department of Land and Natural Resources (DLNR). The seaward end of the intake pipe, however, would extend into Federal waters of the EEZ, beyond the three-mile range of State jurisdiction.[25] The distribution system would be installed mostly under streets and sidewalks under City and County of Honolulu jurisdiction, but some segments would pass under State highways under the jurisdiction of the State Department of Transportation (HDOT). The proposed staging areas are under the jurisdiction of the DLNR and the HDOT. Components of land use plans, policies and controls with relevance to the HSWAC project are described below. The compatibility of the HSWAC system with the plans policies and controls of these various agencies is described in the next chapter.

3.9.1 State and County Land Use Controls

In Hawaiʻi, land use and development controls are shared by the State and the counties. At the State level, these controls are enabled, for the most part, by the State Land Use Law and its coastal zone management program, as described below.

3.9.1.1 The Hawaiʻi State Plan

The *Hawaiʻi State Plan (Chapter 226 HRS)* identifies the goals, objectives, policies, and priorities for the State and provides a basis for determining priorities and allocating limited resources, such as public funds, services, human resources, land, energy, water, and other resources. The plan provides an overall framework for land use through the State Land Use Law, and then requires each of its four counties to be responsible for local planning and zoning ordinances.

[25] There is an unresolved issue concerning the State of Hawaiʻi's jurisdiction over waters beyond three nautical miles from shore. Relevant definitions are as follows. The federal Submerged Lands Act of 1953 confirms and establishes the title and ownership of lands and resources within the boundaries of the State as recognized, confirmed, established, and vested in and assigned to the respective States. The seaward boundary of each original coastal State is approved and confirmed as a line three geographical miles distant from its coast line or, in the case of the Great Lakes, to the international boundary. Any State admitted subsequent to the formation of the Union which has not already done so may extend its seaward boundaries to a line three geographical miles distant from its coast line, or to the international boundaries of the United States in the Great Lakes or any other body of water traversed by such boundaries. Any claim heretofore or hereafter asserted either by constitutional provision, statute, or otherwise, indicating the intent of a State so to extend its boundaries is approved and confirmed, without prejudice to its claim, if any it has, that its boundaries extend beyond that line. Nothing in this section is to be construed as questioning or in any manner prejudicing the existence of any State's seaward boundary beyond three geographical miles if it was so provided by its constitution or laws prior to or at the time such State became a member of the Union, or if it has been heretofore approved by Congress (US Code Title 43 Chapter 29).

Territorial waters, or a territorial sea, as defined by the 1982 United Nations Convention on the Law of the Sea, is a belt of coastal waters extending at most twelve nautical miles from the baseline (usually the mean low-water mark) of a coastal state.

In Hawaiʻi Revised Statutes (HRS) Chapter 187A, Aquatic Resources, State marine waters are defined as extending from the upper reaches of the wash of the waves on shore seaward to the limit of the State's police power and management authority, including the United States territorial sea, notwithstanding any law to the contrary. In HRS 205, Land Use Commission, the coastal zone management area is defined as all lands of the State and the area extending seaward from the shoreline to the limit of the State's police power and management authority, including the United States territorial sea. In HRS Chapter 190D, Ocean and Submerged Lands Leasing, "State marine Waters" are defined as "…all waters of the State, including the water column, water surface, and state submerged lands, extending from the upper reaches of the wash of the waves on shore seaward to the limit of the State's police power and management authority, including the United States territorial sea, notwithstanding any law to the contrary."

3.9.1.2 State Land Use Law (Chapter 205, HRS)

The State exercises the first level of control through this state-wide zoning law, which is administered by the State Land Use Commission (LUC). The LUC establishes land use district boundaries for the entire State. All lands in the State are classified into one of four districts: Urban, Rural, Agricultural, or Conservation. State-wide, 4.8% of the land area is classified Urban, 48% Conservation, 47% Agricultural, and 0.2% Rural.

On the island of O‘ahu, 26% of the land area is classified Urban by the LUC, 33.4% is classified Agriculture, and 40.6% is in the State Conservation District. There are no lands classified Rural on O‘ahu. State Land Use Districts on the Island of O‘ahu are shown on Figure 3-31.

Determining and enforcing land use controls in the Urban District are primarily the responsibilities of the respective counties, and jurisdiction over Rural Districts is shared by the LUC and country governments. Uses permitted in the highest productivity categories in the Agriculture District are governed by statute, and uses in the lower-productivity categories are established by the LUC. Conservation Districts are administrated by the State Board of Land and Natural Resources (BLNR) and uses are governed by rules promulgated by the State Department of Land and Natural Resources (DLNR).

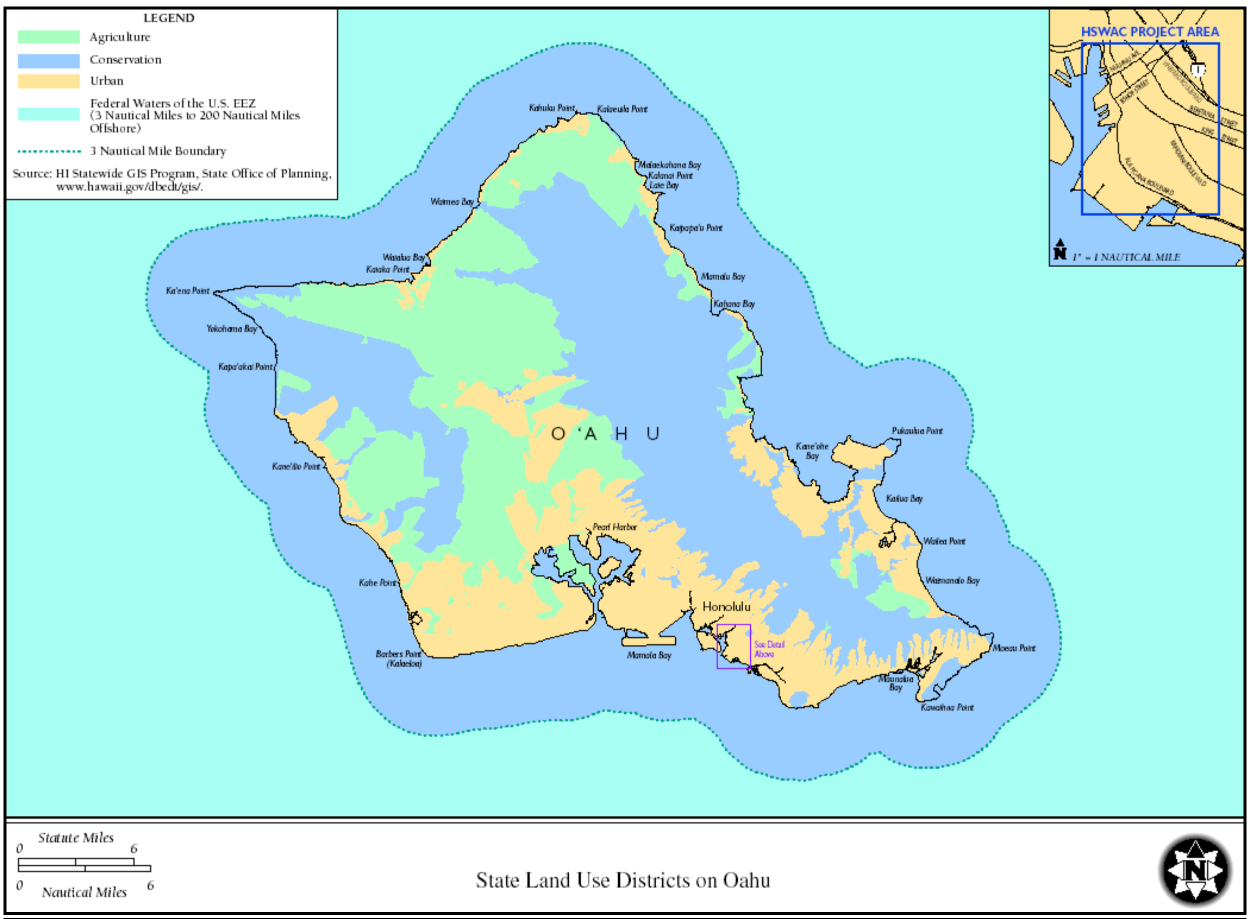


Figure 3-31: State Land Use Districts on O‘ahu

3.9.2 Coastal Zone Management (Chapter 205A, HRS)

The Federal Coastal Zone Management (CZM) Program, created through passage of the Coastal Zone Management Act of 1972, is a Federal-State partnership dedicated to comprehensive management of the nation's coastal resources. It is administered at the Federal level by the Coastal Programs Division (CPD) of NOAA. The CPD supports states through financial assistance, mediation, technical services and information, and participation in priority state, regional, and local forums. Day-to-day management decisions are made at the state level in states with Federally-approved coastal management programs.

The Hawai‘i State CZM program was approved in 1977 (Chapter 205 A, HRS). In response to the goals of the Federal CZM Act of 1972, Hawai‘i declared in its CZM plan that "since no point in Hawai‘i is further than 29 miles from the ocean, all lands of the State and the area extending seaward from the shoreline to the limit of the State's police power and management authority, including the United States territorial sea are part of Hawai‘i's coastal zone." In other words, the entire State is within the coastal zone.

The State Office of Planning (OP) administers the CZM program, including allocation of Federal and State funds and coordination with the counties and the public in preparing guidelines to further specify and clarify the objectives and policies of Chapter 205A. In addition, OP is responsible for the review of Federal programs, Federal permits, Federal licenses, and Federal development proposals for consistency with the Coastal Zone Management Program.

The CZM program includes a permit process to control development within designated Special Management Areas (SMA). "Special Management Area" means the land extending inland from the shoreline, as determined and mapped by the individual counties and filed with either the planning commission or elected council of each county. Although SMA actions are usually administered at the county level, OP serves as the lead agency for administering the SMA permit process for State-administered areas such as Kaka‘ako.

Part III of the CZM Act (205A, HRS) defines "Shoreline Area" as including "all of the land area between the shoreline and the shoreline setback line." The shoreline setback line is defined as a line established by the BLNR, or the respective county where it is located, which runs inland from the shoreline at a horizontal plane. Act 205A establishes setbacks along shorelines of not less than 20 ft and not more than 40 ft inland from the certified shoreline. The planning departments of each county are required to adopt rules prescribing procedures for determining the shoreline setback line. The shoreline setback is intended to serve as a buffer against coastal hazards and erosion, and to protect view-planes. For State-administered areas such as Kaka‘ako, OP also administers the Shoreline Setback permit.

The Hawai‘i Ocean Resources Management Plan (ORMP) is a statewide action plan calling for a fundamental change from the sector-based approach of natural and cultural resources management, to an integrated and area-based approach, focusing on collaboration among jurisdictional authorities, increased community involvement, and stewardship. The ORMP was mandated by Chapter 205A of the Hawai‘i Revised Statutes, and is periodically updated and reviewed by the Hawai‘i Coastal Zone Management Program in the State Office of Planning, and the Department of Business, Economic Development and Tourism.

First published in 1991, the ORMP is a guide to ocean resource management designed to create new perspectives on Hawai‘i's relationship with the land and ocean. The primary goal as stated in the document is "to improve and sustain the ecological, cultural, economic, and social benefits we derive from ocean resources today and for future generations." The most recently updated ORMP establishes management priorities for the next five years in order to achieve the primary goal. The management priorities are organized in the ORMP under three different perspectives, supplemented with management goals and strategic actions to address the implementation process:

- **Perspective 1: Connecting Land and Sea**
  "Careful and appropriate use of the land is directly linked to the preservation of a diverse array of ecological, social, and economic benefits we derive from the sea."
- **Perspective 2: Preserving Our Ocean Heritage**
  "A vibrant and healthy ocean environment is the foundation for the quality of life in Hawai'i and the wellbeing of its people, now and for generations to come."
- **Perspective 3: Promoting Collaborative Governance and Stewardship**
  "Working together and sharing knowledge, experience, and resources will improve and sustain our efforts to care for the land and sea."

3.9.3 Kaka'ako Community Development District

3.9.3.1 Makai Area Plan

The Hawai'i State Legislature created HCDA in 1976 to initiate and guide the revitalization of the underdeveloped urban community in the Kaka'ako District. Among other things, HCDA's Makai Area Plan establishes land use principles, zones, and design standards for Kaka'ako. The preferred site for the HSWAC cooling station is designated "Commercial" in the Makai Area Plan Land Use Map. The Commercial designation permits a wide range of commercial land uses.

3.9.3.2 Makai Area Rules

The Makai Area Rules were established by the HCDA to supersede all previous ordinances and rules relating to the use, zoning, planning, and development of land and construction within the Makai District.

According to the Land Use Zone Rules, the purpose and intent of Commercial-zoned parcels is as follows:

1. To provide a sub-district where a variety of commercial uses may coexist with the emphasis on developing a predominantly commercial multi-storied area providing employment opportunities;
2. To create a vibrant and working environment by regulating the density and bulk of buildings in relation to the surrounding land by requiring open space and encouraging the development of job opportunities within the area;
3. To provide freedom of architectural design, encourage the development of attractive and economic building forms; and
4. Promote the most desirable use of land and direction of building development in accord with a well-considered plan, promote stability of commercial development, protect the character of the district and its particular suitability for particular uses and finally to conserve the value of the land and buildings.

Permitted commercial uses include offices, medical laboratories, governmental services administrative, parking garages (enclosed), and uses customarily accessory and clearly incidental and subordinate to the principal uses and structures.

3.9.3.3 Makai Area Design Guidelines

"The purpose of the Design Guidelines is to supplement the objectives of the Makai Area Plan. The Design Guidelines are intended to guide physical development of the Makai Area including architectural character, environmental quality and visual impression created by individual project components."

Objective
The objective is to create "an outstanding world-class urban environment that is appropriate for the waterfront setting, comfortable and interesting to pedestrians, and responsive to the existing and planned public amenities."

Project Design Guidelines
"New developments should enhance public accessibility to the public open spaces, help to create a pedestrian environment and have appropriate architectural design that relates positively to the public realm and urban design principles expressed in the Makai Area Plan."

Site Development
- Configure buildings/developments to take advantage of public amenities, allow for pedestrian interaction and create social interaction.
- Articulate buildings to reduce overall mass.

Building Hierarchy and Character
Buildings in the Makai Area should fall into two categories:
- Signature Buildings that are to be unique icons. Examples of signature buildings/structures include the Sydney Opera House, the Eiffel Tower, and the Space Needle in Seattle. These are recognizable buildings/structures whose identities are synonymous with their location.
- Secondary Buildings that provide emphasis to building complexes without competing with signature buildings. These buildings are to be based on the "multi-cultural" architectural tradition of 'kamaaina' buildings. Examples include the Honolulu Academy of Arts, the Alexander & Baldwin Building and the Kamehameha School for Girls building. Architectural elements typically consist of double-pitched tile roofs, masonry walls with stucco-like finishes and decorative grills.

Architectural Appearance and Character
- Building design features and materials should respond to the tropical climate, conserve natural resources, and promote quality and permanence. The use of natural day-lighting, natural ventilation and shading devices is encouraged.
- Open spaces should be an extension of public amenities including streets and parks.
- Open space should be scaled appropriately to encourage pedestrian activity and circulation. Providing amenities such as comfortable seating is encouraged.
- Arcades and passageways are encouraged as appropriate forms of open space.
- Articulate building facades.
- Provide indirect outdoor lighting to enhance landscaping, architectural features and promote pedestrian safety.
- Colors and surfaces should generally be absorptive rather than reflective. Signature Buildings may be exempt.
- Appropriate colors include warm earth tones, natural colors of stone, coral and cast concrete colors.
- Roofs of secondary buildings should be in a range of green or greenish blue to blend with surrounding vegetation or reflect the ocean setting.
- Paving in plazas and walkways should be patterned and a combination of earth colors.
- Roof styles should match the appropriate architectural character of the building. Large monolithic roofs should be avoided.
- Rooftop service and mechanical areas should be screened from view by parapets, solid enclosures, trellises, and false pitch roofs.
- Street level service and mechanical areas should be screened by enclosures, walls or landscaping.

Landscape Treatment
- Trees, shrubs, and ground cover should be varied in color and height.
- Vegetation, especially trees, should be used to enhance roadways, soften building exteriors, and screen service areas.

- Small-scale landscape features such as entry gardens and courtyards should be compatible with and match the larger park-like landscaping.
- Projects adjacent to the Kaka‘ako Waterfront Park should incorporate landscape design elements from the park in order to provide a natural transition from private to public open spaces.

Parking Structures and Loading Areas

- Parking at grade fronting public sidewalks is discouraged where it may impact pedestrian activity.
- Situate surface parking lots and parking structures within the interior of lots where practical.
- Parking structures within public view should be designed as an integral element of the project.
- Visible floors of the parking garage should be horizontal only, and ramped and sloping floors should be shielded from public view.
- Lights within a parking structure should be shielded from public view and visible ceilings should be painted a dark color.
- The ground floor should be lined with retail or other active uses.
- Reduce the visual impact of parking structures through the planting of vertical trees, canopy trees if space allows, and/or planter boxes at every level.

3.9.4 State Conservation District Policies and Regulations

The ocean side portions of the proposed HSWAC project would be located in the State Conservation District. As defined in Chapter 13-5, subchapter 1, HAR, “Conservation district means those lands within the various counties of the State and State marine waters bounded by the conservation district line.” The purpose of the Conservation District is to “conserve, protect and preserve the important natural resources of the State through appropriate management and use to promote their long-term sustainability and the public health, safety and welfare.”

Pursuant to Hawai‘i Revised Statutes (HRS) Chapter 183C and Chapter 190D, the BLNR regulates marine activities by the issuance of a Conservation District Use Permit (CDUP). In addition to a CDUP, HSWAC must obtain an easement and right-of-entry for use of marine waters (Part III 190D-21 HRS).

The coastal land and marine waters that would be used by the proposed project, including the Ke‘ehi Lagoon area adjacent to Sand Island proposed for the staging activities, are in the Resource (R) Subzone of the Conservation District. This subzone includes (among others), lands and State marine waters seaward of the upper reaches of the wash of waves, usually evidenced by the edge of vegetation or by the debris left by the wash of waves on shore to the extent of the State’s jurisdiction, unless placed in a (P) or (L) subzone.

The objective of the Resource subzone is to “develop, with proper management, areas to ensure sustained use of the natural resources of those areas.” Energy activities are a permitted marine activity in this subzone.

3.9.5 City and County of Honolulu Land Use Controls

The City and County of Honolulu encompasses the entire island of O‘ahu and most of the Northwestern Hawaiian Islands. According to the 2000 Census, 72.3% of the State’s population resides in the City and County of Honolulu, primarily on the island of O‘ahu.

The City and County of Honolulu guides and directs land use and growth through a three-tier system of objectives, policies, planning principles, guidelines, and regulations. They are the General Plan, the Development Plans (or Sustainable Community Plans in some areas), and implementing ordinances and regulations. These are described below with reference to the proposed project area.

3.9.5.1 City and County of Honolulu General Plan

The General Plan for the City and County of Honolulu is a comprehensive statement of objectives and policies, which sets forth the long-range aspirations of Oʻahu's residents and the strategies and actions to achieve them. It is the focal point of a comprehensive planning process that addresses physical, social, economic and environmental concerns affecting the City and County of Honolulu. It is a two-fold document: (1) a statement of the long-range social, economic, environmental, and design objectives for the general welfare and prosperity of the people of Oʻahu, and (2) a statement of broad policies which facilitate the attainment of the objectives of the Plan.

The General Plan is a guide for all levels of government, private enterprise, neighborhood and citizen's groups, organizations, and individual citizens in 11 areas of concern: (1) population; (2) economic activity; (3) the natural environment; (4) housing, (5) utilities and transportation; (6) energy; (7) physical development and urban design; (8) public safety; (9) health and education; (10) culture and recreation; and (11) government operations and fiscal management. The 11 subject areas provide the framework for the City's expression of public policy concerning the needs of the people and the functions of government.

Objective B, Policy 3 of the Energy section of the City's General Plan reads: "Carry out public, and promote private, programs to more efficiently use energy in existing buildings and outdoor facilities." The HSWAC Project would be consistent with this policy because it would implement energy savings in numerous existing downtown buildings, including a number of public buildings. In addition, it would provide the City an opportunity to promote energy efficiency by connecting its buildings, as appropriate and possible, to the HSWAC system.

It should be noted that all marine waters within three miles of the Oʻahu coastline are considered part of Oʻahu in terms of the applicability of the objectives and policies in the General Plan. Most of Oʻahu's coastal marine waters are included in the State Land Use Conservation District, and thus, are beyond the effective jurisdiction of the City and County of Honolulu. They may be included, however, in Development Plans as may be appropriate.

3.9.5.2 Development Plans

The second tier of Honolulu's land use control system is the Development Plan(s). The Revised Charter of the City and County of Honolulu 1973, as amended, requires that Development Plans provide conceptual schemes for implementing and accomplishing the development objectives and policies of the General Plan. For this purpose, Oʻahu is divided into eight geographic planning regions: East Honolulu, Koʻolaupoko, Koʻolauloa, North Shore, Waiʻanae, Central Oʻahu, ʻEwa and the Primary Urban Center (Figure 3-31).

The Primary Urban Center (PUC) is home to almost half the island's population and three-quarters of Oʻahu's jobs. It is the capital of the State of Hawaiʻi, the State's commercial and financial center, and the home of its premier educational and cultural institutions. It is the heart of Hawaiʻi's economic, political, and cultural life. Because of its dense development pattern, the PUC is further subdivided into three portions: west, central, and east.

A revision of the Primary Urban Center Development Plan was adopted in 2004 (Article 2, Chapter 24, Revised Ordinances of Honolulu 1990, as amended). It designates the PUC as the principal region of Oʻahu for future growth in residential population and jobs[26.] Intended land uses in the central portion of

[26] The PUC and the ʻEwa Region are the areas to which major growth in population and economic activity on O`ahu will be directed over the next twenty years and beyond. Plans for the other six regions are now called "Sustainable Community Plans" to reflect the relative stability of these communities.

the PUC are shown on Figure 3-32. Proposed developments are evaluated against how well they fulfill the development plan's vision for the PUC and how closely they meet the policies, principals, and guidelines selected to implement that vision.

The City's vision for the PUC includes five key elements. Of relevance to the HSWAC Project is that: "Honolulu's natural, cultural and scenic resources are protected and enhanced." The HSWAC project would support this element of the City's vision in several ways. The HSWAC Project would protect and enhance natural resources by reducing the environmental impacts associated with burning fossil fuels and operating conventional air conditioning systems. It would reduce the use of fresh water resources, decrease the volumes of wastewater effluents disposed of into coastal waters, reduce emissions of air pollutants and greenhouse gases, reduce thermal pollution of air and water, reduce transportation, storage and use of hazardous materials, and reduce urban noise. The HSWAC Project also would protect and enhance cultural resources in several ways. Archaeological and cultural studies were completed in preparation of this EIS. The distribution system route was adjusted to avoid areas most likely to contain high concentrations of cultural deposits. An archaeological monitoring plan for the Project has been prepared and approved by the State Historic Preservation Division. That plan requires monitoring of trenching activities and provides procedures that will be implemented should significant cultural resources, such as burials, be uncovered. The HSWAC Project also would protect and enhance the City's scenic resources. Scenic resources refer to views makai to the sea or mauka to the mountains. The only visible part of the HSWAC System would be the cooling station. The location of the station is immediately makai of a much taller and more massive structure. Views from mauka or makai would not be affected by the presence of the cooling station because those views are already blocked by the existing building. Urban views would be improved to the extent that cooling towers rendered unnecessary by a building's connection to the HSWAC System are removed from downtown buildings.

The City's policies and guidelines for the PUC come under two general areas: land use and transportation; and infrastructure and public facilities. Relevant policies under the former mirror the above vision, i.e., protecting and enhancing natural, cultural and scenic resources, and the HSWAC Project would support these policies as it would the City's vision for the PUC. Guidelines for protecting and enhancing natural, cultural and scenic resources in land use and transportation would be supported by the HSWAC System as follows. The architectural character, landscape setting and visual context of historic landmarks would be preserved by burying all system components except the cooling station and by using subterranean connections to any historic structure that might be connected to the System. The HSWAC System would not degrade specific panoramic views the City desires to protect, most specifically, the view corridor up Cooke Street from Kaka'ako Waterfront Park toward Punchbowl and the Koolau Range. Significant East-West panoramic views are not identified for the cooling station area, and there are existing buildings taller than the proposed HSWAC cooling station that block views of Honolulu Harbor and Ala Moana from the project site.

The HSWAC Project also would support a number of City policies and guidelines for infrastructure and public facilities. Under policies for water allocation and system development, the HSWAC Project would support the policy to "adapt and implement water conservation practices in the design of new developments and modification of existing uses, including landscaped areas," by modifying air conditioning systems within existing buildings to save 260 million gallons of water annually. The HSWAC Project would also support the general guideline to conserve the use of potable water. Within the City's electrical power policies, the HSWAC Project would support the policy to "promote and implement energy conservation measures" by saving more than 77.5 million kWh/year on O'ahu. The HSWAC Project also would generally support the intention of the electrical power guideline to avoid or mitigate adverse impacts on scenic and natural resources, as described above.

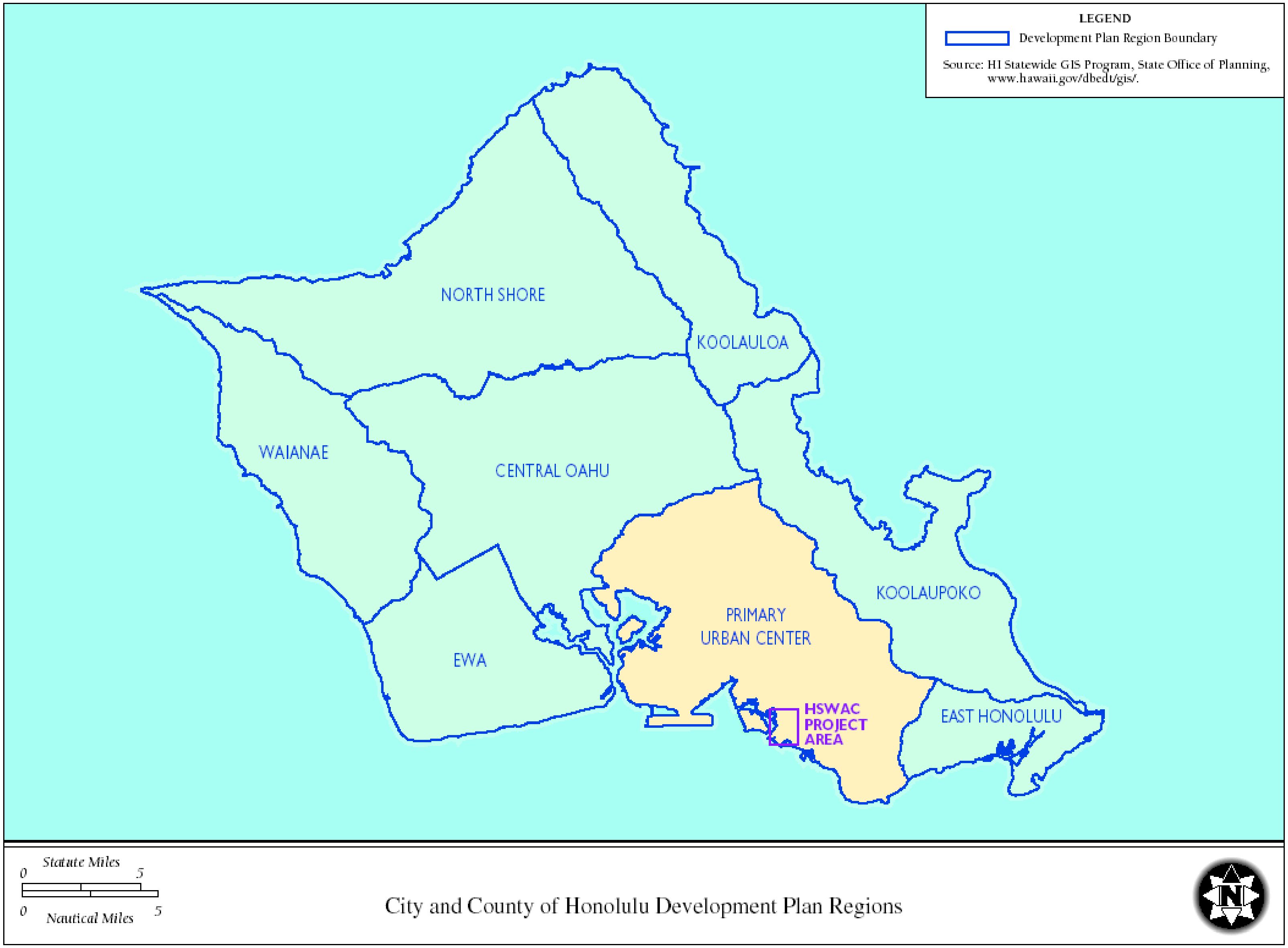


Figure 3-32: City and County of Honolulu Development Plan Regions

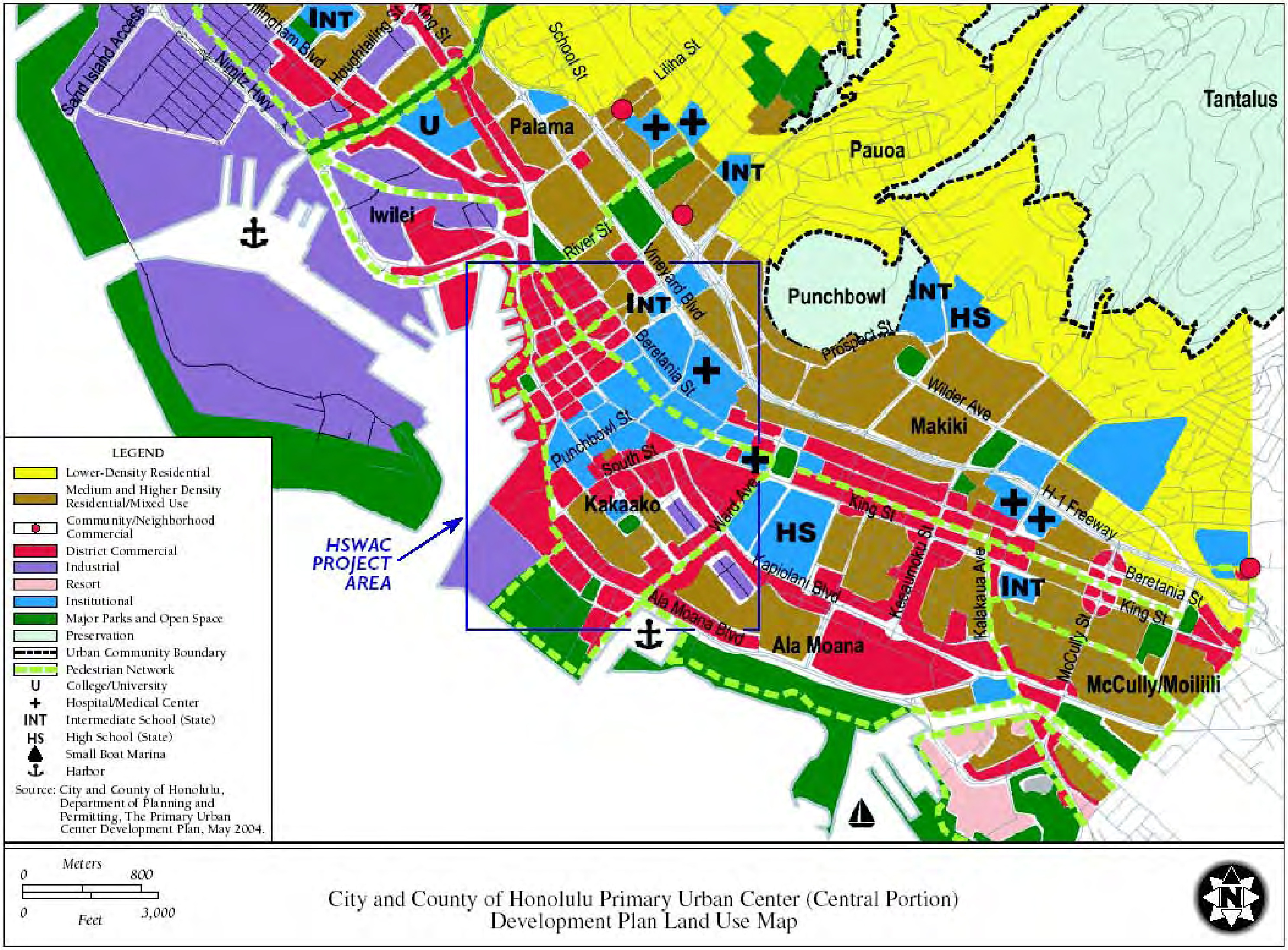


Figure 3-33: City and County of Honolulu Primary Urban Center (Central Portion) Development

In addition to the two Charter-mandated county planning tiers described above, development plans are supplemented by two additional planning mechanisms: the functional planning process and special area planning. Functional plans, some of which are mandated by State or Federal regulations, provide long-range guidance for the development of public facilities such as the water system, wastewater disposal, and transportation. Special area plans are intended to give specific guidance for neighborhoods, communities, and specialized resources.

3.9.5.3 Implementing Ordinances and Regulations

Implementing ordinances and regulations, including the Land Use Ordinance (LUO) (Honolulu's zoning code) and the City's Capital Improvement Program comprise the third tier of Honolulu's land use control system. The LUO (Ordinance No. 86-96 1986, as amended) establishes zoning and development standards for O‘ahu lands under City and County jurisdiction. The City and County also defines, implements, and administers the permit process for SMAs and shoreline setback areas delegated to it by the State.

3.9.6 The Project Area

The HSWAC project is proposed for the downtown and Kaka‘ako areas of Honolulu. The O‘ahu Metropolitan Planning Organization (OMPO), in its Transportation for O‘ahu Plan (Carter and Burgess, 2001) estimates the 2000 resident population of these two areas at 20,466, about 2.3% of the total O‘ahu resident population. The 2000 employment in these two areas is estimated at 89,251, about 18.3% of the total employment on the island of O‘ahu. Based on these figures, and assuming all employees are included in the estimate of the daytime population, the HSWAC project could service a combined day and night population of roughly 109,700, about 13% of O‘ahu's 2000 resident population.[27] HSWAC would also utilize approximately eight acres of nearshore and offshore areas for seawater intake and return seawater discharge pipes.

The land side of the HSWAC project, including the cooling station and the underground chilled water distribution system, would be located within the State Urban District. Activities and uses in State Urban Districts are managed by the respective county as provided by ordinances or regulations of that county.

The permanent landward facilities of the HSWAC system would also be located within the central portion of the Primary Urban Center of the City and County of Honolulu. The HSWAC chilled water distribution system would be installed in several zoning districts of the PUC including: A-2 Apartment; B-2 Community Business; BMX-4 Central; and P-2 Preservation General (Figure 3-34). Utilities installations are an approved use within any zoning district.

The City and County of Honolulu LUO also establishes the boundaries of and development standards for Special Districts. The HSWAC chilled water distribution system would serve buildings within the Hawai‘i Capitol Special District. Special Districts in and near the HSWAC project area are shown on Figure 3-35.

The cooling station and portions of the chilled water distribution system would be located within the Kaka‘ako Community Development District. This area is not under the jurisdiction of the City and County of Honolulu, but rather falls under the State's HCDA. HCDA has its own separate zoning districts (Figure 3-36) and development rules. Because the State retains control of the Kaka‘ako Community Development District land use, the Office of Planning (OP) administers the SMA permit process within the area. The boundaries of the SMA in the project area are shown on Figure 3-37.

[27] These are very rough estimates that do not account for double counting of those who both live and work in the area.

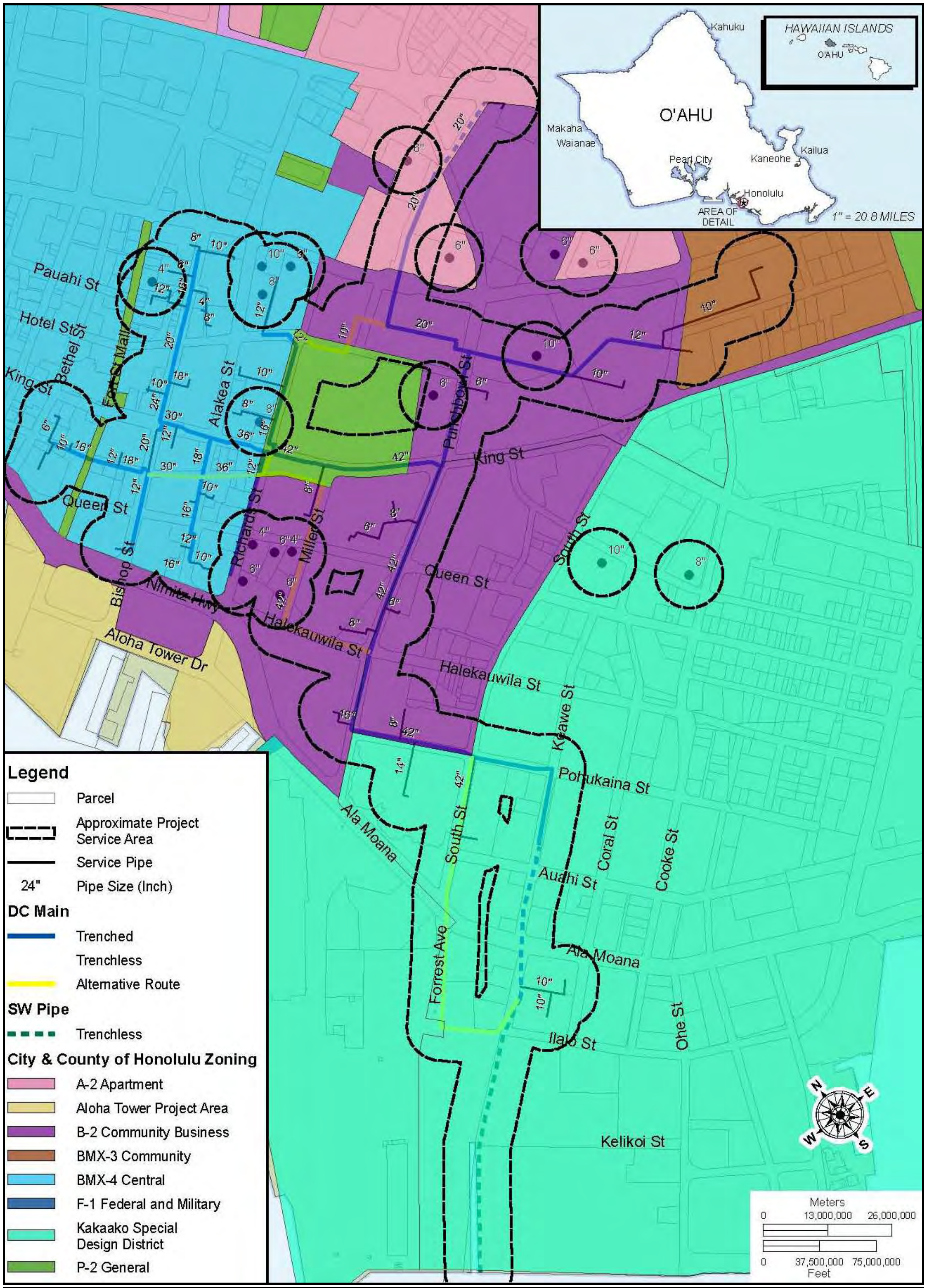


Figure 3-34: City and County of Honolulu Zoning in the HSWAC Project Area

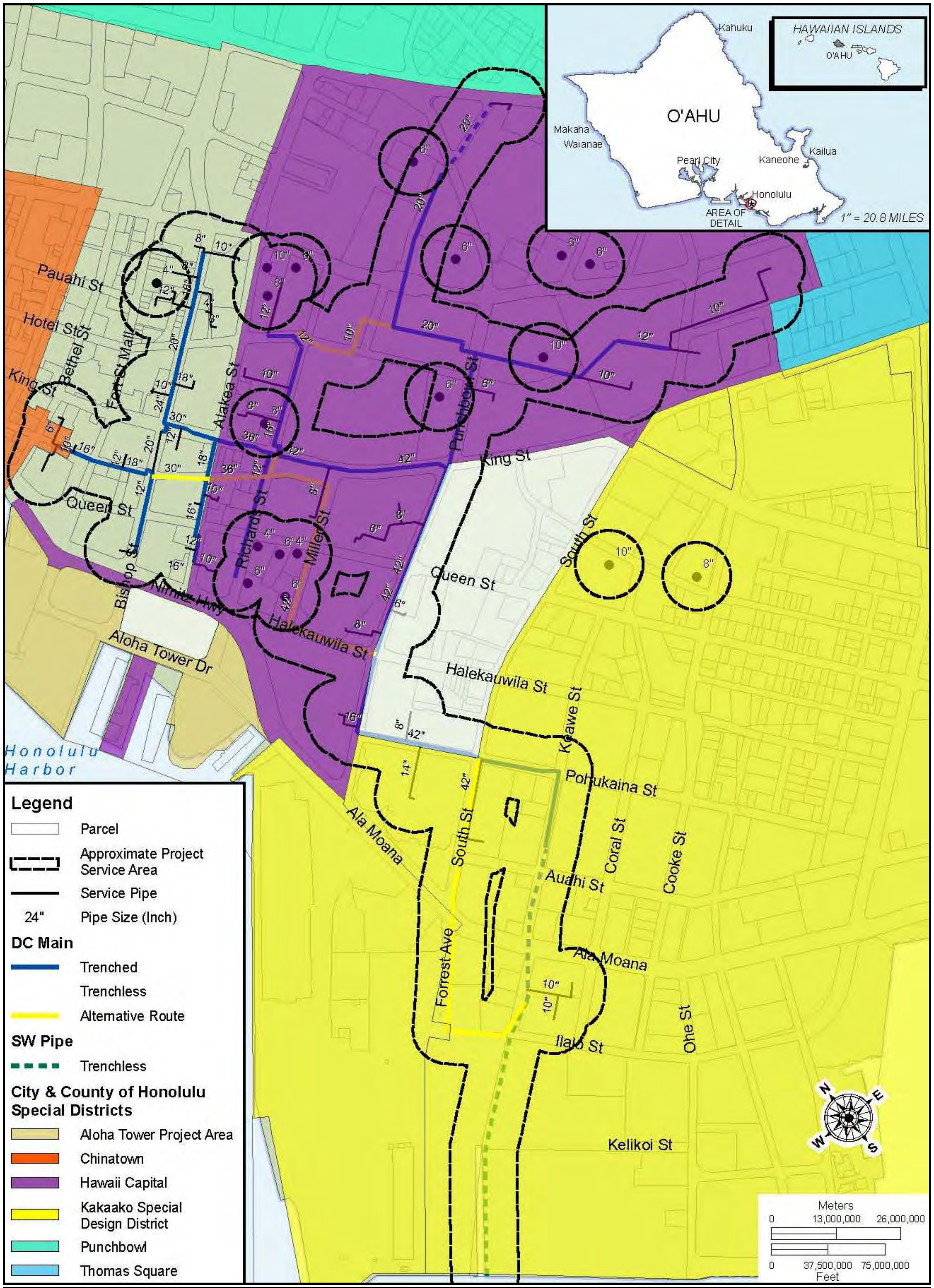


Figure 3-35: City and County of Honolulu Special Districts in the HSWAC Project Area

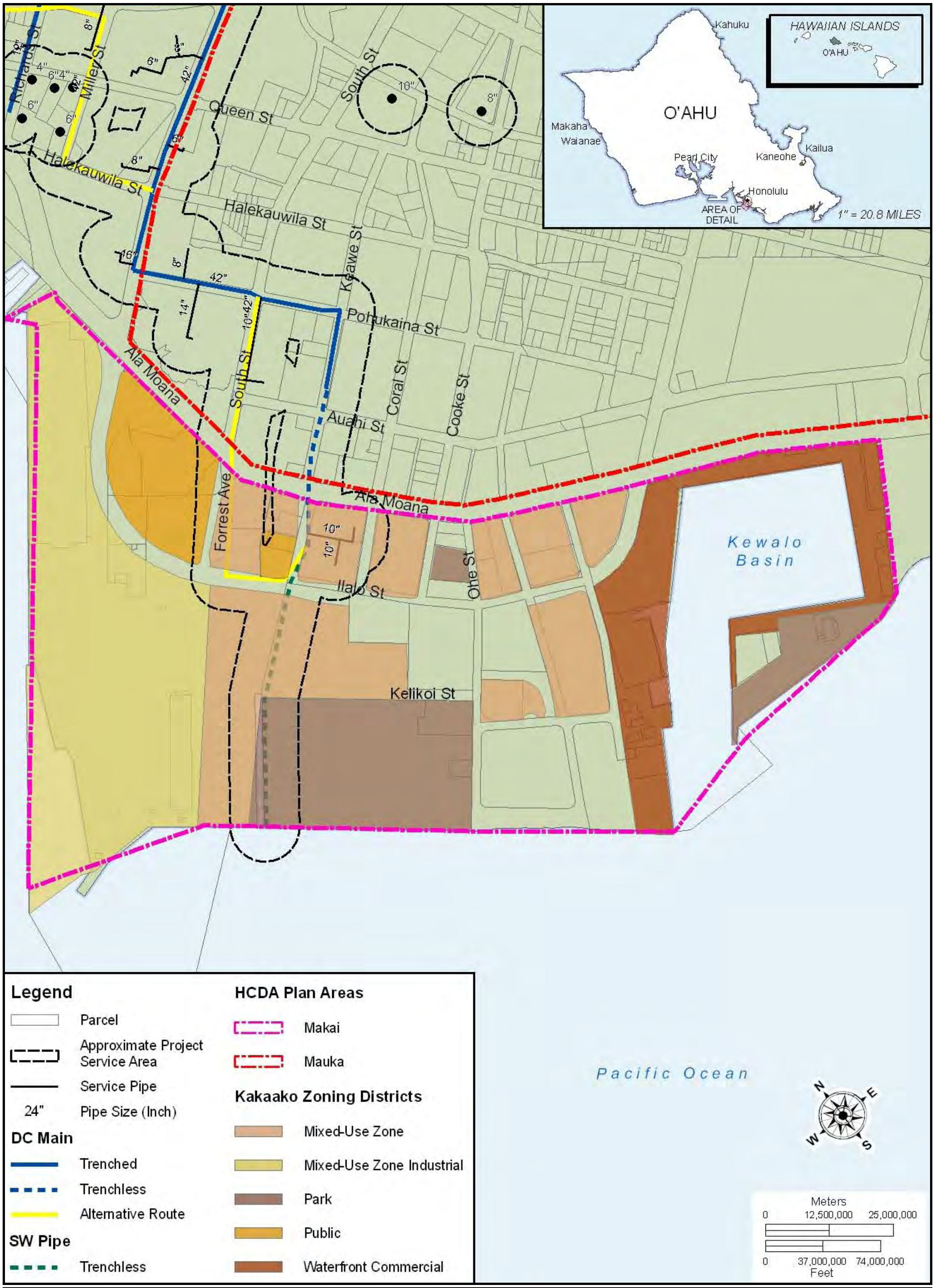


Figure 3-36: Hawai‘i Community Development Authority Kaka‘ako Zoning Districts

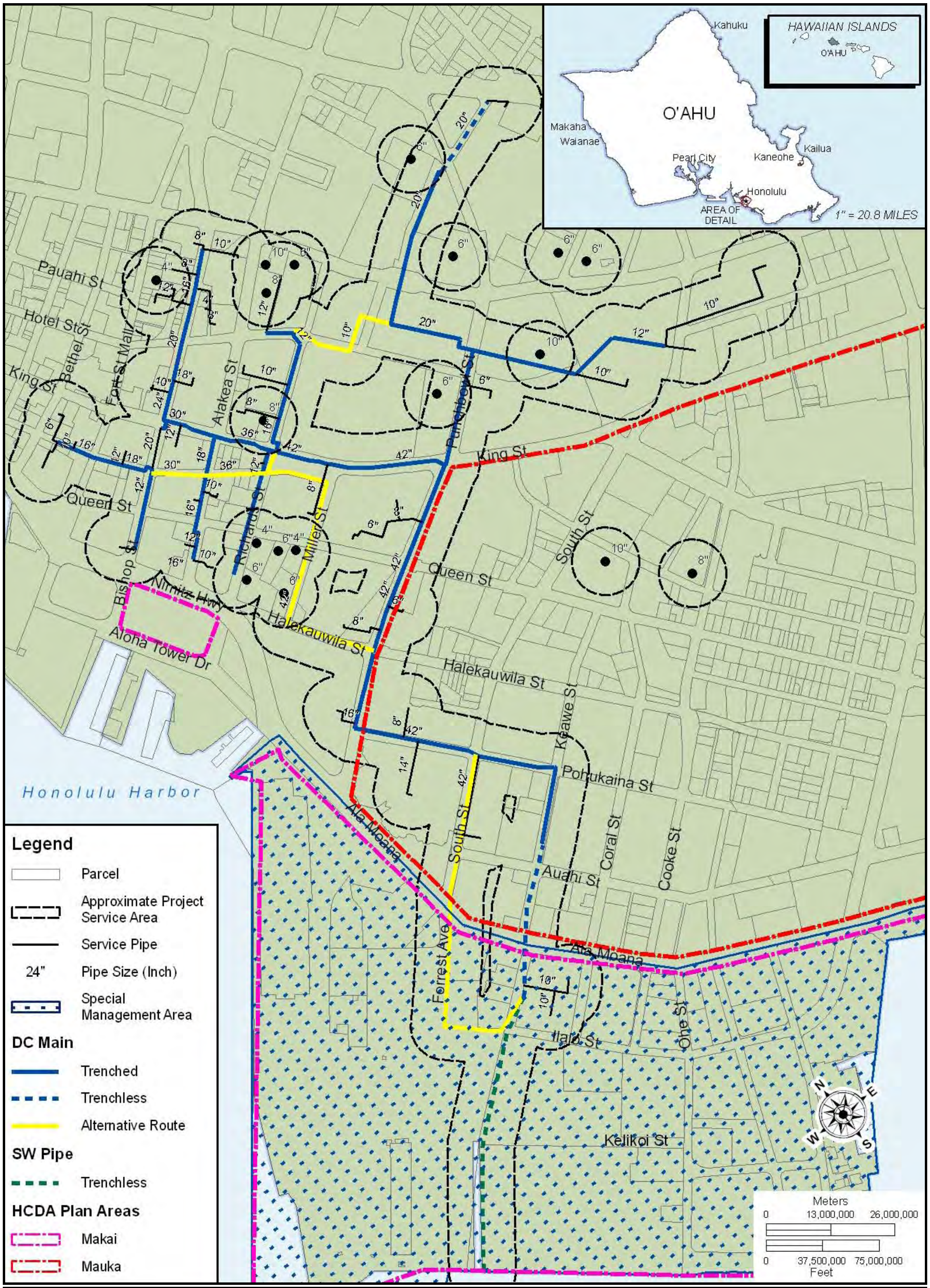


Figure 3-37: Special Management Area in the HSWAC Project Area Off-Shore Facilities

The seawater intake pipe would be installed beneath and on top of the offshore seabed. All submerged lands and surface waters within the State's jurisdiction (from the shoreline out three miles) are in the State Conservation District. The State Conservation District is governed by the Department of Land and Natural Resources pursuant to HRS Chapter 183C. A Conservation District Use Permit would be required to implement the HSWAC project.

The HSWAC seawater intake pipe would extend beyond the three-mile limit of State jurisdiction into Federal waters of the U.S. Exclusive Economic Zone. No special requirements are triggered by this. A Department of the Army permit is required for the proposed work inside the three-mile boundary.

3.9.7 Federal Land Use Controls

The 1976 Fishery Conservation and Management Act (Public Law 94-265) (the Magnuson Act, and later, after amendments, the Magnuson-Stevens Act [MSA], and more recently the Magnuson Stevens Reauthorization Act [MSRA]) established U.S. jurisdiction from the seaward boundary of the coastal states out to 200-nm for the purpose of managing fishery resources. Passage of the Magnuson Act was the first unilateral declaration of jurisdiction over a 200-nm zone by a major power. Presidential Proclamation 5030 of March 10, 1983, established the U.S. exclusive economic zone (EEZ), declaring, "to the extent permitted by international law ... sovereign rights for the purpose of exploring, exploiting, conserving and managing natural resources, both living and non-living, of the seabed and subsoil and the superjacent waters" in the 200-nm zone. The assertion of jurisdiction over the EEZ of the U.S. altered the legal basis for economic exploration and exploitation, scientific research, and protection of the environment by the U.S. The U.S. Congress confirmed presidential designation of the EEZ in 1986 amendments to the Magnuson Act. No specific land use permits are required for activities within the Federal portion of the EEZ. However, the ACOE exercises authority to control development within navigable waters of the U.S, as described in the following paragraphs.

The legislative origins of the ACOE permitting program are the Rivers and Harbors Acts of 1890 (superseded) and 1899 (33 U.S.C. 401, et seq.). Various sections establish permit requirements to prevent unauthorized obstruction or alteration of any navigable water of the U.S. The most frequently exercised authority is contained in Section 10 (33 U.S.C. 403), which covers construction, excavation, or deposition of materials in, over, or under such waters, or any work which would affect the course, location, condition, or capacity of those waters.

The geographic jurisdiction of the Rivers and Harbors Act of 1899 includes all navigable waters of the United States which are defined (33 CFR Part 329) as, "those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible to use to transport interstate or foreign commerce." This jurisdiction extends seaward to include all ocean waters within a zone twelve nautical miles from the coast line (the "territorial seas"). Limited authorities extend across the outer continental shelf for artificial islands, installations and other devices (see 43 U.S.C. 333 [e]). Activities requiring Section 10 permits include structures (e.g., piers, wharfs, breakwaters, bulkheads, jetties, weirs, transmission lines) and work such as dredging or disposal of dredged material, or excavation, filling, or other modifications to the navigable waters of the U.S.

In 1972, amendments to the Federal Water Pollution Control Act added what is commonly called Section 404 authority (33 U.S.C. 1344) to the program. The Secretary of the Army, acting through the Chief of Engineers, is authorized to issue permits, after notice and opportunity for public hearings, for the discharge of dredged or fill material into waters of the United States at specified disposal sites. Selection of such sites must be in accordance with guidelines developed by the USEPA in conjunction with the Secretary of the Army; these guidelines are known as the 404(b)(1) Guidelines. The discharge of all other pollutants into waters of the U. S. is regulated under Section 402 of the Act. The Federal Water Pollution Control Act was further amended in 1977 and given the common name of "Clean Water Act," and was again amended in 1987 to modify criminal and civil penalty provisions and to add an administrative penalty provision.

The Clean Water Act uses the term "navigable waters," defined in (Section 502[7]) as "waters of the United States, including the territorial seas." Thus, Section 404 jurisdiction is defined as encompassing Section 10 waters plus their tributaries and adjacent wetlands and isolated waters where the use, degradation, or destruction of such waters could affect interstate or foreign commerce.

Activities requiring Section 404 permits are limited to discharges of dredged or fill materials into the waters of the U.S. These discharges include return water from dredged material disposed of upland and generally any fill material (e.g., rock, sand, dirt) used to construct fast land for site development, roadways, erosion protection, etc.

With enactment of the Marine Protection, Research, and Sanctuaries Act in 1972, the Secretary of the Army, acting through the Chief of Engineers, was authorized to issue permits for the transportation of dredged material to be dumped in the ocean. This authority also carries with it the requirement of notice and opportunity for public hearing. Disposal sites for such discharges are selected in accordance with criteria developed by the USEPA in consultation with the Secretary of the Army.

The geographic scope of Section 103 of the Marine Protection Research and Sanctuaries Act of 1972 is those waters of the open seas lying seaward of the baseline from which the territorial sea is measured. Along coast lines this baseline is generally taken to be the low water line. Thus, there is a jurisdictional overlap with the Clean Water Act. By interagency agreement with USEPA, the discharge of dredged material in the territorial seas is regulated under the Section 103 criteria rather than those developed for Section 404.

Section 307 of the Coastal Zone Management Act of 1972, as amended (16 U.S.C. 1458[c]), requires an application for a ACOE permit to certify that the proposed project is in compliance with an approved State Coastal Zone Management Program, and that the State concurs with the applicant's certification prior to the issuance of a ACOE permit. The Corps' standard permit form contains a statement notifying the permittee that the Federal permit does not remove any requirement for state or local permits. This has the effect of making the ACOE's permit unusable without these additional authorizations. If the state or local permit is denied before the ACOE has made its decision, the ACOE permit is also denied.

In summary, while the HSWAC project would involve installation of a pipeline extending into EEZ waters under Federal jurisdiction, it is the activities in waters under State jurisdiction that trigger the Federal permitting process.

3.9.8 Land Ownership and Use

Submerged lands out to three miles are owned by the State of Hawaiʻi and managed as part of the Conservation District by the BLNR. Submerged lands seaward of three miles are owned by the Federal government[28]. HSWAC's pipes would extend approximately four miles offshore and enter into Federal government property.

The distribution system would be installed mostly under streets and sidewalks owned by the City and County of Honolulu, but some segments would pass under State-owned highways. The preferred site for the cooling station is owned by Kamehameha Schools, and is under the jurisdiction of the HCDA. Figure 3-38 identifies properties immediately adjacent to the proposed HSWAC facilities by their TMKs.

[28] See footnote 24.

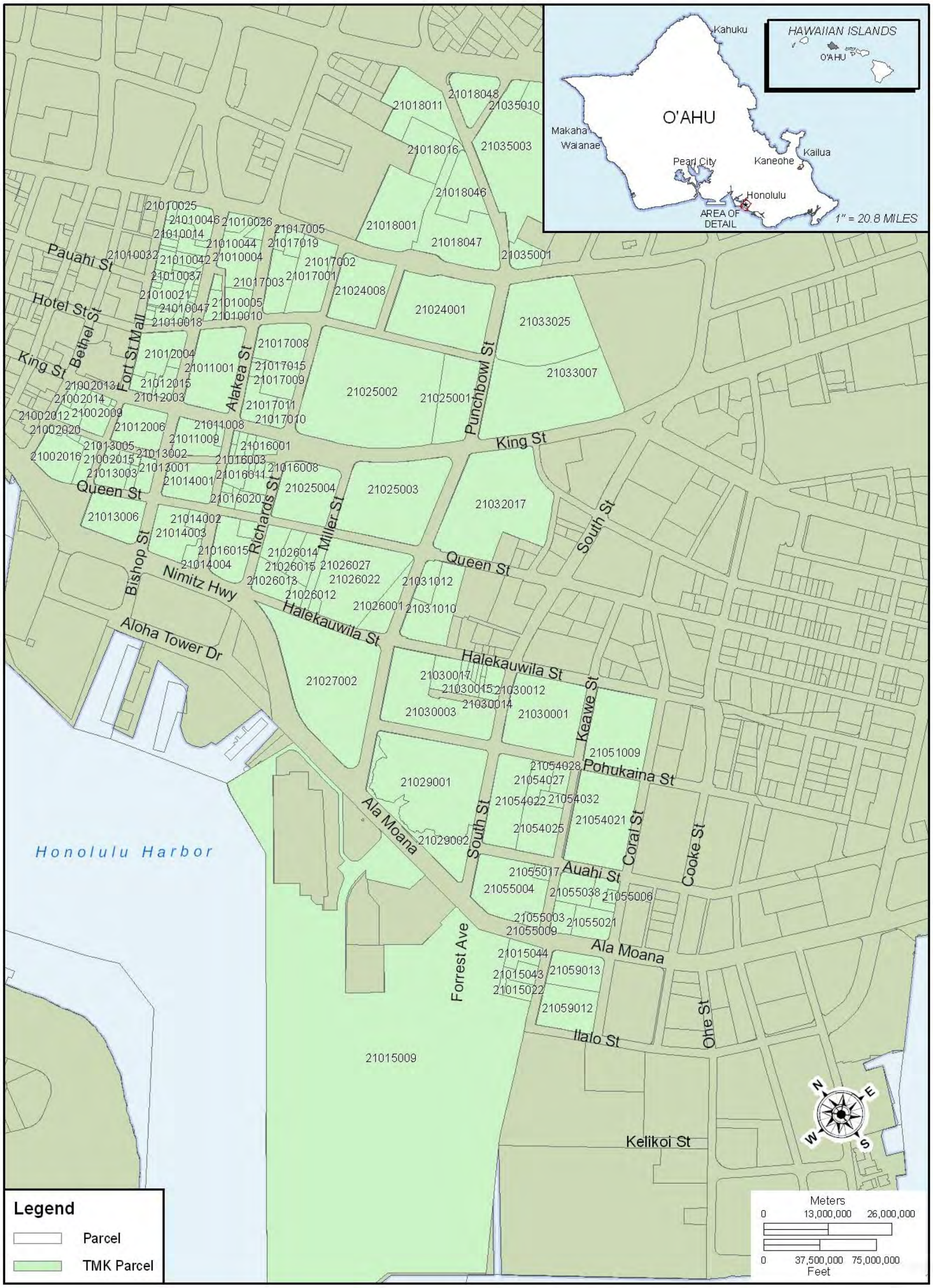


Figure 3-38: Tax Map Keys of Parcels Adjacent to HSWAC Facilities

The great majority of these parcels would be adjacent to buried distribution pipes and no visible structures would be present. Table 3-25 lists the TMKs, owners and uses of the parcels adjacent to the proposed cooling station. TMK 21059012 would be subdivided into three parcels, with HSWAC occupying a subdivided parcel adjoining the 677 Ala Moana Building. Makai of this parcel is the John A. Burns School of Medicine (JABSOM) and Kakaʻako Waterfront Park.

Table 3-25: Ownership and Use of Parcels Adjacent to the Proposed HSWAC Cooling Station

TMK	*Owner/Lessee*	*Current Use*
21015009	HCDA/Hawaiʻi Stevedores Inc./McCabe, Hamilton & Renny Co./ Aloha Cargo Agency Services/Islands Beach Activities	Industrial
21015022	State of Hawaiʻi DOT Harbors Division/ City & County of Honolulu/HCDA	Industrial
21015043	HCDA	Industrial
21015044	HCDA	Industrial
21059011	Bishop Trust Estate	Commercial
21059012	Bishop Trust Estate	Industrial
21599013	Bishop Trust Estate/Ala Moana Property Owner LLC	Commercial
21060003	HCDA	Industrial
21060007	HCDA	Industrial
21060008	HCDA	Industrial
21060009	HCDA/University of Hawaiʻi	Industrial
21060010	HCDA/University of Hawaiʻi	Industrial
21060015	HCDA	Industrial

Māmala Bay includes the ocean area from Diamond Head to Kalaeloa (Barbers Point) on the southern coast of Oʻahu. A large variety of ocean and coastal activities take place in the nearshore and offshore waters of Māmala Bay. These activities include recreational and commercial fishing, swimming, board and body surfing, sailing, canoe paddling, scuba diving, shell collecting, aquarium fish collecting, and others. Māmala Bay has been a disposal area for dredged material from nearby Pearl and Honolulu Harbors for more than a century. Honolulu Harbor has been the primary commercial port for the State of Hawaiʻi since before the turn of the century (Scott, 1968). Storm drainage into Honolulu Harbor and nearby Keʻehi Lagoon carries runoff from Honolulu's streets and suburbs into the ocean.

Māmala Bay, and especially the visitor destinations of Waikiki, draws visitors from all over the world and is a driving force behind the State's economy. In addition, many nearshore and coastal waters are productive areas for the commercial fishing industry. Thus, Hawaiian waters and shorelines have an unusually high level of environmental and economic sensitivity. Generally, nearshore and offshore areas are open to commercial and recreational users at all times and are not restricted. Presently, the only nearshore and offshore waters on Oʻahu that are off-limits to public access are those areas surrounding Department of Defense facilities (e.g., Pearl Harbor and parts of Kāneʻohe and Kailua Bays). Special activities that may result in the temporary restriction of access into otherwise open waters are promulgated through a weekly Notice to Mariners (NOTMAR). Existing public health and safety risks in the proposed project area are associated with recreational activities, commercial boating, and potential hazardous materials release from shipping and industrial activities.

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CHAPTER 4. ENVIRONMENTAL CONSEQUENCES

This chapter describes the potential environmental consequences of the two action alternatives and the No Action Alternative on existing environmental conditions. The analysis of potential environmental consequences follows the same sequence of environmental resources as in the previous chapter.

The section immediately below describes the criteria used in Federal and State EIS processes to determine the significance of an action. These criteria are applied in the subsequent impact assessment sections.

4.1 CEQ GUIDANCE

The Council on Environmental Quality's (CEQ) "Regulations for Implementing the Procedural Provisions of NEPA" is found at 40 CFR Parts 1500-1508. Section 1508.27 defines "significantly" as follows:

Significantly as used in NEPA requires considerations of both context and intensity.

> *(a) Context. This means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short-term and long-term effects are relevant.*
>
> *(b) Intensity. This refers to the severity of impact. The following should be considered in evaluating intensity:*
>
> > *(1) Impacts that may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial.*
> > *(2) The degree to which the proposed action affects public health or safety.*
> > *(3) Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.*
> > *(4) The degree to which the effects on the quality of the human environment are likely to be highly controversial.*
> > *(5) The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.*
> > *(6) The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.*
> > *(7) Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.*
> > *(8) The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.*
> > *(9) The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act.*
> > *(10) Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.*

4.1.1 Army Corps of Engineers (ACOE) Regulations

The U.S. ACOE's document "Procedures for Implementing NEPA," supplements CEQ regulations 40 CFR 1500-1508, as described in the previous paragraph. The guidance in the ACOE document is meant to be used in combination with the CEQ regulations.

The Secretary of the Army has legislative power to issue general permits based on Section 404(e) of the Clean Water Act. The permits can be a State, regional, or nationwide basis if the Secretary decides that "activities are similar in nature, will cause only minimal adverse environmental effects when performed separately, and will have only minimal cumulative adverse effect on the environment." The Rivers and Harbors Act also establishes the ACOE legislative authority, which "establishes permit requirements to prevent unauthorized obstruction or alteration of any navigable water of the United States."

4.1.2 HAR Chapter 200 Guidance

HAR 11-200-12 defines the significance criteria used in the State's EIS process as follows:

> *(a) In considering the significance of potential environmental effects, agencies shall consider the sum of effects on the quality of the environment, and shall evaluate the overall and cumulative effects of an action.*
>
> *(b) In determining whether an action may have a significant effect on the environment, the agency shall consider every phase of a proposed action, the expected consequences, both primary and secondary, and the cumulative as well as the short-term and long-term effects of the action. In most instances, an action shall be determined to have a significant effect on the environment if it:*
>
> > *(1) Involves an irrevocable commitment to loss or destruction of any natural or cultural resource;*
> > *(2) Curtails the range of beneficial uses of the environment;*
> > *(3) Conflicts with the State's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders;*
> > *(4) Substantially affects the economic or social welfare of the community or State;*
> > *(5) Substantially affects public health;*
> > *(6) Involves substantial secondary impacts, such as population changes or effects on public facilities;*
> > *(7) Involves a substantial degradation of environmental quality;*
> > *(8) Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions;*
> > *(9) Substantially affects a rare, threatened, or endangered species, or its habitat;*
> > *(10) Detrimentally affects air or water quality or ambient noise levels;*
> > *(11) Affects or is likely to suffer damage by being located in an environmentally sensitive area such as a flood plane, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters;*
> > *(12) Substantially affects scenic vistas and viewplanes identified in county or State plans or studies; or,*
> > *(13) Requires substantial energy consumption.*

4.2 ARCHAEOLOGICAL, HISTORIC AND CULTURAL RESOURCES

The complete archaeological, historical and cultural report is contained in Appendix B. The sections below are excerpted from that report and describe the potential impacts of Alternative 1, the Preferred Alternative. The potential impacts of Alternative 2 would be nearly identical to, but slightly less than, the impacts of Alternative 1. Under Alternative 2, the initial segment of the distribution system would be routed under Forrest Avenue and South Street, rather than under Keawe Street. The Keawe Street route has a high probability of finding cultural remains, but the Forrest/South route has a moderate probability of finding cultural remains. The remainder of the routes would be the same. The No Action Alternative would not implement the HSWAC system and there would be no direct or indirect impacts to archaeological, historic or cultural resources under that alternative.

4.2.1 Effects on Architectural Properties

Historic architectural properties with the APE would not be significantly affected by either HSWAC action alternative. The proposed pipeline routes currently connect to three or pass near six of 72 historic properties in the APE; the total number includes register sites, register district properties, eligible properties, and historic properties identified through the CIA and research for this report. An architectural survey was not recommended or requested by SHPD because no buildings would require any new additions of attached structures or other appurtenances in order to be connected to the HSWAC system. In all cases where connection to the HSWAC would occur, the distribution pipes would be connected to existing utility systems upon installation. There may be temporary alteration of the ground surfaces adjacent to these buildings as the pipeline trenching is conducted, but such alterations would be temporary and would be mitigated by restoring the ground surface and any landscaping. The HSWAC Project would not have any permanent physical or visual effects to historic buildings. Two register properties merit additional discussion; they are the Hawaiʻi State Capitol and Grounds, and Honolulu Hale and Grounds.

4.2.1.1 State Capitol and Grounds

The preferred configuration of the pipeline routing places one segment running from Richards Street along the pedestrian mall on the makai side of the Capitol building, within the grassy margin between the sidewalk and the ʻIolani Palace property. The current walkway is on what used to be a portion of Hotel Street, in use until the mid-1960s when construction of the Capitol began. On the ʻewa or west side of the Capitol building, the pipeline would penetrate the Capitol's structure beneath the reflecting pool, and extend into the underground parking area where it would be routed in two directions to serve other public and private customers.

First, a pipeline would extend east, along the ceiling to the vehicular entrance on Punchbowl Street. At the vehicular entrance, the pipeline would again be buried, and trenching for this installation would be done along one of the traffic lanes of the vehicular entrance, across Punchbowl Street, and down a traffic lane of the vehicular entrance to the Kalanimoku Building (state offices), which would also be included in the HSWAC distribution system. A second pipeline would extend mauka or north along the Miller Street corridor in order to serve the State Department of Education (DOE) building and the Queen's Hospital area. Like the Kalanimoku routing, the pipeline would be routed along the ceiling of the Capitol's underground parking garage, emerge on the Capitol grounds to go across Beretania Street, and then be installed along the Miller Street pedestrian mall on the side of the Department of Health (HDOH) building, in order to avoid Washington Place and its grounds. The pipeline would then cross over to provide service to the DOE building and then to Queen's Hospital. The Beretania and Miller Street pipeline installations would be carried out through trenching.

The Hawaiʻi State Capitol and Grounds are contributing properties to the Hawaiʻi Capitol Historic District, although they are not historic in age. The Capitol was constructed in the mid-1960s and dedicated in 1969. At the time of its construction, the entire parcel upon which it sits was excavated in order to accommodate both the capitol building and the underground parking areas. The entire area that would be impacted by the HSWAC installation was previously and extensively disturbed during construction of the Capitol building and associated parking areas. Any alterations due to trenching will be temporary and can be completely mitigated by replacing ground cover and landscaping. Insertion of the pipeline into the Capitol building would be below current ground surface, and not visible once it is in place. Consequently, it is believed that the HSWAC undertaking would have no effect on the State Capitol or grounds. Similarly, excavations along the Miller Street corridor beside the HDOH building, to the DOE building, and to the Queen's Hospital complex would have no effect on historic properties.

4.2.1.2 Honolulu Hale and Grounds

Honolulu Hale was originally constructed in 1929; the building and its grounds are contributing properties to the Hawai‘i Capitol Historic District. Designed by renowned Hawai‘i architects C.W. Dickey, Hart Wood and others, the California-Spanish style building was dedicated in 1929. The original building underwent a planned expansion in 1951 with the addition of two three-story wings on the mauka side of the existing structure (City & County of Honolulu, 1982). Through the 1960s, Hotel Street continued to exist as a vehicular route; its right-of-way overlaps with what is now a pedestrian walkway on the mauka side of Honolulu Hale, extending from Punchbowl Street towards the Frank F. Fasi Municipal Building, a 15-story office tower constructed to the east of Honolulu Hale and the Kalanimoku Building in 1975. At this time, the walkways and lawn areas between these government buildings were modified into the configuration seen today.

Honolulu Hale would be serviced by the HSWAC system and current routing shows the distribution pipeline going across the lawn area immediately mauka of the building, with open trenching being used to install the pipe. The HSWAC pipeline would be connected to existing utility systems and would not require any additional structures or appurtenances that would modify the appearance of Honolulu Hale or its grounds. There would be a temporary alteration to the grounds as trenching occurs but this would be mitigated through restoration of the ground surface and landscaping upon completion of excavations.

4.2.2 Effects on Archaeological Properties

The current configuration of the pipeline corridor in the APE is primarily based on two factors: the need to provide HSWAC connections to specific clients and the need to minimize the disruption of traffic on downtown and Kaka‘ako roadways. Additional complications include the fact that all roadways proposed for the HSWAC distribution pipeline contain existing infrastructure components such as sewer, water, or utility lines in their subsurface portions. These constraints thus create a situation where there are few alternatives to the proposed pipeline routes.

Using the data from previous archaeological reports, a map was developed illustrating areas of relative sensitivity for encountering subsurface cultural sites, including human burials, within the APE. Figure 4-1 shows the pipeline distribution routes for both action alternatives as they are assessed for the likelihood of encountering subsurface cultural sites. The green color indicates of areas of expected low probability, the orange color corresponds to a moderate probability of finds, and red indicates an area of high probability of subsurface finds. Currently, most of the installation for the pipeline would be done through open trenching along existing roadways and sidewalks. The only exceptions to this would be short, trenched corridors that go from a main pipeline to an individual building, and the segment that traverses Ala Moana Boulevard which would be done through microtunneling.

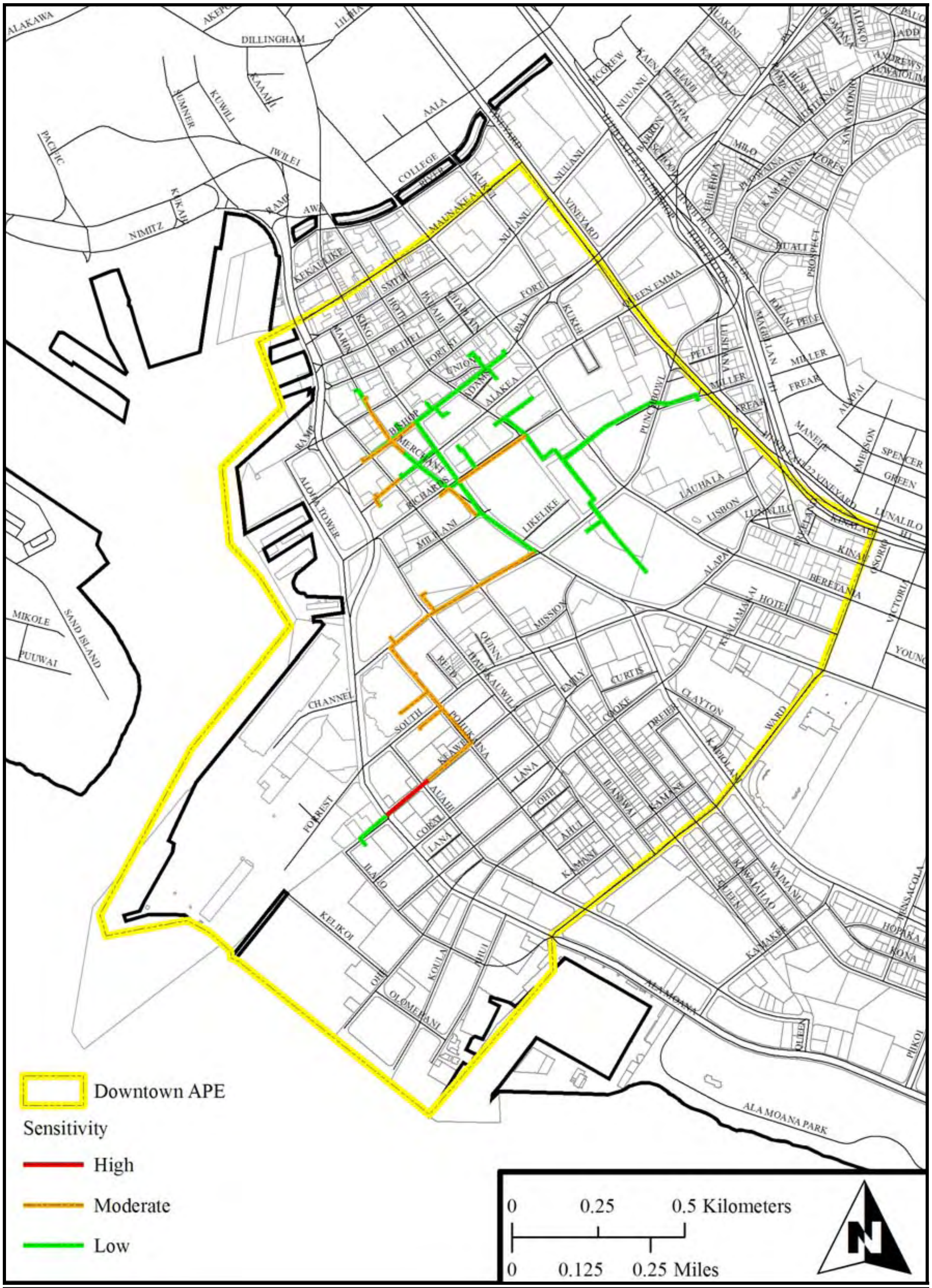

Figure 4-1: Distribution of Archaeological Probability Zones in the APE

A number of segments of the distribution pipeline are deemed to be of low probability for finding subsurface cultural sites, as indicated by the record of previous finds and studies. These areas include portions of the Bishop, King, and Merchant Street corridors, as shown on Figure 4-1, and the entire Miller Street corridor between the State Capitol and the Queen's Hospital complex. In addition, trenching on the grounds of the Capitol and Honolulu Hale are deemed to be of low probability for finding subsurface deposits. In view of the multiple episodes of relatively recent construction in these areas, and the lack of any evidence for subsurface cultural deposits being present in these locations, it is believed that the HSWAC pipeline installations would have no effect on Honolulu Hale or the State Capitol and their grounds. The trenching for the pipeline segment between the cooling station and the makai side of Ala Moana Boulevard is also an area of low probability for subsurface finds since this is filled land, all excavation would take place within fill, and there is no history of prior finds in this part of Kaka'ako.
Areas of moderate probability of encountering subsurface cultural sites are shown on Figure 4-1 as including the following:

- Portions of Merchant and Bishop Streets on either side of the intersection;
- The portion of Alakea Street makai of the intersection with Queen Street;
- The portion of Richards Street from Hotel Street makai to the intersection with Merchant Street;
- The connecting trench to the U.S. Post Office, Custom House, and Court House;
- Pipeline segments through the Honuakaha section of Kaka'ako, from the intersection of Halekauwila and Punchbowl Streets makai to the intersection of Pohukaina and Punchbowl Streets, east along Pohukaina Street to Keawe Street, and makai on Keawe Street to the intersection with Auahi Street.

The area of high probability for encountering subsurface cultural sites is believed to be Keawe Street from its intersection with Auahi Street to Ala Moana Boulevard. The Preferred Alternative is to microtunnel under this segment to avoid contact with cultural remains as well as to eliminate impacts to traffic on Ala Moana Boulevard. The distribution system route for Alternative 2 would be microtunneled under Ala Moana Boulevard, but along a Forrest Avenue/South Street alignment, to minimize traffic impacts.

Given the above information, the proposed HSWAC pipeline system may have an "adverse effect" on subsurface cultural sites that may be present in the portions of the APE that are deemed of moderate to high probability for encountering sites. In view of these facts, it is recommended that the areas of moderate and high probability for finding subsurface cultural sites undergo on-site archaeological monitoring during trenching done for the HSWAC. An archaeological monitoring plan has been prepared and accepted by DLNR (Appendix B). With implementation of the measures specified therein, the proposed undertaking would have "no adverse effect" on significant historic sites.

4.2.3 Effects on Traditional Cultural Properties

Consulting parties in the CIA provided a great deal of information on Kaka'ako's past and the communities who lived there. They also identified several concerns with regard to the potential for finding or disturbing cultural sites during the HSWAC project, including the discovery of human burials. In general, consulting parties acknowledged that former burial locations are now largely unknown, thus it is difficult to predict where they might be encountered. One participant noted that in the old days people generally buried their dead "on the side of their house." Another participant also mentioned the previous find of numerous burials associated with Kawaiaha'o Cemetery when Queen Street underwent improvements in the 1980s.

Participants in the CIA identified sacred places and precincts within the APE. A heiau (name unknown) was formerly in the vicinity of Point Panic, and a sacred pond (now filled in) was in the vicinity of Koula and Auahi Streets. The pond, according to the CIA participant, was a place for ali'i to prepare for ritual sacrifices. These places and others were part of what one CIA participant called a Sacred Triangle that extended from Moanalua on the west to Mānoa on the east makai to the coral flats underlying ʻIolani Palace and nearby properties. This view of the landscape is still held by project participants and others; while they do not necessarily object to modern changes, they do not believe such change has eliminated the sacred and traditional realities of the landscape that they were taught to respect.

Although the CIA participants all recalled fishing, gathering limu, and similar activities along the Kewalo shoreline when living in Kakaʻako, no one identified particular species or resources that might be affected by the HSWAC project. Fishermen and women still frequent the Kakaʻako shoreline, often in the vicinity of the drainage canal on the ʻewa end of Kakaʻako Waterfront Park, but none of them participated in the current CIA. Similarly, the Point Panic area is a popular surfing spot, but none of the CIA participants commented on any effect the HSWAC project might have on this activity.

4.2.4 Recommended Mitigation Measures

Based on the results of the historical, archaeological, and cultural impact studies, the following recommendations are made to mitigate potential impacts:

4.2.4.1 Architectural Properties

As summarized above, none of the architectural properties identified in this study would be adversely affected by installation of the HSWAC components, including the pipeline system. Nonetheless, Chapter 6E-10, HRS, requires that SHPD review and concur with any activity affecting historic properties owned by the State, particularly those on the Register. The relevant statute reads in part:

> **§6E-8 Review of effect of proposed state projects.** (a) Before any agency or officer of the State or its political subdivisions commences any project which may affect historic property, aviation artifact, or a burial site, the agency or officer shall advise the department and allow the department an opportunity for review of the effect of the proposed project on historic properties, aviation artifacts, or burial sites, consistent with section 6E-43, especially those listed on the Hawaiʻi register of historic places. The proposed project shall not be commenced, or in the event it has already begun, continued, until the department shall have given its written concurrence.
> The department is to provide written concurrence or non-concurrence within ninety days after the filing of a request with the department….

Currently, none of the privately-owned properties within the APE that are listed on the HRHP or NRHP would be affected by HSWAC activities. Should any such properties be included in future planning for the project, they may fall under the jurisdiction of Chapter 6E-10, HRS, which governs SHPD review of activities affecting privately-owned historic property on the HRHP:

> **§6E-10 Privately-owned historic property.** (a) Before any construction, alteration, disposition or improvement of any nature, by, for, or permitted by a private landowner may be commenced which will affect an historic property on the register of historic places, the landowner shall notify the department of the construction, alteration, disposition, or improvement of any nature and allow the department opportunity for review of the effect of the proposed construction, alteration, disposition, or improvement of any nature on the historic property. The proposed construction, alteration, disposition, or improvement of any nature shall not be commenced, or in the event it has already begun, continue, until the department shall have given its concurrence or ninety days have elapsed…

Thus, it is recommended that SHPD be given the opportunity to review and concur with any portions of the HSWAC project that may affect privately-owned and State-owned historic properties on the HRHP.

Finally, in order to ensure that no architectural properties are adversely affected by the HSWAC project, it is recommended that any ground surfaces and landscaping associated with any historic building be restored to their original condition if they are disturbed by trenching or other activities.

A Department of the Army permit would be required for the project, and therefore, in addition to HRS Chapter 6E, Section 106 of the National Historic Preservation Act would apply. The Army Corps of Engineers expects applicants for their permits to complete Chapter 6E requirements prior to including the historic preservation information in a permit application. Consequently, an archaeological monitoring plan was completed and accepted by SHPD, and included as part of the permit application. Once the permit application is deemed complete and acceptable, the Army Corps would complete Section 106 consultation, including any meetings and correspondence.

4.2.4.2 Archaeological Properties

Under either action alternative, there is varied potential for encountering subsurface cultural sites within the APE, particularly during trenching for installation of the HSWAC distribution pipelines. A number of locations on the pipeline route have a low sensitivity of encountering subsurface sites; in these areas, the proposed undertaking would have no effect on significant archaeological sites, and no further measures are recommended at this time.

Along pipeline segments deemed to be of moderate and high sensitivity for encountering subsurface sites, the proposed HSWAC pipeline system may have an “adverse effect” on such sites. Consequently, it is recommended that the areas of moderate and high sensitivity for finding subsurface cultural sites undergo on-site archaeological monitoring during trenching done for the HSWAC distribution system.

4.2.4.3 Traditional Cultural Properties

Although extant traditional cultural properties were not identified during the CIA, with the exception of human burials potentially being present within the project area, the participating consultants clearly identified locales within the APE that are of ongoing cultural importance as seen through participants’ beliefs. In such situations, it is difficult to recommend measures that can “protect” these places or “mitigate” accidental harm that might be done to them through project activities. Consequently, it is recommended instead that a proactive approach be taken to consulting with and involving concerned parties who have traditional and/or family ties to the Downtown and particularly the Kaka‘ako areas. Potential measures are as follows:

- Establish a cultural advisory group comprised of community members, particularly those who have long-standing religious and cultural ties to locales within the APE.
- Should archaeological monitoring be accepted as an appropriate mitigation measure, cultural monitors should also be retained to work with the archaeologists in any situation where monitoring is needed. The cultural monitors should be selected by the cultural advisory group and, ideally, would represent that group and other community members. Monitoring procedures and related activities carried out by the cultural monitors should be developed in consultation with the advisory group and the State Historic Preservation Division.
- Given the possibility that human burials would be encountered during excavations conducted for HSWAC, it is recommended that a pro-active search be carried out before ground disturbance begins in order to identify individuals who may have family connections to burials found in the APE. This may be done by working with the cultural advisory group and with the History and Culture Branch of the State Historic Preservation Division.

4.3 BUILT RESOURCES AND HUMAN USES

The following sections describe the impacts of the Preferred Alternative on harbors and shipping; pipelines, outfalls and dredge material dump sites; ocean recreation; commercial fishing; military activities; parks and recreational facilities; utilities; roadways and traffic; and ambient noise. The No Action Alternative has limited impacts on these resources. Continuation of the No Action Alternative would allow the demand for electricity on O‘ahu to continue to grow, eventually requiring additional generating capacity. Continuation of this alternative would also mean that many individual building cooling towers would remain in service, contributing noise and vapor drift to the downtown setting.

4.3.1 Harbors and Shipping

The offshore portion of the HSWAC system would lie between Honolulu Harbor and Kewalo Basin. A large number of alternatives were evaluated for the route of the offshore pipelines. The original intention was to take the shortest possible route from shore to the desired intake depth resulting in a pipeline relatively close to the entrance to Honolulu Harbor. This was considered undesirable because of potential operational conflicts described below and also because of the necessity to undertake the construction and installation near the harbor entrance channel, so the potential route was shifted to the east. This was presented s the Preferred Alternative in the DEIS, and is now part of Alternative 2. Subsequent detailed bathymetric surveys and sub-bottom profiling indicated the presence of a buried alluvial channel east of Honolulu Harbor, which could inhibit anchoring of the pipelines to the substratum. Still further to the east are several mounds remaining from past dredge material dumping operations that also would be obstructions to laying and securing the pipelines.

Although the eastern breakout point and offshore pipe route (Alternative 2) was initially selected to minimize geological and operational risks to the system, that route was determined to have potentially significant impacts to the facilities and operations of UH’s Kilo Nalu Observatory, which maintains a system of cables and sensors on the bottom near the entrance to Kewalo Basin. To avoid these impacts, additional bathymetric and geotechnical investigations were undertaken to further evaluate the feasibility of a western breakout point and pipe route closer to the entrance to Honolulu Harbor. These studies indicated that a western route was feasible from a soils stability standpoint, although it would place the offshore portion of the system closer to the Honolulu Harbor entrance channel. This route was adopted as part of Alternative 1, the Preferred Alternative. Alternative 1 would put construction operations closer to vessel traffic into and out of Honolulu Harbor. Under either alternative, a Notice to Mariners would be published to alert vessel operators to the activities.

In initial evaluations of potential offshore routes for the pipelines, concerns included potential damage to the system from vessel operations after installation. In discussions with HDOT Harbors Division personnel and representatives of the maritime industry it was learned that tugboats pulling barges out of Honolulu Harbor rapidly pay out their tow lines as they exit the harbor. These lines drag along the bottom and potentially could snag the anchor weights attached to the HSWAC pipeline if the pipeline were positioned too close to the harbor entrance. To mitigate this potential impact, special snag-resistant anchor collars were designed that would allow the lines to slide across the pipeline without catching. The snag-resistant anchor collars would be used to depths of 150 feet, regardless of the pipeline route.

The other operational concern would be anchor damage. As described in Section 2.5.3.9, small vessel anchors generally do not have the weight nor does the vessel have the power to damage the pipeline. A large anchor (from a freighter or large Navy vessel – destroyer or larger) contacting the pipeline would not necessarily damage it, but the types of damage it could do include: puncture damage or point load damage (crimping or over bending) from catching on the pipe and then dragging it to one side. The chance of such damage causing the pipe to part is extremely small, as the force needed to shear the very heavy wall HDPE pipe is beyond the capacity of most ships. Nevertheless, as a contingency plan, Section 2.5.3.9 contains a scenario for pipeline repair in the event of anchor damage.

Construction operations would not directly affect harbors or shipping, but small vessel traffic would be restricted in the immediate vicinity of offshore construction operations. The offshore microtunneling operations at the breakout point would require vessels and possibly a pile-supported platform to occupy that area for seven to nine months. Installation of the pipeline itself would be done in about one day, although making the final connection of the offshore pipelines to the pipes contained in the microtunneled shaft, backfilling the breakout pit and capping with concrete would take on the order of another week.

Vessel traffic within the Ke'ehi Lagoon staging area for the pipelines would be restricted for a period of approximately 10 months, although access to the residences on the island there would not be impeded. During the final assembly of the pipelines and towing from Ke'ehi Lagoon, a fleet of picket boats would guide vessel traffic safely around the work area, as described in Section 2.5.3.6.

4.3.2 Pipelines, Outfalls and Dump Sites

Neither construction nor operation of either action alternative would directly affect any existing marine pipelines, outfalls or dredge material dump sites. Indirectly, the HSWAC system would decrease the use of potable water in cooling towers and thus decrease the quantity of sewage discharged through the Sand Island deep ocean outfall.

4.3.3 Ocean Recreation

As noted above, during staging and construction of either action alternative, the Ke'ehi Lagoon staging area and the area surrounding the offshore microtunnel breakout location would be off-limits to ocean users due to safety reasons. The Ke'ehi Lagoon location would be in use for approximately 10 months. Canoe paddling and any other recreational activities in the immediate area surrounding the floating pipes could be inhibited during this time. The breakout location would be occupied for seven to nine months. A larger area along the length of the pipelines would be off limits only during actual deployment of the pipelines, which would take on the order of a day. These direct impacts would be unavoidable, but transient. Once the HSWAC pipeline is operational there would be no impacts to recreational activities.

4.3.4 Commercial Fishing

The area immediately offshore of Kaka'ako has been highly impacted by historical uses, has little relief, and is periodically subjected to high surf events that maintain the marine community in an early stage of succession. Commercial fishery landings data verify that this area is not an important fishing ground. During construction and pipeline deployment the same access restrictions would apply to commercial fishing as described above for recreational uses. This direct impact of either action alternative would be unavoidable and transient. Fishers, however, would be able to shift effort to other nearby grounds if so desired. It is unlikely that any commercial fishing takes place in the proposed Ke'ehi Lagoon staging area, but it too would be prohibited in the operations area during pipeline assembly.

Once the system is installed, the pipeline would supply much needed vertical relief to the benthic environment. It is quite likely that because of additional habitat and shelter provided by the pipeline and anchor collars that fish populations and other components of the benthic and demersal community would increase, providing enhanced opportunities for both commercial and recreational fishing.

4.3.5 Military Activities

The Pearl Harbor Entrance Channel is a Naval Defense Sea Area, and is closed to the public. This area begins about three miles west of the proposed HSWAC pipeline route, and extends about three to four miles offshore in the area fronting the Reef Runway of the Honolulu International Airport. There would be no reason for vessels engaged in delivery of HSWAC materials to the Sand Island staging area to enter the restricted zone, nor would any vessels engaged in construction and pipeline deployment enter this area. There would be no direct or indirect impacts to military activities or areas as a result of either action alternative.

4.3.6 Parks and Recreational Facilities

In the analysis of trenchless construction technologies and their implications for potential offshore pipe routes, an eastern on shore microtunneled route beneath Kaka‘ako Waterfront Park was considered to connect the cooling station and the breakout point. Potential mobilization and migration of contaminants from beneath the park was an unresolved issue, and the route option was eliminated from further consideration.

Kaka‘ako Waterfront Park could still be affected by construction of the HSWAC system. The Preferred Alternative (Alternative 1) is to tunnel beneath the shoreline close to the ‘ewa end of the park. This area of the park is little used and approximately 5,000 square feet would have to be secured for equipment and materials staging and for excavation of a jacking pit. This would be a direct impact, but a temporary one, and the site would be returned to its former condition after use.

During the critical phase of pipeline deployment, portions of the park may have to be closed because of safety considerations. Holdbacks may have to be temporarily sited in the park as part of the tensioning system. This would be a direct impact, but a temporary one, and any areas used would be returned to their former condition after use.

Alternative 2 would not require the jacking pit near the ‘ewa end of the park, but could require that areas of the park be closed during the actual laying of the offshore pipes to allow establishment of on shore positions for attachment of tensioning cables.

Ke‘ehi Lagoon Beach Park or the canoe paddling activities based there would not be affected by either action alternative. If necessary, canoes could race or train alongside the stored, floating pipes in the lagoon. Passage between the pipes would be restricted, but there would be adequate corridors on either side of the pipes for maneuvering canoes or other small boats.

The only other park or recreational facility along the proposed distribution line route is Mother Waldron Neighborhood Park, located east of Keawe Street between Auahi and Pohukaina Streets. The distribution system pipes would be installed in Keawe Street and turn left at Pohukaina Street, away from the park. No portion of that park would be affected.

4.3.6 Utilities

Either action alternative would have substantial direct positive regional and island-wide impacts on demands for electricity, potable water and wastewater treatment. Benefits of the HSWAC system were summarized in Section 1.2 and include savings of more than 77.5 million kWh/yr of electricity, up to 260 million gallons of potable water, as well as elimination of up to 84 million gallons of sewage annually. The HSWAC system also would have substantial indirect positive impacts on utilities infrastructure including eliminating the need for 14 MW of new generation.

The cooling station would require electricity for the pumps, chillers, and other equipment as described in Section 2.5.4.6. Recent upgrades in the vicinity and project-specific connections would adequately serve the facility. New electrical utility service connections would be provided to the cooling station. HECO plans to install new feeders from their nearby substations that would provide electrical power to the project. These feeders would most likely be routed underground in ducts and manholes via two routes. The first route would start at the mauka side of the intersection of Ala Moana Boulevard and Ward Avenue and continue along Ilalo Street to the cooling station. A second route would begin near the intersection of Ala Moana Boulevard and South Street and continue along Ala Moana Boulevard and Keawe Street to the cooling station.

There is also adequate potable water, fire protection, sewer, and telecommunications capacity available at the site. Hawaiian Telcom would provide cabling to support the new facilities. On-site fire protection would be coordinated with the Fire Protection Bureau of the Honolulu Fire Department. Final confirmation of the adequacy of all utilities at the site would be made when construction drawings are submitted for review. These demands would constitute an unavoidable local negative impact, but would be greatly offset by the regional benefits.

HSWAC engineers have been meeting with representatives of all potentially affected utilities and participating in meetings of a utilities coordination committee to minimize conflicts with existing systems and scheduled improvements. Construction of the chilled water distribution system may require relocation of existing utility infrastructure. Where utility conflicts cannot be resolved by altering the route, new underground ducts and manholes would be constructed to reroute the existing facilities away from the chilled water distribution system.

Any damage to existing utilities from construction or operation of the HSWAC system would be repaired by HSWAC and their contractors.

The net effect of either action alternative on the power, water, and wastewater utilities would be to reduce regional demands. Localized demands at either potential cooling station site would be increased, but adequate capacities exist for the proposed facility as well as other potential developments in the area. In the downtown area, utilities demands would be lowered. This excess capacity would be available to other users, new or existing. The HSWAC project would serve existing buildings and populations; it would neither directly nor indirectly induce or constrain population growth. Potential developments in the downtown or Kaka‘ako areas would continue to be evaluated on their respective feasibilities. The existence of adequate utilities capacities in the region and at a specific site would be one of many factors considered in future development planning. If a future development were significantly less costly as a result of HSWAC’s operation, it could induce growth. However, it is unlikely that the presence of regionally adequate utilities capacities would alter the economics of a specific development because development costs would reflect the site-specific requirements of connecting to nearby utility mains rather than regional capacity. Likewise, HSWAC operations would not constrain population growth because additional utilities capacities would result.

4.3.7 Roadways and Traffic

Under either Alternative 1 or Alternative 2, impacts to traffic during construction would be unavoidable because of the trenching of the distribution system pipes. Most of the work would be done in City streets and off-peak hour lane closures would be necessary. A traffic management plan would be developed to identify specific potential traffic management strategies that can be implemented to minimize the effect of HSWAC construction on the downtown Honolulu roadway system. The traffic management plan would describe the construction management, public information program, construction schedule, construction traffic, and traffic control plans during construction. During development of the traffic management plan, all neighboring properties would be surveyed for access requirements, bus routes, stops and schedules will be reviewed, and locations of nearest emergency responders would be determined. The traffic management plan would be provided to City agencies prior to requesting the Street Usage Permit. The following restrictions would be employed to mitigate impacts:

- No work would be done during morning and afternoon peak traffic hours. Standard work hours would be between 8:30 am and 3:30 pm,
- All roads would be open during peak traffic hours before 8:30 am and between 3:30 pm and 5:30 pm,

- Off-duty policemen would be used to direct traffic when working on major/busy intersections,
- The contractor would provide a minimum of two lanes for through traffic unless the street is too narrow to make this practicable, in which case work would proceed in half the roadway while keeping the other half open to traffic and alternating the flow of traffic,
- When activities cross intersections, safe crossings would be provided for vehicles and pedestrians,
- When work is done in pedestrian walkways, an alternate walkway for pedestrians would be provided,
- Work on parallel streets would be performed at different times,
- Access to driveways would be provided when feasible,
- Depending on the situation, steel plates or jersey barriers shall be used to protect open trenches during non-working hours,
- No equipment storage or stockpiling would be done in the street right-of-way, and
- City requirements for repaving trenches would be followed by the contractor.

Mitigation measures to be implemented by the contractor would include:

- Pursuing night work to limit the disruption to local businesses and daytime traffic. In streets in close proximity to residential buildings, night work may be limited. Night work may be permitted between the hours of 7:00 pm and 5:00 am provided that the Contractor obtains a noise variance from the Hawai'i State Department of Health (DOH) Indoor and Radiological Health Branch,
- Ensuring conformance with the traffic management plan,
- Establishing a telephone hotline with advance schedule information and feedback capability,
- Providing construction schedules at least two weeks in advance to emergency providers, transportation companies, and businesses and residents in neighboring vicinities of the project site,
- Launching a project website with similar capabilities,
- Holding a community meeting prior to beginning construction, and
- Prohibiting lane closures during the following times:
    - Chinese New Year;
    - Thanksgiving Day and the following day;
    - Christmas Day and two weeks before and after;
    - King Kamehameha Day Parade;
    - Honolulu Marathon; and
    - Great Aloha Run.

Site-specific traffic control planning has been completed for a section of the distribution system installation, and plans are summarized as follows. Similar plans would be developed for the remainder of the distribution system route and included in the traffic management plan.

4.3.7.1 Keawe Street

The microtunnelling portion of the project from the cooling station to Keawe Street as it connects to the open trench portion would be scheduled so that only a one-time street closure would be necessary. Trench work along Keawe Street, however, would require that the portion of Keawe from the Auahi Street-Ala Moana Boulevard intersection to Pohukaina Street be closed to traffic. Two 42-inch diameter pipes with one foot separation between them would be installed. The trench width would be about 13 feet and the designed alignment of the pipes would take the middle portion of the street to avoid existing manholes and utility lines. In order to mitigate the possible traffic impact to this portion of Keawe Street, entry would only be permitted for local traffic. Steel plates would be positioned to provide vehicle access to driveways and pedestrian access to sidewalks. All pedestrian access to sidewalks would be ADA compliant.

During construction activities no street parking would be permitted on and only local traffic would be allowed access to Keawe Street between Pohukaina and Auahi Streets. The appropriate detour signage would be placed for commuters travelling in the vicinity of Keawe Street. The routes for the detour are described below.

Commuters intending to travel north on Keawe Street travelling north bound on Keawe Street and east bound on Auahi Street:
Traffic shall be routed east on Auahi Street, north on Coral Street, west on Pohukaina Street, and north on Keawe Street.

Commuters intending to travel north on Keawe Street travelling west bound on Auahi Street:
Traffic shall be routed west on Auahi Street, north on South Street, east on Pohukaina Street, and north on Keawe Street.

Commuters intending to travel south on Keawe Street travelling south bound on Keawe Street and west bound on Pohukaina Street:
Traffic shall be routed west on Pohukaina Street, south on South Street, east on Auahi Street, and south on Keawe Street.

Commuters intending to travel south on Keawe Street travelling east bound on Pohukaina Street:
Traffic shall be routed east on Pohukaina Street, south on Coral Street, west on Auahi Street, and south on Keawe Street.

Jersey barriers[29] would also be placed on the road to protect open trenches immediately adjacent to open traffic lanes. Night work between 7:00 pm and 5:00 am would limit the amount of disruption to local businesses.

Portion of Keawe Street fronting TMK 2-1-54:25 & 32
Work on Keawe Street would begin north of the southwestern driveway of TMK 2-1-54:21 (Diamond Head side of Keawe Street between Auahi and Pohukaina Streets). The Contractor shall maintain a minimum 10 ft wide lane of travel on the northwestern portion of the road. The Contractor would place off-duty police officers at the each end of construction to allow local traffic to access TMKs 2-1-54:21, 25 (mauka of the ‘ewa mauka corner of Auahi/Keawe Streets intersection) and 32 (mid-block, ‘ewa side of Keawe Street between Auahi and Pohukaina Streets). The northeastern driveway of TMK 2-1-54:21, the southeastern portion of Keawe Street, and the north bound lane would be closed at this time. Occupants and visitors to TMK 2-1-54:21 would be able to access the property through the southwestern driveway and other driveways on Halekauwila and Pohukaina Streets.

After work hours jersey barriers would be placed to protect the open trench from traffic and a minimum 10 ft wide north bound lane of travel would be opened. Street parking would not be allowed on this portion of Keawe Street after hours.

Portion of Keawe Street fronting TMK 2-1-54:28 continuing to the east bound lane of Pohukaina Street
Work on Keawe Street would continue from the previous location to the intersection of Pohukaina Street. Work in this location would involve the closure of the portion of Keawe Street abutting TMK 2-1-54:28 (ewa, makai corner of the intersection of Keawe and Pohukaina Streets) and the east bound travel lane of

[29] A jersey barrier is a protective concrete barrier used as a highway divider and a means of preventing access to a prohibited area.

Pohukaina Street. Access to the Alu Like facility on TMK 2-1-54:28 would be limited during construction hours. The Contractor would coordinate delivery times with the operators of Alu Like so that their operations would be affected as little as possible.

The northeastern driveway of TMK 2-1-54:21 would also be closed during this work. Access would be provided through the remaining driveway on the property.

Off-duty police officers would be placed on Pohukaina Street to allow vehicular traffic in both directions over a single lane. After work hours steel plates would be placed to cover the trenches and the street reopened.

4.3.7.2 Intersection of Keawe and Pohukaina Streets

This section addresses closure of the south bound lane of Keawe Street and the west bound lane of Pohukaina Street. Night work between 7:00 pm and 5:00 am would be desired because it would limit the amount of disruption to local businesses. The closure of the east bound lane of Pohukaina Street is addressed in the previous section.

The northeastern part of the intersection would be closed during construction in this area. Off-duty police officers would be placed on Keawe and Pohukaina Streets to allow two-way vehicular traffic over a single lane. Jersey barriers also would be placed on the road to protect open trenches immediately adjacent to open traffic lanes. After work hours steel plates would be placed to protect trenches from traffic and the lanes of travel would be reopened.

4.3.7.3 Pohukaina Street

During construction activities no street parking would be permitted in the vicinity of the work area. Jersey barriers would be placed on the road to protect open trenches immediately adjacent to open traffic lanes. Night work between 7:00 pm and 5:00 am would be desired because it would limit the amount of disruption to local businesses.

Portion of Pohukaina Street fronting TMK 2-1-54:28

Work on Pohukaina Street would continue from its intersection with Keawe Street. Work in this location would involve the closure of both lanes of Pohukaina Street fronting TMK 2-1-54:28. Traffic would be redirected to a minimum 10 ft wide temporary lane over the street parking along the west bound side. Off-duty police officers would be placed on Pohukaina Street to allow two-way vehicular traffic over a single lane. After work hours steel plates would be placed to protect the open trench from traffic and the lanes of travel would be reopened.

Portion of Pohukaina Street fronting TMK 2-1-54:27 & 22

Work on Pohukaina Street would continue north from the previous location to its intersection with South Street. Both east and west bound lanes would be redirected through the street parking on their respective sides. No street parking, including after hours, would be allowed during construction in this area. After work hours jersey barriers would be placed to protect the open trench from traffic. Night work would be limited in this area due to the close proximity of One Waterfront Towers located on TMK 2-1-54:22 (Diamond Head, makai corner of Pohukaina and South Streets).

4.3.7.4 Intersection of Pohukaina and South Streets

This section addresses construction activities at the intersection of Pohukaina and South Streets. Night work between 7:00 pm and 5:00 am would be desired because it would limit the amount of disruption to local businesses. However, night work would be limited in this area due to the close proximity of One Waterfront Towers located at TMK 2-1-54:22. Work across the intersection would be divided at its center and performed on its eastern side and then on its western side.

The No-Action Alternative would not involve trenching for distribution pipes and thus no traffic impacts would result.

4.3.8 Ambient Noise and Vibration

State regulations restrict construction noise to certain levels during the hours of 7 a.m. to 6 p.m. Monday through Friday and 9 a.m. to 6 p.m. on Saturday. Noise limits may be temporarily exceeded during construction of either action alternative, and a permit would therefore be required. Because some HSWAC construction would be scheduled to take place outside of the permitted hours, a variance would be required. As indicated above, special considerations would be given to minimizing after hours noise in the vicinity of residential buildings near the distribution route.

Typical noise mitigation measures that would be employed, in addition to the time of day restrictions, include use of proper mufflers on any gas or air-powered equipment and restricting night work to less noisy tasks.

Offshore construction operations under either action alternative would create noise from both vessels and equipment, and vibration from pile driving. It is not anticipated that this noise would exceed regulatory levels at the shoreline and vibrations from construction of the receiving pit would be damped by the substratum without affecting any shoreside structures.

During operation of the HSWAC system no ambient noise impacts are expected. Existing noise from cooling towers would be eliminated at buildings connected to the HSWAC system.

The No-Action Alternative would create no construction noise or vibration impacts, but neither would it eliminate cooling tower noise from buildings connected to the HSWAC system.

4.4 SOCIAL AND ECONOMIC RESOURCES

Neither action alternative would have any significant impact on the social character of Honolulu. The project would have positive economic impacts on system customers because SWAC systems provide customers with reduced and stable cooling costs as a result of their relative independence from fuel price escalation. In addition, large-scale district cooling systems have lower operating and maintenance costs than individual building air conditioning systems. Other Oʻahu businesses and residents would indirectly benefit because the HSWAC system would eliminate about one year of HECO's projected load growth. This reduced need for expensive new electricity generation capacity would help to keep Oʻahu's electric rates lower for longer.

The HSWAC project may displace conventional on-site chiller and cooling tower equipment and service vendors in the downtown area. The HSWAC project would have a capacity of 25,000 tons of cooling from conventional on-site chillers and cooling towers from an estimated 48,000 tons of potential cooling available from buildings in the intended service area.

The HSWAC project would generate millions of dollars in construction spending. In addition to construction jobs, long-term jobs would also be created. Other local economic development benefits would accrue from money that stays in Hawaiʻi, and would not be used to purchase oil. The net effect is expected to be a positive impact on the social and economic character of Honolulu.

Downtown Honolulu and Kakaʻako (the service area for the HSWAC project) are in an enterprise zone. The State of Hawaiʻi administers an enterprise zone program that provides a variety of benefits to eligible businesses in these designated areas. The purpose of providing benefits to qualified businesses in enterprise zones is to stimulate business and industrial growth in areas which would result in neighborhood revitalization of those areas by means of regulatory flexibility and tax incentives. During the 2007 session of the Hawaiʻi State Legislature, legislation was introduced to add SWAC district cooling systems to the definition of "qualified business" to qualify for state enterprise zone benefits. While this initiative was not successful, the effort produced useful estimates of the potential economic impacts of the HSWAC system.

In order to justify the addition of SWAC as an eligible technology for enterprise zone benefits, an Input/Output analysis was completed to determine the fiscal and economic impact of local expenditures[30] in Hawaiʻi during the design, construction and operation of the HSWAC system and for a composite of alternative, stand-alone, conventional cooling systems in individual HSWAC customer buildings.

Appropriate Type II Final Demand Multipliers were applied to local expenditures in applicable industry categories to determine fiscal impacts (State taxes) and economic impacts (output, earnings, and jobs). Type II Final Demand Multipliers used in this analysis were taken from "The 2002 State Input-Output Study for Hawaiʻi."[31]

During the assumed 25-year lifetime of the HSWAC system, local spending would amount to more than $293 million. The calculated output based on this local spending is $484 million. This amount of local spending would also generate $166 million more in earnings and 3,850 additional full-time equivalent person-years (FTEPY) of jobs[33]. This is equivalent to 145 full-time jobs for 26.5 years. The actual useful lifetime of a SWAC system can be more than 50 years. Thus, the above benefits are likely a significant underestimate. The No Action Alternative would not generate these economic benefits. State tax revenues would be $24 million more under the Preferred Alternative than under the No Action Alternative.

4.5 VISUAL RESOURCES

Under either action alternative, after construction, the only visible portion of the HSWAC system would be the cooling station. Alternative 1, the Preferred Alternative, would have the cooling station in a very inconspicuous location makai of a massive structure that blocks mauka-makai views from Keawe Street to Coral Street (see Figure 2-35). Photographs of the site from all angles are included in Appendix G. No visual impacts would result from construction of the cooling station under Alternative 1.

Alternative 2 would place the cooling station on Pier 1. Currently, there is a warehouse on the site that obstructs ground level views toward the inner part of Honolulu Harbor. From the overlooking hill in Kakaʻako Waterfront Park, views toward Honolulu Harbor and ʻewa are industrial in character and somewhat obstructed by stacks of shipping containers. Photos of the site are included in Appendix G. The height of the cooling station would be similar to that of the warehouse, but the design would be more architecturally appealing.

The No Action Alternative may have minor negative effects on views where cooling towers are visible.

[30] Most of the equipment, materials, and supplies that would be used in the construction of the HSWAC system would be manufactured out of state, and some of the required labor and services would also be sourced from out of state. In general, bond financing is assumed to come from out of state. The subject analysis considers only those expenditures that would be made in Hawaiʻi. This includes most of the required labor and services. A significant amount of equity financing would come from within Hawaiʻi and most of the returns on this equity investment are assumed to be expended in Hawaiʻi. Various State taxes are assumed to be paid in Hawaiʻi and expended here. The local share of personal consumption expenditures was corrected for exports, social security, medicare, retirement benefits, etc.

[31] "The 2002 State Input-Output Study for Hawaiʻi," Research and Economic Development Division. Department of Business, Economic Development, and Tourism. State of Hawaiʻi. June 2006. http://hawaii.gov/dbedt/info/economic/data_reports/2002_state_io/2002-input-output-study.pdf/download.

[33] This represents the number of direct, indirect, and induced jobs provided by local spending. Jobs = Local Spending x Appropriate Type II Multipliers.

4.6 NATURAL HAZARDS

The seawater pipelines would be vulnerable to tsunami, storm surge or earthquake. Previous large diameter pipeline installations in Hawai‘i and elsewhere and their responses to natural hazards were studied during the preliminary design phase of the HSWAC project, and this information used in design of the anchoring system for the seawater pipelines. Elevation of the pipelines off the bottom as would occur because of the anchor collars would greatly reduce lateral stresses on the pipelines. Steel pipe piles, filled as required with concrete, would secure the pipelines from the breakout point to the proposed end of the diffuser at 150 ft deep.

Under Alternative 1, the cooling station would be located approximately 1,000 feet inland of the tsunami evacuation zone. The cooling station and distribution piping would be located within FIRM Zone X, which is a Non-special Flood Hazard Area and corresponds to areas outside the 500-year flood plane. A Non-special Flood Hazard Area is an area that is a low to moderate-risk flood zone, and is not in any immediate danger from flooding caused by overflowing rivers or hard rains (http://www.floodsmart.gov, 2005).

The makai half of the existing Pier 1 warehouse, where the HSWAC cooling station would be located under Alternative 2, lies within Flood Hazard Zone A. Zone A includes areas with a 1% annual chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones.

Under either alternative, the cooling station would be susceptible to damage from an earthquake. Natural hazard impact mitigation was one of the criteria used in evaluating potential sites for the cooling station. The cooling station would be built in accordance with the City and County of Honolulu Building Code, which includes standards for wind and seismic loading.

Beyond reducing the vulnerability of the facilities to natural hazards by appropriate siting and design, minimization of the effects of hazard-related damage may be possible in some situations. For example, if power were lost in the Kaka‘ako area, backup power would be provided to run seawater and chilled water distribution system pumps. However, it would not be possible to run the auxiliary chillers. Cooling would be possible to deliver to buildings with power still available, however, at a slightly higher supply temperature of 46° to 47°F.

Infrastructure supporting the No Action Alternative, including power stations, substations, transmission lines and distribution lines are all susceptible to damage due to natural hazards. To the extent possible, these facilities have been sited and engineered to withstand anticipated forces, but protection from all extreme events is not economically feasible.

4.7 MARINE RESOURCES

The No Action Alternative negatively affects marine resources through the disposal of electrical generating station cooling waters in coastal receiving waters. Under either action alternative, these effects indirectly would be reduced to the extent the demand for electricity is reduced by implementation of the HSWAC system. The remainder of this section describes the effects of the action alternatives.

4.7.1 Bathymetry, Geology and Sediments

None of the alternatives would have significant impacts on bathymetry or marine geology. Under either action alternative, construction impacts would be mainly associated with excavation of a receiving pit for the microtunneling machine at the breakout point. Identified temporary impacts would include elevated turbidity surrounding the excavation area and minor physical alteration of the marine bottom. Impacts would be minimized by implementing Best Management Practices (BMPs) during construction, including proper silt containment and proper handling and disposal of excavated material to minimize release of sediments.

As described in Section 2.5.3.3, the receiving pit at the off shore end of the microtunnel shaft would be approximately 30 feet by 40 feet (1,200 ft^2) in plan view and 20 feet deep. About 2,700 cubic yards of material would be removed from the pit. To contain sediments from the excavation process, sheet piles would be installed around the pit and extend about 10 feet above the seafloor.

4.7.2 Marine Water Quality

The No Action Alternative would continue to use electricity for air conditioning all downtown buildings. This electrical demand generates additional cooling water that is disposed of into offshore marine waters, raising ambient temperatures.

Under either action alternative, marine water quality would be impacted both during construction and operation of the seawater pipelines. In development of the conceptual design of the HSWAC system, it was always assumed that some form of trenchless pipeline installation would be used from the cooling station to the offshore breakout point. From that point, however, alternatives to protect the pipelines at depths susceptible to severe storm surge were evaluated. The initial concept was trenching and burying the pipelines from the breakout point to depth of approximately 80 ft and securing them with gravity anchors at deeper depths. This was considered the most protective of the pipelines and the most economical alternative. It was acknowledged that this would create greater impacts to water quality and habitat than surface mounting the pipelines from the breakout point seaward. Subsequent analyses indicated that surface mounting with piles would adequately secure the pipelines from the breakout point to the end of the diffuser and that that alternative would be less expensive and reduce the potential impacts to water quality and marine communities. Hence, an alternative involving submarine trenching was not carried forward.

Under either action alternative, during construction and pipeline installation, sources of impacts would include excavation of the microtunnel receiving pit at the offshore breakout point and deployment of the pipeline anchor collars on the seabed. The receiving pit would be lined with sheet piling extending about 10 ft off the seafloor, but some turbidity would be generated during placement of the sheet piling and excavation of the pit. BMPs, including silt curtains if feasible, would be employed to minimize turbidity in surrounding waters. If silt curtains are required, the contractor may have to wait for favorable ocean conditions to excavate the receiving pit. Silt, or turbidity, curtains are not generally recommended for open ocean operations or in areas where currents may exceed one knot. High winds, breaking waves, water turbulence, and significant tidal fluctuations may also decrease efficiency or result in failure of silt curtains. At the breakout point, currents may exceed one knot at times, and high winds and turbulent conditions may occur. While silt curtains can be effective in reducing water column turbidity, they do not trap all the turbid water. They must be set with a 1-2 foot gap at the bottom which allows dispersion of turbid water to flow under the curtain, or the sediment buildup on the inside will collapse the curtain. Consequently, silt curtains are not as effective at preventing accumulation of sediments on the bottom as they are at reducing water column turbidity. If the overriding concern is to limit deposition of sediments on the benthos, including corals, silt curtains may not be the most appropriate or effective mitigation.

Turbidity from backfilling the receiving pit would be minimized by using only pre-washed, 3/8-inch to 2-inch crushed basalt gravel. Other sources of turbidity would include pile driving, if required to secure vessels, and deployment of vessel and pipe anchors. These would be brief, transient effects.

Turbidity is a characteristic of many coastal waters in Hawaiʻi. Turbidity can be caused by natural events such as storms, heavy rains and floods, which create fast running water that can carry particles and larger-sized sediment. In the coastal portion of the project area, turbidity is caused by runoff from the land during and after rainfall and resuspension of bottom sediments by waves and currents. Marine communities in the project area are adapted to occasionally turbid conditions.

As the pipeline is lowered to the seabed in the deployment process, it could be expected that impact of each anchor collar with the sea floor would result in suspension of a small amount of sediments. This also would be a brief transient series of events.

The HSWAC seawater would return slightly warmed deep seawater to relatively shallow depths. The character of the water would not be changed from that at the intake location except for being warmed approximately 9-13°F. As the ambient condition of the unmodified deep source water is in violation of many of the State's water quality standards, so too would the return water be in violation of those standards (even though the source waters are classed "oceanic" and the receiving waters are classed "open coastal," with generally higher thresholds for violations). Parameters that would not meet standards for open coastal waters (wet coastline) include those for total nitrogen, ammonia nitrogen, nitrate plus nitrite nitrogen, total phosphorus, dissolved oxygen and temperature modification. Consequently, a zone of mixing (ZOM) would have to be approved to permit these exceedances in a specified area. In order to ensure water quality standards would be met outside the ZOM, a diffuser system was designed for the end of the return seawater pipe.

In preliminary design, the design of the proposed diffuser was optimized. A number of design trade-offs were considered including environmental compliance, hydraulic penalty (operating cost), complexity of structure (fixed cost), etc. The goal was to identify a discharge system design that would achieve lowest material and operational cost, while minimizing environmental impacts.

The hydraulics and dispersion characteristics of the following design for the return water system were analyzed:

- 54-inch (ID = 50.81-inch) diameter pipeline from tunnel breakout to a depth of 150ft,
- A 25-port diffuser section between the depths of 120 and 150 ft (~400 ft long),
- Diffuser to be orientated parallel to intake (i.e., perpendicular to shore),
- Ports are vertically facing, equally spaced – approx 15 ft on center, and
- Ports are 8 inches in diameter, basic orifices (rounded) in the pipe wall.

The CORHYD computer program was used to quantify flows and losses, and subsequently select an optimal diffuser design. CORHYD performs calculations based on the application of steady continuity and work-energy equations between ambient fluid at the discharge points and the effluent inside the discharge pipe. The objectives of this optimization were 1) to yield a homogenous discharge distribution along the diffuser, 2) minimize the total head, and 3) prevent sedimentation or ambient water intrusion into the diffuser. The results indicated that:

- The flows through the ports would be quite well balanced with only about a 10% variation in flow rate along the diffuser.
- The greatest port velocity would be observed in port #1 (farthest from shore), 11.7 fps.
- The smallest port velocity would be observed in the port nearest to shore, 10.5 fps.

The CORMIX computer program was then used to analyze the plume from the discharge diffuser. Input parameters used in the analyses were as follows:

- Flow rate 44,000 GPM,
- Discharge water depth 120-150ft,
- Discharge water temperature 53°F (worst case),
- Receiving water temperature 77°F,
- Discharge water density 64 lb/ft^3,

- Receiving water density 63.88 lb/ft^3,
- Bottom roughness, DW 0.05, and
- Windspeed 11 mph.

Three different current cases were considered (these were selected based on review of several data sets in the vicinity of the proposed discharge):

- Low current – 0.16 fps,
- Mean Current – 0.46 fps, and
- High current – 2.0 fps.

The primary objective of this modeling effort was to identify the level of dilution that could be achieved by the diffuser system in each of the current scenarios. The temperature difference between the discharge waters and the receiving waters was identified as a significant concern in scoping. Interestingly, temperature was not found to be the governing pollutant, and a dilution of only 18 would be required to satisfy water quality standards for temperature. Review of water quality data for the intake location (1,600 to 1800 feet deep) showed that the governing pollutant for this discharge would be nitrate + nitrite nitrogen, where deep ocean measurements suggest the effluent stream will have a concentration of ~500 μg/l. To meet water quality standards, a dilution of 100 would be required.

The conclusions of the modeling exercise are:

- The design of the diffuser facilitates significant near field initial mixing of the return water for all current cases considered.
- The discharge near-field behavior is dominated by the negative buoyancy of the plume. Surfacing of the plume (at a low dilution) is not anticipated under any current conditions; after initial mixing the plume will have a tendency to sink. This is considered desirable from a water quality standpoint, as this represents a general movement away from the photic zone where the nutrients could have biostimulatory effects.
- Some plume-seabed interaction is anticipated in the immediate vicinity of the diffuser; however, significant initial dilution implies plume properties will be close to ambient when the seabed is encountered by the plume. Within 10 feet from the centerline of the diffuser the dilution will be sufficient to meet water quality standards for temperature, a characteristic of the return water that could have an impact on benthic communities. Unfortunately, CORMIX does not provide specific results at the seabed, but this can be conservatively estimated by considering centerline dilution plots.
- Under low current conditions, port velocity of the diffuser provides good initial mixing, but the weak ambient flow allows significant upstream intrusion of the plume. This is presumed acceptable, as the zone of initial mixing is not directionally restricted (ZOM considered on a radial distance basis, currently assumed to be 1,000 ft. The required dilution of 100 is reached within 148 ft of the diffuser centerline.
- Under high current conditions, the initially mixed plume is rapidly advected away from the diffuser, and the plume is dispersed rapidly by the turbulent energy associated with the high flow. The required dilution of 100 is achieved within 59 ft of the diffuser centerline.
- Under mean current conditions the required dilution is reached within 128 ft.

In addition to the effects of the return seawater flow on ambient water quality, the temperature fluctuations of the intake water temperature would affect system operations. These effects could be mitigated with the following measures:

1. It might be possible to predict the temperature fluctuations using a model such as the University of Hawaiʻi - Mark Merrifield's Model to give advance warning of what is coming days in advance.

2. Measurements of the temperature fluctuations inside the pipe at some point offshore, say at 120 ft depth, could be taken. This would give a 20-minute warning of a temperature rise and an indication of the persistence of the peak.
3. The offshore temperature fluctuation is on a nominal 23-hour cycle and the AC demand is on a 24-hour cycle. Because these are so close, there would be long periods where they are out of phase and periods where the AC demand and the intake temperature maxima are aligned. Any compensation mechanism implemented would have to deal with these periods of worst-case alignment.
4. Auxiliary chillers would be utilized to mitigate the impacts of variations in seawater supply temperatures and to provide a constant 44°F chilled water supply temperature to customers.

The high density polyethylene (HDPE) pipes themselves would be virtually inert in seawater. HDPE is a petroleum-based plastic used for piping and containers for consumer products. Piping applications include drainage, sewage and potable water. Also known as plastic #2, HDPE is the second most used bottle plastic behind polyethylene terephthalate (PET or plastic #1). HDPE can be found in milk jugs, detergent bottles, medicine bottles, motor oil bottles, shampoo bottles, frozen juice containers, coffee containers and baby bath bottles. A 2006 study found that HDPE drainage pipes leached volatile organic carbons (VOCs) that could contaminate groundwater. Volatile organic compounds are hydrocarbons (excluding methane) which are capable of forming oxidants (particularly ozone) by reactions with nitrogen oxides in the presence of sunlight. Major sources of VOC's are vehicles, solvents and process industry emissions. The HDPE pipes would have limited exposure to sunlight. Additionally, HDPE pipes in the HSWAC system would carry cold seawater rather than freshwater. The low temperature and the tendency of microbiological biofilms to form on structures in seawater would both retard diffusion of VOCs from the pipes. VOCs are ubiquitous in the marine environment; some, including formaldehyde, are produced and utilized in situ by phytoplankton. All are subject to bacterial degradation. Quantities potentially leaching from the HSWAC pipes and passing the air-water interface would be miniscule and insignificant compared with those from vehicular emissions.

4.7.3 Coral Communities

A marine survey was conducted in the vicinity of the proposed breakout point and the report of that survey may be found in Appendix C. Results are summarized in Section 3.7.1.3. It should be noted that the conclusions expressed in that report refer to the since discarded alternative of HDD with a seaward trench from the breakout point to the diffuser. Both action alternatives now consist of microtunneling and surface mounting the pipe from the breakout point seaward, thus greatly reducing the potential for turbidity impacts on corals to the west of the pipeline.

The proposed breakout point for Alternative 1 was selected to avoid coral reefs or coral-dominated communities. The breakout point is within the biotope of dredged rubble where corals are very sparse. The locations of the anchors or piles to be used to hold the pipes during deployment would be close to and slightly shoreward of the breakout point, but within the same biotope. The biotope of dredged coralline rubble is the result of dropping dredge tailings east of the entrance channel to Honolulu Harbor. These materials appear to have been deposited along the seaward edge of the limestone platform where a natural break occurs from about 40 to 60 ft. The area of dredge tailings is best developed close to the Honolulu Harbor entrance channel.

The proposed breakout point for Alternative 2 also would be in the biotope of dredged rubble. However, unlike the situation off shore of the Alternative 1 breakout point where dredged rubble gives way to sand bottom further off shore, seaward of the Alternative 2 breakout point is an area of relatively high coral coverage frequented by recreational divers. Emplacement of the collars supporting the pipes would affect more live coral under Alternative 2 than Alternative 1.

Benthic and fish communities are poorly developed on the rubble slope or sand/rubble, and the deployment of the pipe under either action alternative would have a minor direct negative impact on these communities. The deployed pipe would probably serve as a stimulus for the development of sessile benthic species and the shelter created by the pipe would locally enhance fish communities (Appendices C and D) ultimately benefitting development of these communities.

Focusing on the area between the entrance channel of Honolulu Harbor and the old sewer pipe just east of the Kewalo Basin entrance channel, rough approximations of the area occupied by the three pertinent biotopes fronting the Kakaʻako Waterfront Park were made. These areas are:

- Biotope of scoured limestone = 33 ac,
- Biotope of scattered corals = 74 ac, and
- Biotope of dredged rubble = 33 ac.

Again, making a rough estimate of coral coverage in each biotope, coral coverage in the biotope of scoured limestone is assumed to be zero. In the biotope of scattered corals cover is about 5%, and about 0.01% in the biotope of dredged rubble. In the area directly along the western side of the entrance channel to Honolulu Harbor, the coral community occupies an area of about 3 ac, and has a mean coverage of about 5%. The total surface area of live coral coverage in these areas is therefore:

- Biotope of scattered corals = 3.7 ac or 161,000 ft^2 of live coral,
- Biotope of dredged rubble = 1,450 ft^2, and
- Along the western edge of the entrance channel = 6,500 ft^2.

As described in Section 2.5.3.3, 89 combination collars covering 6,788 ft^2 would be deployed from the breakout point to the end of the diffuser at 150 feet deep. The breakout pit itself would disturb 1,200 ft^2 (Section 4.7.1). The total disturbed surface area would therefore be 7,988 ft^2. Under Alternative 1, all of this disturbance would take place in the biotope of dredged rubble, where live coral coverage is a very sparse 0.01%. Assuming an even coral distribution over the biotope would result in about 0.08 ft^2 of live coral being destroyed. Assuming some additional coral loss by construction operations (vessel anchors, etc.), it is still likely that no more than a few square feet of living coral would be destroyed (less than 0.1% of coral in the biotope of dredged rubble between Honolulu Harbor and Kewalo Basin).

Of somewhat more concern than the very sparse coral resources in the biotope of dredged rubble, are the more abundant corals on the western side of the Honolulu Harbor entrance channel, which could be impacted by turbidity generated by construction activities. Currents in the vicinity, however, generally run toward the west/southwest, and due to the fresh water impacts of Honolulu Harbor, surface currents in the entrance channel would tend to flow out of the harbor, regardless of tidal phase. These factors would act to minimize transport of suspended sediments across the Honolulu Harbor entrance channel to the area of somewhat greater coral coverage. In addition, a water quality monitoring program would be implemented during construction, so that activities could be modified or suspended under conditions resulting in excessive turbidity in areas of higher coral coverage.

A substantial amount of habitat would be created by the pipe collars. As can be calculated from the dimensions of the combination pipe collar shown on Figure 2-14, each of these 89 collars would have an exposed surface of about 370 ft^2. For every square foot of bottom covered, there is a gain of about 5 square feet of hard substratum available for benthic recruitment. Furthermore, the substratum that would be created by the collars would be far superior to most if not the entire natural substratum being covered. It is likely that the HDPE pipes themselves would be a lower quality surface for coral colonization than the concrete collars. However, if the experience at NELHA is any indication, the pipe surfaces would be colonized by soft-bodied forms, such as anemones. Assuming the complete circumferences of the two pipes are available for colonization, and the distance from the breakout point to the end of the diffuser is about 1,800 feet, then about 55,080 ft^2 of new surface would be available on the exterior of the pipes. Combined with the total 32,734 ft^2 of exposed surface on the collars, this provides about 87,800 ft^2 of new surface area available for colonization by sessile benthic organisms. This is approximately 13 times the surface area covered by the collars. In addition, the greater vertical relief afforded by the collars (height = 79 inches) would be far greater than found on existing hard substratum in the pipeline corridor. This greater vertical relief translates into greater vertical distance of recruiting corals and other invertebrates from the scour caused by the movement of sand and rubble during periods of high surf. Thus the presence of the pipe collars would result in significantly greater coral community development than presently exists in the area.

Similarly the standing crop of fishes on a reef correlates with the degree of vertical relief of the substratum. If structural complexity or topographical relief is important to coral reef fish communities, then the addition of materials to increase this relief in otherwise barren areas may serve to locally enhance the biomass of fish present. Such manipulations are well-known and usually take the form of artificial reefs. Artificial reefs in Hawaiian waters may serve to increase fish standing crops to more than 0.2 lb/ft^2 (Brock and Norris, 1989). The HSWAC pipelines would, in effect, constitute artificial reefs that would be expected to greatly enhance resident fish populations.

Identified temporary impacts of pipeline installation are elevated turbidity surrounding the excavation area and minor physical alteration of the marine bottom. These impacts would be further minimized by implementing Best Management Practices (BMPs) during construction, including:

- The employment of standard BMPs for construction in coastal waters, such as daily inspection of equipment for conditions that could cause spills or leaks;
- Cleaning of equipment prior to deployment in the water;
- Proper location of storage, refueling, and servicing sites; and
- Implementation of adequate spill response and storm weather preparation plans.

Water quality monitoring would be conducted during the construction period. Pursuant to section 401 of the Clean Water Act, HSWAC would obtain and comply with the conditions of a Water Quality Certification from the HDOH. The proposed action would comply with the conditions of the NPDES permit required by the Hawaiʻi DOH.

Although the area affected by the return seawater plume around the diffuser would be small, negative effects on corals in that area would likely result. Historically, it has been recognized that the distribution of coral reef communities is restricted to low latitudes where water temperatures are relatively warm. Field observations and laboratory experiments established 16°C (60.8°F) as a thermal stress threshold for most reef corals (Mayor, 1915). More recent laboratory studies in Hawaiʻi have indicated that individual hermatypic (reef-building) corals do not persist at temperatures below 18°C (64.4°F) (Jokiel and Coles, 1977; Coles and Jokiel, 1978). Corals may respond to anomalously low temperatures in a manner similar to how they respond to anaomously high temperatures, that is, by bleaching. Reef-building corals have an obligate symbiotic relationship with single-celled algae known as zooxanthellae. The algae contribute to the relationship by using dissolved nutrients and sunlight to produce carbon through photosynthesis. When bleaching occurs, the corals expel a high percentage of the algae and remaining algae may lose much of their photosynthetic pigments. This effect may be reversible if the cause of the bleaching is removed in a reasonable amount of time. Persistent exposure to temperatures below the thermal threshold (which may vary with species and preconditioning) would result in mortality.

Some studies suggest that temperature may not be an absolute, direct limitation to corals. There are many coral reefs in more variable environments where temperatures regularly fall to 13°C (55.4°F) and lower, at least for short periods of time (Coles and Fadlallah, 1991). It is apparent from these and other studies that there is the possibility of selective adaptation or physiological acclimation that permits corals to persist at lower temperatures than previously assumed.

The HSWAC return seawater discharge would constitute, in effect, a permanent region of upwelling. Upwelling brings a surplus of dissolved inorganic nutrients from deep to shallow water which can increase zooxanthellae densities by a factor of two or three (Buchheim, 1998). Consequently, within the Zone of Mixing, coral growth and/or survival may be inhibited by cold water temperatures, but outside this zone, the nutrient supplements may enhance coral growth through increased densities of zooxanthellae.Impingement and Entrainment

Operation of the intake may result in impingement and entrainment of marine organisms. Clean Water Act (CWA) Section 316(b) requires the USEPA to ensure that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impacts associated with impingement and entrainment of organisms in intake pipes.

Current USEPA regulations are designed to control the impact of shallow water intakes in rivers, bays and over the continental shelf. Deep ocean intakes are a relatively new development that does not present the risks to resident aquatic communities that shallow intake structures do. Experience with deep ocean intakes has been gained at the Natural Energy Laboratory of Hawaiʻi (NELH) at Keāhole Point on the Big Island. NELH has the largest seawater supply system with regards to size and capacity, and employs the deepest large diameter pipeline in any ocean throughout the world. NELH has three deep seawater pipelines. Installed in 1987, NELH’s 40-in pipeline pumps 5,000 gallons/minute of 43°F water to the surface from a pipeline 2,010 ft deep. The offshore pipe length is 6,284 ft. Also installed in 1987, an 18-in pipeline extends offshore at a length of 6,180 ft, and pumps 3,000 gallons/minute from 2,060-ft deep. NELH’s largest pipeline, 55-in diameter, recently came on line. This pipeline extends offshore 10,247 ft, and intakes water at a depth of 3,000 ft. Overall, NELH does not have issues with impingement or entrainment, organisms clogging the pumps, or with fouling delivery pipes.

At NELH, a half inch mesh intake screen box covers the 40-in sump, and the filter is checked every four-six months. Usual findings include small fish (2-4 in), shrimp, and invertebrates. The total volume of organisms found in the filter after four-six months varies from a half to one gallon. The 18-in system has a stainless steel mesh over the intake with a mesh size of 3/8 in-1/2 in. NELH has not experienced impingement issues with this pipeline.

If fish are entrained in the pipeline they usually die before they reach the surface due to changes in atmospheric pressure that cause their swim bladders to burst. Invertebrates, however, are unaffected by the pressure change and can live if entrained in the pipe line. NELHA does not filter the deep seawater before it enters the heat exchangers. The heat exchangers have never been opened or serviced, and have not been fouled or ever required cleaning.

Alternative 1, the Preferred Alternative, would utilize the following approaches to reduce entrainment (and impingement):

- The intake location is approximately four to five miles offshore at a depth of 1,600-1,800 ft. The euphotic zone (zone of photosynthetic light) typically does not extend beyond the first 330 ft of depth. At the intake depth biological productivity is much less than at shallower depths and the lower density of organisms reduces the potential for impingement and entrainment.
- No intake screens would be used at the end of the pipe, and the velocity of the intake (approximately 5 ft/sec.) would limit fish entrainment.
- Use of variable speed pumps provide for greater system efficiency and reduced flow requirements (and associated entrainment).

Alternative 2 would include a grate or screen over the intake. The design of such a structure does not currently exist, and design and fabrication would add significantly to project costs. According to project engineers, such a screen, or grate, would have to have a large surface area to not significantly reduce intake flow. A cylinder or cone shape of polyethylene, stainless steel, or titanium, might be appropriate. A copper structure would have even better anti-fouling properties.

Inclusion of a grate or screen on the intake would create problems in installation and operation. During installation, the end of the intake pipe would be covered by a blind flange. Air hoses providing high pressure (75 psi) would be arrayed inside the pipe. The only practical solution would be to attach the screen after pipe installation using a work class ROV. Such an ROV would be available during the deployment. However, should maintenance be required due to fouling or any other reason, an appropriate work class ROV would have to be mobilized from the mainland at a cost of at least $500,000. In addition, the system might have to be shut down during the maintenance operation which could require up to two weeks.

4.7.4 Protected Species and Habitats

Under either action alternative, work at the breakout point would span about seven to nine months, so there would be obstructions (platform, vessels, etc.), at least intermittently, in shallow water for that duration. Work however, would be confined to the area within the receiving pit. It would be unlikely for a whale to enter waters that close to the shore in Kaka‘ako, but even if that were to happen, the slow movement of work vessels would not present a hazard and the submarine structures (sheet piles, mooring piles, etc.) would be readily apparent. It is more likely that sea turtles would pass through the area, but again, stationary structures or slow moving vessels could easily be avoided by turtles. It is not expected that the slowly moving vessel traffic associated with the project would result in significant impacts to sea turtles.

NMFS recommends the following BMPs be followed to reduce or eliminate adverse effects on protected marine species through potential interactions with in-water activities such as boat operations or diving.

1. Constant vigilance shall be kept for the presence of Federally Listed Species;
2. When piloting vessels, vessel operators shall alter course to remain at least 100 yards from whales, and at least 50 yards from other marine mammals and sea turtles;
3. Reduce vessel speed to 10 knots or less when piloting vessels in the proximity of marine mammals;
4. Reduce vessel speed to 5 knots or less when piloting vessels in areas of known or suspected turtle activity;
5. Marine mammals and sea turtles should not be encircled or trapped between multiple vessels or between vessels and the shore;
6. If approached by a marine mammal or turtle, put the engine in neutral and allow the animal to pass;
7. Unless specifically covered under a separate permit that allows activity in proximity to protected species, all in-water work will be postponed when whales are within 100 yards, or other protected species are within 50 yards. Activity will commence only after the animal(s) depart the area;
8. Should protected species enter the area while in-water work is already in progress, the activity may continue only when that activity has no reasonable expectation to adversely affect the animal(s); and
9. Do not attempt to feed, touch, ride, or otherwise intentionally interact with any protected species.

Deployment of the seawater pipes would extend the work area much farther seaward. Installation of the intake and return pipes would preferably occur in winter when ocean conditions along the southern shores of O‘ahu are calmer than other times of the year. However, winter is also when humpback whales migrate into Hawaiian waters to breed and calve. The volume of vessel traffic in Māmala Bay makes the habitat less attractive to whales than more isolated coastal areas, but humpbacks still occur in the area. Offshore project activities would be done from stationary or very slowly moving vessels decreasing the risk of a collision with a project vessel. Most of the pipeline installation work would be done close to, or on the sea floor rather than in the water column. Installation would be limited in duration to about 24 hours. There is a concern, however, about a juvenile or adult whale striking a partially deployed pipe during the critical hours when the pipe is being sunk into place. A lookout system such as a picket line of tender vessels would be positioned around the work area during the deployment operation to minimize this risk, as well as to temporarily secure the area from other vessel traffic.

Construction activities would cease if listed marine species are observed entering the active project construction site, and work would be allowed to resume only after the listed species departs the construction site on its own volition. The Pacific Islands Regional Office of the National Marine Fisheries Service (NMFS) would be notified of each such occurrence.

Marine mammals and sea turtles have a much greater tolerance to temperature extremes than do corals. Marine mammals in particular are known to forage below the thermocline. In any event, if the temperature in the vicinity of the return seawater discharge was unsuitable for a mammal or sea turtle for any reason, such highly motile animals would simply leave the area. To the extent that the elevated dissolved inorganic nutrient concentrations in the artificial upwelling created by the discharge stimulated benthic algae downstream of the diffuser, turtle foraging habitat could be enhanced. No further impacts of the return seawater on protected marine species would be expected.

The Pacific Islands Regional Office of the National Marine Fisheries Service (NMFS) would be notified of each such occurrence.

It is unlikely that Hawaiian petrels would forage in Māmala Bay, and no impacts to this species would be expected from the proposed project. The HSWAC project would not affect waterbird nesting or foraging habitat. Essential Fish Habitat.

The marine portions of either action alternative would take place within EFH for all life stages of pelagic, bottomfish, crustacean, and coral reef management unit species (MUS). In addition, the project area contains bottomfish HAPC. Construction activities within EFH would be temporary and any impacts transient. A small area of seafloor at the site of the receiving pit would be permanently modified, and the pipelines extending from the receiving pit seaward would represent new habitat for colonization by sessile organisms and aggregation of fish.

Within the Zone of Mixing around the return seawater diffuser, the benthic and water column habitat would be altered. The water temperature would be colder, the oxygen concentration lower and the dissolved inorganic nutrient concentrations higher than in the surrounding receiving water. These conditions would be similar to those found at greater depths and might favor colonization by certain species more typical of deeper water, although light penetration at the diffuser depth may inhibit colonization by some species. The net effect would be that some EFH in the depth range of the diffuser would be replaced by EFH with characteristics more typical of deeper waters.

4.8 TERRESTRIAL RESOURCES

4.8.1 Topography, Geology and Soils

Neither of the action alternatives, nor the No Action Alternative would permanently alter any existing topography, geology or soils. The cooling station site for Alternative 1 is flat and level, currently used for at-grade parking. The Alternative 2 cooling station site is also flat, level and paved. The distribution system would be buried throughout its length. To implement the project would require obtaining a grading, grubbing, and stockpiling permit from the City and County of Honolulu. Obtaining this permit would require a project-specific erosion control plan. With implementation of the procedures required for obtaining this permit, adverse impacts to topography, soils, or geology would not occur.

As noted in Section 3.7.2.1, there is a capped landfill beneath the Kaka‘ako Waterfront Park. Alternative 1, the Preferred Alternative, would establish a jacking pit adjacent to the ‘ewa side of the park, but not within the boundaries of the previous landfill. The near shore jacking pit would not be required under Alternative 2.

4.8.2 Climate and Air Quality

4.8.2.1 Climate

One of the major benefits of the action alternatives compared with the No Action Alternative would be reduction of fossil fuel use with its attendant greenhouse gas emissions that contribute to global warming. Specific reductions of greenhouse gases and other air pollutants that would result from implementation of the HSWAC project are summarized in Section 1.2.3.1.

4.8.2.2 Air Quality

Impacts to air quality would be considered significant if an alternative would generate emissions that may result in air pollutant concentrations above the Ambient Air Quality Standards (AAQS), contribute to pollutant concentrations already above the AAQS, or interfere with AAQS attainment.

Short-term direct and indirect impacts on air quality could occur during project construction. For a project of this nature there are two potential types of air pollutant emissions that could directly result in short-term air quality impacts during project construction: (1) fugitive dust and (2) exhaust emissions from on-site construction equipment. Indirectly, there also could be short-term impacts from slow-moving construction equipment traveling to and from the project site from a temporary increase in local traffic caused by commuting construction workers, and from the disruption of normal traffic flow caused by lane closures on adjacent roadways. Vehicular emissions would occur at the Sand Island staging area and off shore, as well as the cooling station site.

The action alternatives would involve on-shore trenching to install chilled water pipelines from the cooling station to all serviced facilities and construct the cooling station. The amount of trenching that would be needed for either action alternative is approximately 16,000 to 19,000 linear ft and trenches would be excavated from 5 to 13.0 ft wide (averaging 10 ft) for a total of about 160,000 to 190,000 ft^2 of exposed soil during the construction. Pipeline installation time is estimated at 17 months, however, the construction approach would be to open no more than 300 ft of trench at any given time in one location. The cooling station footprint would be about 22,000 ft^2, and approximately 40,000 ft^2 at grade would be needed for construction laydown areas and support areas for the cooling station construction and microtunnel installation. This results in a total of 62,000 ft^2 that would be required in the cooling station area. The amount of time with potentially bare soil exposed for these operations is estimated at six months for the cooling station and 17 months for the construction laydown and support areas.

The State of Hawai‘i Air Pollution Control Regulations (Hawai‘i Administrative Rules [HAR] Chapter 11-60.1) prohibit visible emissions of fugitive dust from construction activities at the property line. To mitigate fugitive emissions a dust control plan for project construction would be prepared in advance. This plan would include BMP techniques to minimize dust such as water spray, wind screens, covering soil piles, establishing temporary ground cover, or halting work during windy conditions. All construction equipment would meet State emission control regulations.

O‘ahu and the proposed project location are in attainment of AAQS. The impact from the proposed action would be an increase in pollutants from operation of construction equipment. However, exhaust emissions from construction vehicles and equipment are not considered major stationary sources, and there are no standards or criteria set for non-stationary equipment. Based on this information, exhaust emissions during construction of the proposed project would not have significant impacts on air quality.

Once operational, the cooling station would produce no regulated air emissions, and by significantly reducing the amount of electricity needed for air conditioning, the project would reduce the annual emissions from fossil fuel consumption by the following estimated amounts: CO_2-83,000 tons, VOCs-5 tons, CO-28 tons, PM_{10}-19 tons, NO_x-169 tons, SO_x-165 tons.

Chillers currently in use by customers of the proposed project services would no longer be needed, or in specific cases only be used occasionally as a backup under emergency conditions. Therefore, refrigerants being used in some equipment would be removed.

Implementation of the No-Action Alternative would not result in significant impacts to air quality. Under this alternative, no trenching would take place and no additional emissions would be generated as described above. Implementation of the No-Action Alternative would not reduce the annual emissions from fossil fuel consumption, and these emissions would continue to be released into the environment with their related detrimental effects. In addition, drift from cooling towers has been identified as a potential source of legionella disease and can cause spotting on cars parked nearby.

4.8.3 Water Resources

4.8.3.1 Surface Waters

No surface water resources would be directly or indirectly affected by either of the action alternatives or the No Action Alternative. The action alternatives would require a grading, grubbing, and stockpiling permit from the City and County of Honolulu. Obtaining this permit would require a project-specific soil erosion control plan. With treatment of dewatering fluids as described below and the erosion control plan, no adverse impacts to surface waters would occur as a result of the proposed project. The construction contractor would be required to comply with Section II (Storm Water Quality) of the City's Rules Relating to Storm Drainage Standards.

4.8.3.2 Groundwater

The No Action Alternative would not affect groundwater. Under the action alternatives, construction of the cooling station foundation would require dewatering and appropriate treatment before discharge to surface waters. In addition, installation of some of the distribution pipelines may also require dewatering. It is anticipated that only short lengths of the pipeline (no more than several hundred feet) would require dewatering based on the 10 to 30 foot depths to groundwater in most of the project area. However, groundwater levels would be affected by tidal fluctuations due to the proximity to the shore, and the total quantity of water to be removed is currently unknown.

Under the proposed action, the dewatering effluent would be discharged under a National Pollutant Discharge Elimination System (NPDES) discharge general permit. Best Management Practices (BMPs) would be used to remove suspended particulates and meet all other permit requirements prior to discharge. Treatment may include settling ponds or tanks, filtration systems, or both. Water would be tested to ensure that discharges meet general water quality parameters and toxic contaminant parameters as specified in the permit.

There would be a benefit as a result of implementation of either action alternative. Reductions of up to 84 million gallons/yr of sewer discharge are estimated. This would reduce the load to the Sand Island Sewage Treatment Plant, and may reduce the potential for exceeding the capacity of the plant with subsequent discharges that do not meet water quality requirements.

Groundwater would be encountered during the construction process but no contaminants would be introduced to the groundwater. Most of the project occurs seaward of the UIC line where the uppermost aquifer is considered less valuable. No adverse impacts to groundwater would occur as a result of the proposed project.

Implementation of either action alternative would not result in any significant negative impacts to water resources. Implementation of the No-Action Alternative would not result in any significant impacts, and potable water usage would not change.

4.8.4 Terrestrial Biota

The No Action Alternative would not affect terrestrial biota. Under either action alternative trenching activities would come in close proximity to a few exceptional trees that are protected by ordinance. These exceptional trees would be noted on construction plans, and if there is a potential to disturb these trees a Hawaiʻi licensed arborist would be consulted to ensure no permanent damage to the trees.

Although white terns are tolerant of people and noise, Vanderwerf (2003) recommends that construction projects that could disturb the birds be conducted during fall and early winter when fewer white terns are breeding, and in ways that minimize disturbance. White terns would be surveyed prior to construction in the project area. If any are nesting within 100 ft of construction activity, noise and visual barriers would be used to prevent any disturbance to the birds. Other threatened and endangered species are very uncommon, and therefore would be unlikely to be disturbed by any construction activity.

With implementation of these measures there would be no adverse impacts to terrestrial wildlife as a result of either action alternative.

4.9 LAND USE PLANS, POLICIES AND CONTROLS

In general, continuation of the No Action Alternative would fail to move society, the economy and the environment in the direction envisioned by elected representatives and the plans and visions adopted for a preferred future for Oʻahu, Hawaiʻi, and the nation. The sections below describe the local and regional benefits to implementation of the Preferred Alternative in terms of these plans and visions. Impacts of Alternative 2 would be similar to Alternative 1 impacts.

4.9.1 Hawaiʻi State Plan

The significance of potential impacts to land use is based on the sensitivity of the land use in the project area. Impacts to land use would be considered significant if an alternative would result in land use that is inconsistent with applicable plans or policies, precludes the viability of an existing land use activity or results in a threat to public health and safety.

Based on those criteria, implementation of either action alternative or the No-Action Alternative would not result in significant impacts to land use.

The HSWAC project would be in conformance with the Hawaiʻi State Plan. HSWAC would be compatible with the State goals identified in the plan and serve to advance the goal of achieving, *"A desired physical environment characterized by beauty, cleanliness, quiet, stable natural systems, and uniqueness that enhances the mental and physical well-being of the people"* by providing a clean, non-polluting air-conditioning system for the downtown and Kakaʻako areas of Honolulu that utilizes the renewable energy source of seawater from the adjacent Pacific Ocean. The HSWAC project also is in conformance with relevant objectives and policies of the State Plan, as follows:

4.9.1.1 Objective and Policies for the Economy - Potential Growth Activities

The proposed HSWAC project would support the objective of "*development and expansion of potential growth activities that serve to increase and diversify Hawai'i's economic base*" by:

1. Facilitating investment in energy-related industries,
2. Enhancing Hawai'i 's role as a center for technology by show-casing its state-of-the-art seawater air-conditioning system, and
3. Facilitating the State's policy of accelerating research and development of new energy-related industries based on ocean resources.

4.9.1.2 Objectives and Policies for the Physical Environmen - Land-Based, Shoreline, and Marine Resources

The mitigating measures proposed for the HSWAC project are in conformance with the "*State's planning for the physical environment with regard to land-based, shoreline, and marine resources and the achievement of the following objectives*" by:

1. Prudent use of Hawai'i 's marine resources, and
2. Effective protection of Hawai'i's unique and fragile environmental resources.

Planning for the project has strived to achieve the marine resources objectives and policies of the State by:

1. Ensuring compatibility between land-based and water-based activities and natural resources and ecological systems,
2. Taking into account the physical attributes of areas when planning and designing activities and facilities, and
3. Designing and managing the project so that construction and operation of HSWAC's seawater systems would use the natural resources within the environs of the proposed pipeline corridor without generating costly or irreparable environmental damage.

4.9.1.3 Objectives and Policies for the Physical Environment - Land, Air, and Water Quality

a) Planning for the HSWAC project has taken into consideration the State's physical environment with regard to land, air and water quality and would support achievement of the objective of *"Maintenance and pursuit of improved quality in Hawai'i's land, air and water resources."*
b) Operation of the proposed project would be in conformance with the State policy to achieve the land, air and water quality objectives by maintaining or improving aural and air quality levels that may enhance the health and well-being of Hawai'i's people.

4.9.1.4 Objective and Policies for Facility Systems - in General

a) The proposed HSWAC project supports the direction of planning for the State's facility systems in general in achievement of the objective of energy systems that support statewide social, economic, and physical objectives.
b) HSWAC is in conformance with the following State policies:
(1) By using seawater, a renewable resource, the project would promote prudent use of resources and accommodate changing public demands and priorities; and,
(2) Ensure that required facility systems can be supported within resource capacities and at reasonable cost to the user.

4.9.1.5 Objectives and Policies for Facility Systems - Energy

a) The HSWAC project would facilitate achievement of the following objectives for the State's facility systems with regard to energy by:
(1) Providing a dependable, efficient, and economical element of the State's energy systems capable of supporting the needs of the people;
(2) By using seawater as its primary resource, increasing energy self-sufficiency and thus increasing the ratio of indigenous to imported energy use; and,

(3) Through the use of non-polluting fuel, reducing greenhouse gas emissions from energy supply and use.

b) HSWAC would facilitate the achievement of the State's energy objectives and be in conformance with the following policies by:
(1) Developing renewable energy sources; and,
(2) Reducing greenhouse gases in utility applications.

4.9.1.6 Priority Guidelines for Energy Use and Development

The HSWAC project is in conformance with the following priority guidelines of the Hawai'i State Plan:

1. The HSWAC project would develop a commercial district air-conditioning system utilizing a renewable energy source (seawater); and,
2. Encourage the use of energy conserving technology in residential, industrial, and other buildings.

4.9.2 Hawai'i Coastal Zone Management Program

The proposed project complies with provisions and guidelines contained in Chapter 205A where applicable. The relationship of the HSWAC project to objectives and policies of the CZM Program is discussed in the following paragraphs.

4.9.2.1 Recreational Resources

The CZM objective is to provide coastal recreational opportunities accessible to the public. Although the HSWAC project would not provide new opportunities, operation of the facility would not permanently foreclose existing activities. During the construction and maintenance phases of the pipelines and associated equipment, the affected areas would be closed to the public for safety reasons. The following policies would guide the construction and operation phases of the project:

1. Coastal resources uniquely suited for recreational activities that cannot be provided in other areas would be protected;
2. If and when coastal resources having significant recreational value are unavoidably damaged by development activities, whenever possible they would be replaced;
3. Public access to and along shorelines with recreational value would be provided whenever such access does not risk public safety and/or does not interfere with facility operations; and,
4. Point and non-point sources of pollution would be monitored and necessary actions would be taken to protect the recreational value of coastal waters.

4.9.2.2 Historic Resources

The objective of the CZM program is to protect, preserve, and, where desirable, restore those natural and manmade historic and prehistoric resources in the coastal zone management area that are significant in Hawaiian and American history and culture. If such should occur in any area of the HSWAC project, all State and Federal Historic Preservation procedures and regulations would be followed.

4.9.2.3 Scenic and Open Space Resources

A CZM program objective related to scenic and open space resources seeks to "protect, preserve, and, where desirable, restore or improve the quality of coastal scenic and open space resources." The makai area plan of the Kaka'ako Community Development District has identified view planes in the area. Any above-ground facilities of the HSWAC project would be designed and located to minimize the alteration of natural landforms and existing public views to and along the shoreline. Under the Preferred Alternative, the proposed cooling station, the only visible part of the HSWAC system, would not affect views in any direction.

4.9.2.4 Coastal Ecosystems

The CZM program objective relating to coastal ecosystems is to "protect valuable coastal ecosystems, including reefs, from disruption and minimize adverse impacts on all coastal ecosystems." To achieve this objective, the project would exercise an overall conservation ethic during the design, construction and operation of the HSWAC system. Preservation of valuable coastal ecosystems, including reefs of significant biological or economic importance, was an important criterion in the selection of the offshore microtunnel breakout point and pipe alignment. To avoid impacts at the shoreline and in nearshore waters, microtunneling would be used to tunnel beneath these areas. In addition, selection of the method and design of the system for seawater return flows has taken into consideration the tolerance of the marine ecosystem, and would maintain and enhance water quality through the development and implementation of water pollution control measures.

4.9.2.5 Economic Uses

HSWAC would provide improvements that support the State's economy in suitable areas that ensure that coastal dependent development is located, designed, and constructed to minimize adverse visual and other environmental impacts in the coastal zone management area.

4.9.2.6 Coastal Hazards

The CZM program objective with regard to coastal hazards is to "reduce hazards to life and property from tsunami, storm waves, stream flooding, erosion, subsidence, and pollution." The cooling station could be susceptible to damage from a tsunami. Both the cooling station and the offshore pipelines would be susceptible to damage from hurricanes and their associated storm surge. Any portion of the system could be susceptible to damage or destruction by a sufficiently large seismic event.

Mitigation of the potential effects of natural hazards on the HSWAC system began in earliest planning. The primary mitigation strategy is to employ appropriate engineering designs for the facilities. In the case of the cooling station, hazard impact mitigation was one of the criteria used in evaluating potential sites. In some instances negative effects of natural hazards would be unavoidable. If power were lost island-wide for example, it would not be possible to run the pumps or auxiliary chillers.

All landside project areas in the Preferred Alternative, including the cooling station and distribution loop, are located within FIRM Zone X, which is a Non-special Flood Hazard Area designating lands outside the 500-year floodplain. This is an area that is in a low- to- moderate-risk flood zone and is not in any immediate danger from flooding caused by overflowing rivers or hard rains (FEMA, 2005).

4.9.2.7 Managing Development

Not Applicable.

4.9.2.8 Public Participation

The HSWAC project has held numerous public information and scoping meetings in the preparation of this EIS.

4.9.2.9 Beach Protection

Not applicable.

4.9.2.10 Marine Resources

The CZM program objective for marine resources is to "Promote the protection, use, and development of marine and coastal resources to assure their sustainability." During the field studies undertaken in support of the EIS, inventories of marine life and habitats were undertaken in order to locate a suitable pipe alignment that would not adversely impact ocean resources. During the operation of the project, additional information would be collected to increase the understanding of how ocean development activities relate to and impact these resources.

4.9.3 Hawai'i Ocean Resources Management Plan

The HSWAC project would further the objectives outlined in the ORMP (HCZMP, 2006) in a number of ways. HSWAC would link the land and the sea to bring a new, alternative energy source into downtown

Honolulu, while upholding the perspectives and goals of the ORMP. The ORMP stresses that beaches, coral reefs, and other ocean and coastal resources provide diverse and substantial benefits to Hawaiʻi. HSWAC conducted surveys of coral reefs and other marine communities, and identified the various biotopes present along the proposed HSWAC seawater pipeline corridor. HSWAC has proposed a number of mitigation measures to decrease or eliminate impact to beaches, corals, and ocean and coastal resources both during construction and operations.

The ORMP outlines how increased urbanization will continue to place greater demands on ocean and coastal resources as Hawaiʻi's population is expected to increase 30% in the next 25 years (HCZMP, 2006). The HSWAC system would help relieve pressure on ocean resources from increased economic and population growth by reducing potable water use by 260 million gallons a year, reducing sewage generation by up to 84 million gallons per year, and reducing the amount of toxic chemicals in the sewage system, resulting from conventional air conditioning cooling towers. The HSWAC system would reduce land-based sources of pollution to coastal water bodies.

4.9.4 Kakaʻako Community Development District - Makai Area Plan

The HSWAC project would support the purpose and intent of the Commercial Zone by providing a commercial use with employment opportunities based on the particular suitability of the area to access nearby seawater. The HSWAC cooling station would comply with Makai Area Design Guidelines to the extent feasible considering its very different character from the residential towers and mixed-use facilities typical of redevelopment in the district.

4.9.5 State Conservation District Policies and Regulations

The coastal land and marine waters that would be used by the proposed project, including the Keʻehi Lagoon area adjacent to Sand Island proposed for the staging activities, are in the Resource (R) Subzone of the Conservation District. The objective of the Resource subzone is to "develop, with proper management, areas to ensure sustained use of the natural resources of those areas." Energy activities are a permitted marine activity in this subzone. The HSWAC project would be a sustainable use of marine natural resources. The deep, cool water is available in virtually unlimited quantities and renews itself through oceanographic and climatological processes. Use of the Keʻehi Lagoon area would be temporary and the area would be returned to a condition as least as good as previously existed. The proposed use would not cause substantial adverse impacts to existing natural resources within the surrounding area; affect scenic vistas or viewplains; nor be materially detrimental to the public health, safety and welfare.

4.9.6 Objectives and Policies of the City and County of Honolulu General Plan

Although all 11 areas of concern addressed in the General Plan were taken into consideration in the planning of the project, the following three areas are directly relevant to the HSWAC project: (1) economic activity; (2) the natural environment; and (3) energy. An analysis of the relationship of the project to each of these areas of concern follows:

(1) Economic Activity
An economic activity objective of the General Plan is to make full use of the economic resources of the sea. The policy to "encourage the development of aquaculture, ocean research, and other ocean-related industries" applies to the HSWAC project in that it would develop and use ocean resources to air-condition buildings in downtown Honolulu.

(2) Natural Environment
The City's policies seek to protect and enhance our natural attributes by mitigating against the degradation of these assets. As described in this EIS, the design, construction and operations of the HSWAC project would conform to City policies for the natural environment. In addition, by its substitution of seawater for electricity used in air conditioning chillers, the HSWAC project would mitigate against degradation of air and

water quality by fossil fuel burning and discharge of thermal effluents to nearshore waters.

(3) Energy

The General Plan's energy policies and objectives address development, utilization, and conservation stressing reduction in dependence on imported energy sources. The objectives are: (1) to maintain an adequate, dependable and economical supply of energy for O'ahu residents; (2) to fully utilize proven alternative sources of energy; and, (3) to develop and apply new, locally available energy resources. The HSWAC project supports the following energy policies:

- Support programs and projects which contribute to the attainment of energy self-sufficiency on O'ahu;
- Give adequate consideration to environmental, public health, and safety concerns, to resource limitations, and to relative costs when making decisions concerning alternatives for conserving energy and developing natural energy resources;
- Support and participate in research, development, demonstration, and commercialization programs aimed at producing new, economical, and environmentally sound energy supplies; and
- Promote programs to more efficiently use energy in existing buildings.

4.9.7 Vision, Policies and Guidelines of the City and County of Honolulu Primary Urban Center Development Plan

The HSWAC project supports the following element of the City's vision for the PUC: "Honolulu's natural, cultural and scenic resources are protected and enhanced." HSWAC would not negatively affect these resources, and would eliminate the visual, air quality and noise impacts associated with operation of cooling towers in buildings connected to the system. Conformance with policies and guidelines of the plan are discussed below.

LAND USE AND TRANSPORTATION

Protecting and Enhancing Natural, Cultural and Scenic Resources

Policies

- Preserve historic and cultural sites. Appendix B provides an analysis of HSWAC's potential effects on historic sites and cultural resources. A site specific mitigation plan would be developed and approved by the Historic Preservation Division prior to beginning construction of the distribution system.
- Preserve and protect natural resource and constraint areas. The areas proposed to be used for the HSWAC project (an existing parking lot and city and State roadways) are fully urbanized and devoid of natural resources. Nesting white terns would be protected and the City's Exceptional Trees avoided in construction.
- Preserve panoramic views of natural landmarks and the urban skyline. The only visible portion of the HSWAC system would be the cooling station which would be invisible from mauka and makai vantage points because of surrounding larger buildings.
- Preserve panoramic views of natural landmarks and the urban skyline. The HSWAC cooling station would not interfere with any panoramic view.
- Improve access to shoreline and mountain areas. The HSWAC project may temporarily restrict access to the shoreline in the immediate vicinity of the microtunnel shaft and jacking pit, however, this would be a temporary restriction. Once construction is complete, the project would not interfere with access to the shoreline or mountain areas.

- Develop stream greenbelts. The HSWAC project would not affect any existing or planned stream greenbelts.
- Provide parks and active recreation areas. The HSWAC project would develop an existing parking lot into a building with green space and landscaping. The open space would more likely be used for passive recreation than for active recreation.

Guidelines

- Historic and cultural sites
  - Preserve architectural character, landscape setting and visual context of historic landmarks. The HSWAC project may include serving historic buildings. If so, connection of the distribution water pipes would be made below grade and the landscaping restored to preserve the setting and visual context.
  - Preserve and enhance the significant historic and aesthetic features of institutional campuses. The HSWAC project may serve The Queens Hospital. As noted above, connections of the distribution water pipes would be made in such a manner as to avoid impacting significant historic and aesthetic features.
- Mauka conservation areas. Not applicable to the HSWAC project.
- Urban skyline and mauka-makai views. The following is the only relevant guideline.
  - Preserve the following panoramic view: From Kakaʻako Waterfront Park toward Punchbowl and the Koʻolau Range. Under the Preferred Alternative, the HSWAC cooling station would be located between the John A. Burns Medical School and the 677 Ala Moana Building. It would not intrude into the mauka view.
- Makai Access. The relevant guideline is as follows.
  - Construct walkways along Waikiki and Kakaʻako-Honolulu waterfronts. The HSWAC project would have no permanent surface structure along the waterfront, and would present no obstruction to creation of such.
- Stream Greenways and Drainage. There are no guidelines relevant to the HSWAC project.
- Parks and Recreations Open Spaces. There are no guidelines relevant to the HSWAC project.
- Other Urban Open Space. There are no guidelines relevant to the HSWAC project.

Cultivating Livable Neighborhoods

Policies

- Make streets pedestrian-friendly. The street frontage of the cooling station would have a sidewalk and be landscaped.

In-Town Housing Choices
There are no policies or guidelines relevant to the HSWAC project.

Develop a Balanced Transportation System
There are no policies or guidelines relevant to the HSWAC project.

INFRASTRUCTURE AND PUBLIC FACILITIES

Water Allocation and System Development

Policies

- Adapt and implement water conservation practices in the design of new developments and modification of existing uses. The HSWAC project would result in conservation of up to 260 million gallons of potable water per year.

Wastewater System
There are no policies or guidelines relevant to the HSWAC project.

Electrical Power

Policies

- Promote and implement energy conservation measures. The HSWAC project would save more than 77.5 million kWh/yr.

Telecommunications Facilities
Develop a Balanced Transportation System There are no policies or guidelines relevant to the HSWAC project.

Policies
Adapt and implement water conservation practices in the design of new developments and modification of existing uses.There are no policies or guidelines relevant to the HSWAC project.
Policies
Promote and implement energy conservation measures.**Telecommunications Facilities**There are no policies or guidelines relevant to the HSWAC project.
Solid Waste
There are no policies or guidelines relevant to the HSWAC project.

Stormwater Systems
There are no policies or guidelines relevant to the HSWAC project.

School and Library Facilities
There are no policies or guidelines relevant to the HSWAC project.

Civic and Public Safety Facilities
There are no policies or guidelines relevant to the HSWAC project.

4.10 CUMULATIVE IMPACTS

Potential cumulative impacts of either action alternative would be most likely to arise as a consequence of installation of the distribution system within the streets of Kaka‘ako and downtown. In development of the preferred distribution system route, HCDA and the City and County of Honolulu were consulted about projects with entitlements that could be under construction within the same time frame as installation of the HSWAC distribution system. Additionally, future projects that would require major street excavations in areas being considered for installation of the HSWAC distribution system were investigated. The greatest potential for future conflicts in use of street rights-of-ways is the proposed

Honolulu rapid transit project. Once the proposed route for the rapid transit system was announced, it was compared with what was then the preferred HSWAC route and conflicts were apparent along Halekauwila Street. Consequently, the HSWAC route was modified to avoid streets that would be used for the rapid transit route.

HSWAC engineers are participating in a joint City and State utilities coordinating committee that frequently meets to coordinate utilities and traffic work to minimize conflicts between projects requiring street closures. The input from that committee would be used in scheduling where trenching would occur at any given time. Major construction projects in the downtown to Waikiki corridor are summarized on the City's Drive Akamai website (http://www.driveakamai.org). Water, sewer, and roadway projects by City, or State agencies or private developers are described and mapped. At the present time, projects within the HSWAC distribution system area include the following:

- Nimitz Highway Median Landscaping Improvements. This project includes landscaping work on Nimitz Highway median around the downtown area.
- Ala Moana Boulevard Fence Repair. This project will include fence repair an Ala Moana Boulevard around the downtown to Kaka‘ako area.
- Aloha Tower Drive, Nimitz Highway and Richards Street 12-inch and 16-inch Water mains. This project entails the installation of a 16-inch water main along Nimitz Highway from Richards Street to Alakea Street and along Richards Street from Nimitz Highway to Aloha Tower Drive and the installation of a 12-inch water main along Aloha Tower Drive from Richards Street to Bishop Street.
- Rehabilitation of Beretania Street from North King Street to Alapai Street. This City project consists of repaving and restriping the section of Beretania Street from North King Street to Alapai Street. In addition, the project entails reconstructing portions of sidewalk, installing new curb ramps and upgrading the electrical system for traffic signals.

Cumulative impacts with these or other projects that will be scheduled during the proposed HSWAC construction period will be minimized through coordinated sequencing of streets to the opened.

4.11 COMPARISON OF THE ENVIRONMENTAL IMPACTS OF THE ALTERNATIVES

Table 4-1 summarizes the environmental impacts of the action alternatives for the HSWAC system as compared with the No Action Alternative. Both Federal and State impacts criteria are included in the comparison. The term “local” is intended to mean site-specific or of island-wide significance. The term “regional” is intended to mean of State-wide significance.

Table 4-1: Comparison of the Impacts of the Alternatives

Impact Criteria	*Alternative 1 (Preferred Alternative)*		*Alternative 2*		*No Action Alternative*	
	Context/Intensity	*Description*	*Context/Intensity*	*Description*	*Context/Intensity*	*Description*
Substantially Affects Public Health or Safety	Local, Long-term and Short-term, Direct and Indirect/Positive but Insignificant	Reduced noise from cooling towers and reduced air pollutants from fossil fuel consumption would have positive public health effects. Reduction of toxic chemical use in existing chiller systems would benefit public health and safety. During construction, public safety around work areas would be protected by implementing BMPs.	Local, Long-term and Short-term, Direct and Indirect/Positive but Insignificant	Reduced noise from cooling towers and reduced air pollutants from fossil fuel consumption would have positive public health effects. Reduction of toxic chemical use in existing chiller systems would benefit public health and safety. During construction, public safety around work areas would be protected by implementing BMPs.	Local, Long-term and Short-term, Indirect/Negative but Insignificant	Existing noise and air quality do not compromise public health or safety. Hawai‘i is in an attainment area for air pollutants. In the long-term, additional generating capacity would increase air pollutant loading. Toxic chemicals used in chillers would continue to be used, stored and disposed of.
Irrevocable Commitment of Natural Resources	Local, Regional, National, Long-term, Direct/Not Significant	Deep, cold seawater is a renewable resource. Fossil fuel would be required for electricity, but there would be significant net savings. A small area of seafloor would be occupied by pipelines.	Local, Regional, National, Long-term, Direct/Not Significant	Deep, cold seawater is a renewable resource. Fossil fuel would be required for electricity, but there would be significant net savings. A slightly larger area of seafloor would be occupied than under Alternative 1.	Local, Regional, National, Long-term, Direct/ Significantly Negative	Substantial quantities of fossil fuels and potable water would be required.
Irrevocable Commitment of Cultural Resources	Local, Regional, Long-term, Direct/Not Significant	Mitigation measures to avoid adverse effects on cultural resources are incorporated in the Preferred Alternative.	Local, Regional, Long-term, Direct/Not Significant	Mitigation measures to avoid adverse effects on cultural resources are incorporated in Alternative 2.	Local, Regional, Long-term, Direct/ Not Significant	Cultural resources would not be affected.

Impact Criteria	*Alternative 1 (Preferred Alternative)*		*Alternative 2*		*No Action Alternative*	
	Context/Intensity	*Description*	*Context/Intensity*	*Description*	*Context/Intensity*	*Description*
Curtails the Range of Beneficial Uses of the Environment	Local, Regional, National, Long-term, Direct/ Significantly Positive	Beneficial uses of the environment would be expanded by use of seawater. Pipelines would provide complex habitat for marine life and recreational/fishing uses.	Local, Regional, National, Long-term, Direct/Significantly Positive	Beneficial uses of the environment would be expanded by use of seawater. Pipelines would provide complex habitat for marine life and recreational/fishing uses.	Local, Regional, National, Long-term, Indirect/ Insignificantly Negative	To the extent the (potentially avoided) burning of fossil fuels contributes to global warming and sea level rise, beneficial uses of the environment would be curtailed.
Violates Laws or Conflicts with Government Policies and Goals	Local, Regional, National, Short-term, Long-term, Direct/ Significantly Positive	All laws, regulations and ordinances would be complied with. Strongly advances energy policies, goals and objectives at all levels of government.	Local, Regional, National, Short-term, Long-term, Direct/ Significantly Positive	All laws, regulations and ordinances would be complied with. Strongly advances energy policies, goals and objectives at all levels of government.	Local, Regional, National, Short-term, Long-term, Direct/	All laws, regulations and ordinances would be complied with. Does not contribute to advancement of energy policies, goals or objectives of government agencies.
Substantially Affects Economic or Social Resources	Local, Regional, Short-term. Long-term, Direct, Indirect/ Significantly Positive	Construction expenditures and jobs would represent short-term benefits. System operation would create long-term jobs and economic benefits.	Local, Regional, Short-term. Long-term, Direct, Indirect/ Significantly Positive	Construction expenditures and jobs would represent short-term benefits. System operation would create long-term jobs and economic benefits.	Local, Regional, Short-term, Long-term, Direct, Indirect/ Significantly negative economic effects, but significantly positive social impacts in terms of jobs creation.	Expenditures for fossil fuel leak out of the State economy. Some of the other expenditures result in local economic benefits. Jobs are created directly and indirectly.
Involves Substantial Secondary Impacts such as Population Changes or Effects on Public Facilities	Local, Long-term, Indirect/ Insignificant	No induced secondary effects would result.	Local, Long-term, Indirect/ Insignificant	No induced secondary effects would result.	Local, Long-term, Indirect/ Insignificant	No induced secondary effects would result.

Impact Criteria	Alternative 1 (Preferred Alternative)		Alternative 2		No Action Alternative	
	Context/Intensity	Description	Context/Intensity	Description	Context/Intensity	Description
Results in a Substantial Degradation of Environmental Quality	Local, Short-term, Long-term, Direct, Indirect/ Insignificantly Negative	Temporary negative effects on traffic, air quality, water quality and noise would be unavoidable during construction. During operation there would be negative effects on water quality within a designated Zone of Mixing. A small quantity of marine organisms would be affected during construction and operation.	Local, Short-term, Long-term, Direct, Indirect/ Insignificantly Negative	Temporary negative effects on traffic, air quality, water quality and noise would be unavoidable during construction. During operation there would be negative effects on water quality within a designated Zone of Mixing. A small quantity of marine organisms would be affected during construction and operation.	Local, Short-term, Long-term, Direct, Indirect/ Significantly negative	Existing operations cause air pollution, water pollution, noise, and waste disposal issues. Marine communities and water quality within existing designated Zones of Mixing for power plant cooling water outfalls are impacted.
Represents a Commitment to a Larger Action	Local, Long-term, Direct/ Insignificant	HSWAC is an independent action.	Local, Long-term, Direct/ Insignificant	HSWAC is an independent action.	Local, Long-term, Indirect/ Significant	Increased demand for conventional air conditioning would eventually lead to a requirement for additional fossil-fueled generating capacity.
Substantially Affects a Rare, Threatened or Endangered Species or its Habitat	Local, Short-term, Direct/ Insignificant	No rare or protected species would be substantially affected during construction or operation of the HSWAC system. During construction, mitigation measures would be put into place to ensure no disturbance of white terns or impacts to sea turtles or marine mammals.	Local, Short-term, Direct/ Insignificant	No rare or protected species would be substantially affected during construction or operation of the HSWAC system. During construction, mitigation measures would be put into place to ensure no disturbance of white terns or impacts to sea turtles or marine mammals.	Local, Short-term, Direct/ Insignificant	No rare or protected species would be substantially affected.

Impact Criteria	*Alternative 1 (Preferred Alternative)*		*Alternative 2*		*No Action Alternative*	
	Context/Intensity	***Description***	***Context/Intensity***	***Description***	***Context/Intensity***	***Description***
Negatively Affects Air Quality, Water Quality or Noise	Local, Short-term, Long-term, Direct, Indirect/ Insignificantly Negative	Temporary negative effects on air quality, water quality and noise would be unavoidable during construction. During operation there would be negative effects on water quality within a designated Zone of Mixing. Noise and drift from cooling towers would be eliminated.	Local, Short-term, Long-term, Direct, Indirect/ Insignificantly Negative	Temporary negative effects on air quality, water quality and noise would be unavoidable during construction. During operation there would be negative effects on water quality within a designated Zone of Mixing. Noise and drift from cooling towers would be eliminated.	Local, Short-term, Long-term, Direct, Indirect/ Significantly negative	Existing operations cause air pollution, water pollution, and noise, Water quality within existing designated Zones of Mixing is impacted.
Affects or is Likely to Suffer Damage by Being in an Environmentally Sensitive Area	Local, Short-term, Long-term, Direct/ Insignificant	The cooling station and distribution piping would be outside a tsunami inundation or flood hazard zone. The seawater pipelines are in a vulnerable zone, but designed to withstand anticipated forces.	Local, Short-term, Long-term, Direct/ Insignificant	The cooling station and distribution piping would be outside a tsunami inundation or flood hazard zone. The seawater pipelines are in a vulnerable zone, but designed to withstand anticipated forces.	Local, Short-term, Long-term, Direct/ Insignificant	Existing facilities are sited and engineered to minimize potential outages.
Affects the Unique Character of an Area	Local, Long-term, Direct/ Insignificant	The only visible HSWAC facility would be the cooling station, which is proposed to be sited within a district undergoing redevelopment.	Local, Long-term, Direct/ Insignificant	The only visible HSWAC facility would be the cooling station, which is proposed to be sited within an industrial area undergoing redevelopment.	Local, Long-term, Direct/ Insignificant	No Action would accelerate the necessity for addition of electricity generating capacity. The location of any new facility is currently unknown.

Impact Criteria	***Alternative 1 (Preferred Alternative)***		***Alternative 2***		***No Action Alternative***	
	Context/Intensity	***Description***	***Context/Intensity***	***Description***	***Context/Intensity***	***Description***
Affects Scenic Vistas or Viewplanes	Local, Long-term, Direct/ Insignificant	The only visible HSWAC facility would be the cooling station, which would be invisible from mauka or makai vantage points.	Local, Long-term, Direct/ Insignificant	The only visible HSWAC facility would be the cooling station, which would be a low-rise building in an industrial waterfront setting.	Local, Long-term, Direct/ Insignificant	No Action would accelerate the necessity for addition of electricity generating capacity. The location of any new facility is currently unknown.
Requires Substantial Energy Consumption	Local, Regional, National, Long-term, Direct/ Significantly Positive	Pumps and other equipment in the cooling station would require relatively small amounts of electricity, but the major purpose of the project is to substitute renewable energy for fossil fuel derived energy.	Local, Regional, National, Long-term, Direct/ Significantly Positive	Pumps and other equipment in the cooling station would require relatively small amounts of electricity, but the major purpose of the project is to substitute renewable energy for fossil fuel derived energy.	Local, Regional, National, Long-term, Direct/ Significantly Negative	No Action would continue use of fossil fuel derived electricity for energy-intensive air conditioning in a significant number of buildings.
Affects a Historic Site	Local, Regional, National, Long-term, Direct/ Insignificant	Siting of the cooling station and routing of the distribution system were done with consideration of historic sites locations. Connections to historic buildings would not affect building character.	Local, Regional, National, Long-term, Direct/ Insignificant	Siting of the cooling station and routing of the distribution system were done with consideration of historic sites locations. Connections to historic buildings would not affect building character.	Local, Regional, National, Long-term, Direct/ Insignificant	Any potential modifications to historic buildings to install or modify air conditioning systems would not affect building character.

Impact Criteria	***Alternative 1 (Preferred Alternative)***		***Alternative 2***		***No Action Alternative***	
	Context/Intensity	***Description***	***Context/Intensity***	***Description***	***Context/Intensity***	***Description***
Has Considerable Cumulative Effects on the Environment	Local, Short-term, Long-term, Direct, Indirect/ Insignificant	Construction scheduling would be done to minimize any potential cumulative effects on traffic. In the long-term, the HSWAC system would have positive cumulative effects on air quality, water quality and noise.	Local, Short-term, Long-term, Direct, Indirect/ Insignificant	Construction scheduling would be done to minimize any potential cumulative effects on traffic. In the long-term, the HSWAC system would have positive cumulative effects on air quality, water quality and noise.	Local, Long-term, Indirect/ Significant	No Action would cumulatively increase demands for electricity, potable water and wastewater treatment.
Entails Unknown Risks	Local, Short-term, Long-term, Direct/ Insignificant	All risks associated with construction and operation of the HSWAC system are well understood.	Local, Short-term, Long-term, Direct/ Insignificant	All risks associated with construction and operation of the HSWAC system are well understood.	Local, Short-term, Long-term, Direct/ Insignificant	All risks associated with installation and operation of conventional air conditioning systems are well understood.
Is Controversial	Local, Short-term, Direct/ Insignificant	An aggressive public involvement program has to date not surfaced controversy. Issues raised thus far can be mitigated.	Local, Short-term, Direct/ Insignificant	An aggressive public involvement program has to date not surfaced controversy. Issues raised thus far can be mitigated.	Local, Short-term, Direct/ Insignificant	No Action is the accepted method for providing air conditioning. It is not controversial.

CHAPTER 5. ENVIRONMENTAL MANAGEMENT ISSUES

5.1 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND MAINTENANCE OF LONG-TERM PRODUCTIVITY

The construction phase of the HSWAC project would have both positive and negative short-term impacts on several environmental resources. Marine habitats, communities, and productivity would be negatively affected by installation of intake and return pipes and appurtenant hardware. In the long-term, however, marine habitats, communities, and productivity would recover. The presence of the pipe structures would provide additional benthic habitat in an area of unremarkable marine resources. Construction of the cooling station and installation of the distribution system would be accompanied by noise, dust and some disruption of vehicular traffic flows. On the other hand, construction activities would result in direct, indirect, and induced employment opportunities with concomitant provision of personal income, increased corporate revenues, and increased government tax revenues. The negative short-term impacts associated with the construction activities would be necessary to realize the highly significant long-term benefits of the HSWAC project. These include reduction of petroleum imports, reduction of impacts to air and water quality associated with production of electricity, reduction of potable water use, reduction of wastewater generation, reduction in the use of ozone-depleting substances, as well as the economic benefits to be realized by HSWAC customers and Oʻahu rate-payers in general.

5.2 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Irreversible and irretrievable commitments of resources required to implement the HSWAC project include the human productivity expended in planning, constructing, and operating the system; much of the construction materials and hardware used in the system (although some could be recycled); the fuels and lubricants used in vehicles and equipment (some could be recycled); and the oil burned in producing electricity for those components of the system requiring it (pumps, auxiliary chillers, etc.).

5.3 ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL OF THE ALTERNATIVES AND MITIGATION MEASURES

Energy in the form of petroleum would be required for construction vehicles and equipment, and for conversion into electricity for construction and operation of the HSWAC system. However, a major objective of the project is to reduce Oʻahu's dependence on fossil fuels. Either action alternative would save approximately 75% of the energy associated with operation of individual air conditioning systems in large downtown buildings compared to the No Action Alternative.

5.4 URBAN QUALITY, HISTORIC AND CULTURAL RESOURCES AND DESIGN OF THE BUILT ENVIRONMENT, INCLUDING RE-USE AND CONSERVATION POTENTIAL OF THE ALTERNATIVES AND MITIGATION MEASURES

The only portion of the HSWAC system potentially visible in the urban setting would be the cooling station, which under Alternative 1, the Preferred Alternative, would be hidden from mauka views to the ocean by an adjacent massive building. The design of the built environment in downtown Honolulu would not be negatively affected. Under Alternative 2, the cooling station would lie within an industrial harbor setting where views are currently obstructed by existing warehouses. (See Appendix G). Urban quality may be incrementally improved by reduction of waste heat from numerous downtown cooling towers. Known historic and cultural resources would be avoided, and appropriate mitigation measures would be employed should there be inadvertent discoveries of such resources during construction of the cooling station or installation of the distribution system. Either action alternative would have a number of conservation benefits, including reductions in consumption of fossil fuels, electricity, and potable water. refrigerant compounds from deactivated individual chiller units could be recycled.

5.5 CULTURAL RESOURCES AND CONSERVATION POTENTIAL OF THE ALTERNATIVES

The HSWAC project is not expected to affect known cultural resources. The approved archaeological monitoring plan (Appendix B) would be implemented during construction. As appropriate, any discovered resources would be preserved, protected, salvaged, and/or documented. Should human burials be discovered the approved plan for dealing with remains would be implemented.

5.6 POSSIBLE CONFLICTS BETWEEN THE PROPOSED ACTION AND THE OBJECTIVES OF FEDERAL, STATE AND LOCAL LAND USE PLANS, POLICIES AND CONTROLS FOR THE AREA CONCERNED

The HSWAC project would not conflict with any Federal, State or local land use plan, policy or control, although variances would be sought for noise from night construction and shoreline setback during pipe staging, and a modification would be sought from HCDA for reduced parking at the cooling station. The project would further the objectives of numerous plans and policies, including the Hawai‘i State Plan, the Hawai‘i Coastal Zone Management Plan, the Hawai‘i Ocean Resources Management plan, the Kaka‘ako Community Development District Makai Area Plan and the City and County of Honolulu General Plan and Primary Urban Center Development Plan.

5.7 NATURAL OR DEPLETABLE RESOURCE REQUIREMENTS AND CONSERVATION POTENTIAL OF THE ALTERNATIVES AND MITIGATION MEASURES

A major objective of the HSWAC project is to reduce the use of depletable natural resources (fossil fuels) by substitution of renewable natural resources (cold seawater). Implementation of the Preferred Alternative would result in highly significant savings of fossil fuels and potable water.

5.8 UNAVOIDABLE ADVERSE IMPACTS

Construction of the cooling station and installation of the distribution system would be accompanied by increased noise, dust and traffic congestion. Offshore construction would create turbidity at the receiving pit and where anchors impact the bottom (Section 4.7.2). Once operational, the system would impact water quality and marine biota within a defined Zone of Mixing. The seawater return flows would be lower in temperature and dissolved oxygen concentrations and higher in dissolved inorganic nutrient concentrations. Under worst case conditions, ambient water quality standards would be met within about 150 feet of the diffuser (Section 4.7.2). A Zone of Mixing (ZOM) would be sought to authorize an area in which adequate dilution could occur. Due to the very sparse coral coverage in the vicinity of the microtunnel breakout point and along the seaward path of the pipes, construction activities would potentially affect only a few square feet of living coral colonies. A great deal more habitat for sessile organism would be created than would be covered by the pipe collars. There would likely be loss of coral colonies within the ZOM if the temperature at the bottom is reduced below thermal thresholds. Coral growth outside the ZOM could be stimulated by nutrient subsidies to zooxanthellae (Section 4.7.3).

5.9 POTENTIAL MITIGATION MEASURES FOR UNAVOIDABLE ADVERSE IMPACTS (TO REDUCE TO INSIGNIFICANCE AND THE BASIS FOR CONSIDERING THESE LEVELS ACCEPTABLE)

Impact mitigation for the HSWAC project began in earliest planning when it was decided to use some form of trenchless technology to route pipes beneath the nearshore area and under major roadways. Planning and engineering design for the project also incorporated decisions about siting, routing, construction methods, etc. which had the effect of reducing the potential impacts of the project. For example, facilities have been sited and engineered to withstand anticipated forces resulting from natural hazards. The decision to surface mount the seawater piles with piles minimized the potential impacts to water quality and marine communities. The proposed microtunnel breakout point was selected to avoid coral reefs or coral-dominated communities. The breakout point under either action alternative would be within the biotope of dredged rubble where corals are very sparse.

Specific mitigation measures were developed to address potential impacts to archaeological, marine biological, and terrestrial biological resources, marine and surface water quality, noise, air quality, and traffic.

All appropriate regulations and permit conditions would be complied with for grading, excavation, dewatering, trenching, repaving, etc. All existing utility installations would be accurately mapped to avoid conflicts or accidents resulting in service outages. Where pipes would be installed by trenching, standard mitigation measures would be employed to minimize impacts to traffic and return the pavement surface to a condition equal to or better than what existed previously. Specific mitigation measures would be detailed in a construction management plan. The grading, grubbing, and stockpiling permit would require a project-specific soil erosion control plan. The construction contractor would be required to comply with Section II (Storm Water Quality) of the City's Rules Relating to Storm Drainage Standards. Dewatering effluent would be discharged under a National Pollutant Discharge Elimination System (NPDES) discharge general permit. Best Management Practices (BMPs) would be used to remove suspended particulates and meet all other permit requirements prior to discharge. Treatment would include settling ponds or tanks, filtration systems, or both. Water would be tested to ensure that discharges meet general water quality parameters and toxic contaminant parameters as specified in the permit.

The Sand Island staging area would be re-established in equal or better condition upon the demobilization of HSWAC's contractor.

A traffic management plan would be developed to identify specific potential traffic management strategies that would be implemented to minimize the effects of HSWAC construction on the downtown Honolulu roadway system. The traffic management plan would describe the construction management, public information program, construction schedule, construction traffic, and traffic control plans during construction.

Special considerations would be given to minimizing after hours noise in the vicinity of residential buildings near the distribution route. Typical noise mitigation measures employed, in addition to the time of day restrictions, include use of proper mufflers on any gas or air-powered equipment and restricting night work when necessary to less noisy tasks.

To mitigate fugitive emissions a dust control plan for project construction would be prepared in advance. This plan would include BMP techniques to minimize dust such as water spray, wind screens, covering soil piles, establishing temporary ground cover, or halting work during windy conditions. All construction equipment would meet State emission control regulations.

Under the Preferred Alternative, the area of high probability for encountering subsurface cultural sites is believed to be Keawe Street from its intersection with Auahi Street to Ala Moana Boulevard. The Preferred Alternative is to microtunnel under this segment to avoid contact with cultural remains as well as to eliminate impacts to traffic on Ala Moana Boulevard. The areas of moderate and high probability for finding subsurface cultural sites would undergo on-site archaeological monitoring during trenching. SHPD would be given the opportunity to review and concur with any portions of the HSWAC project that may affect privately-owned and State-owned historic properties on the HRHP. Any ground surfaces and landscaping associated with any historic building would be restored to their original condition if they are disturbed by trenching or other activities.

Potential cultural impacts would be mitigated using a proactive approach involving consulting with concerned parties who have traditional and/or family ties to the Downtown and particularly the Kaka'ako areas.

Turbidity impacts of pipeline installation would be minimized by implementing Best Management Practices (BMPs) during construction, including:

- The employment of standard BMPs for construction in coastal waters, such as daily inspection of equipment for conditions that could cause spills or leaks;
- Cleaning of equipment prior to deployment in the water;
- Proper location of storage, refueling, and servicing sites; and
- Implementation of adequate spill response and storm weather preparation plans.

The offshore receiving pit would be contained with sheet piles to minimize turbidity. The feasibility of employing silt screens around the receiving pit in this open water environment would be evaluated during permitting. All soil removed from the tunnel, jacking pits and receiving pit would be processed appropriately and disposed of on land. Only washed granular or gravel backfill would be used.

Water quality monitoring would be conducted during the construction period. Pursuant to section 401 of the Clean Water Act, HSWAC would obtain and comply with the conditions of a Water Quality Certification from the HDOH. The proposed action is expected to meet the conditions of the NPDES permit required by the Hawai‘i DOH. To minimize impacts of the return seawater on the ambient receiving water quality a diffuser was computer-designed and optimized. The design of the diffuser facilitates significant near-field initial mixing of the return water for all current cases considered. During operations, a water quality and marine biota monitoring program would be implemented.

Construction activities would cease if listed marine species are observed entering the active project construction site, and work would be allowed to resume only after the animal departs the construction site on its own volition. The Pacific Islands Regional Office of the National Marine Fisheries Service (NMFS) would be notified of each such occurrence.

Construction activities would cease if listed marine species are observed entering the active project construction site, and work would be allowed to resume only after the listed species departs the construction site on its own volition. The Pacific Islands Regional Office of the National Marine Fisheries Service (NMFS) would be notified of each such occurrence.

White terns would be surveyed prior to construction in the project area. If any are nesting within 100 ft of construction activity, noise and visual barriers would be used to prevent any disturbance to the birds.

5.10 UNRESOLVED ISSUES (AND HOW SUCH ISSUES WILL BE RESOLVED OR OVERRIDING REASONS FOR PROCEEDING WITHOUT RESOLUTION)

Preliminary system analysis and optimizations by Makai Ocean Engineering (2004, 2005a, 2005b) based on levelized lifetime costs showed a relatively flat optimum for intake depths between 1,600 feet and 1,800 feet with average seawater temperatures varying between 44°F and 45°F. Initially an intake depth of 1,600 feet with an average seawater temperature of 45°F was selected. Subsequent evaluations have shown that a deeper intake depth may be operationally desirable. The final depth of the intake remains unresolved. It is primarily an economic choice; the environmental impacts would not be significantly different for any intake within this depth range. The economic trade-off is that a deeper intake would increase capital costs for additional pipe lengths and installation, while a shallower intake would increase operational costs because additional supplemental cooling of the slightly warmer water would be required. The benthic conditions are not significantly different between 1,600 and 1,800 feet deep.

The position of the jacking pit in the Preferred Alternative is behind and close to the shoreline. Depending on the contractor’s installation plan, it may be preferable to position this pit further away from the shoreline. The final position could be anywhere from near the shoreline to near the makai end of Keawe Street.

The final routing of the distribution system would have to reflect the eventual system customers, not all of whom are currently known. Future routing decisions would be made using the same criteria as described for the current action alternatives and the types of impacts to be expected would be the same as those evaluated in this document.

5.11 PERMITS, LICENSES AND APPROVALS REQUIRED AND STATUS

Table 5-1 summarizes the permits and approvals required for implementation of the proposed HSWAC project. Many of the permits and approvals necessary for planning work such as geotechnical testing of soils and rights-of-entry for such testing have been acquired. These are the responsibility of the engineering firms doing those tasks. Ministerial permits for construction activities would be the responsibilities of the various contractors. Applications for the discretionary permits listed below are currently in progress and submittals would be accompanied by the final EIS. HSWAC has obtained a zoning waiver from HCDA to allow the cooling station use.

Table 5-1: Permits and Approvals Required for the HSWAC Project

Permit, Approval, or Supplemental Document	***Lead Agency***	***Prerequisites***	***Other Requirements***
Special Management Area Use Permit for Staging Area	City and County of Honolulu, Department of Planning and Permitting; the City Council grants the permit	Environmental impact documentation	Estimate of valuation of the project. Public Hearing.
Shoreline Setback Variance for Staging Area	City and County of Honolulu, Department of Planning and Permitting; the City Council grants the permit	Environmental impact documentation	Certified shoreline map.
Minor Shoreline Structure Permit for Staging Within the Shoreline Area	City and County of Honolulu, Department of Planning and Permitting		Description of structure
Temporary Use Approval for the Staging Area	City and County of Honolulu, Department of Planning and Permitting	Approval of property owner	Site plan
Effluent Discharge Permit	City and County of Honolulu, Department of Environmental Services		Description of effluent
Building Permit for Building, Electrical, Plumbing, Sidewalk/ Driveway, and Demolition Work	City and County of Honolulu, Department of Planning and Permitting	Review of plans by various agencies	Four sets of plans
Certificate of Occupancy	City and County of Honolulu, Department of Planning and Permitting	Building permit, final inspection	
Flammable and Combustible Liquid Tank Installation	Honolulu Fire Department	Inspection by HFD	Plot and cross-sectional plans
Permit to Excavate Public Right-of-Way (Trenching)	City and County of Honolulu, Department of Planning and Permitting	Utility company clearances	Plans
Sewer Connection Permit	City and County of Honolulu, Department of Planning and Permitting	Building permit	Development data
Street Usage Permit	City and County of Honolulu, Department of Transportation Services	Notification of emergency, transit, and utility agencies or companies	Construction plans, Traffic Management Plan
Drain Connection License	City and County of Honolulu,		Construction plans

Permit, Approval, or Supplemental Document	***Lead Agency***	***Prerequisites***	***Other Requirements***
	Department of Planning and Permitting		
Non-exclusive easements for Distribution Pipes under State and County Roads and Through State Structures	State of Hawaiʻi, Department of Transportation, Department of Accounting and General Services, and HCDA; City and County of Honolulu	Description of easements	Appraisal of easement value, liability insurance
HCDA Project Eligibility Permit and Development Permit	Hawaiʻi Community Development Authority	Lease agreement, project description, site plans (including drawings of elevations, sections, floor plans and 3-D renderings), landscaping plan, assessments of traffic, noise and conformance to Makai Area Plan and Rules, development timetable, landowner approval	May require Public Hearing if rules modification or variance is requested
Coastal Zone Management (CZM) Program Consistency	State of Hawaiʻi, Office of Planning (OP)	Application demonstrating consistency of the project with the CZMP. Usually submitted with Draft EIS	Publication of consistency notice in OEQC's *Environmental Notice*
Hawaiʻi Revised Statutes (HRS) Chapter 6E Clearance	State of Hawaiʻi, Department of Land and Natural Resources, Division of Historic Preservation (HPD), State Historic Preservation Officer (SHPO)	Final site for cooling station and final routes for seawater pipes and distribution system	Public notification required if the project is not otherwise required to hold a Public Hearing or give other public notification
State of Hawaiʻi Environmental Impact Statement (EIS) as per Hawaiʻi Revised Statutes (HRS) Chapter 343	State of Hawaiʻi, OP is the Accepting Authority (AA); Office of Environmental Quality Control (OEQC) reviews and publishes public notice in its *Environmental Notice*	Complete project description, all necessary supporting studies of environmental resources and potential impacts	Cultural Impact Assessment
Right-of-Entry for Soils Testing and Construction	State of Hawaiʻi, Department of Land and Natural Resources for Submerged Lands; Hawaiʻi Community Development Authority for Kakaʻako Lands		Description of activities
Special Management Area (SMA) Use Permit (Minor) for Data Gathering	State of Hawaiʻi, Office of Planning		Description of activities
Community Noise Permit	State of Hawaiʻi, Department of Health		Description of equipment and duration of construction activities
Community Noise	State of Hawaiʻi, Department of		Description of

Permit, Approval, or Supplemental Document	***Lead Agency***	***Prerequisites***	***Other Requirements***
Variance	Health		equipment and duration of construction activities
Modification for Number of Parking Spaces	Hawai‘i Community Development Authority		
Special Management Area (SMA) Use Permit (Major) for Kaka‘ako Lands	State of Hawai‘i, Office of Planning	HCDA Development Permit; CZM Consistency Determination, final plans, environmental impact analysis	Public Hearing
Shoreline Setback Variance for Kaka‘ako Lands	State of Hawai‘i, Office of Planning	Final plans, environmental impact analysis, landowner approval	Public Hearing (combined with SMA Public Hearing)
Revocable Permit and Construction Right of Entry of the Staging Area.	State of Hawai‘i , Department of Land and Natural Resources (DLNR) processes, the BLNR grants the permit and ROE		Description of equipment and duration of construction activities
Conservation District Use Permit (CDUP) for Marine Waters	State of Hawai‘i , Department of Land and Natural Resources (DLNR) processes the Conservation District Use Application (CDUA), the BLNR grants the CDUP	FEIS, SMA Permit, Shoreline Setback Variance, site and construction plans, landowner’s consent	Maps, photographs, plans (including: location/area, site, emergency response, business, management). Public Hearing (20 days notice required). Contested case may be initiated
Non-exclusive Easement for Submerged Lands	State of Hawai‘i, Department of Land and Natural Resources (DLNR) processes the Conservation District Use Application (CDUA), the BLNR grants the easement	CDUP, description of easement	Appraisal of easement value, liability insurance
National Pollutant Discharge Elimination System (NPDES) Individual Permit	State of Hawai‘i , HDOH CWB, USEPA reviews	Project description, survey and monitoring reports of existing biota, water quality, and uses of the area, discharge description, assessment of discharge impacts (i.e., EIS), schedule, construction plans	Public Hearing may be requested. Monitoring of discharge and periodic reporting would be required after permit is granted
Notices of Intent for General NPDES Permits for: a) Stormwater Runoff From a Construction Area, b) Discharge of Hydrotesting waters, and c) Construction Dewatering Effluent	State of Hawai‘i, Department of Health		Description of activities

Permit, Approval, or Supplemental Document	***Lead Agency***	***Prerequisites***	***Other Requirements***
Zone of Mixing (ZOM) Approval for Return Seawater	State of Hawaiʻi, HDOH CWB, USEPA reviews	Receiving water and discharge characterization, assessment of discharge impacts (i.e., EIS)	Plume modeling, map of proposed ZOM boundaries
Clean Water Act, Section 401 Water Quality Certification	State of Hawaiʻi, Department of Health (HDOH), Clean Water Branch (CWB), USEPA reviews	Project description, survey and monitoring reports of existing biota, water quality, and uses of the area, discharge description, assessment of discharge impacts (i.e., EIS), schedule, construction plans. NPDES permit	Site-specific Best Management Practices (BMP) Plan. Applicable Monitoring and Assessment Plan. Mitigation/Compensation Plan needed if "special aquatic sites" (e.g., coral reefs) are affected. Public Hearing may be requested
Permit to Perform Work Within a State Highway Right-of-Way	State of Hawaiʻi, Department of Transportation	Traffic management plan including a traffic control plan	Construction plans
Permit for Oversized Loads on Highways	State of Hawaiʻi, Department of Transportation		
Permit to Discharge Process Wastewater	USEPA	Draft NPDES permit prepared by HDOH	Public notification or Public Hearing
Notice of Proposed Construction or Alternation - Form 7460-1	Federal Aviation Administration	Description of obstruction and schedule.	Lat/long position, site elevation, map
Essential Fish Habitat (EFH) Consultation (only required if U.S. ACOE determines project may have adverse effect on EFH)	ACOE consults with U.S. National Marine Fisheries Service (NMFS)	DEIS	Western Pacific Fishery Management Council may comment on actions that adversely affect EFH
Endangered Species Act (ESA) Section 7 Consultation (only required if U.S. ACOE determines project may have adverse effect on a listed threatened or endangered species or its designated critical habitat)	U.S. ACOE consults with U.S. NMFS and/or U.S. FWS depending on species/habitat jurisdiction	DEIS	
National Environmental Policy Act (NEPA) EIS	U.S. ACOE approves, USEPA reviews	Complete project description, all necessary supporting studies of resources and potential impacts	
Department of the Army Permit	U.S. ACOE	NEPA EIS, all previous approvals and permits at state and county levels, EFH and ESA Consultations	Vicinity, plan and elevation drawings. Possible Public Hearing

CHAPTER 6. PREPARERS, SCOPING, DISTRIBUTION AND COMMENTS

6.1 PREPARERS OF THE EIS

- Karl Bromwell, C.E.A., R.E.M., B.S. Biology and Marine Sciences, 21 years experience
- Andrea Gall, B.A. Communications, 19 years experience
- Julie Grass, B.A. Environmental Studies, B.A. English, 1 year experience
- Kerry Halford, B.S. Physics, 6 years experience
- Jeffrey Hart, R.G., B.S./Geophysics, Registered Geologist, 23 years experience
- George Krasnick, M.S. Biological Oceanography, 36 years experience
- Glenn Metzler M.S. Biology, B.S. Biology and Chemistry, 22 years experience
- Lara Payne, B.S. Geography, 10 years experience
- David Rezachek, Ph.D. Ocean Engineering, 32 years experience
- Paige Sims, M.S. Environmental Engineering and Science, B.S. Biology, 4 years experience
- April Teekell, M.S. Environmental Science and Management, B.S. Applied Ecology, 10 years experience

6.2 THE PUBLIC INVOLVEMENT PROCESS

The HSWAC development team has been extremely proactive in initiating dialog with the community. Well before initiating assessment of the potential environmental impacts of the project, the team consulted Federal, State and county agencies, elected representatives, utilities, community and business groups, environmental organizations, and of course, potential customers of the HSWAC system. As these consultations have proceeded, a mailing list was developed, and a series of newsletters about the project was produced and distributed to all identified interested parties. In addition, a formal public information meeting was held at the University of Hawaiʻi at Manoa Department of Architecture Auditorium on June 15, 2005.

6.3 CONSULTED PARTIES

A list of the agencies, organizations, and individuals consulted to date follows. Contacts made for the purpose of marketing the system are not included.

U.S. Congress
Senator Daniel K. Akaka
Senator Daniel K. Inouye
Representative Neil Abercrombie
Representative Ed Case

Federal Agencies
U.S. Army Corps of Engineers
U.S. Coast Guard
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
U.S. National Marine Fisheries Service
U.S. Navy

State Elected Officials
Governor Linda Lingle
Senator Robert Bunda, 22nd District
Senator Suzanne Chun Oakland, 13th District
Senator J. Kalani English, 6th District
Senator Carol Fukunaga, 11th District
Senator Fred Hemmings, 25th District
Senator Russell S. Kokubun, 2nd District
Senator Ron Menor, 17th District
Senator Brian T. Taniguchi, 10th District
Senator Gordon Trimble, 12th District
Representative Kirk Caldwell, 24th District
Representative Cindy Evans, 7th District
Representative Galen Fox, 23rd District
Representative Robert N. Herkes, 5th District
Representative Kenneth T. Hiraki, 28th District
Representative Sylvia Luke, 26th District
Representative Barbara C. Marumoto, 19th District
Representative Hermina M. Morita, 14th District
Representative Calvin K.Y. Say, 20th District
Representative Brian Schatz, 25th District
Representative Dwight Y. Takamine, 1st District
Representative Cynthia Thielen, 50th District
Representative Glenn Wakai, 31st District
Representative Tommy Waters, 51st District

State Agencies
Department of Accounting and General Services
Department of Budget and Finance
Department of Business, Economic Development and Tourism
Department of Commerce and Consumer Affairs
Department of Health
Department of Land and Natural Resources
Department of Taxation
Department of Transportation
Hawaiʻi Coastal Zone Management Program
Hawaiʻi Community Development Authority
Hawaiʻi Strategic Development Corporation
Office of Environmental Quality Control
Office of Hawaiian Affairs
Office of Planning
Public Utilities Commission
University of Hawaiʻi
University of Hawaiʻi Environmental Center

County Elected Officials
Mayor Mufi Hannemann
Mayor Jeremy Harris
Honorable Donovan M. Dela Cruz, City Council Chair
Honorable Charles K. Djou, Councilmember District 4
Honorable Steve Holmes, former Councilmember
Honorable Ann H. Kobayashi, Councilmember District 5
Honorable Barbara Marshall, Councilmember District 3
Honorable Rod Tam, Councilmember District 6

County Agencies
Managing Director
Board of Water Supply
Department of Budget and Fiscal Services
Department of the Corporation Counsel
Department of Design and Construction
Department of Environmental Services
Department of Facility Maintenance
Department of Land Utilization
Department of Planning and Permitting
Department of Transportation Services

O'ahu Neighborhood Boards
Ala Moana/Kakaʻako Neighborhood Board
Downtown Neighborhood Board

Public Utilities
Hawaiian Electric Company
Hawaiian Telecom

Business, Education, Energy, and Technology Organizations
AIA Honolulu Committee on the Environment
American Association of Heating Refrigeration and Air Conditioning Engineers – Hawai‘i
American Institute of Architects
American Water Works Association – Hawai‘i
Building Industry Association of Hawai‘i
Building Owners and Managers Association
Engineering Alumni Association of the University of Hawai‘i
Enterprise Honolulu
Hawai’i 2050 Sustainability Task Force
Hawai‘i Building Engineers Association
Hawai‘i Energy Policy Forum
Hawai’i Energy Reliability Advisory Committee
Hawai‘i Environmental Council
Hawai‘i Ocean Safety Team
Hawai‘i Ocean Science & Technology
Hawai‘i Renewable Energy Alliance
Hawai‘i Science and Technology Council
Hawai‘i Solar Energy Association
Hawai‘i Technology Trade Association
International Facility Management Association
Kamehameha Schools
Marine Technology Society
Pacific Century Fellows
Rebuild Hawai‘i Consortium
The Chamber of Commerce of Hawai‘i
Waikiki Improvement Association

Trade Unions
Plumbers & Fitters Local 675
Media
Associated Press – Honolulu
Building Industry Magazine
Hawai‘i Business
Hawai‘i Public Radio
Honolulu Magazine
Honolulu Star Bulletin
Honolulu Weekly
Pacific Business News
The Honolulu Advertiser
Trade Publishing Company

6.4 ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE

An Environmental Impact Statement Preparation Notice (EISPN) was published in the Office of Environmental Quality Control’s *Environmental Notice* on August 23, 2007 and the comment period ended on September 24, 2007. The distribution list for the EISPN was as follows.

State of Hawai‘i Agencies
Accepting Authority: Office of Planning (2 copies delivered)
OEQC (4 copies delivered)
DBEDT
DBEDT, Energy, Resources & Technology Division
DBEDT Planning office
DLNR (5 copies)
DLNR, Historic Preservation Division
HDOH, Environmental Planning Office (3 copies)
Office of Hawaiian Affairs
UH Environmental Center

Federal Agencies
US Fish and Wildlife Service
US Army Engineer District
National Marine Fisheries Service

Honolulu County Agencies
Board of Water Supply
Department of Planning and Permitting (5 copies)
Department of Parks and Recreation
Department of Facility Maintenance
Department of Transportation Services
Department of Environmental Services

Libraries and Depositories
State Main Library

News Media
Honolulu Advertiser
Honolulu Star Bulletin

Elected Officials
County Councilmember: Rod Tam
Chair, Downtown Neighborhood Board
Chair, Ala Moana-Kaka‘ako Neighborhood Board

Other Consulted Parties

University of Hawaiʻi Environmental Center
Enterprise Honolulu
Hawaiʻi Renewable Energy Alliance
Hawaiʻi Science and Technology Council
Hawaiʻi Solar Energy Association
Life of the Land
Sierra Club
Sierra Club – University of Hawaiʻi
Ocean Engineering & Energy Systems

6.5 COMMENTS RECEIVED ON THE EISPN AND DEIS AND RESPONSES THERETO

The comment letters received in response to the EISPN and the letters of response are reproduced in Appendix E. The comment letters received in review of the DEIS and the letters of response are reproduced in Appendix F. Table 6-1 summarizes respondents to the EISPN and DEIS.

Table 6-1: Respondents to the EISPN and DEIS

#	*Agency, Organization or Individual*	*Substantive*	*Non-Substantive*
#	***EISPN***		
1	Lester K.C. Chang, Director City and County of Honolulu, Department of Parks and Recreation		✓
2	Maurice H. Kaya, Chief Technology Officer State of Hawaiʻi, Department of Business, Economic Development and Tourism, Strategic Industries Division	✓	
3	Laverne Higa, P.E., Director and Chief Engineer City and County of Honolulu, Department of Facility Maintenance	✓	
4	Kelvin H. Sunada, Manager State of Hawaiʻi, Department of Health, Environmental Planning Office	✓	
5	Teney K. Takahashi, Interim Executive Director Hawaiʻi Community Development Authority	✓	
6	State of Hawaiʻi, Department of Land and Natural Resources, Land Division, Division of Boating and Ocean Recreation – Oahu District		✓
7	Morris M. Atta, Administrator State of Hawaiʻi, Department of Land and Natural Resources, Land Division, Oahu District	✓	
8	Eric T. Hirano, Chief Engineer State of Hawaiʻi, Department of Land and Natural Resources, Engineering Division		✓
9	Ken C. Kawahara, P.E., Deputy Director State of Hawaiʻi, Department of Land and Natural Resources Commission on Water Resource Management	✓	
10	Samuel J. Lemmo, Administrator State of Hawaiʻi, Department of Land and Natural Resources, Office of Conservation and Coastal Lands	✓	
11	Russell Y. Tsuji, Administrator State of Hawaiʻi, Department of Land and Natural Resources, Land Division		✓
12	Melvin N. Kaku, Director City and County of Honolulu, Department of Transportation Services	✓	
13	Henry Eng, FAICP, Director City and County of Honolulu, Department of Planning and Permitting	✓	

	Agency, Organization or Individual	*Substantive*	*Non-Substantive*
14	Clyde W. Nāmuʻo, Administrator State of Hawaiʻi, Office of Hawaiʻian Affairs	✓	
15	Keith S. Shida, Program Administrator, Customer Care Division City and County of Honolulu, Board of Water Supply	✓	
	DEIS		
1	Keith S. Shida, Program Administrator, Customer Care Division City and County of Honolulu, Board of Water Supply	✓	
2	Ernest Y.W. Lau, Public Works Administrator State of Hawaiʻi, Department of Accounting and General Services	✓	
3	Abbey Seth Mayer, Director State of Hawaiʻi, Department of Business, Economic Development and Tourism, Office of Planning	✓	
4	Theodore A. Peck, Administrator State of Hawaiʻi, Department of Business, Economic Development and Tourism, Strategic Industries Division		✓
5	Morris M. Atta, Administrator State of Hawaiʻi, Department of Land and Natural Resources, Land Division, Oahu District Land Office		✓
6	Jason Leonard, Aquatic Biologist State of Hawaiʻi, Department of Land and Natural Resources, Division of Aquatic Resources	✓	
7	Eric T. Hirano, Chief Engineer State of Hawaiʻi, Department of Land and Natural Resources, Engineering Division	✓	
8	Barry Cheung, District Land Agent State of Hawaiʻi, Department of Land and Natural Resources, Land Division,	✓	
9	Myles Nakamura State of Hawaiʻi, Department of Land and Natural Resources, Division of Boating and Ocean Recreation	✓	
10	Samuel J. Lemmo, Administrator State of Hawaiʻi, Department of Land and Natural Resources, Office of Conservation and Coastal Lands	✓	
11	Nancy McMahon, Deputy State Historic Preservation Officer State of Hawaiʻi, Department of Land and Natural Resources, State Historic Preservation Division	✓	
12	Henry Eng, F.A.I.C.P., Director City and County of Honolulu, Department of Planning and Permitting	✓	
13	Kelvin H. Sunada, Manager State of Hawaiʻi, Department of Health, Environmental Planning Office	✓	
14	Edward T. Teixeira, Vice President of Civil Defense State of Hawaiʻi, Department of Defense		✓
15	Peter Rappa, Environmental Review Coordinator University of Hawaiʻi, Environmental Center	✓	
16	Brennon T. Morioka, Ph.D., P.E., Director State of Hawaiʻi, Department of Transportation	✓	

	Agency, Organization or Individual	***Substantive***	***Non-Substantive***
17	Anthony Ching, Executive Director Hawaiʻi Community Development Authority	✓	
18	Kirk S. Tomita, Senior Environmental Scientist Hawaiian Electric Company, Inc.	✓	
19	Eugene C. Lee, P.E., Director City and County of Honolulu, Department of Design and Construction	✓	
20	Craig Nishimura. P.E., Director and Chief Engineer City and County of Honolulu, Department of Facility Maintenance	✓	
21	Lester K.C. Chang, Director City and County of Honolulu, Department of Parks and Recreation		✓
22	Wayne Y. Yoshioka, Director City and County of Honolulu, Department of Transportation Services	✓	
23	Gene Pawlak, Associate Professor University of Hawaiʻi, Ocean and Resources Engineering Department	✓	
24	Danielle Jayewardene, Coral Reef Ecologist National Oceanic and Atmospheric Administration, Pacific Islands Regional Office	✓	
25	Steven K. Oney, PhD, Executive Vice President, Chief Technical Officer Ocean Engineering and Energy Systems	✓	
26	Clyde W. N āmuʻo, Administrator State of Hawaiʻi, Office of Hawaiian Affairs	✓	

CHAPTER 7. LITERATURE CITED

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APPENDIX A

CALCULATION OF FUEL OIL SAVINGS AND AIR EMISSION REDUCTIONS FROM HSWAC

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Calculations of HSWAC Energy Savings		
Connected Load	25,000	tons
Utilization Hours	4,050	eq. full load hours
Annual Cooling Requirement for Downtown Honolulu	101,250,000	ton-hr/yr
Without Transmission & Distribution Losses		
Power Requirement for Conventional Cooling (CC)	0.880	kWh/ton-hr
Average Power Requirement for SWAC	0.200	kWh/ton-hr
Power Savings for SWAC vs. CC	0.680	kWh/ton-hr
Energy Requirement for Conventional Cooling	89,100,000	kWh/yr
Energy Requirement for SWAC	20,250,000	kWh/yr
Energy Savings for SWAC vs. CC	68,850,000	kWh/yr
	77.3	%
With Transmission & Distribution Losses		
Average Transmission & Distribution Efficiency	88.8%	
Power Requirement for Conventional Cooling	0.9907	kWh/ton-hr
Power Requirement for SWAC	0.2251	kWh/ton-hr
Power Savings for SWAC vs. CC	0.7655	kWh/ton-hr
Energy Requirement for Conventional Cooling	100,303,951	kWh/yr
Energy Requirement for SWAC	22,796,353	kWh/yr
Energy Savings for SWAC vs. CC	**77,507,599**	**kWh/yr**

Calculations of HSWAC Fossil Fuel Reduction

HECO's Weighted Average Heat Rate	10,689	Btu/kWh
Electricity Generation Efficiency		
Crude Oil Production Efficiency	90.5%	
Crude Oil Shipping Efficiency	98.0%	
Crude Oil Refining Efficiency	90.0%	
Electrical Generation Efficiency	31.9%	
Transmission & Distribution Efficiency	88.8%	
Overall Efficiency	22.6%	
Where: Overall Efficiency is the electricity generation efficiency from crude oil at the source to electricity at the end use		
Calculated Overall Heat Rate of Electricity Generation		
Overall Heat Rate	15,075	Btu/kWh
Total Annual Energy Savings		
Annual Crude Oil Energy Savings	**1,037,921**	**MMBtu/yr**
Higher Heating Value of Crude Oil	5,800,000	Btu/bbl
Barrels of Crude Oil Equivalent	**178,952**	**Bbls COE**

Calculation of Water Usage and Sewer Generation for Conventional Cooling

Connected Load	25,000	tons	
Utilization Hours	4,050	eq. full load hours	
Specific Power Requirement of Conventional Chillers	0.68	kW/ton	1
Thermal Load of Cooling Tower	14,320	Btu/ton	2
Average Number of Concentrations	3.0		3
Evaporation	1.72	gal/ton-hr	4
Drift	0.03	gal/ton-hr	5
Blowdown	0.83	gal/ton-hr	6
Total Water Use	2.58	gal/ton-hr	7
	10,439	gal/ton-yr	8
	260,986,665	**gallons**	
Total Sewage Generation	3,364	gal/ton-yr	9
	84,095,703	**gallons**	

Notes:
1 = Weighted average of chiller power requirements
2 = 12,000 Btu/ton + [(3,412 Btu/kWh) x (Specific Power Requirement of Chillers)]
3 = Weighted average of sampling of large customers
4 = (Thermal Load of Cooling Tower) / [(8.33 lb/gal) x 1,000 Btu/lb)]
5 = [Evaporation (gal/ton-hr)] x [Drift (%)] / [Evaporation (%)]
6 = [Evaporation (gal/ton-hr)] x [Blowdown (%)] / [Evaporation (%)]
7 = (Evaporation) + (Drift) + (Blowdown)
8 = (Total Water Use) x (EqFLH)
9 = (Blowdown) x (EqFLH)

Calculation of HSWAC Emission Reduction

Emissions data were provided by HECO during the IRP process in a spreadsheet entitled "Source: Obj&Meas Base Scenario Graphs r2.xls, Rev 9/24/04".

Emissions were then determined on the basis of lbs/mmBtu, with the ratios of various types of pollutants to CO2 assumed to be constant.

Emission	lbs/MMBtu	tons/year *1
Carbon Dioxide (CO2)	163.3538	**84,774**
Volatile Organic Compounds (VOC)	0.0101	**5**
Carbon Monoxide (CO)	0.0535	**28**
Particulate Matter Under 10 microns (PM10)	0.0359	**19**
Nitrogen Oxides (NOx)	0.3260	**169**
Sulfur Oxides (SOx)	0.3188	**165**
*1 Based on Annual Crude Oil Energy Savings	1,037,921	MMBtu/yr

Calculation of HSWAC Electric Demand Reduction

Connected Load	25,000	tons
Without Transmission & Distribution Losses		
Power Requirement for Conventional Cooling (CC)	0.820	kW/ton
Power Requirement for SWAC	0.300	kW/ton
Demand Reduction for SWAC vs. CC	0.520	kW/ton
Total Power Requirement for Conventional Cooling	20,500	kW
Total Power Requirement for SWAC	7,500	kW
Demand Reduction for SWAC vs. CC	13,000	kW
	63.4	%
With Transmission & Distribution Losses		
Average Transmission & Distribution Efficiency	88.8%	
Power Requirement for Conventional Cooling	0.9231	kW/ton
Power Requirement for SWAC	0.3377	kW/ton
Demand Reduction for SWAC vs. CC	0.5854	kW/ton
Total Power Requirement for Conventional Cooling	23,078	kW
Total Power Requirement for SWAC	8,443	kW
Demand Reduction for SWAC vs. CC	**14,635**	**kW**

Equivalence to Other Electricity Generation Technologies		
Wind - Utility Scale		
Capacity Factor	0.32	
Annual Energy Production	77,507,599	kWh/yr
Rated Capacity	27,650	kW
Equivalent Utility Scale Wind	**28**	**MW**
PV - Utility Scale		
Capacity Factor	0.21	
Annual Energy Production	77,507,599	kWh/yr
Rated Capacity	42,133	kW
Equivalent Utility-Scale PV	**42**	**MW**
Municipal Solid Waste (MSW)-to-Energy - Utility Scale		
Capacity Factor	0.65	
Annual Energy Production	77,507,599	kWh/yr
Rated Capacity	13,612	kW
Equivalent Utility-Scale MSW-to-Energy	**14**	**MW**

Equivalence to Residential Solar Water Heating Systems

Annual Energy Savings Per Residential Solar Water Heating System	2,485	kWh/yr
Average Transmission & Distribution Losses	88.8%	
Annual Energy Savings Per Residential Solar Water Heating System (with Transmission & Distribution Losses)	22,247	kWh/yr
Overall Heat Rate	15,075	Btu/kWh
Annual Energy Savings Per Residential Solar Water Heating System (with Transmission & Distribution Losses)	37,461,628	Btu/yr
	6.459	Bbl COE/yr
Equivalent Amount of Residential SWH Systems	**27,706**	**SWH Sys.**

Decrease in HSWAC Thermal Pollution

Each ton of air conditioning is equal to 12,000 Btu/hr of heat removed from an air conditioned space. Ultimately, all of the energy used to make electricity used for cooling is also exhausted to the environment (this includes the heat equivalent of the electricity, as well as the waste heat generated from the electricity generating process).

Therefore, thermal pollution can be calculated as follows:

Conventional Air Conditioning

Total Heat Released to Environment

12,000	Btu/ton-hr +	0.88	kWh/ton-hr x	15,075	Btu/kWh =		25,266	Btu/ton-hr

HSWAC

Total Heat Released to Environment

12,000	Btu/ton-hr +	0.20	kWh/ton-hr x	15,075	Btu/kWh =		15,015	Btu/ton-hr

Reduction in Total Heat Released to Environment

(	**25,266**	**-**	**15,015**	**) /**	**25,266**	**=**	**40.6%**

APPENDIX B
FINAL ARCHAEOLOGICAL AND CULTURAL IMPACT STUDY
AND
FINAL ARCHAEOLOGICAL MONITORING PLAN
WITH LETTER OF ACCEPTANCE FROM THE
STATE OF HAWAI‘I, DEPARTMENT OF LAND AND NATURAL RESOURCES

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FINAL REPORT

ARCHAEOLOGICAL AND CULTURAL IMPACT STUDY IN SUPPORT OF THE HONOLULU SEAWATER AIR CONDITIONING PROJECT IN PORTIONS OF KAKA`AKO AND DOWNTOWN HONOLULU, PAUOA AHUPUA`A, HONOLULU (KONA) DISTRICT, ISLAND OF O`AHU, STATE OF HAWAII

TMK: VARIOUS

Prepared for:

TEC Inc.
1001 Bishop Street
American Savings Bank Tower
Suite 1400
Honolulu, Hi 96813

Prepared by:

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720 Iwilei Road, Suite 424
Honolulu, HI 96817

October 2008

FINAL REPORT
Archaeological and Cultural Impact Assessment Study
in Support of the Honolulu Seawater Air Conditioning Project
in Portions of Kaka`ako and Downtown Honolulu,
Pauoa Ahupua`a, Honolulu (Kona) District, Island of O`ahu, State of Hawaii
TMK: Various

By
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INTRODUCTION

At the request of TEC, Inc. (TEC), Pacific Consulting Services, Inc. (PCSI) conducted an archaeological and cultural impact assessment study in support of an Environmental Impact Statement (EIS) prepared for the Honolulu Seawater Air Conditioning Project. This report was prepared in compliance with Act 50 and Chapter 343, HRS. Selected, appropriate elements of the State of Hawaii Environmental Council's "Guidelines for Assessing Cultural Impacts" will be applied to the assessment.

PROJECT DESCRIPTION

General Description

The Honolulu Sea Water Air Conditioning (HSWAC) project would provide 25,000 tons of centralized air conditioning for downtown Honolulu. The primary means of cooling would be through the circulation of deep, cold seawater accessed through a long offshore intake pipeline. The Area of Potential Effect (APE) for HSWAC includes the major system components are as follows:

- Seawater intake and return pipes extending between the on-shore cooling station and submerged offshore locations;
- On-shore seawater cooling station (cooling station) containing;
    - Seawater pumps;
    - Freshwater pumps;
    - Heat exchangers;
    - Auxiliary chillers;
- Chilled (fresh) water distribution system on land consisting of underground pipes connected to participating buildings in downtown Honolulu;
- A staging area for equipment and construction materials

Figure 1 shows the locations of these system components, as currently proposed, and Figure 2 shows the primary APE for this report and the proposed routing of the underground pipes on land that connect individual buildings to the system.

Offshore Intake Pipeline and Onshore Cooling Station

Offshore, cold seawater will be transmitted through a 63-inch diameter high density polyethylene (HDPE) pipe to the heat exchangers on shore. The length of the pipe from shore to the intake location would be approximately four miles. Water depth at the offshore intake point would be approximately 1,600 feet. The HDPE pipe would be constructed from 40 to 80 feet segments at the on-shore staging area (currently proposed for the west side of Sand Island), and then connected and submerged.

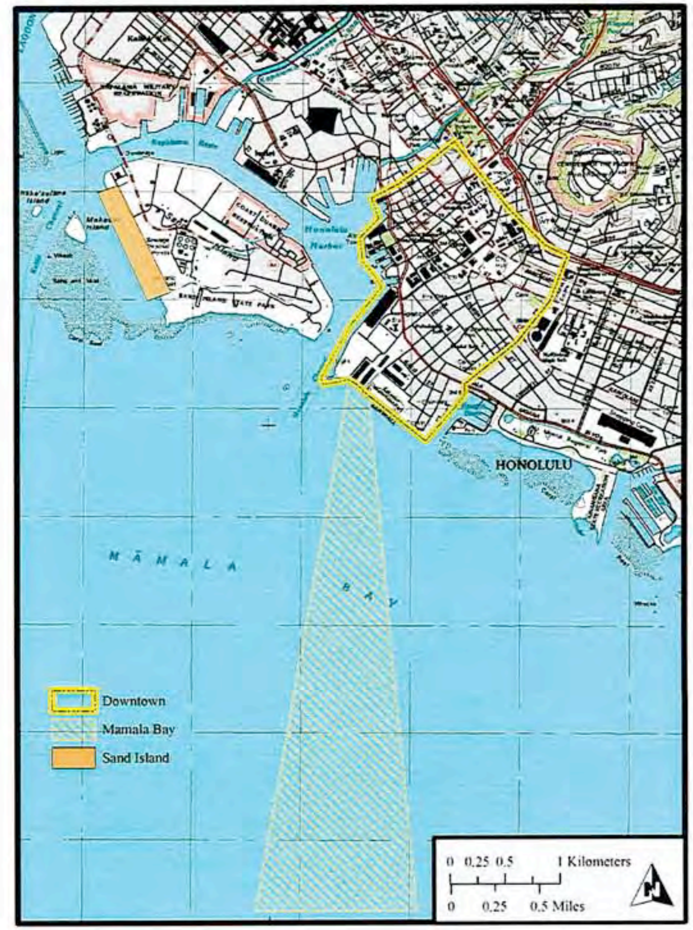

Figure 1. Project Area Showing Downtown Honolulu, Mamala Bay, and Sand Island Portions of the Project Area on a U.S.G.S. Quadrangle Map.

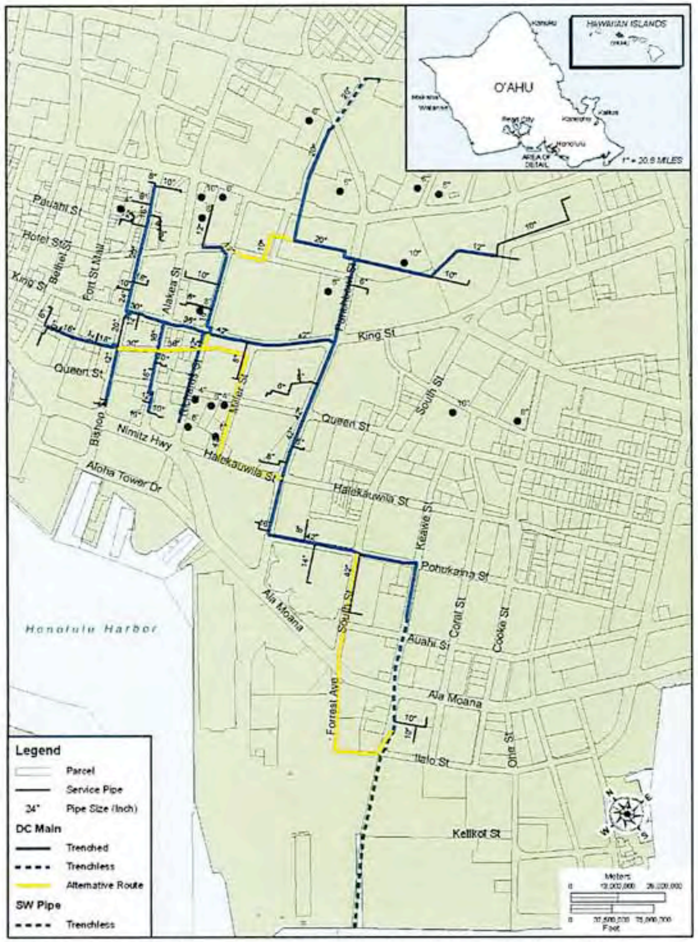

Figure 2. Location of Honolulu Seawater Air Conditioning Pipeline Route.

The seawater pumps, heat exchangers and auxiliary chillers would be housed in a cooling station. The currently preferred location for the cooling station is on a lot *makai* of 677 Ala Moana Blvd. Construction of the cooling station would require excavation and dewatering because the seawater pump room must extend below sea level to allow for correct and safe operations. The elevation of the main floor will be dependent on the integration of it into surrounding structures.

On-Shore Distribution System

Once the cold seawater is transmitted through the cooling station from the ocean, a system of pipes installed beneath the streets of downtown Honolulu would distribute chilled freshwater into customer buildings. Because each building is unique in its piping and chiller placement, connection points to the common chilled water loop and the amount of internal piping required to implement the conversion will be individually determined but will all be below current ground surface.

Depending on the specific locations of HSWAC's customers, the total length of the distribution system may vary from approximately 15,000 to 17,000 feet. Distribution pipes would be larger in diameter closer to the cooling station and smaller at greater distances. Pipe sizes would vary between 8 inches and 42 inches, with a length-weighted average of 26 inches. The total volume of fresh water in the distribution system would be close to one million gallons.

In general, the distribution pipes would be buried in trenches dug in streets or beneath sidewalks (Figure 2); currently, the average depth of open trenching would be 3 – 4 feet below existing ground surface. All existing utility installations would be accurately mapped and agreements made for new or shared easements where required. In most cases, "cut and cover" trenching would be done. Where potential traffic disruption is too great, such as on Ala Moana Boulevard, micro-tunneling or horizontal directional drilling (HDD) would be used to create a conduit for the pipe beneath the roadway without interrupting traffic flows. To the extent possible, routing has been planned so as to avoid potential traffic impacts.

Pipeline Returning Water to Ocean

The return pipe would begin at the cooling station and pass through a directionally drilled shaft from the shoreline to 40 to 45 feet depth, similar to the intake pipe. The breakout point for the return pipe would be at the same depth as for the intake pipe, and again some trenching would be required to protect the pipe from large storm waves. The return pipe would be buried in a trench from the shaft breakout point to a depth of 80 feet, a distance of approximately 1,000 feet. Water depth at that location is approximately 130 feet.

Temporary Staging Area

A temporary staging area is needed for storage of pipe sections, gravity anchors, stiffeners and other materials during the pipeline assembly process; the currently preferred location for the staging area would be along the western shore of Sand Island. This area would be restored to its original condition after the seawater pipes have been deployed (see Figure 1).

PROJECT ENVIRONMENT

Climate and Rainfall

Annual rainfall averages less than 760 millimeters (ca 30 inches) per year (Giambelluca et al. 1988). There are currently no natural drainages within Kewalo although Manoa and Makiki Streams are on the east, and Nuuanu Stream is to the west. Judging from observations made in the early 19th century, the wetlands of Kewalo were drained by small streams and rivulets that flowed through the marshes; fishponds were also prominent features of the traditional Kewalo landscape (Bingham 1981).

Soils

There are a variety of soil regimes in the project area. Figure 3 is roughly based on Foote et al. (1972: Map 62), and shows the project area and APE with the location and boundaries of the various soil series present. Based on Foote et al. (1972) and Figure 3, there are four soil series present in the APE. From seaward areas towards the mountains, these soils include Mixed Fill Lands (FL), Ewa silty clay loam (EmA), Makiki clay loam (MkA), and Tantalus silty clay loam (TCC). These soil series are described below.

Mixed fill lands are found in Pearl Harbor and in Honolulu adjacent to the ocean. In the APE, the mixed fills consist of materials dredged from the ocean, garbage and construction debris, and general materials from other sources (Foote et al. 1972: 31). Lands containing this soil type are used in urban development including airports, housing areas, and industrial facilities. It should be noted that this soil type is often found seaward of nineteenth century coastlines (see Figure 3).

Mixed fill lands occur in seaward portions of the APE, including areas immediately *mauka* and *makai* of Ala Moana Boulevard, seaward portions of Keawe,

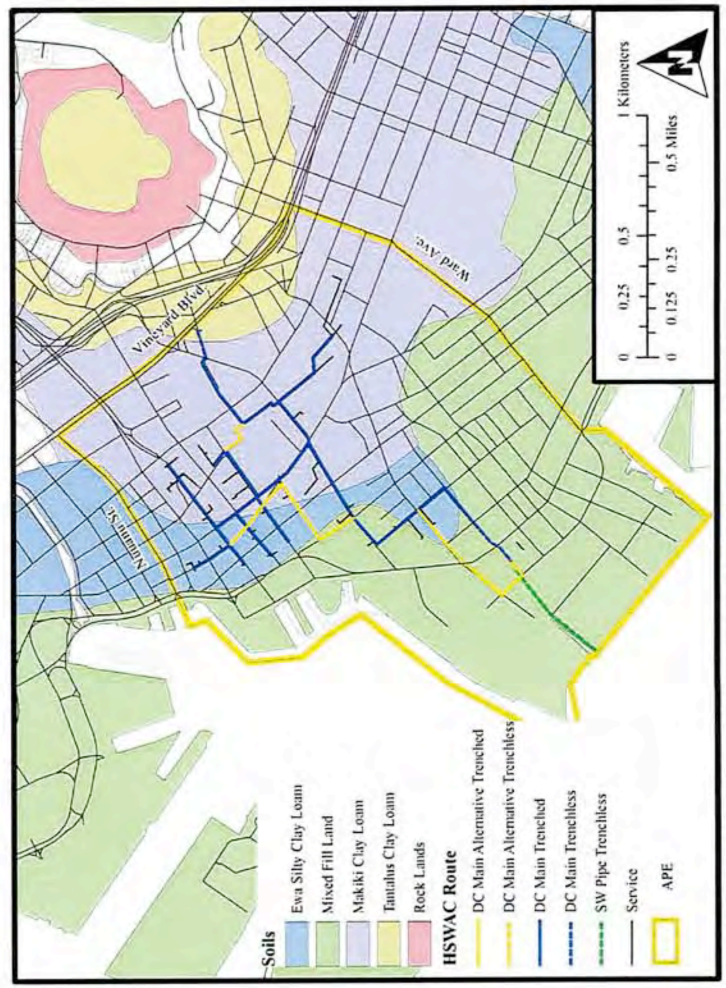

Figure 3. Location of Soil Types in the Area of Potential Effect and Adjacent Areas.

further inland south of the APE (see Figure 3). A majority of the mixed fill lands in the South, and Punchbowl Streets, as well as portions of Pohukaina Street. The fills extend APE were created during the 1930s in an effort to drain wetland areas along the southern coast of Oahu. Based on Foote et al. (1972), and on previous archaeological studies in the APE, these soils range in thickness from about 20 inches (50 centimeters-cm) to about 6.5 feet (2.0 meters-m).

Just inland of the mixed fill lands in the APE, a relatively narrow band of Ewa silty clay loams (EmA) are encountered (see Figure 3). These soils are moderately shallow and are present in areas with 0 to 2% slopes. Ewa silty clay loams are well-drained soils occurring in basins and on alluvial fans and have developed in alluvium derived from basalts.

Ewa silty clay loams occur only in seaward portions of the APE. Streets identified as having underlying Ewa silty clay loams include portions of Keawe, Pohukaina, South, Punchbowl, Alakea, Merchant, Richards, and Bishop Streets. Based on Foote et al. (1972), and on previous archaeological studies in the APE, Ewa silty clay loams average about 20.0 inches (about 50 cm) in thickness.

Inland of the Ewa silty clay loams in the APE Makiki clay loam (MkA) soils are encountered (see Figure 3). Makiki clay loams are somewhat similar to Ewa silty clay loams. These soils occur on 0 to 2% slopes, and consist of well-drained soils on alluvial fans and terraces in the city of Honolulu. The soils were formed in alluvium mixed with volcanic ash and cinders, and are used almost entirely for urban purposes.

Makiki clay loams occur in central and inland (*mauka*) portions of the APE. Streets identified as having underlying Makiki clay loams include portions of Punchbowl, Alakea, Merchant, Richards, Hotel, Miller, and Bishop Streets. Based on the Foote et al. (1972), and on previous archaeological studies in the APE, Makiki clay loams range in thickness from about 20.0 to 30.0 inches (50.0 to 75.0 cm).

The fourth soil series located within the APE includes Tantalus silty clay loam (TCC). Tantalus silty clay loams occur inland of Makiki clay loams in the APE (see Figure 3). Tantalus soils occur on 8 to 15% slopes, and consist of well-drained soils on upland areas (foothills) of Oahu. The soils were formed in volcanic ash and materials weathered from cinders, and are used for urban purposes such as home sites, water supply and recreation.

Tantalus clay loams occur only in the inland-most (*mauka*) portion of the APE. The only street where these soils may be encountered is along the upper reaches of

Miller Street. Based on the Foote et al. (1972), Tantalus clay loams range in thickness from about 20.0 to 30.0 inches (50.0 to 75.0 cm).

CULTURAL AND HISTORICAL BACKGROUND

Legendary History and Place Names in the APE

The seawater APE includes two sections of the urban center of Honolulu, Downtown Honolulu and Kaka`ako, both of which are within the traditional *ahupua`a* of Pauoa (Figure 4). More recent shifts in land boundaries as established through the tax map system have resulted in parcels within the APE variously designated as being in Honolulu, Nu`uanu, and Waikīkī *ahupua`a*, as seen in a number of reports consulted for this study. Downtown Honolulu comprises the area of land bounded by Nu`uanu Stream on the west, Vineyard Boulevard on the north, Ward Avenue on the East, and Honolulu Harbor on the south. Kaka`ako lies immediately to the east of the Downtown area includes portions of what were formerly known as Kewalo, Kukuluāe`o, and Ka`ākaukukui (Pukui et al. 1974). There are previous studies for these areas that provide a comprehensive review of historical and archaeological data (Griffin et al. 1987; O'Hare et al. 2008; McElroy et al. 2008). Consequently, a briefer overview for Downtown Honolulu and Kaka`ako will be presented here.

In pre-Contact times, the Downtown area was not heavily populated, with the exception of small Hawaiian settlements such as the one at Kou. In the Kaka`ako area, settlement was also sparse, with a small group of fishermen living on the shoreline (Ii 1959). The landscape was generally level, sloping down from the *mauka* areas to the ocean on the south and towards drainages such as Nu`uanu Stream on the west (Daws 2006). Taro complexes or *lo`i* stretched *mauka* along the stream into the valley. Elsewhere in Honolulu and Kaka`ako, the dry leeward climate meant that only crops like sweet potato – tolerant of intermittent rainfall -- could be grown away from permanent water sources like the stream. The *makai* portions of both areas had natural features such as tidal mudflats in addition to sandy shoreline. In pre-Contact times, people made use of the natural features to construct fishponds or salt pans to enhance access to preferred resources.

The legendary histories contained in secondary sources such as Westervelt's work do not include many events that took place within the downtown Honolulu or Kaka`ako areas. Instead, the *mauka* portions of Nu`uanu Valley – particularly Waolani Stream – are the primary settings for a number of stories (Westervelt 1987). In *Myths and Legends of Hawaii* Westervelt (1987) refers to several locales within or near the

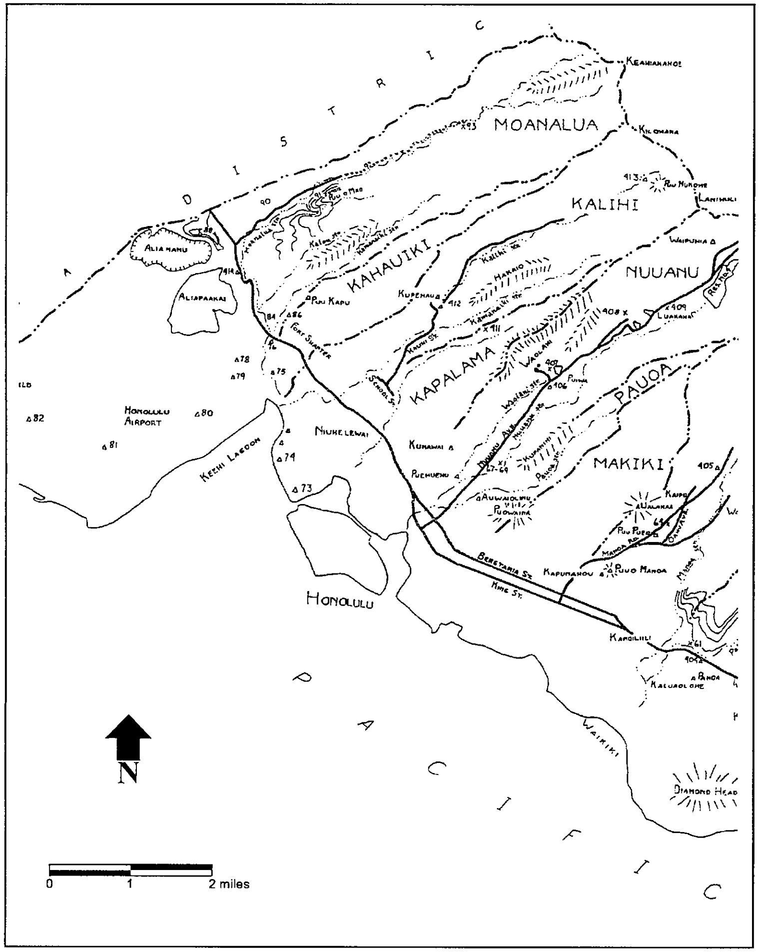

Figure 4. Location of Pauoa Ahupua`a (Adapted from summers & Sterling 1970)

current APE that played a role in the region's legendary history.

Kou was the principal place name for what became Honolulu. Kou was named for the chief Hono-kau-pu, an *`ilāmuku* or executive officer of Kākuhihewa, the ruling chief of O`ahu in the 16th century A.D. Kou lay between Hotel Street and the ocean, and between Nuuanu Avenue and Alakea Street (Westervelt 1987; Pukui et al. 1974). Kou was known for its proximity to the harbor, as this *`ōlelo noe`au* (proverb) says: *Ke awa la`i lulu o Kou* (The peaceful harbor of Kou) (Pukui 1983).

Māmala or ***Ke Kai O Māmala*** was the surf at the entrance to the natural harbor at Kou, named for the chiefess Māmala, a renowned surfer. Māmala was married first to the shark man Ouha and then to the chief Hono-kau-pu, to whom Kakūhihewa gave the land named for him at Kou (Westervelt 1987). Several *`ōlelo noe`au* refer to the surf of Māmala such as this saying: *Na `ale kuehu o Māmala* (The billows of Māmala with wind-blown sprays) (Pukui 1983)

Pākākā was the name of a landing and a *heiau* located at what became the *makai* end of Fort Street. Thrum (1907) called it a *heiau* of the "pookanaka" (sacrificial) class but did not provide a location. Built before Kakuhihewa's time (in the 16th century A.D.), the *heiau* was established by the King of O`ahu to house the powerful god Ku-hoo-nee-nuu he had brought from Maui (Westervelt 1987).

Kawaiaha`o was a freshwater spring (*wai*) that belonged to the Chiefess Hao that was located on what became the church grounds near the intersection of King and Punchbowl Streets.

Kewalo was known as the place where slaves (*kauwā*) were put to death by drowning. Also, the owl at the center of a battle between the owls of O`ahu and Kaua`i and the chief Kakūhihewa had its nesting area in Kewalo. An *`ōlelo noe`au* associated with Kewalo describes the fresh-water springs the area that many once went to: *Ka wai huahua`i o Kewalo* (The bubbling water of Kewalo) (Pukui 1983). Participants in the CIA recalled such fresh water sources from their own childhood days in Kewalo in the first half of the 20th century; by this time, the actual springs had been covered over but the consultants remembered the clear, cold, refreshing water that came from artesian wells sunk into the aquifer.

As seen above, the place names formerly given to locales in the Nu`uanu-Downtown and the Kaka`ako regions provide information on past land uses; a number of the old place names still appear on government maps and other documents. Table 1

Table 1. Traditional Place Names of the Downtown Honolulu and Kaka`ako Areas.

Former Site or Place Name	Location
	Downtown Mauka
Honuakaha	Old section of Honolulu near Kawaiaha`o Cemetery (Ii 1959)
Kaahaimauli Heiau	Said to have been located near the site of `Iolani Palace (Thrum 1907)
Kamanuwai	Ancient taro patch belonging to Keopuolani, near the junction of Nu`uanu & Beretania Streets (Handy & Handy 1972)
Kapu`ukolo	Old section of Honolulu bordered by Nu`uanu Stream & Honolulu Harbor (Ii 1959; Pukui et al. 1974)
Kaumakapili	Former land area & location of church in Honolulu near Smith & Beretania Streets (Westervelt 1915)
Kawaiaha`o Spring	Located at Kawaiaha`o Church grounds (Westervelt 1915)
Kīkīihale	Old section of Honolulu bordered by Mauna Kea & King Streets to Nu`uanu Stream (Ii 1959; Pukui et al. 1974)
Manua Heiau	Said to have been located *mauka* of Queen's Hospital (Thrum 1907)
Kou	A district from Nuuanu to Alakea Streets, and from Hotel Street to the ocean (Westervelt 1915; McAllister 1933)
Pa uhi (or Pa umi)	Large yam (sweet potato) field formerly located near the modern junction of Pali Highway and Beretania Street (Ii 1959)
Pele ula	Said to be where Vineyard Street crosses Nuuanu, formerly the location of many healing *heiau* (Ii 1959; Pukui et al. 1974)
	Downtown Makai
Honoka`upu *ulu maika* course & pond	Former land section along waterfront & a nearby surfing area (Westervelt 1915)
Ka`ākaukukui	Former reef area in Honolulu Harbor, now filled-in; also, former land section *makai* of Kaka`ako & fishery (Hustace 2000)
Kaimuhai kanaka or Umukanaka	Literally "the oven of human sacrifice." Formerly a fish pond near area of current Waterfront Plaza (Griffin et al. 1987; Ii `959))
Kuloloia	Former beach extending from foot of Fort Street to Kaka`ako (Ii 1959)

Table 1. Traditional Place Names of the Downtown Honolulu and Kaka`ako Areas.

Former Site or Place Name	Location
Māmala, Ke Kai O Māmala	Bay extending from Pearl Harbor to Honolulu Harbor; reef entrance at Honolulu Harbor & surfing area at Kou (Westervelt 1915)
Nihoa	Waterfront area extending from Kaahumanu to Nu`uanu, formerly owned by Ka`ahumanu, site of shipyard by 1810 (Ii 1959)
Pākākā	Old canoe landing & former palace of Kamehameha I at Honolulu Harbor, said to have been located at the *makai* end of Fort Street (Ii 1959; Westervelt 1915)
	Kaka`ako & Kewalo
Kaka`ako	Land section of Honolulu bounded by Ala Moana Blvd, Cooke, Queen & Punchbowl Streets (Pukui et al. 1974)
Kewalo	Former harbor & surfing areas; place where the *kauwa* were put to death (Westervelt 1915)
Kolowalu	Former land area *makai* of Kewalo & *mauka* of Kukuluāe`o (Hustace 2000)
Kō`ula	Land section in Kewalo, bordered by King, Ward & Waimanu Streets (Hustace 2000; CIA, this volume)
Kukuluāe`o	Land section, salt works & fishery *makai* of Kewalo (Hustace 2000)
Kulaokahu`a	Former land section near Thomas Square, between Alapa`i & Punahou Streets (Westervelt 1915)
Puunui	Large hill; an area of Kewalo *mauka* of Ka`ākaukukui, as shown on historic maps (Brown 1880; Bishop 1884)

lists place names and former landmarks such as *heiau*. Many of these places appear on Figures 5 and 6; although both are schematic maps, they provide some insight into the former locations of now-vanished place names. Figure 5 is taken from a map of Honolulu in 1810, issued by Bishop Museum in conjunction with its publication of John Papa ʻIʻi's *Fragments of Hawaiian History* (1957). Figure 6 is a schematic map prepared by Bruce Cartwright (n.d.) and included in an appendix on historical background data for the Harbor Court Parking archaeological data recovery report (Kalima & Maly 2002, Appendix A in Lebo 2002).

History and Land Use in the APE

The place name of "Honolulu" has various meanings. Pukui et al. (1974) give a meaning of "protected bay" while Westervelt (1987) suggests that the place name actually referred to a locale near the present-day intersection of Liliha and School Streets that belonged to a chief named Honolulu, one of Kakuhihewa's high chiefs in the 16th century A.D. Until the early 19th century, what is now called downtown Honolulu was known as the location of smaller settlements such as Kou which existed between the ocean and the *mauka* farming areas, the barren Makiki plain, and the ocean. The area was not as desirable a location as the sand berms along Waikīkī's shores, where *aliʻi* dwelled, or the well-watered flats adjacent to Nuʻuanu Stream. An *ʻōlelo noeʻau -- Hoʻa ke ahi, koʻala ke ola. O na hale wale no ka i Honolulu; o ka ʻai a ka iʻa i Nuʻuanu* (Light the fire for there is life-giving substance. Only the houses stand in Honolulu; the vegetable food and meat are in Nuʻuanu) (Pukui 1983) – alludes to the primary use of Honolulu for residential purposes.

Westervelt (1987), in retelling the legends of the owls, describes the Honolulu area as follows, as seen from Kahehuna (near the modern-day intersection of Fort and Beretania Streets):

> ...the seacoast was a place of growing rushes and nesting birds. A dry, heated plain, almost entirely destitute of trees, extended up to the foothills. Taro patches and little groves of various trees bordered each watercourse. The population was small and widely scattered....

The place name of "Honolulu" only came to be identified with a permanent settlement in the late 18th and early 19th centuries. The western sailing ships arriving at this time found safe anchorage within the relatively deep Honolulu Harbor (Daws 2006). Before the advent of western shipping, Hawaiian *aliʻi* preferred to live in the Waikīkī area. The composite map of Honolulu in 1810, drawn by Paul Rockwood (Rockwood 1957) from John Papa ʻĪʻī (1959) shows a traditional settlement pattern, with the chiefly residential compounds (including recreational and religious precincts) and agricultural areas, and the beginnings of western land use, such as the shipyard near Pākākā

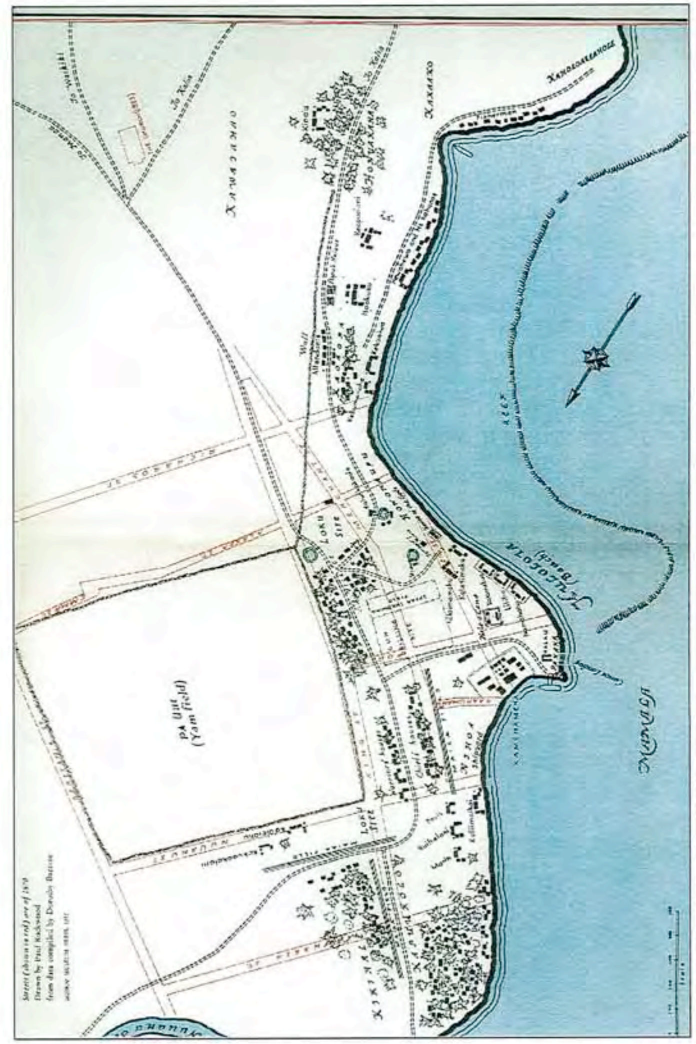

Figure 5. Honolulu in 1810 (from Rockwood 1957)

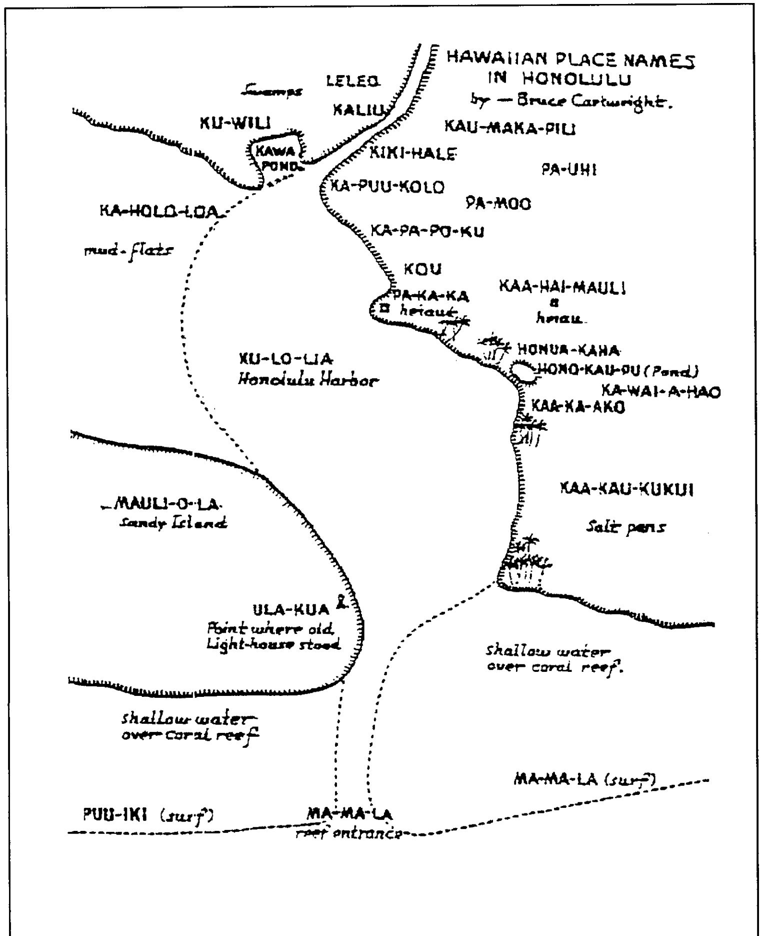

Figure 6. Place Names of the Legendary Period in Kou and Honolulu (Cartwright, n.d.)

see Figure 5).

The first western map of Honolulu Harbor and environs was drafted by the Russian Otto Von Kotzebue in 1816; Figure 7 is a later adaptation of this map (Moffat & Fitzgerald 1986), with English translations for the various features Von Kotzebue labeled in Russian. As can be seen, Kou, and the Kewalo or Kaka`ako areas are still pretty much as John Papa `Ī`ī described them in 1810; while the fort has been constructed and a powder magazine established, the region is still very much a royal residential compound with traditional gardens nearby.

Within a few years, growing western maritime traffic attracted more permanent settlement in the immediate vicinity of the harbor, including Hawaiian monarchs, *ali`i*, and their families, as well as Euro-Americans who built commercial and residential structures nearby (Judd 1975). A map of Honolulu Harbor and its environs, drafted in 1825 by Lieutenant Malden (from Simpson 1843, cited in Judd 1975), shows the juxtaposition of western development such as the wharf, fort, and westerners' residentces with traditional features such as the fishponds (Figure 8). It appears that the Kaka`ako area was still largely unsettled during the first quarter of the 19th century as the Malden map shows. The Māhele data presented below also shows that Kaka`ako was considerably less settled – indeed parts of it were referred to as "waste lands" – even at the mid-19th century.

Within 20-30 years of Lt. Malden's visit, Honolulu had become an urban center, with varied commercial, residential, and other interests reflected in its buildings. Figure 9 is taken from a map drafted in 1855 by LaPasse (Moffatt 1986). The area immediately surrounding Honolulu Harbor has established streets in addition to the government and commercial structures constructed there, but nearby Nu`uanu Stream is still a major agricultural area, with many *lo`i kalo* shown. The coastal portion of Kaka`ako is still largely unsettled, and is shown as having marshes (*marais*) as well as its fishponds.

By 1887, the government survey map prepared by W.D. Alexander (Figure10) depicts an essentially modern layout for Downtown Honolulu. Landmarks such as `Iolani Palace are present; major religious, commercial, and other government buildings are also shown on this map. The Kaka`ako area in 1887 is still largely unsettled and appears to have little construction apart from the immigration station and Fort Armstrong battery along the shoreline. Shortly after this map was drafted, however, a massive reclamation project began in Kaka`ako with the infilling of the marshes and lowlands that characterized the region. The area filled with dredge coral extended from near the intersection of Punchbowl and Halekauwila Streets northeast to the vicinity of the intersection of Ward and King Streets, and east to Cooke Street and Kapi`olani Boulevard, including the land under McKinley High School (Hirata 1979). The extensive

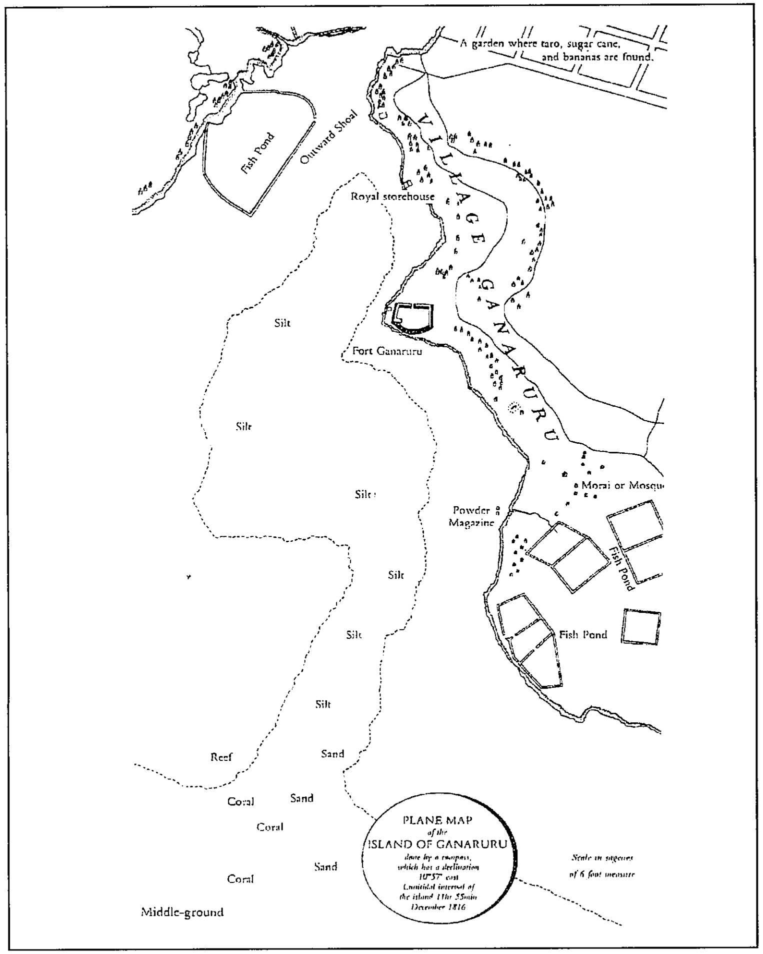

Figure 7. Portion of Otto Von Kotzebue's Map of Honolulu Harbor in 1816.

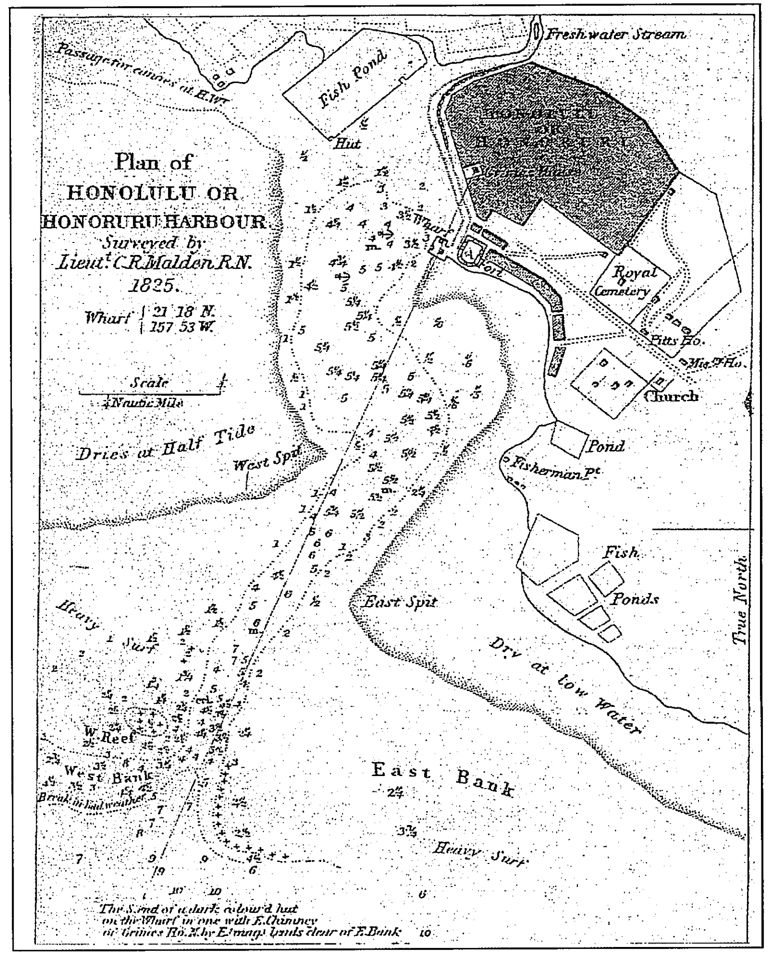

Figure 8. Plan of Honolulu Harbor in 1825 by Lt. Malden.

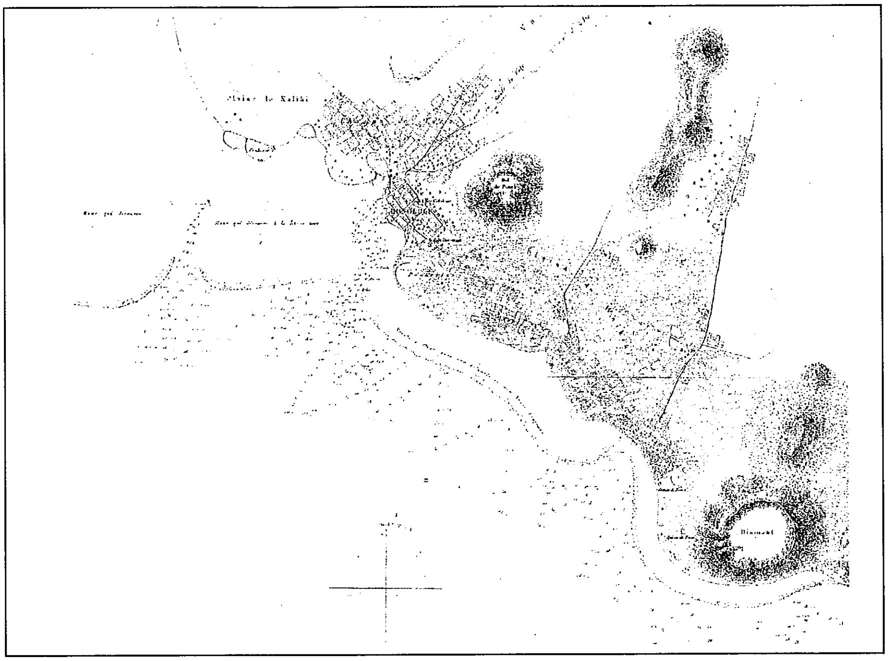

Figure 9. Honolulu in 1855 by de La Passe

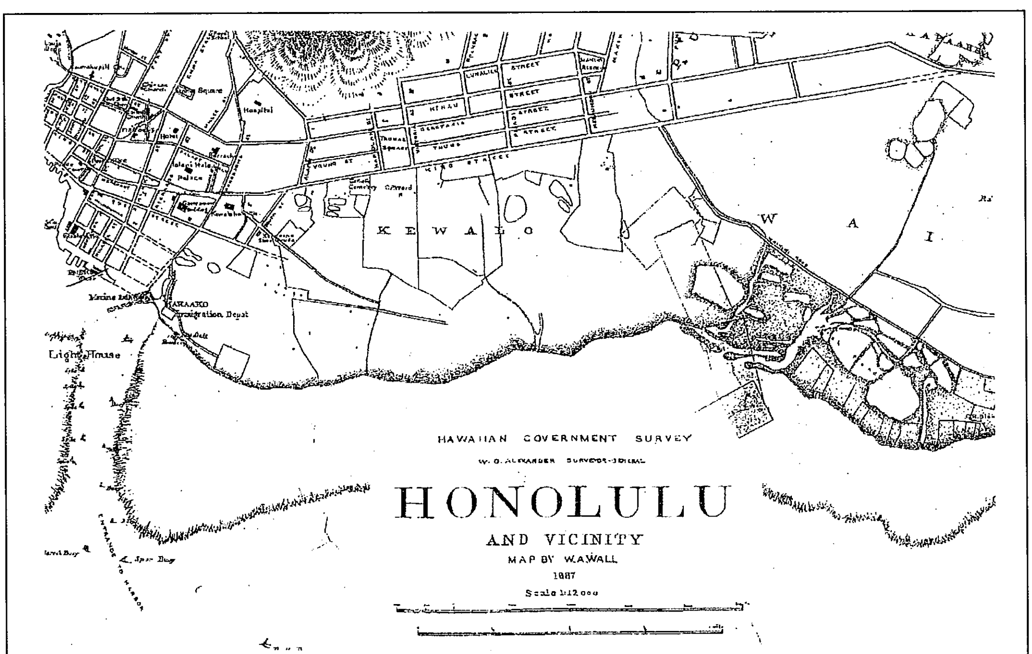

Figure 10. Honolulu and Vicinity in 1887 by Wall (Hawaii Government Survey).

infilling created an area suitable for industrial, commercial, and residential development.

Within 25 years of the Alexander survey map of 1887, a street grid is laid out in Kaka`ako amidst the property of private and public landowners, as shown on the government survey map prepared by G. Podmore in 1911 (Figure 11). By 1927, the Kaka`ako area is home to a robust, multi-cultural community who live in clearly defined settlements, as seen in this composite map drafted for the 1978 University of Hawaii (UH) oral history study of Kaka`ako residents (Figure 12). Kaka`ako businesses catering to particular ethnic groups existed alongside their respective residential communities; consulting parties in the CIA (below) emphasized this factor and also described the various institutions (religious and educational) that served the Kaka`ako neighborhoods.

Both the Downtown and Kaka`ako areas underwent substantial changes from about 1950 onwards. In the Downtown area, a number of new commercial buildings replaced older structures or were constructed in available vacant spaces (Ames 1996). The mix of residences and commercial establishments that existed from the early 19th century through the first half of the 20th century gave way to a Downtown comprising commercial and government buildings, interspersed with some public spaces such as parks or squares. In Kaka`ako, residents moved out and were replaced by businesses that could not afford to lease or buy commercial space in the more expensive Downtown area. By the late 1970s, in response to multiple issues – the need to upgrade infrastructure, the need for affordable commercial and residential space near the Downtown area, the need – the Hawai`i Community Development Authority (HCDA) was established as a state agency in 1976. Responsible for all future activities in the Kaka`ako area, the HCDA commenced a multi-year planning program for the region based on the vision of a "mixed use" plan including commercial and residential development in accordance with publicly approved plans (HCDA 1979). The ensuing Kaka`ako redevelopment has radically changed the appearance of the area, with many new high-rise residential towers and commercial-retail centers constructed where the low-rise stores and houses once stood. The consulting parties in the CIA all noted the massive scale of this change, and how their old neighborhoods have virtually disappeared except for a few locations and historic buildings.

THE GREAT MĀHELE: LAND COMMISSION AWARDS (LCAS) WITHIN THE APE

During the period between 1839 to 1855, several legislative acts transformed the centuries-old Hawaiian traditions of *ali'inui* land stewardship to the western practice of fee simple or private land ownership. Traditionally, each island was divided into *moku* or districts that were controlled by an *ali'i 'ai moku*. Within each of the *moku* on each island, the land was further divided into *ahupua'a* and controlled by land managers or *konohiki*.

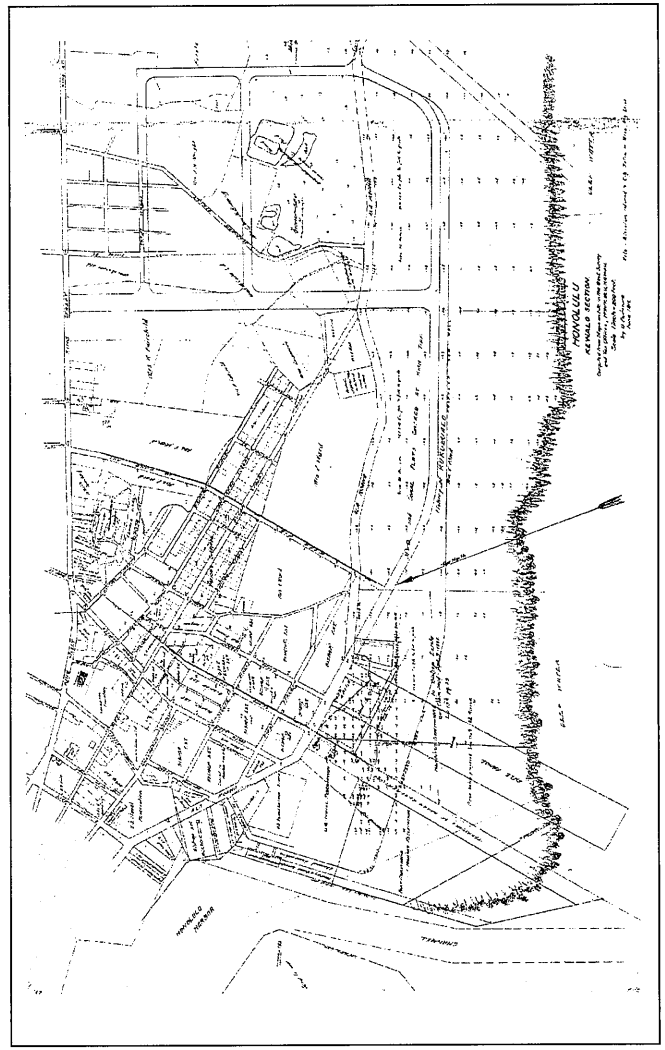

Figure 11. Kewalo in 1911 by Podmore (Hawaii Government Survey).

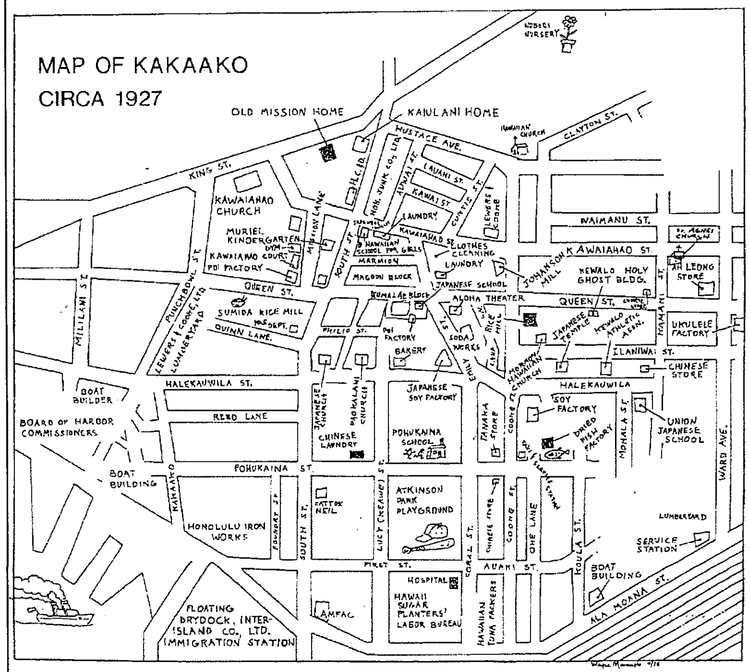

Figure 12. Kaka`ako in 1927 (UH Oral History Program).

The boundaries of the *ahupua'a* were delineated by natural features such as shoreline, ridges, streams and peaks, usually from the mountain to the sea, and ranged in size from less than ten acres to 180,000 acres (Moffat and Kirkpatrick, 1995:24-29, see also Chinen 1958:3; Gay 1965:50). "The principal tax levied on an ahupua`a were hogs. *Ahu* [altar] is a place where things were brought in and stored or piled up, and *pua`a* is hog or pig. Hence the name *ahupua`a*" (Gay 1965:49).

Each *ahupua'a* was often divided and sub-divided several times over (i.e., *ili, kuleana, mo'o, pauka, koele, kiha pai*), with each subdivision answerable to the *ali'i* where the lesser division was located. However the *ili kupono* or the *ili ku* was "completely independent of the *ahupua'a* in which it was situated… [and] tributes were paid directly to the king himself" (Chinen 1958:4). Rights to lands were mutable or revocable. A ruling chief or any "distributor" of lands could change these rights if displeased with the recipient(s), or redistribute lands as favors--usually after a victorious battle, and after the death of the *ali'inui* (Chinen 1958:5).

Kamehameha III, in his mid-thirties, was persuaded by his *kuhina nui* and other advisors to take a course that would assure personal rights to land. In the first stage King Kamehameha III [Kauikeaouli] divided up his lands among the highest ranking *ali'i* (chiefs), *konohiki* (land managers), and favored *haole* (foreigners) (Chinen 1958:7-14; Moffat and Fitzpatrick, 1995:11, 17). One-third of all lands in the kingdom would be retained by the king; another one-third would go to *ali`i* as designated by the king; and the last one-third was supposed to go the *maka`āina na*. In 1846 he appointed a Board of Commissioners, commonly known as the Land Commissioners, to "confirm or reject all claims to land arising previously to the 10th day of December, AD 1845." Notices were frequently posted in *The Polynesian,* a widely distributed local newspaper (Moffat and Kirkpatrick, 1995). The legislature did not acknowledge this act until June 7, 1848 (Chinen 1958:16; Moffat and Kirkpatrick, 1995:48-49), known today as *The Great Mahele.*

The *mahele* did not actually convey title to the various *ali'i* and *konohiki*; it essentially gave them the right to claim the lands assigned to them--these lands became known as the *konohiki* lands.. They were required to present formal claims to the Land Commission and pay a commutation fee, which could be accomplished by surrendering a portion of their land to the government (Chinen 1958:20). The government could later sell these lands to the public. Upon payment of the commutation fee, the Minister of Interior issued a Royal Patent to the chief or *konohiki.* The last one-third was originally designated to the *maka`āinana* , but not acted on--instead it was set aside to the government, "subject always to the rights of the tenants" (Moffat and Kirkpatrick, 1995:41-43; see also Chinen 1958:15-21). *Ili kupono* were the only *ili* [parcel] recognized in this process, all the *ili* and lesser divisions were absorbed into the *ahupua'a* claim (Chinen 1958:20). In 1892 the legislature authorized the Minister of Interior to issue Royal Patents to all *konohiki* or to their heirs or assignees where the *konohiki* had failed to receive awards for their lands from the Land Commission. The Act further stipulated "that these Royal Patents were to be issued on surveys approved by the Surveyor General of the kingdom…" (Chinen 1958:24; Moffat and Fitzpatrick 1995:41-43).

Kamehameha III formalized the division of lands among himself [one-third] and 245 of the highest-ranking *ali'i* and *konohiki* [one-third] between January 27 to March 7, 1948. He acknowledged the rights of these individuals to various land divisions in what came to be known as the *Buke Mahele* or 'sharing book.' Many *ali'i* were awarded portions of or entire *ahupua'a*. Many *ali'i*, especially descendants of the royal line, inherited very large land awards on all the islands, including Ni'ihau. This occurred because the royal children of Kamehameha I did not leave any immediate descendants. Their lands were subsequently awarded to descendants from lesser lines.

Land Commission Awards in the APE

Table 2 (below) lists a number of Māhele awards and grants made for properties within the Downtown portion of the APE. While many of the awardees listed in Table 2 were members of or politically connected to the Hawaiian royal families, the types of properties claimed illustrate the considerable growth of an urban center in less than 75 years after the first known Western contact. It also shows that much of Honolulu was still a residential area where people had their homes and gardens, as well as their businesses. In addition, by the mid-19th century there had already been considerable turnover in some properties, affecting both commoners and royalty. For example, Ka'ahumanu's residential compound on the shoreline at Kou, called Nihoa, had been acquired by the English Counsel in 1843, just prior to the Māhele. The development of the growing urban center also affected landowners through the alteration of boundaries or even truncation of property due to roadways. Figures 13 and 14 which follow Table 2 show the location of many of the Māhele awards and grants listed in Table 2 in the Downtown area. Figure 13 shows the *mauka* portions of the HSWAC pipeline route in the Downtown area superimposed on a Government Survey map titled "Original Titles Honolulu of unknown date and author while Figure 14 shows the *makai* portions in conjunction with recorded LCAs.

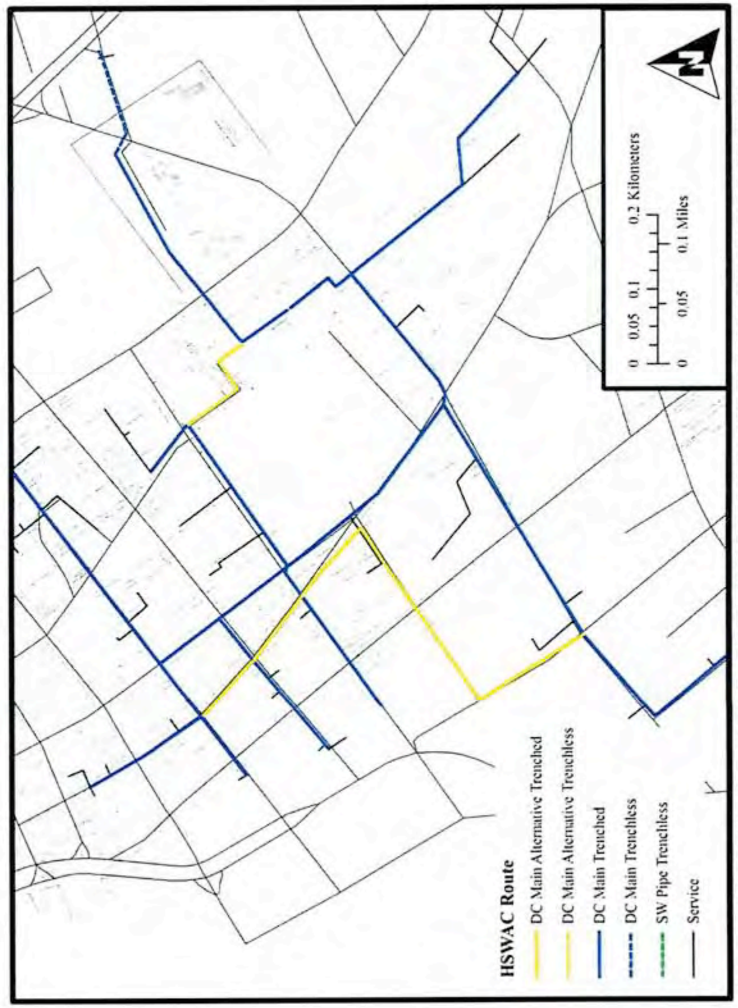

Figure 13. HSWAC Pipeline Route in Relation to Māhele Awards and Grants in Downtown Honolulu (*Mauka* Portion).

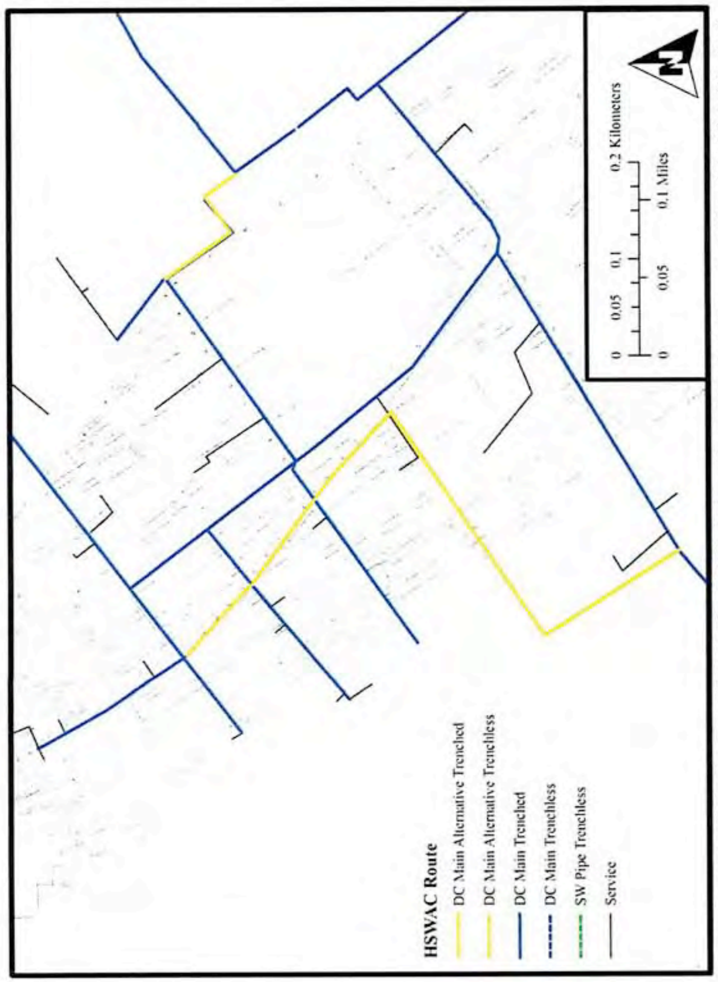

Figure 14. HSWAC Pipeline Route in Relation to Māhele Awards and Grants in Downtown Honolulu (*Makai* Portion).

Table 2. Māhele Awards & Grants in the Downtown Portion of the APE

LCA #	Awardee	Associated Street Or Place	Associated Structures & Resources
18	Geo Wood	Union St	Land given by Boki; fenced; Garden Lane; house
19	Naehu/Naahu (w)	Queen/Kaoaopa	Fenced house lot; house
21	Nakookoo	Merchant/Mililani Sts	House lot
33	Thos Cummins	Fort/Merchant Sts	Fenced house lot (from father-in-law Keauiaole)
36.1	Poeha & Napoeha (husb of Charles 2nd wife)	Merchant & Richards Sts	2 houses & a fence
56	Eliab Grimes	Union/Adams Lane	Large grass house on fenced lot (Wm French sold to Capt. Grimes; property given to his daughter by Opunui)
62	John Reeves (Rives)	Hotel St off Bishop St	Large house-hotel. In 1823 John Reeves went with Liholiho to Britain and bequeathed the property to his 3 children: John, George & Kahoa Pearse-Tolman
62B	Kaahoa/Kahoa (w) Pearse-Tolman	Hotel St off Bishop St	House; (daughter of John Rives, sister of John & Geo Reeves)
63	Namaau	Honuakaha (*makai* side of Queen between Richard & Punchbowl)	2 house lots, total of 16 houses; school house for foreigners; canoe landing (disputed)
65	Wm. Bacle	Beretania	Fenced house lot with frame house; land from Kamehameha I
73	Unauna	off Punchbowl	House lot; taro patches
97B	Kaohipau	Merchant/Alakea	2 houses; road/path; from mother Sally White
113	A. Paki	King/Bishop	House lot with several houses
115	A. Paki	Alakea/Queen	House; fence (Kinau once lived here)
119	A. Paki	Punchbowl	Fence
128	Kahikona & Kekoa (Haia's 2nd wife)	On King St near Richards St	Adobe fenced lot with 6 houses; kukui trees; path/road
131	Eli Jones	Merchant/off Fort	
137	Wm Summer	Hotel/Richards	House; well; former *kapu* lands; grass hut; storehouse
155	Wm Sumner	Richards Street	House lot; fence
157	Wm Sumner	Richards Street	Several houses; fence

Table 2. Māhele Awards & Grants in the Downtown Portion of the APE

LCA #	Awardee	Associated Street Or Place	Associated Structures & Resources
159	M. Kekuanaoa	Queen & Merchant Streets	Fence; house lot
161	M. Kekuanaoa for V. Kamamalu	Merchant	Fenced house lot with 2 houses; former playground (Kekuanaoa lives there--father of Victoria Kamamalu and husband of Kinau)
164	V. Kamamalu	*Makai* side of Queen (on the shoreline)	Road; house lot
177	V. Kamamalu	Richards	"Improved" – no other details
184	M. Kekuanaoa	Merchant/Richards	Vacant or "idle" land
189	H.S. Davis	Bishop	House lot; fence; road; hotel formerly on land
191	Kekauonohi/Haalelea	Hotel	5 house lots; store house; former *kapu* lands
191B	Kapule	Punchbowl at Palace Walk (Hotel St)	Fenced houselot
221	Kekuaiaea	Merchant	3 houses; fence
226	Keauiaole	Merchant & Fort Streets	Fenced house lot; 2 houses; well; milo & pandanus trees
247	Wm. Lunalilo	12 apana at various locations: Beretania, Queen, King, Fort, Merchant & Punchbowl Streets; Printer's Lane; Kaka`ako	House lots with dwellings, including royal residences; commercial buildings (incl. Hudson's Bay Co., shoe store)
280	Kaaha & Kamaile	Punchbowl/Printers Lne	5 houses; fence; trees; well; taro patch; road
387.2	A.P. Mission	Punchbowl & King (Kawaiaha`o & Kukula`aeo)	Mission buildings; adobe schoolhouse
561	Kalei	Hotel & Cross Sts	Fenced house lot with 2 houses & a well
570	Amow	Hotel & Richards Sts	House lot; formerly owned by watch maker
577	Kalaimoku	Merchant-King	From father Kapelepele; houses; fence;
611	Leoiki (w)	Fort Street	2 pili grass houses; 2 adobe houses; road; (from George Wood; wife of Capt Buckle)
626	S. Reynolds	Hotel & Merchant Sts, `*ewa* of govt wharf	House; hotel; canoe landing; livestock (turkeys & pigs)
628	S. Reynolds	King-off Merchant	House & livestock enclosure

Table 2. Māhele Awards & Grants in the Downtown Portion of the APE

LCA #	Awardee	Associated Street Or Place	Associated Structures & Resources
681	M. Kekuanaoa	Makai side of Queen St at Kaahumanu St (formerly Nihoa)	Formerly a residential compound for Kaahumanu mā, with houses & fence; acquired by English Consul in 1843
721	Mahuka & Kaai	Merchant/Bishop/King	Fenced house lot with 5 houses
786	Robinson & Lawrence	King/Nuuanu	Public house (Ship & Whale); 4 houses (from Captain Dowsett)
801	A. Adams	Bishop/Hotel	Several houses & fence (from Kamehameha I)
814	Kepahukepau	Hotel/Richards	7 houses; fence
816	A.H. Fayerweather (attorney)	Garden Lne-Bishop-Adams	2 houses; cook house; fenced (from Gov John Adams Kuakini)
971	Isaac Harbottle	Hotel/Bishop	2 houses; fenced; from his wife Kauluha on her death
1003	Koiamai, Mark	King/Alakea	1 house lot w/4 houses; another house lot w/3 houses; fenced lots; road (from Kaleohano; claimant is husband of Kahiaonui Wahine-sister of Kaleohano)
1026	Mary Dowsett	Bishop/Garden Lne or Union Str	Sold to her by Capt Alexander Adams who recd from Kamehameha I in 1815 for services rendered
1802	Jose Nadal (Spaniard)	Merchant/Richards	3 houses; fence; from Kekauonohi for Kinau as a relative by marriage--Kekuanaoa's first child
1975	Robert W. Wood	Hotel/Bishop	2 house lots; enclosure
2019	Pupule	Mililani	House lot; road; fence; the land came from Kaheana, his mother; after the war on Kaua`i she came back and built a house
3322	Tute	Richards Street & Palace Walk (present-day Capitol Grounds)	3 houses; stone wall (Tute or Kuke, named after Capt Cook, came from Borabora and given several lands by Kaahumanu; he was a missionary and chaplain to Kamehameha III)
3658	Charlotte A. Hooper	Hotel (*mauka*) near Richards	Widow of Wm C. Little; house lot

Table 2. Māhele Awards & Grants in the Downtown Portion of the APE

LCA #	Awardee	Associated Street Or Place	Associated Structures & Resources
3708.8	Gov Barracks	Palace Walk (Hotel St – present-day Capitol grounds)	Royal school; land known as Pahukaina; once owned by Kaahumanu; later owned by Kinau
4883	Wm French	Alakea, *mauka* of Hotel	House lot; residence; fenced. Paid $4,600 at auction in 1838 after death of John Ebbets who got the land from Kalaimoku.
5166	Keikenui	Merchant/King	From Kekuanaoa in 1844; house; enclosure; road;
5527	John Duke	Hotel/Bishop	house lot; road; from Boki for services; fence
5573	Kualii	Merchant Street between Fort & Alakea Streets	3 houses; wife of Kaua
6506	Ahu (Pake/Ahpong)	Queen/Alakea	House lot; land given by K-III
8515	Keoni Ana	Mililani & Queen Streets	House lot
10806	Kamehameha III	Alakea-Queen-Richards to the sea	Occupied by the King's people since the war (1826) on Kaua`i; Imilealani lived with `ohana under King's mother since the time of Liholiho; occupied by King's retainers

Māhele awards and grants made for the Kaka`ako portion of the APE are much less numerous than those for the Downtown area. This is partly because a particularly large award recorded for property within the APE – LCA 7713 – went to Victoria Kamamalu; this LCA comprised much of the *makai* portion of Kaka`ako with its fishponds and coastal marshes. Figure 15 shows the locations of the Kaka`ako awards and grants in conjunction with the proposed HSWAC pipeline routes through this portion of the APE; the base map is the 1884 government survey map of the Kewalo section of Honolulu by S.E. Bishop. Table 3 lists the Mahele and LCA awards for the Kaka`ako portion of the APE.

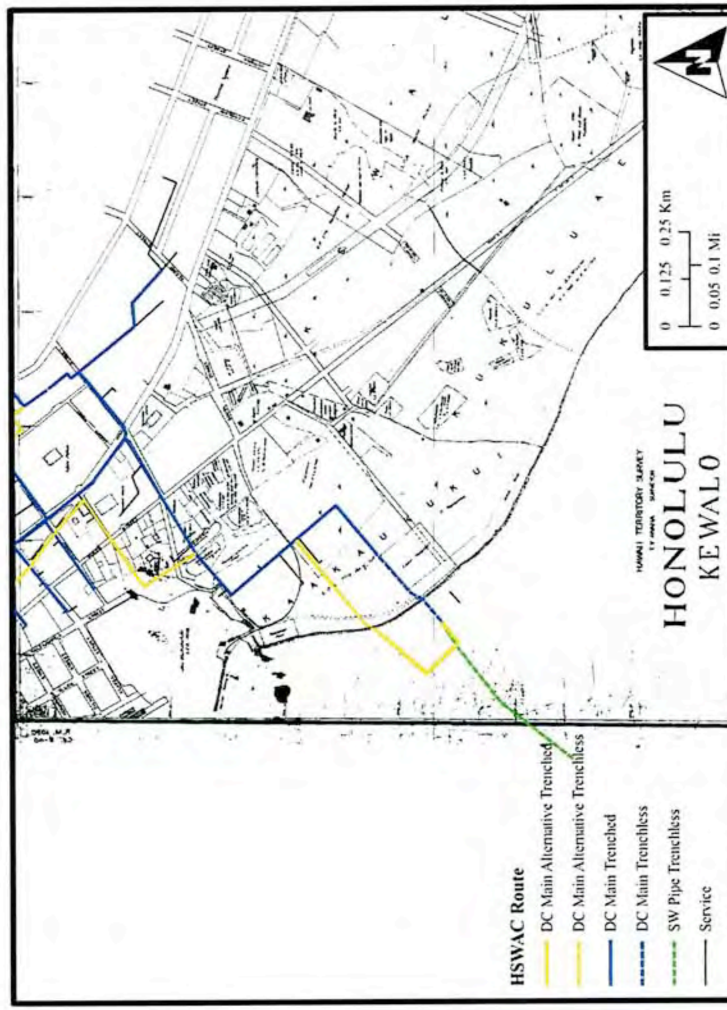

Figure 15. HSWAC Pipeline Route in Relation to Māhele Awards and Grants in Kaka`ako.

Table 3. Mahele Awards & Grants for the Kaka`ako Portion of the APE

LCA #	Awardee	Associated Street or Place	Associated Structures & Resources
129.1	Kinimaka	Queen & Punchbowl Sts	Fenced house lot with house
677	Kekuanaoa for V. Kamamalu	Honuakaha	Fenced lot with 2 houses; *mauka* of salt ponds; a portion later became Honuakaha Smallpox Cemetery
729	Kekuhaupio	Queen St	Fenced house lot with 3 houses
735	Kaahumanu	Honuakaha	Partly fenced house lot with 2 houses
805	Kaaluea	Honuakaha	Fenced house lot with 1 house
1082	Kekuanui no Kahakai	Honuakaha	Partly fenced house lot with 2 houses; 40 *lo`i kalo*
6489	Kaihiwa	Honuakaha (Kawaiahao)	House lot
7713	V. Kamamalu	Ka`ākaukukui (Ft. Armstrong)	Kawa fishpond, later partially dismantled to construct sea wall;

HISTORIC SITES

Architectural Properties - Overview

Many of the most distinctive and significant historic architectural properties in Hawai`i are found in downtown Honolulu. The buildings exemplify a range of architectural styles and periods, and, in the case of register districts, preserve remnant portions of former architectural landscapes. The APE for the HSWAC encompasses a number of historic architectural properties that are classified as follows:

- Individual ***sites*** that are ***currently listed*** on the Hawai`i Register of Historic Places (HRHP) and/or National Register of Historic Places (NRHP);
- Register ***districts currently listed*** on the HRHP or NRHP that include multiple contributing properties;
- Sites that have been formally deemed ***eligible for listing*** on the NRHP by the Keeper of the National Register;
- Buildings and structures that are ***historic*** in age (50 years old or more) that were identified by participants in the CIA, but are not currently listed on the HRHP or NRHP
- Buildings and structures that are not historic in age but were identified as ***culturally significant*** by participants in the CIA

Site listed on the HRHP or NRHP are protected by State and Federal laws designed to avoid or minimize any impact on them by proposed development or construction activities. Under State law (Chapter 6E-10, Hawaii Revised Statutes), any project that may affect a historic site on the HRHP must be reviewed by the State Historic Preservation Division (SHPD) before it takes place in order for the SHPD to assess the effects, if any, and recommend needed mitigation. Figure 16 shows the locations of sites listed on the HRHP or NRHP in the APE.

The sites that have been deemed eligible for listing on the NRHP represent the outcomes of earlier approaches to historic preservation, particularly during Section 106 evaluations. Prior to the mid-1980s, eligibility determinations were requested of and made by the Keeper of the National Register. At that time, only historic sites actually listed on the NRHP were subject to the oversight and protection provided by the NHPA. With the 1985-86 amendments, the NHPA expanded the category of historic sites considered under Section 106 evaluations to include those sites found eligible for listing. Although formal rules still exist for making an eligibility determination (36 CFR Part 63), if a Federal agency and a state historic preservation office concur that a property is eligible for listing (called a "consensus determination"), the property is eligible and thus undergoes evaluation in the Section 106 process (King 2008).

Individual Architectural Properties Within the APE on the HRHP and/or NRHP

Table 4, below, lists individual architectural properties placed on the HRHP or NRHP, and that are located within the overall boundaries of the APE for the underground distribution system for the HSWAC. With the exception of the Falls of Clyde – a historic sailing vessel moored at Pier 7 -- the listed properties include buildings with a range of public and private functions from commerce to religion. Although all listed properties provide information on Honolulu's and Hawai`i's past, some also exemplify specific building styles or techniques.

Table 4. Individual Architectural Properties in the APE That Are Listed on the Hawaii and/or National Register of Historic Places.

Name of Property	Year Built	SIHP[1] No.	TMK	HRHP[2]	NRHP[3]	Adjacent to Pipelines
The Hawai`i Theatre	1922	-1332	2-1-03:14	X	X	
Kaka`ako Fire Station	1929	-1346	2-1-31:18	X		
Joseph W. Podmore Building	1905	-1357	2-1-16:04	X	X	X
Emerald Building	1941	-1379	2-1-10:41	X		X
Falls of Clyde	1878	-9700	2-1-01:60		X	

Table 4. Individual Architectural Properties in the APE That Are Listed on the Hawaii and/or National Register of Historic Places.

Name of Property	Year Built	SIHP[1] No.	TMK	HRHP[2]	NRHP[3]	Adjacent to Pipelines
Kaka`ako Pumping Station	1900	-9710	2-1-15: 43, 44	X	X	X
Yee/Kobayashi Store	1918	-9739	2-1-49:08	X		
Saint Peter's Church	1914	-9740	2-1-18:02	X		
Mabel Smyth Memorial Building	1941	-9765	2-1-35:01	X	X	
Central Intermediate School	1926	-9774	2-1-09:01	X	X	
Irwin Memorial Park	1930	-9829	2-1-13:07	X		
Dillingham Transportation Building	1929	-9900	2-1-14:03		X	
Our Lady of Peace Cathedral	1843	-9906	2-1-10:14	X	X	X
Royal Brewery	1900	-9917	2-1-31:21		X	
Alexander & Baldwin Building	1929	-9925	2-1-13:01	X	X	X
Aloha Tower	1926	-9929	2-1-01:13	X	X	
C. Brewer Building	1930	-9938	2-1-13:03	X	X	
US Immigration Office	1934	-9964	2-1-15:18,19		X	

[1] Statewide Inventory of Historic Places
[2] Hawaii Register of Historic Places
[3] National Register of Historic Places

Of these 19 individual properties only five are immediately adjacent to the proposed pipeline system. Should any of these buildings be added as customers for the HSWAC, as currently envisioned, pipeline connections will not affect a building's appearance or structure, but instead tie into the existing utility infrastructures.

Historic Districts Within the APE on the Hawaii and/or National Register of Histoic Places

Portions of several HRHP and/or NRHP districts are also found within the boundaries of the APE for the subsurface distribution pipelines. Table 5, below, lists the Register Districts having one or more contributing properties within the HSWAC APE. Of the 40 architectural sites listed as contributing properties in Table 5, a total of 27 are generally adjacent to the proposed distribution pipelines as they pass by but only three buildings are currently connected to the proposed distribution pipelines. The majority of these properties are within the Hawai`i Capitol and Merchant Street Register Districts.

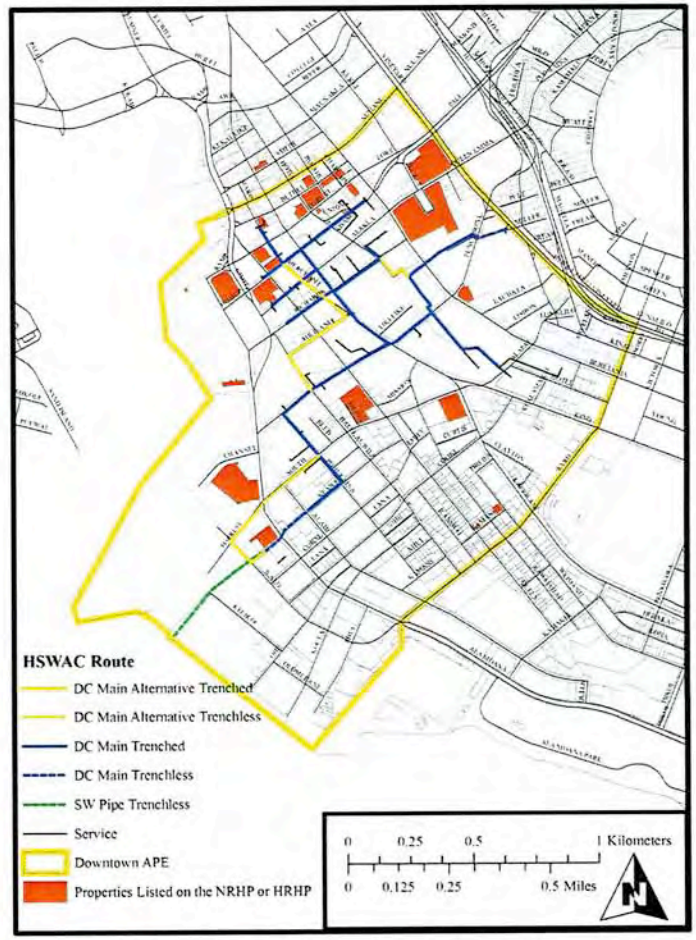

Figure 16. Location of Historic Properties Listed on the State or National Register Of Historic Places in the Area of Potential Effect.

Table 5. Historic Districts Within the APE Listed on the Hawaii and/or National Register of Historic Places

District Name	SIHP No.[1]	Contributing Properties Within the APE & Year(s) Built[2]	TMK	HRHP[3]	NRHP[4]	Adjacent (A) or Connected (C) to HSWAC
Hawai`i Capital District	-1321	State Capitol & Grounds (1969)	2-1-24:01		X	C
		YMCA (1928)	2-1-		X	C
		YWCA (1927)	17:01,02		X	A
		Hawaiian Electric Company (1927)	2-1-17:09		X	C
		Territorial Office Building (1926)	2-1-16:01		X	C
		Hawaii State Library (1913)	2-1-25:03		X	C
		Honolulu Hale & Grounds (1929)	2-1-25-01		X	C
		Mission Memorial Building (1916)	2-1-33:07		X	A
		The Kamehameha Statue (1883)	2-1-33:07		X	A
		State Tax Office (1939)	2-1-25:03		X	A
		Washington Place and Grounds (1846)	2-1-26:22		X	A
		Ali`iolani Hale (1874)	2-1-18:01		X	C
		`Iolani Palace & Grounds (1882), includes	2-1-25:03		NHL[5]	A
		Old Archives Building (1906) & Old	2-1-25:02			
		Mausoleum	2-1-25:02			
		`Iolani Palace Bandstand (1883)				A
		`Iolani Barracks (1871)				
		US Post Office, Custom House & Court	2-1-25:02		X	C
		House (1922)				A
		Kapuaiwa Building (1884)	2-1-25:04		X	A
		Kawaiaha`o Church & Grounds (includes	2-1-25:03		NHL	
		Lunalilo's Tomb & Adobe Schoolhouse)	2-1-32:17			
		(1835 & 1842)			NHL	A
		Mission Houses (1821 – 1831)	2-1-32:02			
Fire Stations of O`ahu	-1346	Central Fire Station (1935)	2-1-9:26	X	X	
		Old Kaka`ako Fire Station (1929)	2-1-31:18	X	X	
City & County of Honolulu Art Deco Parks	-1388	Mother Waldron Playground (1937)	2-1-51:05	X		

Table 5. Historic Districts Within the APE Listed on the Hawaii and/or National Register of Historic Places

District Name	SIHP No.[1]	Contributing Properties Within the APE & Year(s) Built[2]	TMK	HRHP[3]	NRHP[4]	Adjacent (A) or Connected (C) to HSWAC
Merchant Street Historic District	-9905	Multiple Properties:			X	
		T.R. Foster Building (1891)	1-7-02:35			
		Royal Saloon (1890)	2-1-02:35			
		Waterhouse Building (1870)	2-1-02:34			
		Yokohama Specie Bank (1909)	2-1-02:33			A
		The Friend Building (1917)	2-1-02:32			
		Old Police Station (1931)	2-1-02:24			A
		Kamehameha V Post Office (1871)	2-1-02:12			A
		Melchers Building (1854)	2-1-02:20			
		Old Bishop Building (1878)	2-1-02:19			A
		Old Bishop Estate Office (1896)	2-1-02:19			A
		Judd Block (1898)	2-1-13:04			A
		Stangenwald Building (1901)	2-1-13:05			A
Chinatown Historic District	-9986	Multiple Properties:			X	
		King's Court (1916)	2-1-02:42			
		McLean Block (1903)	2-1-03:16			
		Perry Block (1888)	2-1-03:17			
		Pantheon Bar (1911)	2-1-03:18			

[1] SIHP = Statewide Inventory of Historic Places Number 50 (Hawai`i) – 80 (O`ahu) – 14 (Honolulu Quad) – XXXX (unique site number)
[2] APE = Area of Potential Effect
[3] HRHP = Hawai`i Register of Historic Places
[4] NRHP = National Register of Historic Places
[5] NHL = National Historic Landmark

As shown in Table 6, below, seven architectural properties that have been determined to be eligible for listing on the NRHP are within the APE but only one – Hotel Street Sidewalk Features – is adjacent to or potentially affected by the proposed routing of the distribution pipelines for HSWAC. The types of sidewalk features deemed eligible for listing on the NRHP include blue rock cut curbstones. Discussion with staff at SHPD and a review of their files did not yield information on the specific locations of the Hotel Street properties deemed eligible or on all types of features considered to be contributing.

Table 6. Historic Buildings & Structures Within the APE That Have Been Deemed Eligible for Listing on the National Register of Historic Places

Name of Property	Tax Map Key	Date of Eligibility Ruling	Adjacent or Connected to HSWAC
Brass Foundry	2-1-49:54	1/24/1979	
Hawaii Building	2-1-03: 12	1/11/1980	
Hotel Street Sidewalk Features	1-7-03: various; 2-1-03: 10, 11, 12, 13, 14	1/11/1980	X
J. Campbell Building	2-1-02:01, Lots5, 7, 11, 12	1/11/1980	
McCorriston Building	2-1-10:20	1/11/1980	
Portland Building	2-1-10:13	1/24/1979	
Advertiser Building	2-1-47:04	1/24/1979	

Finally, participants in the CIA identified a number of buildings and structures of historic age (50 years to older) or of cultural significance during the interviews. Table 7, below, lists these architectural properties; in the interval since the CIA interviews were carried out, two of these buildings have been demolished. Furthermore, one of the buildings listed – the current church of Ho`omana Naauao o Hawai`i congregation – is less than 50 years old, having been built in 1969. The congregation, as seen in interviews conducted for the CIA, has long-term ties to the Kaka`ako area though, and the current church is on the site of an earlier church structure.

In addition to the architectural properties discussed above, there is one other historic structure within the APE that has not been formally recorded. This is the historic seawall or dock structure that abuts the modern-day Pier 12 along its base and *makai* sides (Figure 17). Pier 12 lies *makai* of Nimitz Highway, between Bethel Street and Nu`uanu Avenue. Clark (2002) states that the coral blocks used to construct this feature

Table 7. Structures of Historic Age and/or Significance Identified During Oral History Interviews.

TMK	Street Address	Name of Property	Year(s) Built	Type of Structure(s)	Land Use
2-1-049:079	505 Kamani Street	NA	1941	Quonset hut	Industrial
2-1-049:009	512 Kamani Street	NA	1920 1950	Residence Warehouse	Industrial
2-1-050:034	815 Queen Street	Church - Kewalo Holy Ghost	1958 2001	Church, Community Hall	Industrial (Religious Institution) Demolished 2006
2-1-050:040	871 Queen Street	NA	1915	Residence	Industrial – Demolished 2007
2-1-050:042	885 Queen Street	Hamada Store	1958	Warehouse	Industrial
2-1-050:049	901 Queen Street	Ching Store	1913 1912	Residence Apartments	Industrial
2-1-051: 001	640 Cooke Street	Aloha Theatre/Kewalo Theatre	1938	Theatre, Commercial	Industrial
2-1-046: 009	910 Cooke Street	Ho`omana Naauao o Hawai`i	1969	Church, Shrine	Commercial (Religious Institution)
2-1-058:002	121 Ahui Street	Incinerator No. One (Old Kewalo Incinerator)	1930	2-story building	Industrial
2-1-058: 041	59 Ahui Street	NA	1921 1936	Warehouse Frame Shed	Industrial

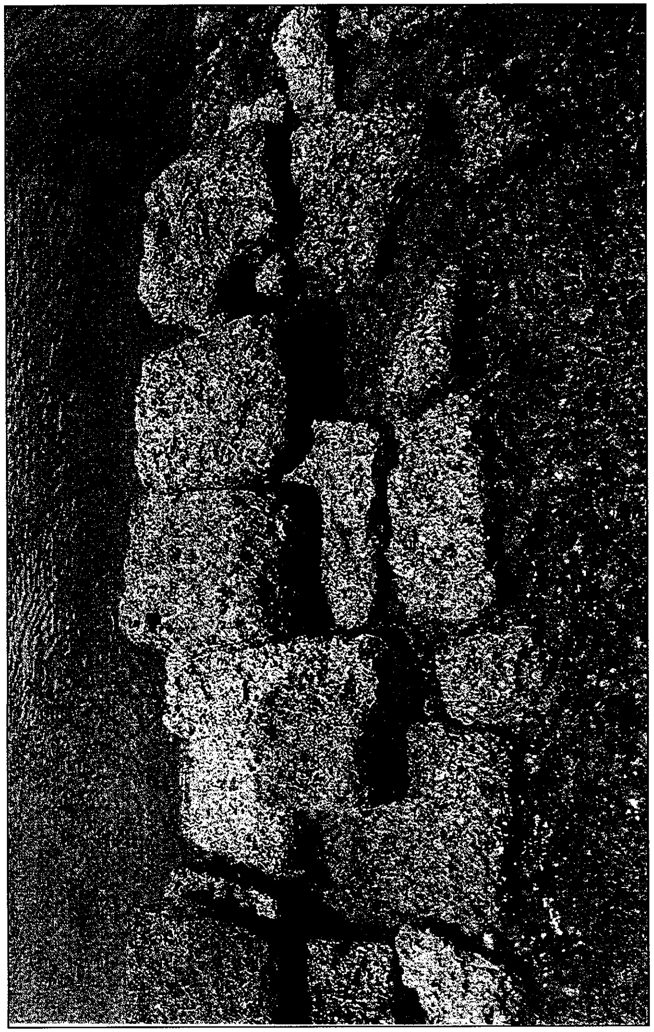

Figure 17. A Portion of the Coral Blocks Taken from Fort Kekuanohu to Construct a Sea Wall at Pier 12 (Looking South).

were taken from Fort Kekuanohu, which once stood nearby where the *makai* end of Fort Street is at the Harbor Court building. A remnant of the foundation wall of Fort Kekuanohu was located during the archaeological inventory survey for the Harbor Court project , then called the Kaahumanu Parking Garage (Hurst & Allen 1992). Given Clark's (2002) and Cheever's (2005) information, the structure at Pier 12 dates to sometime after 1857 when Fort Kekuanohu was demolished. The current study does not include a formal inventory survey of the property which would yield more data on the site's significance and integrity. Nonetheless, it seems likely that the site, which is historic in age, would be found significant under one or more criteria. In any event, current plans do not indicate that the structure will be affected in any way by project activities.

ARCHAEOLOGICAL SITES

Previous Archaeological Work in the Vicinity of the APE

The APE lies mostly within the Downtown and Kaka`ako sections of modern-day Honolulu. Although these areas are extensively developed, and indeed are undergoing continuous development, they are rich in historic and cultural resources, as evinced by the summary data in Table 8. Table 8 lists selected archaeological projects and findings made over the last 35 years within the APE. Included in Table 8 are brief descriptions of the project areas, the nature of work, general age of findings, the State Inventory of Historic Places (SIHP) or site number (if known), and whether or not human burials were found during a specific project. Figure 18 shows the locations of these previous project sites within and near the APE. Figure 19 shows the locations of some previous burial finds in and near the APE.

One of the earlier sources of information on known historic and cultural sites is J. Gilbert McAllister's work, *Archaeology of Oahu*, published in 1933. McAllister traveled the length and breadth of O`ahu in 1930, working with Native Hawaiian informants to identify the then-present and former locations of historic sites and cultural places. McAllister states that at the time of his field investigations (ca 1930), none of the previously known historic sites were extant in the Honolulu area, nor did his informants know of any remaining sites. Table 1, above, lists a number of the traditional site locations; Figures 5 and 6, above, show the locations of some of the sites recorded by McAllister (1933).

Archaeological properties within the APE have been documented primarily through work done in the last 35 years. Although significant sites were known from early surveys of traditional properties (cf. McAllister 1933), the bulk of our knowledge on archaeological sites is derived from a variety of projects that included subsurface

Table 8. Selected Archaeological Projects Within the Area of Potential Effect.

Source	Project Location	Procedure	Findings	General Age	SIHP[1] No 50-80-14	No. of Burials
Seelye 1968	Hale Akala, `Iolani Palace	Monitoring	Structural elements, artifacts	Historic	-9912	-
Seelye 1969	Hawaiian Mission Houses	Subsurface testing	Artifacts	Historic	-9991	-
Pearson 1970, 1980	Hawaiian Mission Houses	Subsurface testing	Artifacts	Historic	-9991	-
Altonn 1971	Kekela Building at Queen's Medical Center	Inadvertent Find	Five burials interred in traditional matter found during construction	Unknown	?	5
Fairfax 1971	`Iolani Palace –moat & carriage road	Subsurface testing	Structural elements, artifacts	Historic	-9912	-
Rosendahl 1971	`Iolani Palace – carriage road	Subsurface testing	Structural elements, artifacts	Historic	-9912	-
Spilker 1974	`Iolani Palace – moat	Monitoring	Artifacts	Historic	-9912	-
Luscomb & Reeve 1976	`Iolani Palace	Monitoring	Artifacts	Historic	-9912	-
Sinoto 1977	`Iolani Palace Barracks	Monitoring	Features, artifacts	Historic	-9912	-
Ota & Kam 1982	State Office Bldg No. 2	Monitoring	Artifacts, burials	Unknown		6
Han 1980	Royal Queen Emma	Inadvertent Find	Burials	Unknown	?	2
Tomonari-Tuggle 1983	Block J, Downtown Honolulu	Assessment; Subsurface testing	Artifacts	Historic		-
Kennedy 1984	Hotel & Bethel Streets	Subsurface testing	Artifacts	Historic		-
Yent 1985	Honolulu Iron Works	Monitoring; Data recovery	Features, artifacts, burials	Historic		7
Athens 1986	Judiciary Parking Garage	Monitoring	Feature, artifacts	Historic	-3984	-
Clark 1987	Makai Parking Garage, Punchbowl & Halekauwila Streets	Monitoring	Features, artifacts, burials	Prehistoric, Historic	-2963	6
Leidemann 1988	Judiciary Parking Garage	Monitoring	Feature, artifacts	Historic	-1973	-
Pantaleo 1989	Chinatown Gateway Plaza	Monitoring	Artifacts	Historic	-2142	-
Bordner 1990	Kawaiha`o Church	Subsurface Testing	Artifacts	Historic		-
Chiogioji et al.	Hawaii State Public Library	Subsurface	Features, artifacts	Historic	-9959	-

Table 8. Selected Archaeological Projects Within the Area of Potential Effect.

Source	Project Location	Procedure	Findings	General Age	SIHP[1] No 50-80-14	No. of Burials
1991		Testing; Monitoring				
Simons et al. 1991	Armed Forces YMCA	Monitoring	Features, artifacts	Historic	-1307	-
Douglas 1991	Human Remains from the Honolulu Iron Works	Monitoring	Analysis of burials found during monitoring	?Historic		6
Hurst & Cleghorn 1991	Kekaulike Parking Lot (Chinatown)	Inventory Survey	Artifacts	Prehistoric, Historic		-
Hurst & Allen 1992	Ka`ahumanu Parking Structure	Inventory Survey	Structural elements, features, artifacts	Historic	-2456	-
Landrum & Dixon 1992	River-Nimitz Redevelopment	Monitoring; Data recovery	Features, artifacts, burial	Prehistoric, Historic		1
Dunn & Rosendahl 1993	Nuuanu Court (a.k.a. Harbor Court)	Inventory Survey	Features, deposits, artifacts, burials	Prehistoric, Historic	-2456	6
Denham & Kennedy 1993	State Capitol Complex Conduits	Monitoring	Features, artifacts, burial	Prehistoric & Historic	-4605 & -4606	1
Avery & Kennedy 1993	South Street Building Complex	Monitoring	Features, artifacts, burials	Historic	-3712	4
Pfeffer et al. 1993	Kaka`ako Improvement District 1 (Queen Street Widening; South, Punchbowl & Halekauwila Streets)	Monitoring	Features, artifacts, burials	Historic	-4531 – -4534	149
Cultural Surveys Hawaii, 1993	Honuakaha Elderly Housing Project	Inventory Survey	Features, artifacts, burials	Historic	-3712	11
Athens et al. 1994	Kapi`olani Blvd & Pi`ikoi St	Inadvertent Discovery Data recovery	Burial, wetland deposits	Prehistoric	-4847	1
Athens & Ward 1994	Kekaulike – Diamond Head (Chinatown)	Data Recovery	Wetland/fishpond deposits	Prehistoric		-
Erkelens et al. 1994	Kekaulike – Diamond Head (Chinatown)	Inventory Survey	Structural elements, features, deposits, artifacts, burials	Historic	-4875	3
Kennedy et al. 1994	Kekaulike - `Ewa Block (Chinatown)	Inventory Survey	Fishpond, features, deposits, artifacts	Prehistoric & Historic	-4587 & -4588	3

Table 8. Selected Archaeological Projects Within the Area of Potential Effect.

Source	Project Location	Procedure	Findings	General Age	SIHP[1] No 50-80-14	No. of Burials
Anderson & Williams 1995	King Street between Cooke & Ward	Background Assessment	Historic cultural resources likely	Historic		-
Anderson 1995	King Street between Cooke & Ward	Inventory Survey	Artifacts	Historic	-5373	-
Carpenter & Yent 1995	Washington Place – Kennel	Monitoring	Artifacts	Historic		-
Riley et al. 1995	Kekaulike - `Ewa Block (Chinatown)	Data recovery	Features, deposits, artifacts, burials	Prehistoric & Historic	-4587 & -4588	5
Garland 1996	Hawaiian Mission Houses	Data recovery	Features, artifacts	Historic	-9991	-
Goodwin et al. 1996	Marin Tower Development (Chinatown)	Inventory Survey	Structural elements, features, deposits, artifacts, burials	Prehistoric & Historic	-4494	15
Winieski et al. 1996	Honuakaha Elderly Housing Project	Monitoring	Features, artifacts, burials	Historic	-3712	14
Allen & Williams 1997	Kapi`olani Boulevard & Ward Avenue	Inventory Survey	Paleoenvironmental data from geoarchaeological coring	Prehistoric		-
Anderson 1997	King Street between Cooke & Ward	Monitoring	Artifacts, trash pits; coffin burials	Historic	-5455	30
Goodwin 1997	Kekaulike – Diamond Head (Chinatown)	Data recovery	Structural elements, features, artifacts, burial	Prehistoric & Historic	-4875	1
Hammatt & Chiogioji 1998	Pali Hwy & Beretania	Assessment	Historic cultural resources likely			-
Lebo & McGuirt 2000	800 Nuuanu Avenue	Inventory Survey	Structural elements, features, artifacts	Prehistoric & Historic	-5496	-
Major & Carpenter 2000	Washington Place	Monitoring	Artifacts	Historic		-
Perzinski et al. 2000	Block "J" Redevelopment Project	Inventory Survey	Structural elements, features, artifacts, isolated human remains	Historic	-5760	3
Winieski & Hammatt 2000	Pohulani Housing Development	Monitoring	Features, artifacts, burials	Historic	-4380 & -5820	20
Lebo & McGuirt 2001	800 Nuuanu Avenue	Data recovery	Structural elements, features, artifacts	Historic	-5496	-
Elmore & Kennedy 2001	King Street	Monitoring	Artifacts, burial	Historic		1
Winieski &	Nimitz Highway Reconstructed Sewer	Monitoring	Structural elements, artifacts	Historic	-5942	-

Table 8. Selected Archaeological Projects Within the Area of Potential Effect.

Source	Project Location	Procedure	Findings	General Age	SIHP[1] No 50-80-14	No. of Burials
Hammatt 2001						
Lebo et al. 2002	Harbor Court	Data recovery	Features, deposits, artifacts	Prehistoric & Historic	-2456	-
Mann & Hammatt 2002	King Street Rehabilitation Project	Monitoring	Features, artifacts, burial	Historic	-6371	1
Souza et al. 2002	Kaka`ako Improvement District 7	Monitoring	Features, artifacts, burials	Historic	-6376 – -6378	3
Dockall 2003	Washington Place – New Residence	Inventory Survey; Monitoring	Features, artifacts	Historic	-9907	-
Clark & Gosser 2005	Public Storage Property	Inventory Survey	Pond deposits, artifacts	Prehistoric, Historic	-6636	-
Perzinski et al. 2005	Queen and South Streets Intersection	Inventory Survey	Burials, historic features & artifacts	Historic	-1604 & -6766	2
Carney et al. 2005	Block "J" – Capital Place Development	Data Recovery	Historic artifacts	Historic	-5760	
Leu Cordy & Hammatt 2005	Punchbowl Street Improvements	Monitoring	No cultural resources found		-1321	-
McIntosh et al., 2006	Smith-Beretania Parking Lot	Inventory Survey; Data recovery; Monitoring	Structural elements, features, artifacts, deposits, burials	Prehistoric & Historic	-6722	26
Perzinski et al. 2006	Kewalo HECO Dispatch Center	Inventory Survey	Two historic coffin burials, artifacts	Historic	-5455	2
Bush & Hammatt, 2006	(HECO) Hokua Tower	Monitoring	No cultural resources found.			-
Hammatt et al. 2006	Kawaiaha`o Church	Monitoring Plan	Numerous previously-documented burials, mostly cemetery interments, within project area			-
O'Hare et al. 2006	Queen Street Extension: Kaka`ako I.D. 10	Monitoring	Features	Historic burials & trash pits	-6658 to -6660	30
O'Hare et al. 2007	Alapai Transit Center	Inventory Survey	Features, artifacts, burials	Historic & Unknown	-6901 & -6902	3

Table 8. Selected Archaeological Projects Within the Area of Potential Effect.

Source	Project Location	Procedure	Findings	General Age	SIHP[1] No 50-80-14	No. of Burials
Bell et al. 2006	Ward Village Shops	Inventory Survey	Subsurface cultural layer, burials	Prehistoric & Historic	-6854 to -6856	11
Rainalter et al. 2006	Washington Place	Monitoring	No cultural resources found		-9907	-
Stein et al. 2007	Kaka`ako Fire Station	Monitoring	No cultural resources found			-
Cultural Surveys Hawaii, n.d.	Queen Street Extension	Monitoring	Features, artifacts, burials	Historic		30

[1] SIHP = Statewide Inventory of Historic Places site number assigned by the State Historic Preservation Division.

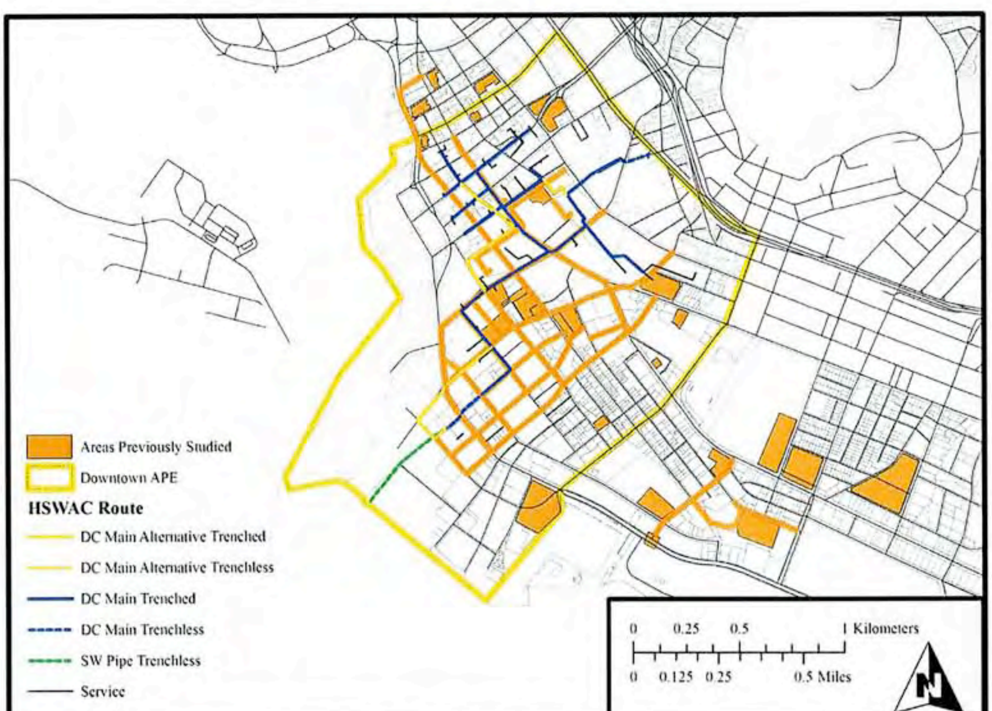

Figure 18. Location of Previous Archaeology Studies in and Near the APE.

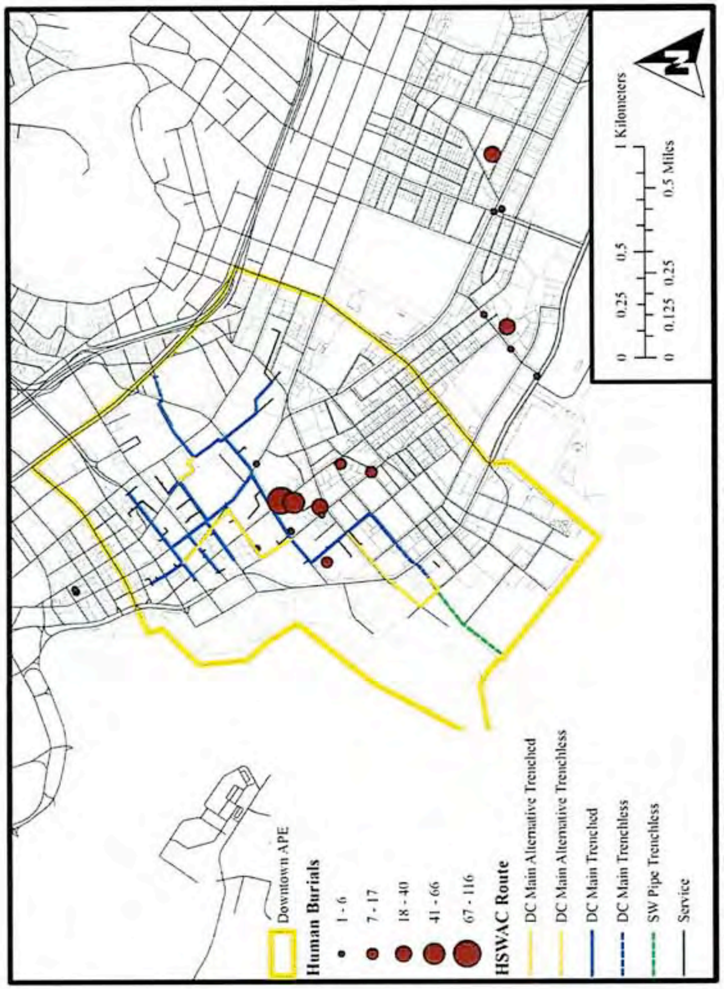

Figure 19. Location of Previous Burial Finds Within and Near the APE.

testing and monitoring of construction work in the Downtown and Kaka`ako areas. A brief synthesis of these archaeological reports follows, outlined according to their geographical locale.

Downtown – Capital Historic District

Numerous investigations within the Capital District (Site -1321) have occurred, predominately within the Washington Place and `Iolani Palace areas, which document development from pre-Contact settlement into a burgeoning historic-period residential, political, and commercial area. Four studies in Washington Place have resulted in the observation of typical 19th and 20th century historic artifacts like glass, ceramic, metal, architectural items, and faunal remains, etc (Carpenter & Yent 1995; Dockall et al. 2003; Major & Carpenter 2000; Rainalter et al. 2006).

In the `Iolani Palace vicinity, historic features such as a carriage road, coral foundation remnants of the Royal Bungalow, and a Palace Walk gate pier foundation associated with the late Monarch period, as well as historic trash pits and privies with associated artifacts have been identified, dating from the late 19th-20th centuries (Chiogioji et al. 1991; Fairfax 1971; Rosendahl 1971; Seelye 1968; Sinoto 1977). During monitoring of moat wall waterproofing surrounding the Palace, Spilker observed 4 former road surfaces including a portion of an old carriage road, 14 anchors, a coral block foundation, and several trash pits with numerous glass, ceramic, bone, coin, clay pipe, buttons, marbles, etc. artifacts (1974). Further monitoring in the `Iolani Palace area allowed Luscomb & Reeve to observe a portion of the old carriage road, a brick beehive-shaped cesspool, cement blocks possibly used as gunnery mounts, and several trash pits, as well as one traditional Hawaiian artifact, a coral abrader (1976).

Two sites are identified within the State Capitol Complex area: Site -4606 consists of 9 historic trash pits and Sites -4605 contains a historic-period burial, a ditch, pit, and trash pit, as well as a firepit that dates between 1390-1700AD and six postholes, one of which produced a date of 860-1330AD (Denham & Kennedy 1993). Finally, across from the Palace grounds and on Richards Street, Site -1307 consists of a trash pit containing glass, ceramics, metal, bone, and stone dating from 1790 to 1880, which is associated with the first Royal Hawaiian Hotel and nearby residential dwellings and a doctor's office (Simons et al. 1991).

Downtown – Chinatown Historic District

Archaeological investigation within the Chinatown Historic District has revealed a Native Hawaiian presence, yet emphasizes the overwhelmingly Chinese residential and commercial development in the historic era. In addition, site areas identified with renowned historic personage Don Francisco de Marin, an early non-native settler, are documented. Early archaeological investigations within the Chinatown District illustrated the presence of disturbed historic artifacts within fill soils (Pantaleo 1989) and six incomplete burials (Douglas 1991). In 1989, inadvertent discovery of a human burial at the River-Nimitz Redevelopment Project led to emergency mitigation of Site -4192 (Landrum & Dixon 1992). In addition to the well-preserved *in situ* skeletal and soft tissue (brain) remains, which were located in a flexed position within an estuarine, marsh, or lagoon environment and thought to be of Hawaiian descent, four historic-period artifact deposits and one remnant structural feature were observed during the mitigation efforts. These artifact deposits consist of two intact refuse pits and two refuse areas of secondary deposition. The historic debris dates between the 1840s and the 1920s and the intact nature of the two pit deposits point to a lack of organized garbage disposal or general sanitation practices in Honolulu during this period. The partially intact brick, mortar/concrete, and coral foundation supporting a 6" pipe is speculated to have been a part of sewage infrastructure developed in the project area in 1929.

An inventory survey for Ewa Block of the Kekaulike Revitalization Project bounded by Kekaulike, Hotel, River, and King Streets revealed two sites: Site -4587 consists of Pehu's Pond, a small fry fishpond; Site -4588 represents various periods of occupation and use, from pre-Contact to the modern era, consisting of walls, crushed coral foundations, burn layers, trash pits, postholes, pits, firepits, and 3 human burials (Kennedy & Riley 1993; Kennedy et al. 1994).

An inventory survey for the Diamond Head Block of the Kekaulike Revitalization Project bounded by Kekaulike, Maunakea, King, and Hotel Streets documented Site -4875, which includes 3 incomplete burials in a secondary context, theorized to be a family buried together following either an epidemic or the Chinatown fire, as well as the incomplete remains of a 6-7month fetus within a historic refuse deposit (Erkelens et al. 1994). The inventory survey with subsurface testing also identified habitation sites spanning the Pre-Contact era into the historic Chinese occupation period (Goodwin 1997). The Pre-Contact archaeological features include house and fence line postholes, living surfaces, fire pits, cellars, trash pits, and sheet midden. The historic Chinese features consisted of structural remains, privies/wells, trash pits, and cellars.

In 1994, further data recovery efforts for Site -4875 resulted in the observation of features and artifacts associated with four house compounds and a blacksmith's shop that span the late pre-Contact period through the modern era. Over 1000 features were identified, including postmolds, firepits, and trash deposits (Goodwin & Allen 2005). Inventory survey for the Marin Tower development located between King, Smith, and Maunakea Streets and the Nimitz Highway identified household remains dated between

1810-1860 associated with the Don Francisco de Marin family, in the form of postholes, cooking areas, trashpits, a privy, a coral block wall and a small family cemetery (Goodwin et al. 1996). Other later occupation phases within this site (Site -4494) consist of remains from the Honolulu Iron Works and various, but predominately Chinese, mercantile establishments and residences in the form of kitchen areas, privies, and sheet middens. Inventory survey with test excavations within a parking lot on the corner of Smith and Beretania Streets yielded (Site -6772) trash pits, cooking features, building foundations and an European and Asian artifactual assemblage dating between 1850-1900 (McIntosh et al. 2006). As well, some deposits may be associated with early 19th century Hawaiian settlement and with the pre-Contact period – traditional artifacts observed included poi pounder fragments, an `ulumaika, cowrie shell lures, a stone adze and a complete conch shell trumpet.

Downtown – Merchant Street Historic District

The archaeology in the Merchant Street District has revealed a wealth of data spanning 1250 – 1955 A.D within the Harbor Court Tower property, illuminating the area's transition from Native Hawaiian settlement into a commercial center. The first monitoring and subsurface testing effort within Harbor Court occurred in 1991 and led to site recordation (Site -2456) of exposed building foundations, some of which predated 1850, as well as the observation of pre-Contact and early-Contact period cultural deposits. Artifact classes included basalt flakes and debitage, cut shell, glass bottles, ceramic sherds, clay pipe fragments, metal, and building materials (Hurst & Allen 1992).

Another inventory survey of the property in 1993 resulted in the identification of features and artifacts that span the Late Prehistoric, Transitional, and Historic periods. Features identified consist of a basin-shaped pit, prehistoric and historic postholes, and a historic pipe trench, ash lens, walls and floors (Dunn & Rosendahl 1993). In 1997, data recovery expanded the record of Site -2456, as remains from the following occupations were recorded: multiple Native Hawaiian house structure living surfaces predating 1820, followed by the remains of a 1820s warehouse and the post 1858 Janion Green building which are indicative of the area's transition into a commercial center (Lebo, ed. 1997).

Subsequent data-recovery efforts in 2002, which focused upon pre-1850 features and artifacts (Site -2456), continue to document habitation within the Pre-Contact, Transitional – Late-Contact, and Transitional periods. A total of 450+ post molds, 120+ in-filled pits, and 18 fire pits were documented spanning the three periods. As well, numerous faunal taxa and traditional Hawaiian artifacts such as basalt flakes and tools, volcanic glass flakes, modified bone and shell, bone net gauges, and abraders were present in the Pre-Contact era. The Transitional – Late-Contact and Transitional periods are evidenced in traditional Hawaiian artifacts, like basalt cores, adzes, hammerstones, and slingshots, volcanic glass tools and flakes, and perforated shells, along with numerous faunal remains, in combination with non-traditional historic period artifacts such as glass, metal, and ceramics (Lebo et al. 2002).

Downtown - General

Several investigations within the Downtown area, which do not fall within the bounds of the Capital, Chinatown, or Merchant Street Districts, have produced a burial, as well as historic-period features and artifacts. In 1984, studies within a parking lot bounded by Nu`uanu, Hotel, & Bethel Streets produced evidence of only modern refuse (Kennedy 1984). In the early 1980s, test borings within Block J of Downtown, where the Pali Highway and Beretania intersect, produced various glass, ceramic, metal, and faunal artifacts from the historic period (Tomonari-Tuggle 1983).

Further investigation of Block J led to the observation of Site -5760, which consisted of trash-filled pits, probable privies, and utility installation trenches, yielding historic artifacts that included glass, ceramics, marine shell, and faunal remains (Perzinski et al. 2000). Still further data recovery within Block J resulted in the observation of more historic glass bottles, ceramic vessels, personal items, and household goods dating between the early 19th and early 20th centuries, and one isolated polished basalt adze , all assigned as part of Site -5760 (Carney et al. 2005). Monitoring of sewer improvements resulted in the observation of a remnant of light gauge trolley rail (Site -5942) and a brick-lined manhole at the intersection of Queen Street and the Nimitz Highway (Winieski & Hammatt 2001). In addition, a brick alignment was found at the Queen & Punchbowl Streets intersection and a historic rubbish scatter in fill was seen at Maunakea Street & Nimitz Highway (Winieski & Hammatt 2001).

During King Street rehabilitations, in the project's Richards Street intersection, a pit feature with butchered animal bones was observed (Mann & Hammatt 2002). Finally, data recovery within the 800 Nuuanu Block resulted in the identification of Site -5694, which consists of three cultural zones. The first cultural zone (1810-1860s) contains postmolds and a living surface that attest to traditional activities, which transition towards Western land use strategies, as evidenced by the incorporation of boundary walls, residential and commercial structures and inner yard areas, as well as historic products found in trash pits. The second cultural zone (1860s-1890s) contains evidence of a loss of traditional Hawaiian activities and the use of the block for residential purposes, giving over entirely to commercial business housed in wood-framed structures. The third

cultural zone (1890s-present) contains evidence of the removal of the wood-framed buildings, followed by the construction of the Honolulu Iron Works and later an auto garage, as well as infrastructural improvements like sewer lines and a parking lot (Lebo & McGuirt 2000).

Kaka`ako

Through University of Hawaii-sponsored Archaeological Field Schools at the Mission Houses site (-9991), 30 features including earthen floors, privy holes, and sheet middens were documented that reveal transitional post-Contact artifact deposition, with research focus on the site's ceramic tablewares and faunal remains assemblage. The site catalog lists the following ceramic types: creamwares, pearlwares, whitewares, ironstones, earthenwares, porcelains, porcellaneous stonewares, redwares, yellowwares, and refined stonewares. The site catalog also details chicken, pig, dog, bovine, fish, and mollusk faunal remains (Garland 1996).

Numerous human burials have been recorded within Kaka`ako, most of which are associated with historic-period cemetery interments dating from the post-Christianity era (post-1820). Isolated burials have also been recorded in Kaka`ako, some of which may be pre-contact and not associated with cemetery interment. Additionally, a variety of archaeological features and artifacts have been observed in this portion of Honolulu.

From 1986 through 1988, monitoring for the Kaka`ako Improvement District 1 Project resulted in the discovery of four burial site areas located below the Queen Street and South Street/Quinn Lane roadways. It was determined that a total of 116 burials were once a part of Kawaiaha`o Cemetery (Site -4534) and 31 burials were once a part of Honuakaha Cemetery (Site -3712), as well as two isolated burials identified as Sites -4532 and -4533 (Pfeffer et al. 1993). In 1993, an additional 3 in-situ human burials were reported near the intersection of South and Halekauwila Streets, thought to be associated with the 1853 smallpox epidemic and lying within the historic Honuakaha Cemetery (Avery & Kennedy 1993). A multicomponent site (Site -2963) was observed within a parking lot at the Punchbowl and Halekauwila Streets that consisted of 6 human burials, trash pits, animal bones, pits, a posthole, a buried surface, a burned soil area, and several foundations (Clark 1987).

Archaeological inventory survey conducted at the development of a condominium on King Street between Cooke and Ward yielded historic artifacts; monitoring work for the same project resulted in the discovery of 30 historic burials during the monitoring phase (Anderson 1997). All burials were determined to be associated with the adjacent Roman Catholic Cemetery and reinterred in the area. Testing within a condo parcel at the intersection of Queen & South Streets also revealed two sites: Site -6766, consisting of a historic garbage pit, a post hole, and a slab and wall remnant, all of which date to the mid- to late-1800s; and Site -1604: 2 isolated bones (Perzinski et al. 2005). Monitoring in the vicinity of the project listed above, at the current Kaka`ako Fire Station location revealed historic materials like glass, ceramic, and cut bone, but these were not considered significant (Stein et al. 2007).

During King Street rehabilitations a previously-disturbed and incomplete human burial (Site -6371) was observed at the Punchbowl Street intersection (Mann & Hammatt 2002). Examination of test trenches within the Alapai Transit Center at the corner of King and South Streets revealed two sites: Site -6901 consisted of 4 historic trash pits dating between 1820-1920, containing refuse suggestive of the affluent consumption patterns of the Cooke & Atherton families, who resided in the project area; and Site -6902: 3 burials, of which two are coffin interments (O'Hare et al. 2007).

Within the present-day Judiciary complex, two separate monitoring efforts for a parking garage led to the observation of historic-period soda, beer, champagne, liquor, perfume, medicine, and food/condiment glass bottles, and porcelain, whiteware, stoneware, earthenware, and terra cotta ceramic vessels, as well as metal items. It is speculated that these artifacts, which represent American, Asian, and European imports were deposited as refuse by area residents, but the site itself is heavily disturbed (Athens 1986; Leidemann 1988).

Monitoring and testing within improvements on Keawe, Coral, and Halekauwila Streets and in the present-day locations of Pohulani Elderly Rental Housing and Mother Waldron Park, a total of 20 human burials were revealed that span pre-Contact into post-Contact times. Site -4380 consists of 9 burials found in the housing facility portion of the project area, while Site -5820 consists of the remainder of the burials (2 on Keawe Street, 4 at Halekauwila & Coral Streets, and 1 at Halekauwila & Keawe Streets). In addition, a buried 'A' horizon was observed that contained a historic trash pits, scattered traditional and historic artifacts, and a probable outhouse feature filled with refuse (Winieski & Hammatt 2000).

Inventory survey for the present Public Storage Facility, at the corner of Kamake`e and Kapi`olani Streets resulted in the observation of gleyed deposits containing freshwater snail remains, representing an un-named freshwater fishpond's sediments, which are included in Site -6636 (Clark & Gosser 2005). An earlier investigation – at the Symphony Park property at the *mauka-`ewa* corner of Kapi`olani Boulevard and Ward Avenue – did not yield evidence of cultural sites but provided solid data on the marshy, pre-Contact environment.

Most recently, there have been discoveries of multiple burials. Although technically outside the current APE, information pertaining to these projects is included here since similar types of environments exist within the APE. During monitoring of improvements on Kamake`e Street between Queen Street and Ala Moana Boulevard and in a section on Ala Moana Boulevard, despite previous extensive disturbance, pockets of undisturbed beach sands and 3 burials were discovered (Sites -6376, -6377, and -6378)). Only one of the burials was found located in-situ beach sand matrix (Souza et al. 2002). In 2003, archaeological monitoring of the construction of the Queen Street Extension resulted in the discovery of 30 human burials; 28 of the burials appeared to belong to a historic cemetery and two burials were each an isolated find (O'Hare et al 2006). In 2004, archaeological monitoring of the construction of the Ko`olani Condominium project along Auahi Street resulted in the discovery of 18 burials; 16 burials may have been part of a historic cemetery, and two burials were each isolated finds (Hammatt 2007).

From 2006 to the present, archaeological inventory survey and monitoring work, conducted at Ward Villages near the intersection of Kamake`e and Queen Streets led to the discovery of at least 60 burials, a number of them apparently part of one or more burial grounds (Cultural Surveys Hawaii, in prep.). Eleven burials were documented during the inventory survey phase, and the remaining burials were found during monitoring of construction.

Assessment of Effects on Historic Properties Within the APE

Architectural Properties

As noted above, the majority of significant historic architectural properties with the APE will not be affected by HSWAC. The proposed pipeline routes currently connect to or physically access nine architectural properties, and pass near 19 of 74 historic properties in the APE that are register sites, contributing properties to register districts, register-eligible properties, and historic properties identified through the CIA and research for this report. In all cases where a building is to be connected to the HSWAC occurs, the distribution pipes will be connected to existing utility systems upon installation. There may be temporary alteration of the ground surfaces adjacent to these buildings as the pipeline trenching is conducted, but such alterations are temporary and will be mitigated by restoring the ground surface and any landscaping. No additional, permanent structures or appurtenances are required for the HSWAC. Two register properties merit additional discussion; they are the Hawaii State Capitol and Grounds and Honolulu Hale and Grounds.

State Capitol and Grounds

The current configuration of the pipeline routing will connect the State Capitol to the HSWAC system through a pipeline that will be installed beneath the vehicular access off Punchbowl Street (see Figure 2). From the vehicular entrance, the Capitol pipeline will be extended across Punchbowl Street, and down a traffic lane of the vehicular entrance to the Kalanimoku Building (state offices), which is also to be included in the HSWAC distribution system. A second pipeline route will extended *mauka* or north from the Capitol across and underneath Beretania Street along the Miller Street corridor in order to serve the State Department of Education (DOE) and the State Department of Health (DOH) buildings. The pipeline will be installed along the Miller Street pedestrian mall on the side of the Department of Health (DOH), in order to avoid Washington Place and its grounds. The pipeline installations for much of Capitol Grounds, Beretania and Miller Streets will be carried out through trenching. Exceptions will be within the Capitol structure, where the pipeline will be suspended from the ceiling of the underground parking area, where existing utility lines are placed, and the upper part of Miller Street, adjacent to Queen's Medical Center. In this locale, trench-less excavations will be conducted to extend the Queen's pipeline across Punchbowl Street, and up Miller Street to the connection point.

The Hawaii State Capitol and Grounds are contributing properties to the Hawai`i Capitol Historic District, although they are not historic in age. The Capitol was constructed in the mid-1960s and dedicated in 1969. At the time of its construction, the entire parcel upon which it sits was excavated in order to accommodate both the capitol building and the underground parking areas that were planned (Belt et al. 1961). The entire area impacted by the HSWAC installation was previously and extensively disturbed during the construction the Capitol building and associated parking areas. Any alterations due to trenching will be temporary and can be completely mitigated by replacing ground cover and landscaping. Insertion of the pipeline into the Capitol building will be below current ground surface and not visible once it is in place. Consequently, it is believed that the HSWAC undertaking will have no effect on the State Capitol or grounds. Similarly, excavations along the Miller Street corridor adjacent to the DOH building, to the DOE building, and to the Queen's Hospital complex will have no effect on historic properties.

Honolulu Hale and Grounds

Honolulu Hale was originally constructed in 1929; the building and its grounds are contributing properties to the Hawai`i Capitol Historic District. Designed by renowned Hawai`i architects C.W. Dickey, Hart Wood and others, the California-Spanish style

building was dedicated in 1929 (City & County of Honolulu, 1982). The original building underwent a planned expansion in 1951 with the addition of two three-story wings on the *mauka* side of the existing structure (City & County of Honolulu, 1982). Through the 1960s, Hotel Street continued to exist as a vehicular route; its right of way overlaps with what is now a pedestrian walkway on the *mauka* side of Honolulu Hale, extending from Punchbowl Street towards the Honolulu Municipal Building, a 15-story office tower constructed to the east of Honolulu Hale and the Kalanimoku Building in 1975. At this time, the walkways and lawn areas between these government buildings were modified into the configuration seen today (City and County of Honolulu 2982; Belt et al. 1961).

Honolulu Hale will be serviced by the HSWAC system and current routing shows the distribution pipeline going across the lawn area immediately *mauka* of the building, with open trenching being used to install the pipe. The HSWAC pipeline will be connected to existing utility systems and will not require any additional structures or appurtenances that would modify the appearance of Honolulu Hale or its grounds. There will be a temporary alteration to the grounds as trenching occurs but this can be mitigated through restoration of the ground surface and landscaping upon completion of excavations.

Effects on Archaeological Properties

The current configuration of the pipeline corridor in the APE is primarily based on two factors: the need to provide HSWAC connections to specific clients and the need to minimize the disruption of traffic on Downtown and Kaka`ako roadways. Additional complications include the fact that all roadways proposed for the HSWAC distribution pipeline contain existing infrastructure components such as sewer, water, or utility lines in their subsurface portions. These constraints thus create a situation where there are few alternatives to the proposed pipeline routes.

Using the data from the previous archaeological reports summarized above, PCSI has developed a map illustrating areas of relative sensitivity for encountering subsurface cultural sites, including human burials, within the APE. Figure 20 shows the pipeline distribution routes as they are assessed for the likelihood of encountering subsurface cultural sites. The green color indicates of areas of expected low probability, the orange color corresponds to a moderate probability of finds, and red indicates an area of high probability of subsurface finds. Currently, most of the installation for the pipeline will be done through open trenching along existing roadways and sidewalks. The only exceptions to this will be as follows: (1) short, trenched corridors that go from a main pipeline to an individual building; and (2) the segments of trenchless excavations including the pipeline *makai* on Keawe Street from Auahi Street, across Ala Moana

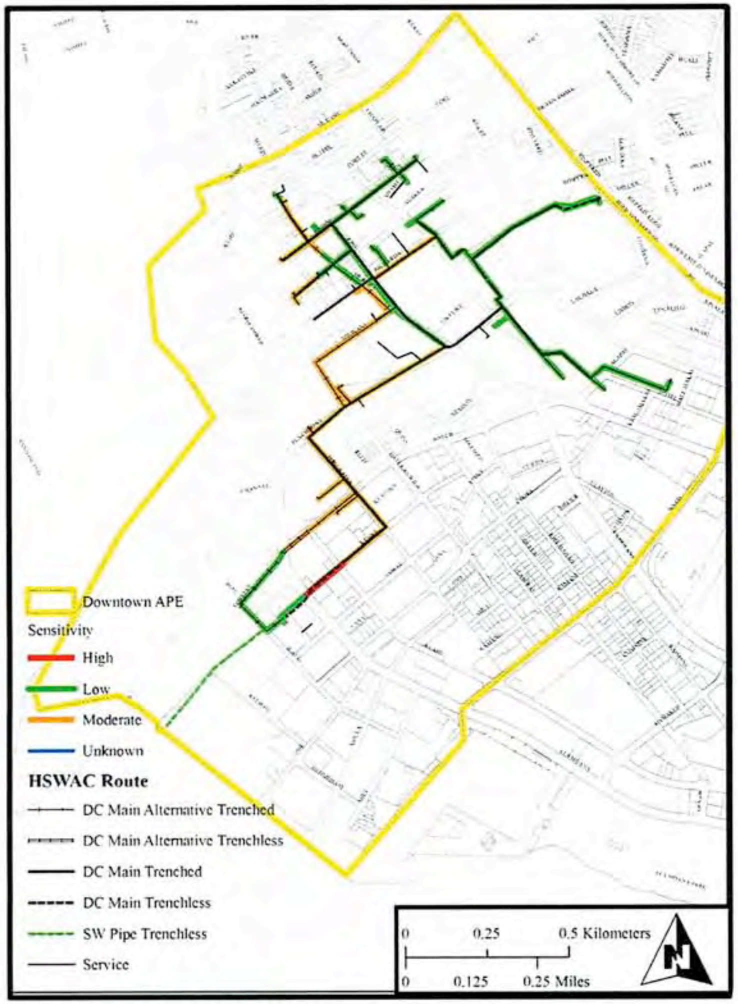

Figure 20. Distribution of Archaeology Probability Zones in the APE.

Boulevard and down to the cooling plant, the pipeline segment from DOE on Miller Street to the Queen's Medical Center. Trench-less excavations generally occur at depths well below those where cultural resources, including burials, are found. The only portions of trench-less excavations that may require monitoring are the jacking and receiving pits needed for the drilling equipment.

A number of segments of the distribution pipeline are deemed to be of low sensitivity for finding subsurface cultural sites, as indicated by the record of previous finds and studies. These areas include portions of the Bishop, King, and Merchant Street corridors, as shown on Figure 20, and the entire Miller Street corridor between the State Capitol and the Queen's Hospital complex. In addition, trenching on the grounds of the Capitol and Honolulu Hale are deemed to be of low sensitivity for finding subsurface deposits. In view of the multiple episodes of relatively recent construction in these areas (summarize above), and the lack of any evidence for subsurface cultural deposits being present in these locations, it is believed that the HSWAC pipeline installations will have no effect on Honolulu Hale or the State Capitol and their grounds. The trenching for the pipeline segment between the cooling station and the *makai* side of Ala Moana Boulevard is also an area of low sensitivity for subsurface finds since this is filled land, all excavation will take place within fill, and there is no history of prior finds in this part of Kaka`ako.

Areas of moderate sensitivity of encountering subsurface cultural sites are shown on Figure 20 as including the following:

- The connecting pipeline for the Honolulu Emergency Operations Center at King and Alapai Streets;
- Portions of Merchant and Bishop Streets on either side of that intersection;
- The portion of Alakea Street *makai* of the intersection with Queen Street;
- The portion of Richards Street from Hotel Street *makai* to the intersection with Merchant Street;
- The connecting trenches to the US Post Office, Custom House, and Court House, Ali`iolani Hale, the Hawaiian Electric, Kekuanaoa and Kapuaiwa Buildings,
- Pipeline segments through the Honuakaha section of Kaka`ako, from the intersection of Pohukaina and Punchbowl Streets, east along Pohukaina Street to Keawe Street;
- Areas of trenchless excavations between Auahi Street and Ala Moana Boulevard where jacking and receiving pits will be located.

The area of high sensitivity for encountering subsurface cultural sites is believed to be Keawe Street from its intersection with Auahi Street to Ala Moana Boulevard.

Given the above information, the proposed HSWAC pipeline system may have an "adverse effect" on subsurface cultural sites that may be present in the portions of the APE that are deemed of moderate to high probability for encountering sites. In view of these facts, it is recommended that the areas of moderate and high probability for finding subsurface cultural sites undergo on-site archaeological monitoring during trenching done for the HSWAC. If this measure is approved, and an acceptable archaeological monitoring plan is prepared, then the proposed undertaking may be found to have "no adverse effect" on significant historic sites

Effects on Traditional Cultural Properties

Consulting parties in the CIA provided a great deal of information on Kaka`ako's past and the communities who lived there. They also identified several concerns with regard to the potential for finding or disturbing cultural sites during the HSWAC project, including the discovery of human burials. In general, consulting parties acknowledged that former burial locations are now largely unknown, thus it is difficult to predict where they might be encountered. One participant noted that in the old days people generally buried their dead "on the side of their house." Another participant also mentioned the previous find of numerous burials associated with Kawaiaha`o Cemetery when Queen Street underwent improvements in the 1980s.

Participants in the CIA identified sacred places and precincts within the APE. A *heiau* (name unknown) was formerly in the vicinity of Point Panic, and a sacred pond (now filled in) was in the vicinity of Koula and Auahi Streets. The pond, according to the CIA participant, was a place for *ali`i* to prepare for ritual sacrifices. These places and others were part of what one CIA participant called a Sacred Triangle that extended from Moanalua on the west to Mānoa on the east *makai* to the coral flats underlying `Iolani Palace and nearby properties. This view of the landscape is still held by project participants and others; while they do not necessarily object to modern changes, they do not believe such change has eliminated the sacred and traditional realities of the landscape that they were taught to respect.

Although the CIA participants all recalled fishing, gathering *limu*, and similar activities along the Kewalo shoreline when living in Kaka`ako, no one identified particular species or resources that might be affected by the HSWAC project. Fishermen and women still frequent the Kaka`ako shoreline, often in the vicinity of the drainage canal on the `ewa end of Kaka`ako Waterfront Park, but none of them participated in the current CIA. Similarly, the Point Panic area is a popular surfing spot, but none of the CIA participants commented on any effect the HSWAC project might have on this activity.

ETHNOGRAPHIC SURVEY & ANALYSIS

METHODS

Purpose and Legal Guidance

The Honolulu Sea Water Air Conditioning Cultural Impact Study/Assessment was conducted in 2005 and 2008. The study consisted of three phases: (1) cultural and historical archival research (literature review); (2) ethnographic survey (oral history interviews), transcribing taped interviews, analysis of ethnographic data (oral histories) and (3) report writing. This cultural impact study/assessment is based on two guiding documents: Act 50 and the Office of Environmental Quality Control Guidelines, as well as the *Criteria for Historic Preservation* cited below.

Act 50 (State of Hawai`i 2000)

House Bill No. 2895 H.D.1 was passed by the 20th Legislature and approved by the Governor on April 26, 2000 as Act 50. The following excerpts illustrate the intent and mandates of this Act:

The legislature also finds that native Hawaiian culture plays a vital role in preserving and advancing the unique quality of life and the "aloha spirit' in Hawai`i. Articles IX and XII of the state constitution, other state laws, and the courts of the State impose on government agencies a duty to promote and protect cultural beliefs, practices, and resources of native Hawaiians as well as other ethnic groups.

Moreover, the past failure to require native Hawaiian cultural impact assessments has resulted in the loss and destruction of many important cultural resources and has interfered with the exercise of native Hawaiian culture. The legislature further finds that due consideration of the effects of human activities on native Hawaiian culture and the exercise thereof is necessary to ensure the continued existence, development, and exercise of native Hawaiian culture.

The purpose of this Act is to: (1) Require that environmental impact statements include the disclosure of the effects of a proposed action on the cultural practices of the community and State; and (2) Amend the definition of "significant effect" to include adverse effects on cultural practices.

SECTION 2. Section 343-2, Hawai`i Revised Statutes, is amended by amending the definitions of "environmental impact statement' or "statement" and "significant effect", to read as follows:

'"Environmental impact statement" or "statement" means an informational document prepared in compliance with the rules adopted under section 343-6 and which discloses the environmental effects of a proposed action, effects of a proposed action on the economic [and] welfare, social welfare, and cultural practices of the community and State, effects of the economic activities arising out of the proposed action, measures proposed to minimize adverse effects, and alternatives to the action and their environmental effects....

Hawaii Administrative Rules (HAR) Chapter 13-275-6(b) and 13-284-6(b) for the Evaluation of Significance for Historic Sites

The "significance" of a site is determined by assessing whether a historic property meets one or more of a set of significance criteria. The State of Hawai`i has established the following significance criteria for historic sites found during public sector (HAR 13-275-6(b) and private sector (HAR 13-284-6(b) projects:

- Criterion A: Be associated with events that have made an important contribution to the broad patterns of our history.
- Criterion B: Be associated with the lives of persons important in our past.
- Criterion C: Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value.
- Criterion D: Have yielded, or be likely to yield, information important for research on prehistory or history.
- Criterion E: Have an important historical cultural value to an ethnic group of the state due to important cultural practices once carried out, or still carried out, at the property, or due to associations with traditional beliefs, events, or oral accounts – these associations being important to the group's history and cultural identity.

Personnel

The personnel consisted of the principal investigator who has a doctorate in Anthropology and was primarily responsible for the archival background research and report writing; the Ethnographic investigator who has a Masters degree in Anthropology, with a graduate curriculum background in anthropology theory, cultural resource management, ethnographic research methods, and public archaeology; an undergraduate curriculum background that included Hawaiian History, Hawaiian Language, Hawaiian Archaeology, Pacific Islands Religion, Pacific Islands Archaeology, Cultural Anthropology, as well as a core archaeology track, Geology, and Tropical Plant Botany; and ethnographic field experience that includes over 300 interviews to date.

Level of Effort

The level of effort for this study included a broad archival research literature review and an ethnographic survey [11 interviews].

Ethnographic Theoretical Approach

This study is loosely based on *Grounded Theory,* a qualitative research approach in which "raw data" [transcripts and literature] are analyzed for concepts, categories and propositions. Since this was a semi-focused study, categories were pre-selected as part of the overall research design. However, it is not always the case that these research categories are supported in the data. Categories were generated by forming general groupings such as "Land Resources & Use," "Water Resources & Use" "Marine Resources & Use" and "Cultural Resources & Use." Conceptual labels or codes are generated by topic indicators (i.e., agriculture, flora, burials, fishing). In the *Grounded Theory* approach, theories about the social process are developed from the data analysis and interpretation process (Haig 1995; Pandit 1996). This step was not part of this cultural impact assessment as the research sample was too small.

Phase I Archival Research.

Archival material for the archival cultural and historical literature review was compiled taking several weeks of intermittent archival research. The majority of the primary source material came from the Hawaiian Collections of the University of Hawai`i Hamilton Library (Manoa Campus); the Bishop Museum Archives; Hawai`i Children's Mission House archives; Waihona `Aina Corp.; State Historic Preservation Division library; information from State Bureau of Conveyances; personal library; and Internet searches. Primary source material included Land Court records, maps, newspapers, visitor journals, genealogies, oral histories and other studies. Secondary source material included translations of 19th century ethnographic works, historical texts, indexes, archaeological reports, and Hawaiian language resources [i.e., proverbs, place names and dictionary].

The Ethnographic Survey (oral history interviews) is an essential part of the Cultural Impact Study and Assessment (CIS) because they help in the process of determining if an undertaking or development project will have an adverse impact on the cultural practices or access to cultural practices. The following are initial consultant selection criteria:

- Had/has Ties to Project Location(s)
- Known Hawaiian Cultural Resource Person
- Known Hawaiian Traditional Practitioner
- Referred By Other Cultural Resource People

The consultants for this CIS/A were selected because they met the following criteria: (1) consultant grew up or lived in Kaka`ako and vicinity; (2) consultant is familiar with the history and *mo`olelo* of Kaka`ako and vicinity; or (3) consultant referred by other people connected to Kaka`ako. Copies of signed "Consent" and "Release" forms are provided in (Appendix A and Appendix B).

Research Themes or Categories

In order to comply with the scope of work for this cultural impact study/assessment (CIS/A), the ethnographic survey was designed so that information from ethnographic consultants interviewed would facilitate in determining if any cultural sites or practices or access to them would be impacted by the implementation of the *Honolulu Sea Water Air Conditioning* (HSWAC) development project. To this end the following basic research categories or themes were incorporated into the ethnographic instrument: Consultant Background, Land Resources & Use, Water Resources & Use, Marine Resources & Use, Cultural Resources & Use; Anecdotal Stories and Project Concerns. Except for the 'Consultant Background' category, all the other research categories have sub-categories or sub-themes that were developed based on the ethnographic raw data (oral histories) or responses of the consultants. These responses or clusters of information then become part of the supporting evidence for any determinations made regarding impacts on cultural resources and/or practices.

Consultant Background and Demographics

Each consultant was asked to talk about their background; where they were born and raised, where they went to school and worked, and a little about their parents and grandparents. This category helps to establish the consultant's connection to the project area, their area and extent of expertise, and how they acquired their proficiency. In other words, how the consultant met the consultant criteria. Twelve individuals were identified as potential consultants; eleven were interviewed. Five consultants are Part-Hawaiian, five are Japanese and one is Caucasian. Nine consultants once lived in Kaka`ako, the parents of the one lived in Kaka`ako and two had businesses in Kaka`ako, one lived there for a while.

Table 9. Consultant Demographics in Relation to Project Lands.

Consultant	Ethnicity	Born	Raised	Worked	*C-P
Louis Agard, Jr.	Part-Hawaiian	Kauai	Kealia	Kaka`ako	
Lex Brodie	Caucasian	Elsewhere	Kauai	Kaka`ako	
Kanoe Bright Cheek	Part-Hawaiian	Oahu	Kaka`ako	Kaka`ako	C-P
Lorraine Kaina	Part-Hawaiian	Oahu	Kaka`ako	UHM	
**Poni Kamauu	Part-Hawaiian	Oahu	Papakolea	Oahu	C-P
Elaine Masuda	Japanese	Oahu	Kaka`ako	Mililani	
Roy Masuda	Japanese	Oahu	Kaka`ako		
Neal Okamoto	Japanese	Oahu	Kaka`ako	Downtown	
Joseph Pekelo Recca	Part-Hawaiian	Oahu	Kaka`ako	Waikiki	C-P
Alice Watanabe	Japanese	Oahu	Kaka`ako		
Jean Watanabe	Japanese	Oahu	Kaka`ako		

*C-P=Cultural Practitioner; **Parents lived in Kaka`ako

There is always a danger of not allowing the consultant's "voice" to be heard; of making interpretations that are not theirs; and of asking leading questions. To remedy this, the "talk story" method is used and allows for a dialogue to take place, thereby allowing the consultant to talk about a general topic in their own specific way, with their own specific words. In the sections presenting specific information, all of the excerpts used are in the exact words of each consultant or paraphrased to insert words that are "understood" or to link sentences that were brought up as connected afterthoughts or related additions spoken elsewhere in the interview. The following excerpts in "Consultant Background" provide a summary of each consultant, as well as information about their parents and grandparents. They are presented below alphabetically according to their first names as some people have the same last names.

Louis Agard, Jr. I'm Louis Agard, Jr. I was born and raised in Kealia on the island of Kauai. And my father was born in New York, my mother was born in Honolulu, Hawai'i. My grandparents on my mother's side we were born in Honolulu and they lived in Honolulu all of their lives and they are buried here in Honolulu. On my father's side, his father and mother were born in Denmark and I don't know where my great-grandparents on my father's side were born or lived. My father's name was Louis Agard, Sr. and my mother's name was Kahalohihi Mariah Prestige; her father was a Prestige; Mr. Prestige was born in New South Wales, Australia. And my grandmother on that side of the family married to Prestige was Hapikaila Kealoha. Her grandfather was Kepahoni Kealoha. And her grandmother Liliakahu Oliver born on O'ahu. My father's parents – all I know is that my father is an Agard and his father was an Agard. And my grandmother on that side, I don't really remember her name. My mother grew up in the Palama section of the island, where they have Palama Settlement today; in the vicinity. They had a large taro patch running from School Street down to what is Mayor Wright Housing today...that used to be all taro patches and the water was coming from that stream that came from the mountain that used to be there, which is now covered over by the highway and developments, but the water is running under those places, to the ocean. I first came to O'ahu in 1936 to Kamehameha Schools; I was a boarder for the six years that I was there.... I took my six years of military training, 'cause Kamehameha was a military school, and that became valuable. I graduated with honors and Kamehameha gave me a college scholarship. So I went away to college at University of Redlands in Electrical Engineering.... In about 1938, 1939 I was already here [in Kaka`ako], my father was here starting another business in Kaka'ako on the corner of Queen Street and Ward Avenue, which today that site has a Shell Gas Station...my father had two 5,000 lots in there; first it was a roofing business, then it became fishing business. My father was there till about 1945, I think.... Well, then I started to work on fishing boats, first on our own, then I started working on larger ones that Hawaiian Tuna Packers were operating. They had four Japanese sampans, large ones: the Koyomaru, the Kiyomaru, the Kasuga, and at least those three vessels I can remember. And I was working on those as a tuna fisherman in 1940s. And then I started my own business and bought my own boats, and worked under the title or the company of Marine Supply and Exchange. 'Cause I was purchasing and distributing marine gear and netting and ropes and hardware and equipment and I still operated the business till today in 2005. At the end of that building I had two offices in there. We operated for a while, well I've operated several businesses, marine supply out of there, then we had the interisland ferry system, the first one with Augustine and my wife ran the office where Hawaiian Parasail is, and the next office. We had the two on this end. And we ran the Pearl Harbor cruises out of there and we two other cruise boats here.... And then this vessel I bought from Henry Kaiser; he built this for his wife Ally. I worked around Kewalo for years, I'm probably the oldest tenant in the

yard there. I have two lease parcels of ceded land. And, I have my old shop there where I was processing fish, cutting it up and distributing it and drying up and processing it, packing it and weighing it for years. Then I just quit that a few years ago, maybe about five or six years ago; I gave up after working in it after seventy years -- almost seventy years.

Alexander H. "Lex" Brodie. I'm Alexander H. Brodie (the H is for Huffguard), my son is Alexander C. Brodie. My grandson, who has a flourishing business in Santa Barbara, is another Alexander. My father was Alexander Brodie, no middle name, born in Quebec; taught chemistry at McGill University in Canada. He had seen an advertisement for Control Chemist at Kilauea, applied for the job, got it--this was 1899. Shortly thereafter we moved to a larger plantation, Kekaha on Kaua`i. My great grandmother came up from Norway, I guess it was around 1918, something like that. And one of her daughters had a house right down there, close to the Ward girls' house. And the house was about seven or eight feet above the ground. My grandfather didn't want to serve in the military; that was mandatory for all young men, for a few years in the army. So they left and came to the islands and then he brought his brother to be his bookkeeper, as I told you. But adjacent to the Huffguard farm was another farm and that farm was owned by a couple that had five daughters. And when their father passed away, their mother could not run the farm and I know my grandfather was in contact with them on a continual basis. And they decided that the mother and the five girls come to Honolulu. And at that time my grandfather had his store going on Kaua`i, had his brother there. They came to Honolulu and met the sailing ship that came in with this mother and her five daughters. And of the five daughters, my grandfather married one, his brother married one, and two other girls found husbands. My grandfather was fluent in Hawaiian. And the University of Hawaii tried to get him to come and teach Hawaiian. [He learned] on the job in Kauai, but you know the Europeans, they're good linguists. And he knew German, he knew French, and he knew some Spanish--multi-lingual. [He was Norwegian], the Danes, the Swedes, the Dutch somewhat, more or less, the same language. You know, he was so good at Hawaiian and also Chinese, and Japanese, that they made him magistrate in Waimea, Kaua`i. They needed somebody with a multi-lingual base. And when I was small kid, five, six, seven, I'd sneak into the courtroom and here he'd be talking in rapid Filipino, Tagalog. We have two different kinds of Filipinos. And he could get along with them, get along with the Chinese. He was a fascinating guy. After he was well established, he went back to Norway for six months and dug up the family history. And Huffguards were very heavy, not only in Norway, but the name Huffguard was in Sweden and it was in Denmark. And I have a book, well bound, at least two full inches thick, of Huffguards. It was right next to Germany. He was quite a guy. His Hawaiian name was Hapakole. While I was in the tire business for those thirty years, I had other business ventures. For example, we had a milk production operation just after Pearl Harbor because cattle feed could not be brought in the mainland. And substitute milk was needed. We brought in milk powder and necessary butter from New Zealand. We produced thousands of gallons of reconstituted milk for the Navy. During that period I also got into the helicopter business. A close friend, Jack Harter (sp.) on Kaua'i had a little financial trouble and I put together a group who bought Jack a helicopter, which he operated very successfully. Also, during my years at Kaka'ako I had other ventures, outside ventures.... I think the highlight of my business life was the fact that we had thirty consecutive profitable operating years. We never lost money.

Kanoe Bright Cheek. My name is H. Kanoeokalani Cheek and I was born and basically raised right here in Kaka'ako right where we're sitting now, at 910 Cooke Street. It's a family church that was founded by my great grandfather, who was John Kekipi, who got the land from the ali'i. This is the last piece of land from the ali'i that is Hawaiian-operated, in the entire Kaka'ako district. We used have an older church; this is our newer church which was built in 1970. The older church was built in 1890 and with that church there was a family house where my family lived and where I was born and raised. My father was Sampson Kuahiwiakala Bright, who was number fourteen of the Bright children. I'm part of the generation after my dad's generation and we have two more generations after us. So this has been our family church. I was born and raised in the church and I still attend it.... Both of my father's parents were ministers in the church. My dad's mother's father was the founder, John Kekipi...actually his name was Kekipi Maia; there were several brothers and one was Kamanamaia, another one was Kapohulimaia, and then they had dropped the Maia. So it became like three different families, Kekipi, Kamana, [Kapohuli] and then before he died he had his name changed to put the Maia back. So when he died it was John Kekipi Maia again. I don't know the reason why, but I know he had changed it, legally changed it to drop the Maia, and then he legally changed it to put the Maia back.... His daughter Alice Kekipi married Andrew Iaukea Bright, and the two of them have the fourteen children, my dad is the youngest. Andrew Iaukea Bright was the next president, then he was followed by Alice Kekipi Bright, and then after she passed away we had Moses K. Piohia, and then when he passed away we had Nancy K. Piohia – his wife -- they were all the presidents [of all the churches]. Then we had Reverend Lei Regina Kahiwakaneikopolei Bright Recca, who was our minister and who just passed away this year [2005]... that's Joe Recca's mom... right now Joe Recca's sister Tina Recca is the president of this church Ke Alaula.... My grandfather, Andrew Iaukea Bright, was one of the first that started the Royal Order of Kamehameha with Prince Kuhio. My mom's name was Adeline Mokihana (Mokihana--it's the flower) Kama'i Bright...on my mom's side, the Kama'i side, one of our relations is Hussey and Hussey too had

plenty brothers and sisters; we're related to Josephine, who's one of the first Hussey's. We're related to all the Husseys; I haven't even met all of them.

Right now I'm over fifty years old, so I do have a lot of history with this area... I'm actually the genealogist in our family, for the Bright side, you know. Our genealogy goes back to Kamehameha the First, from his first wife who was Kaneikopolei, and then they had two children, and then one passed away and the other one was Kahiwakaneikopolei and that's who we're descended from. Then she married Namiki--she was married twice. The first marriage she had three children, one was a boy, the other one was a girl who married Parker--that's how we got the Parker Ranch [in the family]. And the third one was a girl Honu; she was crippled. Then Kahiwakaneikopolei married again to Namiki, who we are descend from and she had three [more] children. One was Victoria Kaleiula, who married Aiu. Another one was Puahao and the third one was a boy Ernest, but he later passed away. He had family -- he married and had children, but they all passed away, so that line kind of stopped. We have a fluid history here (from Puahao who had Hanamuahaleonaihe) Hanamuahaleonaihe's son was Andrew I'aukea Bright, who married Kekipi. So our line comes from Puahao who was Kahiwakaneikopolei's daughter, who had Hanamuahaleonaihe. Puahao and Kepelino were brother-sister, from the second marriage. Kepelino is one that wrote genealogy [Kumuhonua]. And he got the genealogy from his father Namiki. He's the one credited with actually the correct genealogy. He wrote his genealogy, which was kept in the Catholic Church 'cause this was around the time when the Catholics came over here. It was kept in the Catholic church and was not released until 70 years later--which was in the 1930s or 1940s around there. But by then my great grandmother Hanamuahaleonaihe had written a genealogy for our family. And so we already had it, so having Kepelino's come out after she had written the genealogy, to match the genealogy, you know it just made our genealogy stronger 'cause we already knew it anyway. But then my great grandmother wrote our genealogy, my grandfather wrote the genealogy, but see the ali'i always had the genealogy, so we always had our genealogy, so we know where we came from. When we have our family reunion next month, we are actually known as the Bright-Aiu-Kepelino. Kepelino's are higher up than our generation but they're still part of our family that's still alive. Before Kalākaua became king, Kepelino was the secretary to Queen Emma, so when she went to England, Kepelino accompanied her to England. Puahoa was my great, great, great grandmother, the mother of Hanamuahaleonaihe (Hana the first in the house of Naihe). Hanamuahaleonaihe is the mother of Andrew Iaukea Bright. Hanamuahaleonaihe wrote the genealogy that her grandmother was Kahiwakanekopolei, her mother was Puahao. Kepelino when his genealogy came out, he says he had a sister Puahao and his mother was Kahiwakanekopolei. So that's where it matched, but we already knew that anyway; Hanamuahaleonaihe, Victoria Keleiula who married Aiu, and Ernest.... But see, Kepelino wouldn't have gotten [his information] unless he got it from his father who was Namiki. And Namiki was from the Pa'ao line. Well the Pa'ao line was the high chief of that kind of religious type of thing -- there's an old story about Pa'ao. But anyway, Namiki in his years he was, everything was memory. He had to memorize all of that. Kepelino when he started going with the Catholics, learned how to write and so basically that's how Kepelino got it written down. But Namiki was the one that would chant it. So there's these stories on Namiki when I look inside there, there's a Father Marciel. When you look at this notings and everything, he calls Namiki an idolatrous old man, a *sascedotal* or whatever, I don't know what that means, I never bothered looking up, but mostly religious old man. What he wrote nicely about Namiki is that he memorized the generations and when he wrote it down he says it seems to match more the right way than these others, 'cause there was these other ones that wrote genealogy. And they all have different beginnings and the Kepelino's one is the most correct--so just nice to know.

[Kamehameha I = Kaneikopolei→ Kahiwakaneikopolei = Namiki→ Puahaunapuoko [Kepelino sister]=Ewaliko Piimauna → Hanamuahaleonaihe=Andrew Nohokaikaleikini→ Andrew Iaukea Bright = Alice Keahiokekuahu Kekipi→ Sampson Kuahiwiakala Bright = Adeline Mokihana Kama'i → Hillary Kanoeokalani Bright Cheek]

So basically my title in the organization -- the name of our organization is Ho'omana Naauao O Hawai'i, and then under Ho'omana Naauao O Hawai'i, which is the name of our religion, we have different churches on the other islands. My position is Waiwai I'o and basically I oversee all the properties, anything of value for Ho'omana Naauao O Hawai'i. So that's my title, as far as the church. I oversee anything of property, that's not necessarily just the land 'cause we own the land, it's our land.... In four weeks we're having a family reunion next month in Kaua'i at the Aloha Beach. It's the Na Kuauhau o Kahiwakaneikopolei reunion, that's the name of our organization -- we're all cousins. But we do things like we raise money, we give scholarships, but mainly we perpetuate the Hawaiian ways. And one of the things about our church which is very unique -- I've heard a lot about how the Hawaiian language was lost and then lately it's come back, but we never stopped talking Hawaiian. Our aunties and uncles, that generation, they were all told -- and it was like everybody in the state pretty much on pain of death -- they had to stop speaking Hawaiian. So they weren't allowed to speak Hawaiian in public, outside, in the schools, or in the homes. I remember as a young girl growing up, they still used to speak Hawaiian, but they all spoke fluent Hawaiian, but they would always whisper it. But when it came to the church they could not tell us what to do in the church. That place was off limits to the State -- separation of church and state. So we never stopped speaking Hawaiian; we always had Hawaiian classes, we had our Hawaiian Bible studies, our sermon is in Hawaiian, our Bibles are in Hawaiian...we had churches on Moloka'i, Maui, Lanai, O'ahu and Big Island of Hawai'i.

Lorraine Kaina. My name is Lorraine M. Kaina. I was born in Honolulu and raised since about age three in Kaka'ako -- Ilalo Street to be exact. I attended the Mission School – not preschool -- Kindergarten and then went to Pohukaina School from grades one through six. And then I boarded at Kamehameha Schools from seven through twelve. And graduated and moved out of Kaka'ako in 1948. I'm an education major, with physical education and health background, secondary education. My first teaching assignment was at Konawaina for two years, and then three years at Castle High School and ten years at University Laboratory School. Then I was accepted as the Assistant Professor, University of Hawai'i College of Education, HPER Department and taught for twenty-four years. So I have a total of forty-one years of service as a teacher, so. I retired in 1992. I do volunteer work; I'm a docent at Iolani Palace. I also volunteer at the Archives Department, Bishop Museum. I take Hawaiian language class, I do hula, I swim for exercise. I go to all the sports events at UH. I'm in many clubs; I'm a member of Ahahui Ka'ahumanu -- I wanted only one Hawaiian club, so I chose that one and that's it. And at Bishop Museum I work with DeSoto Brown, but I'm really working with Pat Bacon, that's who I work with. See I'm doing the computer work. Mrs. Pukui went out to all the different islands and did interviews and they have it all on tape. So she takes the tapes and she records it all in Hawaiian and then she translates it and that material I put in the computer. So if you came in and wanted to hear a tape on Hawai'i, and then they would bring it out, but instead of giving you the tape, they can crank out a transcript so it saves the tape. And it's hard, even if you listen to the tapes; it's hard to get the Hawaiian. But this you get the Hawaiian plus the English. So out of two hundred something tapes, we've done a hundred something. I've done most of the typing.

My mother's name was Elizabeth Kaina; she was from Keanae, Maui. And my father was William N. Kaina and he was originally from Puna, Island of Hawai'i -- they both met at Kamehameha Schools, graduated and married and raised children in Honolulu. My father died when I was just two years old, so my mother had to find a place and Kaka'ako seems to be the place where she could find cheap housing. Like maybe thirteen dollars to fifteen dollars a month. So she had to raise five kids, so we located Kaka'ako. And now in Kaka'ako those days you relocated in a camp. A camp is made up of a number of houses, usually along one street and we happened to be along Ilalo Street -- camp name was Ilalo Street Camp. My mom worked at Dole Cannery.

Poni Kamauu. Aloha, my name is Poni E. Kamauu. Both my parents came from Kaka`ako area; my father was born in the Mokauea area--that's Iwilei and then Mokauea -- that's how it would go -- Kaka`ako, Honolulu, then you have Iwilei then Mokuea and Mokauea -- anyway Nimitz! And so, my Kamauu family comes from Kapoho, Kipahulu, Hana. Also from Hilo, living in Hilo at a time of cultural difference -- that's when Christianity and cultural religion were clashing. So most people were doing Christianity - I don't know but in our home, we did. My father comes from the Mailekini-Kamauu ohana and one member was a Reverend William Kamau; he was also in Kaka`ako--actually at Kawaiahao Church; he was a

Reverend there, so there's plaque in there for him. But I come from the Samuel Mailekini line. So Mailekini was more about traditional or that we needed to take care of traditions. And one of the traditions was to make sure that the manō, the sharks were okay--they were fed and what they needed; like you would take care of your own pets if you had pets. He had pets and they were sharks. It was natural for many families at that time to engage in these things and then again it was not because times were changing and they needed to leave those things alone. Cause a lot of people didn't understand that and it was considered not good; according to the brother who was Reverend Kamau. It was a clashing of what was [considered] good and what was [considered] bad. I don't know what it was, but it wasn't bad because that would have been the tradition of that Kamauu family. They were fisherman and so they found their way from Hilo and from Maui (from Big Island to Maui) coming to Honolulu.

My Grandpa had two *aku* boats and my father and all my uncles ... he adopted a boy from one of the cousins and then later he had twelve kids. My father was one of the oldest; he worked as a fisherman, but they learned many things because of living in Kaka`ako during their time. They lived on Coral Street and that's where the Kamauu's lived. My grandpa, Samuel Kamauu --Mailekini was his Hawaiian name and it goes back in the genealogy. Mailekini was also the brother to William and he was a fisherman (*Lawai'a, Kahuna Lawai'a*) so he was the one that had to take care of the *kapu* that had to do with fishing and had to do with offerings and prayers and things like that. The brother didn't like that because they said he had to be a Christian and he had to give up his old ways. But he didn't, he stayed that way and he shared what he had to his own children. And my grandpa ended up becoming very educated instead of becoming the fisherman that he was when he was a young boy and teenager. As an adult and married and now raising a family, my grandpa needed to become a businessman. He loved to play music -- he was a musician like all Hawaiian fishermen; they all ended up becoming musicians and they all saw how happy he was as a fisherman. My grandpa used to have Gabby Pahinui and all the well-known entertainers all on his *aku* boat. And they would leave from Kewalo basin, and they would go out and come in and my father, my uncles, that's what

they did. So my grandpa was the businessperson, he had his boats; he put his sons and their friends on it. They went out and he told them in his quite way (because most times when you were taught, there were less words and they tell you maybe two words and then figure it out). And that was more about what you was going to do, and many of it was *'ike*, observation, *'ike*, look and watch and count, wave and count, watch how this going, wind blowing, anything. So my father became very skilled at what he knew and being born and raised. Well, living first at Mokauea, but when you think about it, it's like all one area. They were always across from the beach. My grandpa was never any place else but across from the beach. So my father's side was primarily across from the beach. They were on Coral Street across from the beach, right off of Ala Moana, actually. My grandpa living in Kaka`ako was also a bandmaster. He had his band in the 1920's and 30's. It was called Sammy's Swing Band. They played music from those times -- it was a regular orchestra band with a lady singer.

My uncles, my father and all his brothers all had water names. My father's name was Wai'lana. Wai'lana means a peaceful place in the sea. But it was also a place where the waters were very calm and it was in these calm waters that you would find fresh water, so it's still waters. My other uncle was a Navy Diver and he was Na'wai and that was my Uncle Johnny. He was very skilled; he dived in the deep sea and fixed the big huge battleships and navy ships. He would go and fix the propellers and stuff like that for many years. And my other Uncle Kamuela, who was Samuel, named after the older brother, my grandpa. And he was also a Sea Merchant, a Merchant Marine. They all had water jobs and then my Uncle Solomon, he was with the Board of Water Supply. So all my uncles had water jobs that they made money and took care of their family and raised the big family from their water jobs.... My grandpa owned the ship and he played his music and he ran his business that he was good at. Then the next generation, my father was a fisherman from the beginning to the end. He retired from the NOAA, the National Oceanographic Aromatic Association and his job primarily after they were hired to go on the ship was to take care and chart the Pacific Basin. They were two ships in that Federal Government; you had the *North Ship* and the *South Ship*. Honolulu basically was in the Northwest and Seattle where the headquarters was. But Honolulu was where they had the Pacific headquarters. And they went and charted every single island you could think of and atoll and sandbar and whatever came out of the ocean. And on there's trips back after six months, he would talk about Kaka`ako.

Now my mother was also from Kaka`ako and she came from Ilaniwai Street and that's where Keahiluahina ... was – that was our family, our *tutu*. Keahi was a noted composer and hula master of her times coming from Kauai area. And also a relative to the Kapiolani side, Kaumualii-Kapiolani side of the Royal. They were all involved in the dance. King Kalaukaua was a composer and Queen Lilioukalani and Princess Likelike, they were all composers. It was his wife's side, Kapiolani side, they were dancers. That's where this line comes and when you talk about Royal dancers...the next time you look at those in the archives about the hula dancers in Kalākaua's time, they were known as Royal Dancers. Then you also have to remember that they were family members -- first cousins, second cousins, third cousins, they were all related. They would have to be a relative to the Royal household--whether it was the wife side, the King side or the Queen side. But that's the only people that could be a part of the Halau. They had to be a cousin or something. You could not have been a commoner to be a Royal Dancer; you got to be in the household--even the ones that were cleaning the house and the whole household, Hale O Na Alii. That's primarily what it was. Their genealogies will all go back into the Royal lines--whatever way you look at it. The ladies-in-waiting, they were all related too and they were half [white] too, 'cause you had to understand that Queen Emma was half. John Young's family and I think Davis family, they were all hapa, half-half, Royal households -- that's where the Peabody family comes in. And then Hernandez, they were prominent -- they were all Lucy Peabody. But anyway, that's the house my mom was raised in. Aunty I`olani Luahine, my Grand-Aunt was given to Keahi; Keahi had *hānai* Aunty I`o. My grandma, Pu`uhainahau was the oldest sister and the youngest sister was Aunty I`olani Luahine. When Aunty I`o was born in Napo`opo`o, her father told *tutu* Betsy, Aunty Io's mother, that he was giving this child to his Aunty. And tutu Betsy was not well, she said no; this is my last child. And she said all your other children went to your side of the family now I want to give one to my side. And my Aunty Keahi didn't have children. So when Aunty I`o went to Keahi, she also learned the hula of the Kauai style and many other things, protocols and became one of Hawaii's most [well-known hula dancers]. But every time I think of Aunty I`o, to us she was like Aunty Maime....

Now Keahi lived all her life and she passed on in Kaka`ako. Her husband Frank Sylvester Gomes lived on and remarried.... For many years, Keahi lived there in Kaka`ako and Aunty I'o went to Saint Andrews Priory. She did many things when she was a baby. Many people came to the house and then later at the Centinel up Punahou School. Now Keahi was married to Frank Sylvester who was a prominent Portuguese man. He was on the Commissioners Board of Holy Ghost Church. Keahi gave birth to a son and this was on the centennial anniversary of Punahou School. Now the centennial anniversary of Punahou School making it 100 years, it's 1920. So in 1920 Renown Kahakuhulukahili Sylvester was born. Keahi was well known for her feather work. She was making the *kāhili* and she was at home the day of the pageant, they were saying Keahi and she say's come, the *kāhili*'s are ready, come pick them up and I'm going to get ready and I'll meet you there. Nobody knew she was with child. How could you not know? I guess because she was a big woman and then they wore loose clothes anyway. They came to pick up the beautiful *kāhili*'s -- I think I have pictures of them. They had Ka'ahumanu, Kamehameha the whole pageant took place on the hillside above Punahou School. So they waited for Keahi to come up. All the dignitaries were there, everybody was there and she didn't show up, so they wondered what happened. When they came back to Kaka`ako, Ilaniwai Street, they went to check on her, she was with child. Now the same time she gave birth, the Prince of Whales came in and the name of the Prince of Whales

ship was *Renown*. So Keahi said, and then the Prince of Whales comes and visits him and Abigail Kawananakoa...she was his hostess and she took him around and...Keahi was a part of all that. But now that she had *hānau*, something very special to the Hawaiian community at that time happened. She had a child and she was already 40 years old in 1920. I have a journal all in Hawaiian and it was dated 1920. She's writing to Mrs. Fernandes, Mrs. Purdy--Charlotte Purdy.... [Renown's Hawaiian name] had to do with fashioning the *kahili*'s -- Kahakuhulukahili and had to do with the *kahili*'s that were being made on the day of his birth, the centennial – 100th anniversary of the arrival of the missionaries.

So when my mom came to Kaka`ako, my father was already there in Kaka`ako as a young boy and he was already into their fishing. My father was already down there. My mother came first from Napo`opo`o. Actually she was born at Kamohoalii Street in Kalihi. The midwife delivered her and then they took her to Queens Hospital in 1929 and then she went up to live with the tutus. She went up to live with her great grandparents for a little while, up until she was eight years old. By that time they were passing on so she later went to her tutu Betsy's place. So my mom was born in Kalihi, Honolulu, Kamohoalii Street then she was raised in Napo`opo`o till about nine years old. Then she went to Molokai to stay with her grandma them over in Ho'olehua and then from Ho'olehua my grandma moved them back to Honolulu where my mom (in the eighth grade) moved back to... right after the war. Cause they were in Molokai when the war broke out, they didn't even know about the war until late that evening. And then right after the war in '43 or '44, she came to Honolulu and that's when she lived with Aunty I`o; she lived at Ilaniwai Street and then she would go home on weekends to Palolo to where my Grandma was staying. And up there in Palolo they had those Army housing, where Anuenue School is, way in the back. So my mother would go there and then go back to Aunty I`o, so Aunty I`o raised my mother from that point on and that's how she learned all the hula and everything was from those years all the way to when Aunty I`o had passed on and my mother carried on all the way till her passing.

So we had our last Thanksgiving at Ilaniwai Street in 1967 or '68 and then it was sold and Aunty I`o was living up at the Mausoleum That's where she was living and she was a curator and we all lived up there at the Royal Mausoleum too, as children. I remember Aunty I`o went into the hospital for a little while and so we took over until she got better and we actually went there to live. There were three of us, my older brother, myself and the brother right below me. We were all about one year apart from each other. And we would junk-and-a-po who was going to clean where. So there were three jobs and we would junk-and-a-po and the one that won would choose chapel of crypt. And the last one would choose grounds and everybody wanted the grounds. Because that one you could run around the whole grounds and just pick-up whatever fallen leaves, like the palm tree leaves or whatever. That was the best one. The other one would have to dust and mop the chapel. And the other one had to do the crypt. All of these would take place at five o'clock in the morning. So we had this skeleton key that would open up these places. And all the time I ended up with the crypt.

I had to go all the way down there and sweep, sweep and mop the concrete crypt and inside. Change the flowers, put new *lauwa'e*. And this is why when it comes to floral kind stuffs or just plants, I know exactly how it's going to be and I know exactly what the smell going be. You pick the *lauwa'e* of the *makana* variety that's on the *mauka* side of the house, right here. Don't forget to add the fern with it. What happens is that this fern you put into your *laukahiko lei*, it's a sharp fern, not that big. But you put one and you add it to the *lauwa'e*, the entire scent enhances because of that fern and then it smells like *maile*. So the prep was always *maile* scented because of the *lauwa'e makana*. Lauwa'e *kamana'o a nono e kauwake keana nono e.* That was Kalākaua's *maile* chant, *Lauwa'e Kamama'o*. (Chanting) *'Alae hanalei*, the tongue of the *moa*. But anyway, that's the fern that we would pick and that's the same things that happen in the homes in Ilaniwai. All Hawaiian homes that participated in things like that, their house smelled like that. Their house smelled like that no matter how old and dried up the lei's are, you going smell that scent.

Aunty I'o [later] built a home [at Papakolea], actually at that time you couldn't own property when you were going for Hawaiian homes so she turned the property over to my mother. She built her home in 1948 and she stayed in it and yet she acquired other property also. She tried to save as much property in Napo'opo'o because family members were selling them and it meant a lot to Aunty that these places were not sold because of what took place there during there during their times. My mother went to Washington and McKinley High School. Aunty I'o was always called to go visit the Ward sisters -- they would always call to her behind the wooden fence, high wooden fence that was the entire [lot] -- King Street, Ward, and Kapiolani, all the way down to Pensacola and up again.

So my father went to Pohukaina School up till the eighth grade and then he went to CC Camp. That's where most of the teenage boys went. Then he was a pier diver for boat days, for coins. It was so funny because he was doing all those things and my mother was dancing. That's why I wrote this little children book called, *The Fisherman and The Hula Dancer*. Talking about him living near the sea and how he enjoyed all the things and as he grew up, his jobs were diving for coins. Then my mother dancing for boat days. They would go out on a tug boat, meet the ship over at Diamond Head, the *Lurline*, the *Matsonia*, jump up on the ship, dance and play music all the way until the ship came in [to Honolulu Harbor] and then met with the Royal Hawaiian Band there, came off and met up with the other dancers over here. That's what she did and daddy was diving for coins and hula dancing and they never knew each other. But they met in Kaka'ako and they were introduce because my tutu Kalai, she was a Kahalewai and she was married to a Filipino man who was also on the *aku* boat. They were more or less fishing buddies, drinking buddies because my father drank before he met my mother; my mother made

him a good man and he stopped his smoking and drinking. But he continued to be with all his friends and everyone respected him for his change. My grandma, my dad's mom was Louise Apio who was Chinese-Hawaiian. Her mother was Kauaikahikaunaaina who married John Apio. John Apio was the caretaker of Oahu Cemetery and that's where you have Apio Lane, right up Judd Street. Kahunaaina's were very popular and the Apio family, they were in the royal circles.

Elaine Masuda. I am Elaine Masuda born (1942) and raised in Kaka'ako. The address was 324 Kamani Street. My father's name is Hiroshi Kanehiro and my mother's is Ruth Hisaiyo Kanehiro. My mom was a homemaker and my father used to be a technician. Actually, what I remember is, he was more in the radio, at KGMB. And later on he was maintenance, engineering like. You know they use to fix all the equipment at KGMB. I went to school at Pohukaina from kindergarten to sixth grade. And after that was Central Intermediate, 7th to 9th and then McKinley 10th to 12th. Use to be all three years, not like now. I lived there [Kaka'ako] all the way till, I think it was 1958.... My mom's parents use to live down Moiliili first, then they moved up Pauoa Valley and then they stayed there till they passed on and then my mom sold the place.... He was some kind of supervisor and my grandmother lived Moiliili and Pawaa; she was a homemaker. She used to run a Barber Shop when they used to live down Moiliili, downstairs. I have a vague idea of about the area. I don't know what street they were living on. All I know it was a concrete building and they were living upstairs, but only through pictures I kind of remember. But other than that, I don't quite remember you know, we going there all the time. Cause when they moved up Pauoa that's when I remember more.

I have older sisters [b. 1940 & 1941] and they're two years older then I. My parents used to live with the in-laws at Damien Track for a while and she gave birth to them there. [They moved to Kaka'ako just before I was born]. My father actually came from Water Town then they went Damien Track, so every so often he used to tell us how he used to raise pigs and all that. You know like what they used to do with the slop, how they use to boil them and with the oil or whatever they use to make [pig stew] or whatever. As far as I remember, my grandparents lived there at Damien Track -- they were chicken farmers. So they were raising all chickens there. And they used to sell the eggs.

After high school I worked at the Cannery for 2 summers in a row I worked at the Dole Pineapple Cannery, as packer. It used to be crazy because after that, the second year I used to work night shift. So when we got off in the morning, we used to go to my girlfriend's house and we used to take a shower and after that we used to hit all the Japanese Theater. Cooke side, Aloha Theater and we used to get the Nippon Theater at Aala Park. But by then end of the first Theater, we fell asleep in them. Then after that, I worked at Kress little while. Kress, cashier. And then went Business School and worked for a real-estate broker E.S. Umemoto. At the time they used to tell me, you should get your brokers real-estate license; I should have listened. At the time they had good commission. At that time the houses was only twenty something thousand. And after that I was in Hawaiian Marble and Granite--Finks. That's the monument shop; there's one by the Queens. One of them, the brother just passed away, Tommy. And then after that I went to Hawaii Warehouse. And then after that they sent me to IBM School. IBM just came out and then after that...we got married and then I went back for about 6 months then I stayed home 'cause my daughter, every time we used to drop her off my mom's house, she would cry and he was on night shift. So she would cry and she would point. But I was looking at transferring to move to Firemen's Fund. They had an opening at IBM, so I was trying to get into there. But then after that he said, just stay home. So I stayed home all the way till the youngest. Then after that I went volunteer over here at Uka School. Volunteer work. I tried for supervisor, but he was in kindergarten. They used to tell me try for cafeteria, but I tried for one year substitute. Then after that I started to work for Hawaii Children's Center. Then they changed to Kama'aina Kids...the first six months I was teacher's substitute and after that I became the cook. And after that, get the title of head cook and all that.

Roy Masuda. My name is Roy Masuda, I was born and raised in Kaka'ako 1938 – 1955...for 17 years. You know on my birth certificate was 809 Halekauwila Street. We used to pronounce it Halekawila, we forget the "u" in there you know. And then we changed to 815. Why, I don't know that part. I went to Pohukaina Elementary, Washington Intermediate and McKinley High School. My dad's name was Kass K. Masuda (Keisuke) and my mom's name was Shizue Ito Masuda. My dad at first was working as a machinist I think, at Tuna Packers and went to Tripler General Hospital as a plumber and retired from Kelly-Edgewater as a plumber. It's all Reef Hotel and all that now--the son is running it now. My mom was a housewife through her whole life. She was born in Ewa and my dad came from Japan, actually from Yamaguchi Ken. I use to deliver paper [in Kaka`ako]; actually my route was Halekauwila up to Queen Street and all the way up to South Street was my route. I think I delivered paper up to Intermediate, 'cause the paper route was all hand me down from my older brother's. I started actually when I was in Intermediate I think and we use to have the afternoon route. It was one of my duties. [After high school] I went in the Service...the US Army from 61 to 63, stationed at Schofield, unfortunately. After the Service I went to work for my dad's company as construction laborer. And then I met my friend and I got into Channel 2 (1964) and I just retired this year (2005). Basically, I did

technical work and my last position was master control. We handle the incoming, outgoing, prepping the tapes and program like that, on air, off air. Actually I started as a floor person and worked my way up. And I ended up as master control for about... you see when we started; it was the black and white days, the cameras. And then when I ended, it was all automation. The master control was all automated. Some well either the tapes and stuff like that, but everything is on the computer. You just set the time; the thing just set the satellite and stuff like that. It was a cruise job, so I said all right, let me try it. That was his six-day [trial]. So I tried it and I lasted all the way till now

Neal Okamoto. My name is Neal Okamoto, I'm a local boy born (1938) here and raised in the Kaka`ako area – Queen Street & Pohukaina, also Queen & Cooke...Holy Ghost was right across from where we used to live.... I grew up in Pohukaina first and then we moved when we were in High School. I attended the famous Pohukaina (Elementary) School and from there went to Washington and then to McKinley High School.... I used to deliver papers, go house to house right down Queen Street, Ilaniwai and on into Farmer's Market; I used to get up at 5:00, 5:30 -- about 7:30 I'm done. I bought a brand new bicycle from Ike Cycle. And the owner of Ike Cycle was nice enough to let me pay monthly. I think it was about $10 monthly. It took me about a year to pay off my bicycle -- it cost I think about $75. $75 was expensive. My friend bought the same one but he came from a wealthy family and his mother paid for it. So, he didn't have to deliver papers. After McKinley I had my bachelor's degree at University of Hawaii and got my Master Business (MBA) from Pepperdine. I lived here all my life and I've been a trust officer all my life, for about 40 years. My mother was from Kukuikuhaele (Waipio Valley on the Big Island), her name was Grace. Just before you go down Waipio Valley there's a little [village] down there. Nobody knows too much about it anyway, she was from there and my father came from Japan. I guess they met here on Oahu. She was just a housewife and he was just a truck driver at Dole Cannery, Hawaiian Kine I think they used to call it before...in Kakaako. They were both Buddhist. Its funny, they were raised Buddhist and yet when it was time for us on Sunday, they used to send us to Kakaako Mission. Isn't that funny? We lived in kaka`ako 'till about after high school. Once we graduated that's it, we moved away (1956). We eventually moved to Manoa; my brother bought a home there. Since my parents weren't around (they died early). So I lived with my brother and went to school (UHM). I had two older brothers and two younger sisters. I'm right there in the middle.

Joseph Pekelo Recca. My name is Joseph Pekelo Kekipi Bright Recca. I was born in 1946. My dad is from Brooklyn, New York and my mom's is from Honolulu, Hawaii. I was born here in Honolulu and the family home was located at 910 Cooke Street. That's between Kapiolani and King on Cooke. And that area from the time my mama lived there -- she was born 1917 -- the family home was there when the first church -- Keaulaolao Kamalamalama was built 1897--the family home was there. And that area was known as Koula, in fact Kewalo -- Kaka'ako is like a part of that entire area and then it's broken down into little areas. My mom is Regina Kahiwakane Kopolei Bright Recca. She was part of that Ku'auhau 'O Kane Kopolei Kamehameha…descendant of Kamehameha and one of his wives – in fact it was his first sweetheart. It comes down to my great grandmother, Hanamua Hale 'O Naihe and her son was my grandfather Rev. Andrew I'aukea Bright. So Kamehameha the first and Kane Kopolei and then all the descendants from that union; it all came down to us. My father was Salvator Bernard Recca and he's a Sicilian; he was in the Navy when my mom met him. When they first got married (they lived at the Church) and then they moved down to Waimanalo. So we lived there when we came back from Japan – my dad played professional baseball – so we lived there for about a year and a half. I was in the 5th grade when we came back, so we lived there for a little while. My auntie Alice lived there all her life 'till she passed away, at the home. My uncle, Kanoe's father, they lived there for the longest. In fact they went to Pohukaina School and I'aukea Bright my cousin, he's on the Big Island now, but Kanoe's still here. My mom actually retired from the City and County. She took care of all the records from the City and County of Honolulu's Ambulance Service. That's why at her service when she passed on (2005) the street was closed and she laid and stayed there at the church. We had a huge tent covering the whole parking lot. It was filled to the brim with friends and family, maybe friends from City and County of Honolulu. In fact you know the last thing my mom did was to bless the pre-owned area across Lexus--pre-owned car unit across the street. And she also did (blessed) that excavation at that site by Ala Moana -- that tower, she went over there, Waimanu Street; the building over there. If you go down Pensacola and you take that right there, and then you go around the corner that whole, that's construction over there; she went down there to bless the area again.

Her father and mother were both once Bishops of the Church. He was Kahu Kihapai and that's the pastor. And then my grandmother Alice Keahi Kekipi was the assistant pastor until he passed away and then she became Kahu Kihapai at the church. My sister is now a pastor of the church, Betttina Moana Bright. Well, my great grandfather's son, my grand uncle, was very very ill and Rev. John Pulelehua was called and for one month he stayed with my grand uncle and healed him and so my great grandfather who was a rancher at the time in Kohala used his wealth to build. And they formed Ho'omana Naauao against the likes of the missionary churches that were already here. The Episcopalian, the Calvinist, all of them were up in arms about this new organization. But they, John Pulelehua was director to the Holy Spirit through different scripture to bond this organization and religion and it's basically from the Bible and we believe in the Father, Son and Holy Spirit. And so, my great grandfather used his wealth to build the churches on all the islands including Lanai which they still have that one church there in front of the lodge at Ko'ele. And Big Island, they were a total of fourteen (14) branches on different islands, but down to just four (4) different churches now. So when they

moved here…this is where they ended up settling. My great grandfather got the property here and the rest is history. My family moved here in fifty-six (1956) when we came back from Japan. But the (Church) home was there from what the late1800's. My mom was born in the home (1917) and they lived there when they got married in forty-five ('45). And then my dad found a home out in Waimanalo, across from the beach. So we grew up, I went to Waimanalo School -- Kindergarten and First grade. Then we moved to Kapahulul went to Liholiho School, 6th grade, then I went to Kamehameha, I started 7th grade there. After high school I was going to the University to School of Architecture and then before transferring to New York Pratt Institute, I decided I wanted to sing. So that's when I stayed home and I was with Haunani Kahalewai for three years and then she passed away. And it's been entertaining ever since.

Alice Watanabe. My name is Alice Watanabe. I was born on South King (1929) when we moved to 511 Ahui Street. I went to the kindergarten which was at Kakaako Mission and then went to Pohukaina School and McKinley High School I went at 1941, when the war we had to close down; I went from first grade right on. My parent's name was Matsuichi Nagato and Shinaio Nagato. My father was born on Kauai, my mother was born in Japan. We had to move from South King Street and they probably found a place in Kakaako. My father was a chauffeur; my mom eventually worked for the Hawaiian Tuna Packers [Kewalo Basin] -- It's not there anymore because there's the dry dock. A lot of the ladies used to work at the Tuna Packers because we had a lot of those fishermen's. So naturally, they would be out for a week at the beach, I mean on the ocean. And they needed workers at the Tuna Packers. So, we had a lot of the ladies working. My mother used to be the oilier. She had to come through to see that the oil is properly set into the Tuna cans…. My dad used to work for the Peachtree's and the Vanderbelt's as a chauffeur. He would come home on the weekends. The Vanderbilt's lived in Kahala. A lot of people talked about it like it's a big thing to them, but for us, we just work for them as a chauffeur. So my dad was never a fisherman, even if Kaka`ako was a fishing district. He had to transport -- they had a small room for him; we used to go visit, my sister and I. There were seven of us; there's only two left now, just the two of us. We just lost my brother. We had three girls and four boys. We weren't in a camp, we had a house (Ahui and Pohukaina), a duplex home, a two-story home. But they did have a lot of camps in that area.

Jean Watanabe. My name is Jean Nagato Shitabata [Watanabe]. I was born in 1940, just before the war and I really don't remember too much. Before going to Pohukaina School, I lived on Ahui Street, 511 Ahui Street. Before going to Pohukaina School, I know I was in foster homes because my mom wasn't well. And I remember coming back prior to going to Pohukaina School. Even my dad, I don't remember him too well because he had tuberculosis and he was in Leahi Hospital. So I went Pohukaina School, walked to school. The singer in my family was my older sister. She sang with the Honolulu Orchestra. In fact, we still have some records. And then I think it was 1956 when we moved to Kapahulu and I continued at McKinley all the way to Central. Central Intermediate School and it was too far for me to walk so I used to ride the bus.

Land Resources and Use

Land resources and use changes over time. Evidence of these changes is often documented in archival records. Cultural remains are also often evident on the landscape and/or beneath the surface and provide information regarding land resources and use. However, oral histories can give personal glimpses of how the land was utilized over time and where the resources are or may have been. Oral histories can also provide confirmation of cultural practices. Much of the project lands have been continuously utilized for a range of uses; from traditional [e.g. *kalo lo`i* (taro pond fields), *loko* (fishponds), *heiau* and ceremonial] to modern [e.g. villages, camps, businesses]. Most of the consultants grew up in the vicinity with their parents who worked nearby in various industries. All of them had memories of growing up and/or visiting areas of Kaka`ako as children. In each of the following sections, the name of the participant who provided information is in brackets after his or her statement. Figure 21 shows the locations referred to by the consultants.

Kaka`ako Area

According to ethnographic consultants, Kaka`ako was an area that seemed to cross *ahupua`a* boundaries and included an ethnic mixture of residences and businesses; most of the residents of Kaka`ako eventually moved elsewhere. Kaka`ako was described in many ways.

There were beaches actually in Kaka`ako -- had beautiful sandy beaches and the park, the kiawe trees and the coconut trees went right down to the [shore]. Right now you just see landfill and you see what you see today. But during their time you could actually walk across

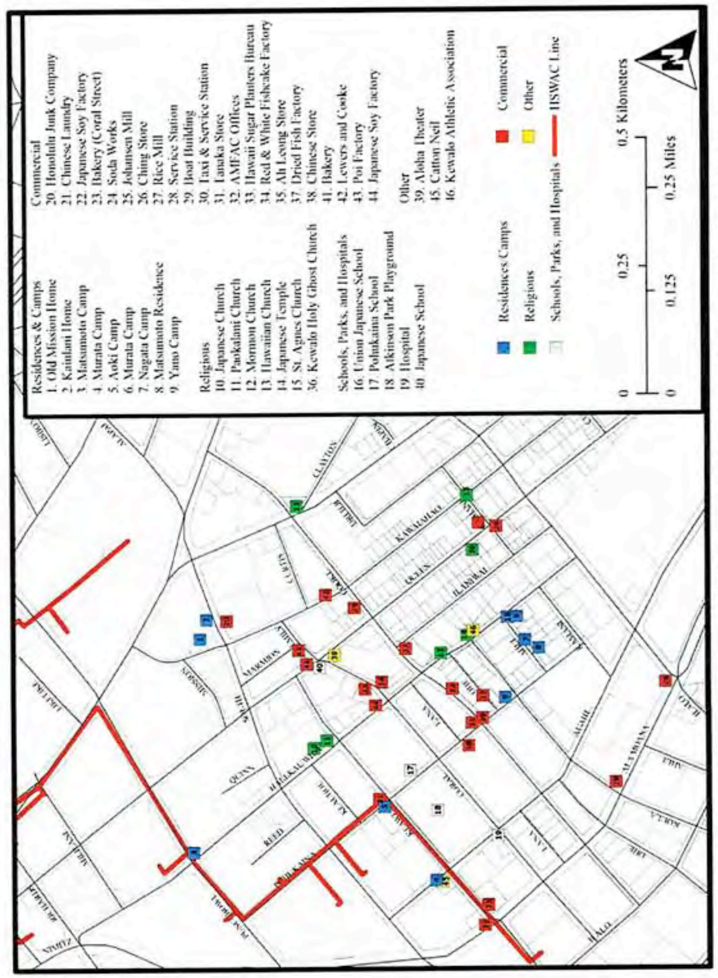

Figure 21. Location of Residences, Camps, Religious, Commerical, and Public Buildings in Kaka`ako, As Described by CIA Participants.

the street. Many of the people that's in Papakolea and in Kewalo Hawaiian Homes, are people thathad come from Kaka`ako. And many of them down in Waimanalo homestead had come from Kaka`ako. So Kaka`ako was a mixture actually; they had all kinds of people living in Kaka`ako. Eventually Kaka`ako was changed in the late 40's because that's when it became industrialized; I guess it became an industrial area. So many of the families, they sold their properties and they moved out and some of them went onto Hawaiian homelands [Poni].

Figure 22. "Coconut trees still there; no sand."

At the time I didn't even think about it; all you say is "Kaka'ako" and it's just one, that area. We never did think about the boundaries...according to my mom, she said it was just like a new area. But Kaka'ako was the last area that she really wanted to go and live according to her.... [We lived] in a block. On our side everybody had just like their own road way to go all the way to the back--each one had that--I guess we just called it Camp [Elaine].

We had a Portuguese next door neighbor - it was all mix, Japanese, Portuguese, Filipino, Chinese, and Korean. Not too many Koreans, mostly Japanese because most of them worked as fisherman. So it was a good thing growing up. When we would go to my Filipino friend's house and his mother would make fried banana and coconut candy. Oh, I couldn't forget that. So, till today I still love that, those two deserts. And a Portuguese neighbor, every year we used to help them carry that -- we used to take bread house to house and they would donate. I would hold the little bowl. Although I'm not Catholic, they told me to help...for Holy Ghost [Church]. On Queen Street get, that's where Holy Ghost was close by behind there. And there are still people at that Pohukaina School gathering; they're still into Holy Ghost. I think the Church is still there. I met a couple of them; they're still at that Church. They always invite me to come for the annual....I guess party [Neal].

The community, the homes were all close, they were all old houses. Lots of them were termite eaten and they were all clustered, very compact. Everything was like...you could hear your neighbors talking and all of that. They were all old homes. Today, very few homes are still there in Kakaako; I would say just a hand full--maybe 5 to 8 homes scattered all over [Neal].

Project Area Tour with Uncle Buzzy. I was here in 1936. Before, all of this was low level housing everywhere. That's why you could get rid of 'em, push 'em out and you build a big structure. That's why the buildings are here. They started tearing down the old Amfac Buildings

and putting up these big, blue towers. Almost all of it [was houses]. This was little city, Kaka'ako. [Kaka`ako] was usually from Ala Moana Beach Park till almost to downtown Fort Street. All this was, this is all new stuff here, lawyer's buildings..... The ones [buildings] on Merchant Street [were here ca 1936].This is all kinda new, all this, all new [Queen Street]. Within the last thirty years, this all came up. Well, let's use 1960 -- from 1960 on, we started seeing it. People began the value of the land and its long term value, which has only one way to go, is up because our famous Madam Pele is not producing any more land here. What is here is what you've got. And therefore, there's no way to go but up. These are all old buildings [Merchant Street], this was here when I was here, this kind of structure – Portuguese stone cutters built that. The Portuguese were experts; they had talent. They were used to that kind of hard work in the home country. This was here a long time, this building. Post Office was here a long time. Same as the building – the building across from it was here longer. City Bank building is new. It's called now the City Financial Tower but actually this is the City Bank, which is no more. It's now call City Center. Been bought out by Central Pacific Bank, which unfortunately happens to be my bank in both cases. The City got bought out by my new bank, the Central. And I don't know if it's good or bad. But Merchant Street been here a long time, you gonna find that they have a stone structure. Merchant Street in the old days was the financial capital of here. That's an old building there, that Dillingham Building. They never did change that...that's Dillingham Transportation Building. This one is A & B. This is Alexander – but it's kinda old. This [in between the old buildings] is all new - small businesses, shops. This is all brand new [on Bethel] built by Thorton, Thornwell, or something like that. He used to be my neighbor, this guy. He built this too, the restaurant Palemino, you know, high class restaurant. Same guy -- Thorn, Thorton, Thornwell, something like that. He's a contractor. That's Kamehameha V Post Office Building, old, old building.... He built it right across from the Palace, which was the time of Kalakaua. That's an old building, Territorial Office Building, doesn't have the date, but that's an old building. That's an old building, the one with the gold ring [corner of Merchant & Bethel]. And this is an old building. This is during Walter Murray Gibson's time, the time of Kalākaua. This is the [work of] Portuguese stone cutters. Those Portuguese tradesmen were really good you know. The labor to do that, and that was the only building material you have, those days, and then. The ones with blocks like Kawaiahao Church, those stone cutters did that. But that's coral...was across right down here in the ocean. Cut the blocks, and then bring 'em up here and build Kawaiahao Church. And there's lots of construction like that around town. I don't know the exact, but I believe it was where today you have the where they call that, the park, it's Ala Moana Park. OK. The front of that has been cut out, the coral, the white coral. I think that's where it came from because it was close to the shore. So you could go right in there and quarry it out and bring it up there Kawaiahao at Punchbowl. And we have trolley going through here, our railroad track - it was here when I got here in '36 -- it was running for about three, four years after I got here. And then the electric trolley came in, which is rubber tired but used the same overhead electrical wire and connection to the bus. Before it was on the train, with train tracks. Wheels, steel wheels. Then it switched to rubber. This Walter building, this is old. That one is

1902, see? This is old stone [next to Walter Murray Gibson Building]. And the one right behind there is an old building. The one on Merchant Street, the Standingwall Building is one of the oldest here on Merchant. But that was the financial center; you had all the business located on that street [Uncle Buzzy].

This Keawe Street had all small little homes. My fishermen used to live in these tiny little hovels. Lots of small homes here. Interspersed, you had small businesses that actually took over our home and then set up the business inside the place. But they didn't spend much money. Everything was on a small scale. This was a home district. This was lots of little hovels in here; the whole thing was all small homes. And interspersed was little business, so they pushed all that out now and put low level buildings on here. [Pohukaina] same thing. I remember when you walked here was all housing. You didn't have any buildings here; within the last forty years maybe you had something. But you know like this is all new, this is kind of brand new, this is Bishop Estate. This was a place where people lived, but they're all gone now so you have this kind of development -- the State Courthouse, the Federal Courthouse. Across these are what you call friendly condemnations between the state and the federal government...they called it a friendly condemnation, but is wasn't very friendly, it was one way [Uncle Buzzy].

Figure 23. Keawe Street, looking *mauka*.

That area [Queen and Cooke], there were so many houses there and also Pohukaina and Cooke [Neal].

When I was growing up here in Kaka'ako, my brother, who is Iaukea Bright, and myself would attend Kamehameha School. We were attending Kamehameha Schools from kindergarten. So we would always walk Cooke Street, up to the corner where King is, and cross the street to catch the Number 2 bus. And it's the same Number 2 bus as today, you know, to get to School/Middle Street and um, to the Kamehameha terminal. So every time when we'd walk up there was always, we always had this brick walls out here, those buildings. And they were built before we were born I guess. Just toward the corner of Cooke Street there was a Hawai'i Hotel, and then we'd pass this old shop, which I went to the Archives and I got pictures of that um whole area. There was like Sonochi Store, there was a little Pool Hall, they had like this trophy place, and right behind this wall here on the, this big wall out here, was a Japanese Camp, and we weren't allowed to go in. But we would always go run through, you know, 'cause we were kids, we used to explore everywhere. But it was always very neat, very clean. You

know the people all have these small little houses, there were hardly any door, you could just see right inside the house, you know, was that kind of place [Kanoe].

It was just a nice place where we could walk around, and it was very safe for us. I always felt safe here. But when I tell people later years, "Oh, I came from Kaka'ako" they would say "Whoa" you know like it was really bad, "You came from Kaka'ako?!" But we never really had a bad experience here. The church was a long ways on the sidewalk and then the house was an L-shape behind it. So most people didn't know our house was here. And this whole wall here was covered with mango trees. So you could drive past this road, you'd see the church, but you wouldn't know a family lived there. But in the middle was ours--where the cars would park, and we would always play--that was our playground. And so that's how we kind of grew up over here. We had dogs and cats you know like normal, normal people [Kanoe].

It was really unusual, the different nationalities getting together. And of course, we never had to lock our doors. We really felt safe in the community [Alice].

Kaka`ako People and Camps

The consultants spoke about the various people they remembered who lived in Kaka`ako and where they lived.

Ward Avenue and Vicinity

When we used to walk around; you know where Neal Blaisdell is now--that use to be the Ward Estate--use to be all fenced up. We used to be kind a scared to walk there [Elaine].

Aunty Bertie lived, actually they had a boathouse...and the King had a boathouse -- I have pictures of that boathouse that Aunty Bertie them lived on -- right off Kaka`ako, right off Fort Street. They had it right there by Fort Armstrong area and they had a home up where Straub Hospital is, that's the land they owned. So their home was right there at the corner where Straub Hospital is. From their boathouse they looked over toward the Palace and watched the flag lowered. Aunty Bertie...told me that story over and over. She told me about the Kanao's who were also chanters. And they conducted couple hulas in Kaka`ako. That's when Aunty Bertie's mother went and told Nathaniel Emerson, because he wanted to write. Do you remember *Unwritten Literature* -- he wrote it. Okay, he never ever witnessed any of those hula. It was Aunty Bertie's mother that arranged for him to have these closed doors and told him to be very quite, they're going to have couple hula. And he did, he was very quite...there was a wall right there, you're over here and you're going to hear the mo'olelo and everything behind. That's how it was [Poni].

Right at the corner of Queen and Ward Street, we had across the street directly from us was the Fuji Gasoline Station. And across from us on the Queen Street side was a little Chinese restaurant. Next to my father's lot on the same side of the street was a little Clorox-making Portuguese family. Many Portuguese families living on our side of the street and the street just mauka of Queen Street. But always lots of small family homes in there; mostly all of that's gone today and small businesses have largely moved in there. The housing that was there or those homes haves mostly sold off to other uses [Uncle Buzzy].

I went to the [Ward] house that was right before they bust it down. It was this huge house and we were all going to do a show. It was something that the Ward Sisters had requested and they wanted Aunty I`o to go there and they wanted a special thing about the grounds, the lagoon and then they opened it up to the public to come see the play. For the first time and for the last time and they went and sat down with them. And the lagoons were there.... It was a place that many people came to; the Royal family was there, Curtis P. Ward was this southern person, but Victoria the wife was Hawaiian of royalty, of the Royal Household.... Victoria Ward came from the Kamamaluhai line and the first of the Kamamalu now. Kamehameha II and then she also comes out of old ancient Chiefly lines...Pā'ele'kūmaueali'i cause she was Māmakakaua too. Curtis Ward came to the islands and he became a good friend to Kamehameha IV and he was a southern gentleman, you know from the South. He came and built a replica of his home in Georgia and it was all Old Plantation. But the neat thing about him was he planted 100 coconut trees, the Royal Ali'i trees on the grounds [Poni].

This was Portuguese town here [Queen Street towards Ward]. This is where my father's yard was, the Shell Station -- that 10,000 square feet -- my father had two 5,000 lots in there for the fish business. First it was a roofing [business], then it became fishing. After my father gave up and T. H. Broadhead moved in here and did something, he tore that down and put a Shell Station up. And I was hoping to put the station up but I couldn't get the funding from the company. This was all businesses...this was where Henny Fuji Service Station was. The Chinese restaurant was here before the bank. [The Quonset hut] was built after the war, somebody moved in...he was doing some business but he went broke.... Used to have that church [Holy Ghost] had lots of festivals, you know. Here's one, that's da kine [old house]. And in the back, there's one like it too, right in the back of it, it's still here; maybe ninety to hundred years old. Yeah, this old block here was Garcia family had two houses, my dad had the corner, the Japanese guy in the back Amiya had that [white] building, it's still there -- he was in the termite business. He lived there. He had a little different style. We were here when he built it, which was in the 1940s -- that's 60, 70 years ago [Uncle Buzzy].

Figure 24. Chinese Store on Queen Street.

Figure 25. Hamada Store on Queen Street.

The Siu family...they were the ones that owned the corner where the American Savings Bank is, used to be City Bank where Gems is on Queen and Ward; the Siu family owned all of that, all the way back down [Poni].

We were there on Ward Estate property too...I knew where it was, but they had big tall fence -- we couldn't see what was inside. My Mom didn't want me to go pass Ward Avenue because the cars -- Ala Moana Boulevard was already kind of busy. She didn't want me to go there. And the reason why we would go to Ward Avenue [to skate] was because that was the only place where there was a paved sidewalk. Our street, Ahui Street was bumpy; it had potholes and the sidewalk wasn't even paved. So we couldn't skate there, so we had to go to Ward Avenue. The skates were cheap then; riding skates, walking on the stilts, no skateboards [Jean].

Shiro Amioka lived in that camp...the former University of Hawaii President...Department of Education Superintendent. He lived across the street in that camp...Harada camp. Actually, it was leased from the Ward Estate [Jean].

Various Camps/Communities

[Kaka`ako] did have its groups and it was different gatherings, but it wasn't like camps. It was more like the Portuguese was in this one section; the Filipino was in this section. But on Ilaniwai, you looked out this way and you were at a Filipino wedding. You look out the other window and you're at a Portuguese Fiesta. You go across the street and that's Mama San's house and she's making saimin for you. That street went right down to where the Kaka`ako Theater is. So Ilaniwai went across with only a block from Queens [Poni].

I knew some people that lived by the Kaka'ako Fire Station, but I hardly use to go there. Like the old days, they kind of prejudice too. They no like you, well they don't show it but actually....like mom, she don't want us to intermingle with you know. Certain area in Kaka'ako used to have the Hawaiian families. And by the park behind there used to have all the Portuguese families. That's why we call it camp too. Certain areas used to get all certain kind of racial you know. And then the side we were had more Japanese. [Japanese camp] from Kamani Street all the way to the Cooke Street until the Fuji and then from Pohukaina all the way to Ilaniwai [Elaine].

[Japanese Camp] Ilaniwai to Pohukaina I think was. Get all that side streets like Koula and all that [Roy].

[Hawaiian Camp] they used to be more across. I think they used to be more the Gold Bond Building side [Keawe] Street [Elaine].

The people, there'd be a number of them at the reunion that are from Keawe Street, because they had several camps [Lorraine].

You got Keawe, you got Coral, Ohe Lane, Kola Street, Koula Street, Lana Lane. That used to be all residential [Roy].

[Keawe Street area] all of that was all small parcels, family parcels. Some of it having been passed on for a long period of time, but was lots of homes in there. And there were some businesses, some automotive businesses that opened up there, they would do repair work and painting of cars [Uncle Buzzy].

In Kaka'ako those days you relocated in a camp. A camp is made up of a number of houses, usually along one street. And we happened to be along Ilalo Street [street runs mauka of current Medical School]. Camp name was Ilalo Street Camp and it was a Japanese family, I can't remember the name, because they left, they were the original owners of all the houses in the camp. So we paid rent to them. But just before December 7th, they got a call from Japan to go back. Evidently they knew something was coming up, or their relatives did. But they left in like October or November 1941 and of course we were bombed in December, 1941. In our camp there was a real mixture of people. There were the Palinapa's, Nuuhiwa's, Smith Family, Kaina, a Portuguese family, the Kauhane family. There was a Filipino family, a Lopez, the Galuterias, the Konos, Otos, Hayashi and Nagata. And then there was also a rooming house where they had some bachelors who were of Filipino descent, plus a Kane family and a Freitas family that had rooms in that boarding house. So a real mixture. Oh, a Bell family also [Lorraine].

Figure 26. Ilalo Street Sign.

Figure 27. Ilalo Street today.

There was a Hawaiian group, they were the ones that did more of the Hawaiian dance and things like that at our school activities. They were living closer to Ilalo street side. That's where the Hawaiian groups were. And the Portuguese group, they were on Queen Street. There was some Chinese. I know there was a bakery that was run by a Chinese family and some stores along Keawe Street…near the school…Pohukaina School. I know there was a Chinese store there. May Day program was really something. Like I said, we had all this ethnic groups. Japanese with their Kimono's doing their Japanese dance. The Filipino's had their own kinds of thing. That was something really -- the May Day programs were really elaborate I remember [Alice].

Like I said, we hardly ever…the only time we associated with the Japanese Camp really cause we didn't have any friends there 'cause the Sonochi children actually worked in the store so they could never come out and play with us. So I guess when we were growing up, Halloween night we had the best candies and cookies and snacks at the Japanese Camp. And we'd go until 10 o'clock nighttime. I mean we had good fun [Joe].

Right behind the Mother Waldron Park, behind Pohukaina School, over there used to have more Portuguese families--mix. That block, that's Pohukaina, Halekauwila. I don't know the side street name, right behind the park, and Cooke. All the way up. That block used to be all mixed…because one of my classmates, behind Pohukaina School on the other side--I don't know what street that is; they used to live up there. Over there use to get up and down houses and that side used to have some Filipino family--more Filipino families [Elaine].

Kamani Street was suppose to go straight through, but they had this big monkey pod tree there and use to have a Hawaiian family living there. And then the church use to be right next, so to go across the other side of Kamani Street suppose to be all the way to Queen, pass Queen Street, but to go that way you have to go, we use to cut through there. It was just like dirt road [Elaine].

That area was known as Koula, in fact the Kewalo area, Kaka'ako is like a part of that entire area. And then it's broken down into little areas. Kewalo and then our area, Koula and then you get up to the Punchbowl area. And Pohukaina is up that area. And going up there you know we had Japanese camp. See we were surrounded. That area, down by Kaka'ako, by the incinerator area, that was all Filipino camp. There was Portugese camp down Queen Street where the Holy Ghost Church is [Joe].

Kaka`ako Families

We had a plumber living in the back of us and it was all duplex type of houses...two families actually and it was more like a camp type of living. Everybody had their own driveway to go inside. But on our particular road, had only one, two and three families because the plumbing, that was Masaki Plumbing. That plumbing area took most of the space. They had a big area where they stored all their plumbing equipment and everything. And then since we were all duplex, use to have this other people that use to live in front of us and we used to live the next. The first people were the Takahashi's and after that I'm not too sure; I think was Mishima.... The area we were living in was mostly duplexes. Use to get some houses and the whole family use to take. I guess it depends if the family was big or not [Elaine].

When the Filipinos had their wedding--that was it. Anybody who got married in Kaka`ako, the whole Kaka`ako was there. So I look at the last of the true Hawaiian communities and right after that they were separated. Everybody separated and then the next generation to follow went more and more into separation. And yet you know who these people were? The Ball at Mother Waldron, they would have the dances and Aunty I`o would go to the dances. Not only was she a hula dancer and did her Kahiko hula, but Aunty I`o was a really good polka dancer and that was her favorite. They had dances and they had orchestras and my grandpa would play -- his Sammy Swing Band would play at Mother Waldron Park. It was a big pavilion over there and he would play for the dancers. If I go look and dig in the trunks, which I haven't done since the time my parents passed on, I would find all these pictures cause that's all they took. My grandpa had photos, my Aunty I`o had photos--they all had photos. And I also remember--which is not in Kaka`ako, but it's on *mauka* -- the housing, Kamamalu Housing. The old homes turned into little rooming houses and my tutu Kalai was staying there, Kahelewai's were staying there, and the Malo's were down in Kaka`ako; the Akina's, the Oloeole's, they were in Papakolea too, the Ho'omokini's and Waiholuwa's. Do you know up into the early part of 1970's we still took our clothes for iron down to the Portuguese lady down in Kaka`ako, right above Queen Street [Poni].

Do you know Fujita Matsuda, director of transportation? He is like my second cousin. He was there [Kaka`ako], he attended Pohukaina. He spent a lot of time away. He went to MIT you know...some type of engineer. That's why he became the director of transportation. He

was the director of transportation and also president of UH. One of his daughters married to Andy Bumatai [Neal].

You see, I hardly use to go that area; we were confined. Only into Kewalo, piano and all that area too, by Kewalo Theater on the side by Star Market--behind side used to have all residential too--was Oriental, Japanese--mixed too over there. I know my girlfriend--one of my childhood friend, Suioka...and we use to get Kawamoto's [Elaine].

There used to have this Kano family, which used to have all girls. And our family was mostly all boys, so he [grandfather] used to treat them more better than us. At my camp had Shimamoto, Kamita, Nishimoto, Nakamura. Shimamoto, that guy used to work for the Post Office....and Yonemoto I think they had at the small camp and Yamashita [Roy].

The home I used to live in was a single dwell house and the rest was duplex. The Shimamoto's had the up and down single-dwelling and the rest was all those townhouses... so many families in one [Roy].

About 56 and from then, people start moving out. I guess people wanted to buy their own homes, like my friend's family. I guess they saved enough money so they moved to Kaimuki [Neal].

We were evicted because of the industrial business going there. So most of the families had to move out and we left there in 51, I think. We were about the last people besides the_____. We were able to stay there a little longer...and we were in school; my sister was in high school, I think. I must have been already out [Alice].

Frances [Yano], their family was the last to move from Kakaako. The Yano camp and the Mizotani; i's all by the surname of the person, whether Matsumoto camp or Funai Camp--it was close to Ala Moana Boulevard. The father used to make boats; the Matsumoto's, they were the ship builders -- Ala Moana Boulevard and in that Keawe Street area. Oh, that's where she used to live, Kazuko. You know one of the waitresses here, she's from Kakaako[Jean].

KAKA`AKO ESTABLISHMENTS

Kaka`ako was once a thriving community that included schools, businesses, churches, parks and other facilities.

Schools

The school that was there on Ilaniwai is still there and that was Mother Rice Day Care. Mother Rice was a real person…just like Mother Waldron. The Motrher Waldron Park took care of all the runaway kids and orphan kids. That's why when they had the Mother Waldron Park reunion, it was so nice. Everybody came and had a party for Mother Waldron [Poni].

Kakaako was a good place to grow up. And so now we have this annual gathering -- Pohukaina School Elementary reunion. At first, there were only about 25 of them I heard. Now it's about, every year it's about 250. We were there at the last one, where we celebrated the anniversary at the Japanese Cultural Center. I don't know what year, but it's been going on for quite a while. One of those old time fellows that put this together, was Boyd A_____. He was a big guy. We all had a lot of respect for him. He always mingled with the kids and sit up straight. I don't think I see that today [Neal].

We had two…Japanese school and of course Pohukaina Elementary School. Mother Rice Kindergarten, in Moiliili now, started in Kaka'ako. Pohukaina School was located at Mother Waldron Park, if you look at the map there's a Pohukaina Street and Mother Waldron Park and Ewa of Mother Waldron Park was Pohukaina School. It started as a school first of all workers who had to work in the area. Then it became for the indigent, who then moved out from the plantations into Honolulu. It was an elementary school until –I have the dates on my paper at home -- and then it became a school for M.R., mentally retarded children. Then they broke it down and they moved the whole school to where Kaimuki Intermediate School is and that's where it's located now. But we remember it fondly, that's why we call our reunion Pohukaina No Ka Oe, the best one, 'cause we had really fun times going to that school [Lorraine].

[At Pohukaina] we had a lot of those nice programs, May Day program with the ethnic group. And we also had a teacher named Mr. Gonsales; he was a one-man band. He used to play the harmony and play the drums, you know for our assembly kind of things. I went at 1941, when the war, we had to close down. I went from first grade right on, and when the whistle blow, we were playing those bean bag games [Alice].

Pohukaina School was just a regular elementary school. By then I left six grade, I think it was fifth or six grade, then they converted one side of the building all for the handicap; they had so many classrooms for the handicap children. That's when they first started, I think when I just left there, grade six they started to open up for handicap children strictly-- the classes were strictly handicap [Elaine].

We would go to school first, pre-school, then we go to our language school…the language school get the Saturday classes, we used to go to that. That was growing up until we got older, in high school [Alice].

We walked [to school]. The only time we caught bus was when we started to go Central. We walked…what was that, Pohukaina and a lot of times we use to cut through all the lanes. They use to get just like a small walkway all in between. So we use to cut through there [Elaine].

Lex Brody…Queen and Coral, around that block was…that's the area that Pohukaina School was [Roy].

Pohukaina School…I thought it was a big school. Had one big main building where there were two stories, the Library and the Office was there and the six graders. But she mentioned Mr. Gonsales. Mr. Gonsales was the, he was like the, today you would call him the Outreach kind of a person because he had a garden. All the fifth and six graders would participate in cultivating and doing acts. Everybody loved him because he was the center of the school. I remember his one-man band. They stopped it. He would also have this show where all the boys would paint themselves black…like Al Jolson -- the Black Sambo Club -- with the dancing, we used to enjoy that. Of course they put a stop to that. As far as Pohukaina School, that was a new thing. The garden, the May Day programs and we had some strict teachers. Another thing we had that I remembered is the chores. We had a teacher named Mrs. Hoe; she taught all the classes Hawaiian songs. And that's why I guess today when I hear some of the old songs, some people are surprised that I know what the songs are because at Pohukaina School, that's what they did, they taught you Hawaiian songs. She was Chinese, maybe she was part Hawaiian, I don't know. There was a Mrs.Tseu, she would help out with that too, I remember. Lots of Chinese teachers, mostly Chinese; that time was mostly Chinese or Hawaiian and some Portuguese teachers. They had a lot of Chinese teachers. They had Mrs. Lum, there was a Mrs. White who was a Hawaiian teacher -- she was really good. The Hawaiian kids really took to her because she was very kind. I remember that [Jean].

I remember during the summer we used to go Bon dance…at the Mother Waldron Park…before that, they used to have it at the Japanese School--Halekauwila toward Kamani…Asade's then Nakata's and then the Japanese School…but the school was more towards Halekauwila Street [Elaine].

There was Opportunity School, which later became Alomana School and it was a school for young high school boys and girls who were not into academics. So they went to the Opportunity School. And that school featured different kind of crafts that they learned and maybe some other kind of trade, I don't know. But they went to school there and it had a big yard and then it came the beach, which is this now, Kaka'ako Park [Lorraine].

And the Opportunity School right where the Gold Bond Building, the school that was over there....that was like a school where you go to learn and take up a trade.... Koula is the next street. It was on Koula; it was right in that area, Koula the back part. The school was big. I remember they made the neatest wicker furniture. We were going into the trade of making wicker furniture [Poni].

Figure 28. Gold Bond Building.

Food Places

We would go to Kewalo Inn over here, or was it Kewalo Tavern. Old Plantation was the inn down by TGIF that was the Old Plantation Inn. Right up here at the corner by Ward house that was Sampan Inn was over there. They used to make the best *aku* bone. They were right there. I used to go in and see all the stuck fish on the wall. They used to have all these stuck fish from one end of the wall to the other end [Poni].

Star Supermarket family started in Kaka`ako--and then branching. They were right there on Queen. You know where the Kaka`ako Theater is; they were right across, right there. And they started their *mama-sun* business selling saimin and soup--*miso* soup from their garage at night. People would just come at night and they would have the soup going [Poni].

They [parents] used to go shopping right down the street...there was a supermarket, on Cooke and right over there, Ilaniwai. I think that's the beginning of Star Market, but they didn't call it Star Market at the time...it was called Fujieki's Store. But they were the founders of Star, I think. You know when you young, you don't pay attention to those things, where they get the food. But, they had other stores; they had barbershops where you go cut your hair, restaurants. And my second cousin was a Masuda that owned a saimin stand. Masuda Saimin Stand. It was on Pohukaina and Cooke, somewhere over there [Neal].

There used to be Star Market you know. That's the first place they opened, on Cooke Street--Cooke and Pohukaina...and after that they moved to -- you know where on Kapiolani used to get Flamingo Chuck Wagon--they were over there. They moved there afterwards--Star Market. Then they went to Moiliili [Elaine].

We had the different stores, the Fujieki Store--the Star Market and the Yamane Store. They were the ones that really stand out when we were growing up...between Ilaniwai and Cooke Street [Alice].

The place that we were staying, the corner [Ahui and Pohukaina] became Kamaboku Factory, a fishcake factory [Alice].

The small, just like Mom and Pops Store, used to have--never have too many though. One--had the Tropical--Kagia they used to call it. I don't know the names of a lot of [stores]. We used to go to Queen and Kamani used to get, they're still there I think, but I don't know if the same owner -- Ching Store. We used to go buy *manapua* over there... the pink store, right across Hamada's. And then across the street used to be the Kimura Store...right across Hamada's...they sell grocery, they carry can goods and all that.... And then we used to go to this other one; I cannot remember the name...right across the Tropical, used to have a _____ Store. And I remember the *kachimochi* we used to buy only 5 cents in the small bag. Actually, everything was cheap at that time. And used to get Fujikami Store--that used to be, I think on Cooke Street. But that was more on the other side [Elaine].

They used to have this saimin place, Matsuda's Saimin Stand. And it used to be real old days, just like the thing on the wagon. So we used to eat saimin and bar-b-q stick there...that was so good [Elaine]

And in that area where I was born and raised, they had a Tofu Factory; that was on Pohukaina and Koula Street corner...they used to have a Tofu factory there. And on Koula Street they used to have this Tropical Produce -- they used to carry all those produce -- like a mini market. And next door they had this Yonemoto Store -- they used to sell all kind stuff -- snacks, *kachimochi* and stuff. And at that corner had Kagiya Store, they used to sell candy, ice cream, soda, whatever more like snack shop like. And towards, Pohukaina and Coral Street we used to have this place that they sell Okazu -- like chow fun, hamburger sandwich and stuff like that. And Koula Street, we used to have this lady -- you know those days you can do business at your home -- we used to have one lunch wagon and they used to sell sandwiches to curry stew or whatever you need. Eventually she opened one small shop right next to her house. That's where we used to hang out too. She used to make curry stew; like an Okazuya shop -- Haguchi. And they used to have a lunch wagon, I think they used to go down towards the Incinerator side, if I'm not mistaken. [Kagiya Store] was on the corner of Pohukaina and Koula Street. And on Cooke Street they used to have this market, Fugikawa Market; Tateishi Store is on Cooke Street too. And right across on the same street on Pohukaina, they used to have one Service Station and mechanic shop. And then they had a Barber Shop right next to the Service Station I remember. And after the Barber Shop they had the Matsuda Saimin. Fujiyo Matsuda was the President of the University -- that's the parent's place we used to go. And a large saimin used to cost 50 cents -- big bowl too you know -- that's the large size, 50 cents. The small one was 25 cents I think. They had 25, 35, 50 cents. B-B-Q stick was 10 cents. And the plate lunches we used to buy from Higuchi -- I think they used to charge you like 25, 35 maybe 50 cents. 50 cents you suppose to be a big eater. That's how much used to cost. And I used to remember I used to buy bologna sandwich for 10 cents. The Red and White Kamaboko used to be on the corner of Pohukaina and Kamani Street -- they used to make *kamaboko* from shark those days [Roy].

Red and White Kamaboku Factory...what I remember about that was at night when I'm sleeping, all of a sudden I would hear yelling and people running because somebody came to steal *kamaboku* because they would put the *kamaboku* outside to cool. It would be outside to cool and somebody would come to steal and run. So the man who picked the *kamaboku* was chasing after them. So once you get in the camp, you cannot find them already...the camp was across the street from us 'cause we didn't live in the camps, but the camps were across from us. Most of my friends lived there [Jean].

Some days we used to have this Manapua Man come, sell *manapua, pepeau,* and stuff like that. He used to carry that [pole on his shoulder]. M a n a p u a...p e p e a u (singing like), used to be like that [Roy].

We always had Hawaiian food....I was a small kid, we used to eat it, but it's not that they were fishermen or anything like that. I remember my dad used to go to the market over here; we'd always go down to the Farmer's Market -- we still go to the Farmer's Market. That was the highlight on Sunday mornings, we'd go down. We'd always have that big Pyrex bowl full of poi, and then we'd have lomi fish -- it would be like the lomi salmon, but it was the fish...its like aku, but its lomi like salmon; you know you have the onions and tomatoes, but it was with fish instead of the salmon. There was always a big bowl of that [Kanoe].

We used to have the Manapua Man who used to come around. There was another one besides the Manapua Man who came around and sold taffy candy, pink and light brown – caramel and strawberry. Then the vegetable wagon would come, with all kinds of vegetables. And then the fish man would come, selling only fish. So we didn't always have to walk up to the stores, they'd come around [Lorraine].

[John Dominis has been there] not long, at least twenty years. When John Dominis got there...that's when I think they started calling it Point Panic... I guess cause the waves. I didn't know it was called Point Panic. I guess some people made the name [Jean].

We used to go there in the sixties -- that's forty years. John Dominis was first build in the sixties. Chris was still in the infant seat when we took him. Where Point Panic and all that area is, that's where you guys going to put your pipes [Alice].

Churches

The Holy Ghost...every year they have an annual festival where you cook and come over. And the women would make sweetbread and you go around and sell the loafs, donations for the Church. It was more like you go to the fundraiser just before Easter [Neal].

That was the chapter of the Holy Ghost in Kaka`ako, the parade and the whole thing. And that was where the Holy Ghost halls, that's where everybody had their luaus. And that hall is still there. You know what I was always curious about was going up those steps just to look at the statues inside there--the Blessed Mary. That's where it's kept and then they go and march down...they got to go down to Fort Street to get it blessed. So that's the only place I know of that has the Holy Ghost parade. And then they have the blessing of the bread. That's when you want to go because they have all the food. The blessing of the meat and the bread and that's the sweet bread, the juice. But you see how Kaka`ako was [Poni].

Figure 29. Holy Ghost Church

[Holy Ghost Church], that was the one on Queen Street--they're going to tear it down--as long as I can remember, it was there [Roy].

You know what we used to laugh about? We would go to a Christian Church in the morning, then in the afternoon; we would go to a Buddhist Church [Alice].

We had a nice Church called Kakaako Mission that was on Kamani and Ilaniwai...they had so many good projects for the kids. They had workshops, wood workshops, painting, sewing, and all these things for the girls. It was just a fun place to hang out and where we grew up.... Kaka`ako Mission...it was such a good place where we had fun. So many good people. I think that was the heart of Kaka`ako, for the kids. It was so funny -- most of the parents were not Christians 'cause they didn't have a Buddhist Temple around, you know. I think that's why. So they did a good job. I remember the Reverend's name, Oier...O I E R [Neal].

Kaka`ako Mission across had a playground; I was very active with the Sunday school. We had the English version and the Japanese version. We also had a language school. In fact, there were two language schools. I went to one that was more on the strict side. One, because the principle used to go to Ala Moana beach to swim for his health, they were called the Hie B Yo that's the TB school – Tuberculosis. And there was another school close to Queen Street; we used to call them the Mangu Docko because the student, they had to gather the student and give them something, like a bribe for them to come to the school. And we always made a joke about them [Alice].

Some were outstanding memories besides our parties and singing and Church [on Cooke & Kapiolani]. My great grandfather John Kekipi Maia and Rev. John Polowailehua and my great grandfather who was a minister as well, founded Ho'omana Naauao o Hawaii and that was the first independent Christian organization in Hawaii. And in fact Queen Kapiolani was going to have Ho'omana Naauao through her husband Kalākaua because of the help that she got through prayer when she was very ill, declared as the island kingdom's official religion but that's just before Kalākaua's journeys to San Francisco where he passed away and all of that was kind of just put aside and forgotten. But it was through the Church because, see at that time all the missionaries had tried to suppress the speaking of Hawaiian language. And it was through the churches through Ho'omana Naauao that they couldn't do a thing about it. And so that is why my mother and all of the descendants of Ho'omana Naauao were so fervent in making sure the language was continued and it was through the Church. The missionaries couldn't do anything about it. They mandate telling us not to speak Hawaiian... So the significance of the mother church...growing up there was wonderful.... We are right on the corner of...in fact we're right behind the Lexus dealer now. Lexus is right on the corner and the church is right behind -- the walls separates us from the Lexus dealership and then also the other side the wall separates us from the service department. The new church was built in 1970. The family home was taken down because of the new City ordnance and all the trees were taken down too. They had to put up a parking lot.... Let's see, because it's the type of district it is now. If we were able to leave the family home and just kinda fix it up, we could still live in that, but the home was too termite eaten [Joe].

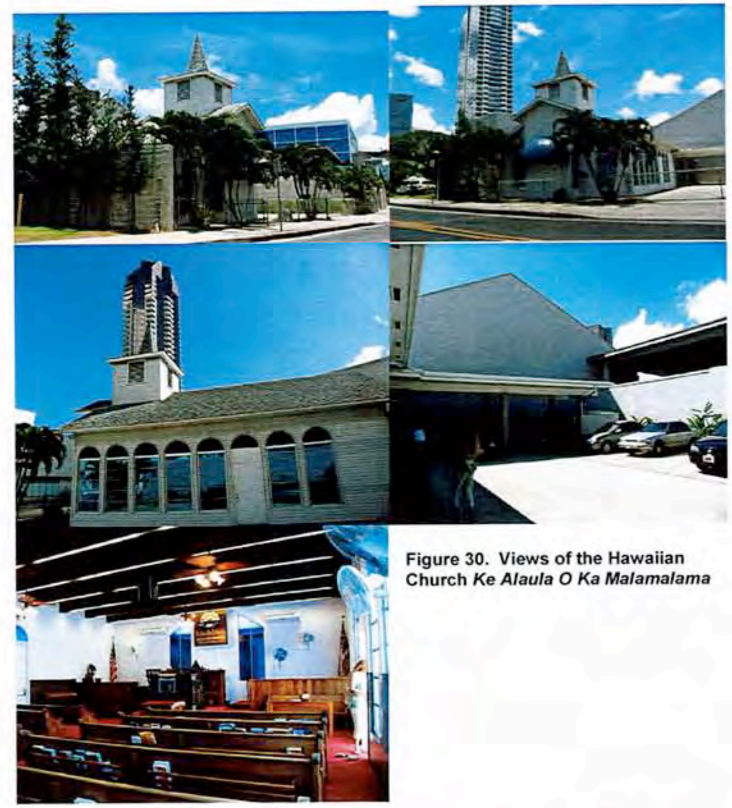

Figure 30. Views of the Hawaiian Church *Ke Alaula O Ka Malamalama*

This church is actually one of the – well it's considered the mother church. It is actually the first independent Hawaiian church in the State of Hawai'i. So we hold that distinction. A few years ago we celebrated our hundred and fiftieth birthday of our religion. There's quite a few Hawaiian language teachers that came from our church. Kauanoe Kamana pretty much started the Hawaiian studies program in UH Hilo -- and then UH Manoa kicked off after that, but I know she was the first in Hilo. And we've had a lot of celebrities that used to come to our church. Hilo Hattie used to be one of our Sunday School teachers.... And then the Bright family -- a lot of them are entertainers -- they're very active in this area, growing up. So, there's a lot of history over here [Kanoe].

People came from around the whole island to come to our church. We had people from Wai'anae, from Waimanalo, Haleiwa, would come to our church. And it would take a long time to get to the church. But...my grandfather's was very active; he was active in the Legislature; he was very active with the Royal Order of Kamehameha. So this church was kind of known -- they used to call it the Bright Church. And I guess because of the Bright Family and then because the name of the church is Ke Alaula O Ka Malamalama, which is the "bright morning rays of the sun." It's like your morning sun is a new day, it's a new church, it was a new start of something new, type of thing. So they always call us the Bright Church [Kanoe].

Cooke Street used to be called Kanoa Lane and Kanoa, that's the one from Kaua'i I was telling you about, that's the one helped us to get this land, this used to be Kanoa land before it became Atherton 'cause then it was affiliated with Atherton.... The agreement is as long as there is a Bright worshipping in this church, we have the land. But once this ceases to be a church or we cease to practice our religion or anything of that nature, then it will revert back to the Kanoa family. I remember we used to have a Kanoa that used to come to the church just to make sure there was somebody in there practicing [Kanoe].

My sister used to sing in that orchestra, the band. That was entertainment after the movie. But I guess movie was one of entertainment that we had while we were growing up...at one of the Buddhist Church...that would be Koula. I think that type was more for like the fisherman's. I guess everybody was able to go. My mother used to go there also, do volunteer work. It's more like a Shinto Shrine [Alice].

Parks

I guess what I miss the most is the park, playing baseball with all my friends, getting dirty. That's what I miss the most and at Mother Waldron Park - it's still there - we used to play there a lot. We used to play handball; there was a handball court called Wallberry and we played handball all the time. They don't have that anymore [Neal].

Mother Waldron Park is still here and I know that was a gathering place for everybody [Jean].

Had Ala Moana Park, we used to go camping out there. There's a lot of good memories and lots of friends to play with. We never short of finding friends to play with...it was good times because we had a lot of things to do because there were so many kids to play with growing up. That area was so congested; you were bound to find your classmates or friends in that area [Neal].

You know, they had two incinerators in Kaka'ako--I think was Ala Moana and you go down Ahui Street that area. There's a park now [Kaka'ako Park] that used to be all landfill

before the thing came about. The incinerator used to do their thing and we used to just keep land filling so land came more toward the ocean [Roy].

This whole area here where the park [Kakaako Park] is now was a wonderful area for children. Parents used to let us just come down the beach to play, without any supervision, because the older kids were always the babysitters. Not subscribed, but they just knew they had to watch out for the little kids....it was a wonderful playground area, the whole of Kaka'ako, for children [Lorraine].

Figure 31. Kaka`ako Beach and Park greatly modified today.

[At Kaka`ako Park] they didn't want a single flat surface; they didn't want a single viewing plane. These interrupted viewing planes [mounds] are like giving you exercise to get up and down the hill, that's what is park is about, you go there, spread around and walk. But also, it gives you a special view from the height. When you get up there you can overlook anybody and any tent in front of you, that you will be able to find a place on that plane that you will be enjoy a view of the ocean. I think that's why they have done it that way. It used to be in cases it was pure, just straight flat. But then they rethought it and some new thinking came in and they started making these mounds. The kids now slide down the mounds, run down the mounds, so that's created that type of use. But for a person who needs exercise walking on just plain grass, then you get exercise working in a mound like this. But the view plane is also very important, that if it's flat, you cannot oversee any obstacles like cars and tents and garbage cans if you're a hundred feet inland. But if you wanted to get a real view, you can walk up to a mound and see your view and enjoy that view and walk away and do something else [Uncle Buzzy].

[Kaka'ako Park] you know we never went there 'cause it was kind of like a junkyard. We'd always go to Ala Moana Beach Park because that's only place my dad would take us. He would never take us here to Kaka'ako. Now that they've really fixed up the park, I've been to the park, 'cause I come here [to the church] every week. I've been to the park and it's a beautiful job they did, but it's still not a place to go swimming, you know. If you go swimming there you get run over by the boat [Kanoe].

Facilities

The incinerator used to be...we just went by there and we noticed the incinerator was all rusty and it's not there anymore of course. They used to have an Opportunity School there too...on Ilalo Street right [Jean].

Also along Ilalo Street, there was the Quarantine Station. And there was the, a big huge park and an incinerator that burned rubbish. And right mauka of Ilalo Street and the Camp was a Peerless Roofing Company, they used to have a lot a barrels of tar there where we kids used to run and play on. Also out, up there was Hawaiian Telephone Company and further down the road was the Immigration Center [Lorraine].

The incinerator came later, but now today that's the Children's Center...they have recreational things here. And that's part of the old – used to have a dog pound in front of here [Uncle Buzzy].

They also had a Humane Society on our street [Ahui and Pohukaina] [Jean & Alice].

Businesses

It was quite a mix, real chop-suey. Queen Street, beyond the theater...I guess that theater went in there probably about 1930, something like that -- Kewalo Theater. On the Waikiki side of that there was a jungle of small shops and what not. There were some homes in there [Lex].

Every Saturday [at Kewalo Theatre] they had the Woody Wood Pecker Club. I think it's for 9 cents you get old movie and you get drinks and everything. Kewalo Theater is after the Advertiser used to drop off all the newspaper, cause they had a nice entry. It's covered from rain and the 3 of us used to go there [Neal].

Figure 32. Kewalo Theatre on Queen St.

Now Kewalo Theater is still there, but it's not called the theater anymore. I think it houses old films if I'm not mistaken. And Woody Woodpecker Club on Saturdays was only nine

cents. You take a dime and you get a penny back. You can buy bubble gum or something you know...that's the kind of stuff I used to do [Jean].

When we were growing up aside from Aloha or Kewalo Theater, we had King Theater, Princess Theater, and Hawaii Theater, and Liberty Theater, we could go to movies. King (Theatre) is where the the Financial Plaza is now, you know First Hawaiian, Downtown, First Hawaiian and then to the Pearl Harbor side of that, I don't know what that building is now, but that's where King Theater used to be. The Princess was where the Hawaiian Food, People's Café by Longs. That was where Princess Theater was. In fact, People's Café used to be used to be next to Princess Theater. And Liberty Theater is across of the old Hawaii Theater, that -- how do I put it--where the Blaisdell Hotel was. It's a side street around that area. Chamberlain Lane, there's one, where the Blaisdell Hotel is in downtown, right there. I know I'll go home and think of one thousand things I forgot to tell you [Lorraine].

The Kewalo Theater -- they had 10 cents movies on Saturdays for children. And out by where we stayed, there was a Firestone Recap next to the family home and Hawaii Hotel. Hawaii Hotel was an interesting kind of a place. Some day we should make a movie out of it.... And then there was a Sonochi Store -- neighborhood Japanese grocery store that the children could go and get things or they would be charged to the Bright or Recca account and Mrs. Sonochi and all the family would take care of us. There was a Pool Hall and all we could remember was, it was always filled with Filipino smoking stink cigars. And the Eki Cyclery was next to us. And across the street was the Car Barn and that's where all the busses were parked. For many years it was over there. In fact growing up, when they use to have the trolley type, the electric trolley, the busses, that was like one of the turn around points where they would switch that connecting thing to the cable, the electric cable to turn it around. And sometimes we would be standing on the corner just watching that. Cause we didn't have video games or you know...stuff like that to keep our time occupied [Joe].

Blair's was right over here. Was the back part of it, where Honolulu Ford is--the back part 'cause they had all the cars way back to there [Poni].

Used to have Blair's...there was that monkeypod shop right at the corner Ward and Halekauila Street and right next to there was the church they call Kaka'ako Mission [now Dixie Grill]...its gone long time. Gee, I haven't been there for a long time [Elaine].

After Dixie, there's a condominium up that area now. I don't know what is, and there's a machine shop, Todoki Machine Shop on the same street. And I think Napa is corner of Halekauwila and Cooke Street [Roy].

The Kewalo Boat Harbor, that was a major step because the road came around past the Coast Guard. And then next to Coast Guard was the pumping station. And then today there's a major building, been there for a long time.... That was a major step, the Gold Bond Building was. All the other places remained empty for a long time. I would have thought that when a building of that size, the Gold Bond, came in, that everybody would flock to it. But it was very slow. There was no road all the way through Ala Moana. There was a bottleneck down there [Lex].

Figure 33. Pumping Station.

My dad's business was Hawaiian American -- well, the first business he ran there was a roof repair. He had a roofing repair business and he was importing the products from Texas, which were by-products of oil and the Texas company was called the Zone Company. My father was selling all those products to the military to re-cover the roofs of their many warehouses and structures that they had. My father was in the contracting business to do the work of covering the buildings with this new tar-like substance to make it waterproof. And he then almost immediately opened up another business when he saw the opportunity in the stoppage of the Japanese fisherman from going out to sea and the what shall I say, the seizure of their vessels because of the attack on Pearl Harbor. And these vessels were sold by the military to the public at auction; my father bought about four of them and he started a little fishing fleet. So he used the name Hawaiian American Fisheries--that was his company. And that was a company that initially leased French Frigate Shoals from the Hawaii Aeronautics Commission and continued to do fishing in the Northwestern Hawaiian Islands in about 1946 and thereafter [Uncle Buzzy].

I remember use to have Kida Fishing Supply. That used to be on Ward and at the corner of Ala Moana and Ward, use to be a Service Station with a Pool Hall way in the back. And then next used to be a Dairy Queen on Ala Moana...because when we use to go riding around Waimanalo side, on the way back my father used to stop there as a treat ... so we use to buy Dairy Queen...right across Fisherman's Wharf...just about there, that area. And then used to have a big lumberyard--Pohukaina to Ala Moana use to be a big lumberyard there...from Ward Street up [Elaine].

Well, on the street there where the [Fisherman's Wharf] restaurant now is, we had [1920s] several boat builders, and they were building sampans, fishing boats. The customs people were there already [Lex].

[Japanese people] came seeking a new job away from the plantations, so a lot of them Tuna Packers was a big draw and becoming fishermen and because their fishermen were here,

they had industries to build sampans. So that Funai family had a boat building. And other people can tell you about all the number of boat builders that were along the way. And then of course you had businesses coming up to feed the people who were moving in. And then you had other people like I said the shoyu factory, and there was another building company it sold lumbar, and then the tofu factory, and the peanut factory, bakeries came up, so. And then just started to blossom and grow [Lorraine].

Where this Fisherman's Wharf is, was there a long time when we working, but that used to be a Spencecliff Restaurant. And then in this open space between here and the sheds was the Shipyard, and the Hawaiian Tuna Packers that was here over a hundred years. Now they got a big floating dry dock, looks like. I never saw that thing before. These were all marine land... I worked there for years. Well it's been here a long time, over a hundred years. [The buildings] was part of the old Tuna Packers -- that's storage, and all that [Uncle Buzzy].

Figure 34. Fisherman's Wharf.

That's Fisherman's Wharf -- I think it's been here since I came, you know, because it was a Spencecliff Restaurant. Spencecliff had all the restaurants and if you remember the Spencecliff chain -- that's the two brothers, Spencer Weaver, and Cliff Weaver. And so they combined the names – Spencecliff. The two clowns well I knew because I was always in there anyway. But they liked to go out on the boat and they liked to go out on my boat because I had the dredge [Uncle Buzzy].

And they used to have hardware store across Pohukaina -- not Lewers and Cooke --- Lewers and Cooke was on Piikoi Street. There used to have a hardware store, lumbers and all that stuff. It was a pretty big hardware store; I think Fisher Corporation is in there now [Roy].

And used to get the Fuji Sake; we used to have one at the corner. They used to have a store like and they used to make *sake*. They used to have a plant like [factory] over there [Elaine].

But anyway, talking about recycle...my uncle used to collect PRIMO beer bottles and we used to go up to the PRIMO factory on King Street and Kapiolani -- Kapiolani was a big block you know. And we used to, for one case we used to get 50 cents I think. That was on Kapiolani and King Street corner and the building still there at the [...]. That used to be the PRIMO factory [Roy].

It was a very good central location. And we had half a dozen major tire companies that are in and surrounding Kaka`ako. Had Firestone Tire, right there by the Advertiser Building. Had Goodyear, down there near the waterfront at Sears Roebuck, in the vicinity. Had Goodrich in Kaka`ako. They were all there and the traffic at that time in Kaka`ako moved slowly. I didn't want to be on the freeway where they buzz, buzz, buzz, buzz by. The long term lease we had was very reasonable.... Right at our location on the corner of Queen [and Coral], had a bar. I think that bar is still there. They occupied the space immediately adjacent to us. When we sat down at 5 o'clock in the afternoon, the people would come into the bar, and the following morning we'd have to deal with cleanup because it would go into our parking area [Lex].

Honolulu Ironworks also brought in a lot of people. We had laundry, American Sanitary Laundry and then by Kawaiahao Church that's Kawaiahao Court, there's a huge group from there and Marmion Court, lot of people [Lorraine].

I know we walked up Cooke Street then we went on Queens, and we cut through by Kawaiahao Church and kinda zigzagged from there, Alakea and right over to Fort Street to Kress Store [Lorraine].

Kress Store the building I think is still there. It's been modified. Not there anymore. That was the place for all us young men -- high schoolers to be seen, who are you with -- that kind of stuff [Uncle Buzzy].

There was Fort Armstrong and then you had Ala Moana Boulevard. To the left there were a lot of warehouses and I can't remember what they all were for, some businesses. And then Tuna Packers had their big cannery there 'cause a lot of the women worked in the tuna factory. And there were along Ala Moana, a lot of boats, sampans, buildings, shops, and of course, other kind of stores, grocery stores. And we had up on Cooke Street, we had the Soy Factory, they made *shoyu*. We had a tailor shop and of course a meat market, a saimin stand. One of the most interesting one is the saimin stand with that outdoor wagon kind of thing. And the son, who used to work in the saimin stand, later became the president of the University of Hawai'i -- Matsuda. Star Market had its start down Kaka'ako. And there was Times Market; Times had a small store, started in Kaka'ako. We had a peanut factory, made peanuts. I'm sure we had a tofu factory somewhere [Lorraine].

Trader Vic's [now TGIF] was on the corner of Ward Avenue; Ward and King Street. That was real popular there. That was as far as we could go. We couldn't venture too far; we could go to the Japanese camp -- that was always considered safe. And actually, we never really were warned about anything really about the area [Joe].

As children we weren't allowed to venture, you know we could go up to the Car Barn. We couldn't cross the street cause; we know Sonochi Store stay up on King Street, right at the corner and Eki Cyclery -- had the Pool Hall and then Eki Cyclery. So the only reason why we'd even go past the Pool Hall – 'cause we weren't allowed to go there – 'cause we went to Eki Cyclery so we could look at the bikes and things like that; smell the new tires. I remember, smelling the bicycle tires; we use to like the smell of that. We watched the change around of the busses, the turning of the busses. But we weren't, we could not venture. Even towards Iolani Palace, we never. I mean we were so close. You know thinking back was the Ward Estate. That's as far as we been, that we never really venture. Cause we had so much to, I guess, do and Kewalo Theater and couldn't go pass there and across the street to Times Grill. But we pretty much stayed right there in that property area [Joe].

Actually they were more Hawaiian's...wait, maybe Jr., Jr. and his family. There was one Hawaiian family down the street but they didn't live there that long. He's was kind a like the bully, that boy -- a little older than us. I hardly ever saw the mother; I think the mother was Japanese...'cause we had all Japanese Camp after Hotel Hawaii [Cooke Street], was Japanese camp. Kanoe might know cause they lived there. So, I mean they knew everybody. I'm sure they ventured more than we did.... This is Kewalo Theatre and then Firestone and then Hotel Hawaii was set down. It's like when the parking lot. There was like a trophy store here and then, there was, this is that Japanese Camp. It looked like those days like townhouses. It was like simple but façade. All the fronts were different, but they all had verandas. Kind of street level ... there were just Kapiolani Boulevard and Sonochi Store. This is all, such historic. We lived next to the Pool Hall and there was a Trophy store on Cooke Street, this side. This is a trophy shop. [The other side of the street] that was the used car lot. This whole area...the church was here. They had that used car lot for the longest time on the corner there and then it got bought by Servco. In fact you know the last thing my mom did was to bless the pre-owned area across Lexus--pre-owned car unit across the street [Joe].

Kudo's was the liquor store that my uncles use to work and that was across the street where the Primo Brewery used to be. Well, use to be Times Grill where the Advertiser is. Columbia Inn, that was Times Grill [Joe].

When you got to the top of Cooke Street over here, where King meets, across the street there was a bowling alley and there was a tavern over there. And then at that time the law, there was some kind of liquor law, you couldn't be within so many feet of a church. And they measured it, and it came right into the bottom step of our church. And so one day, somebody came, these guys came and cut our stairway and made it steeper so that it was out of that measurement.... But now they're not there anymore, but we're still here [Kanoe].

They had a bakery past Kapiolani, going down. We'd walk the whole Cooke Street 'cause when we were allowed to go and play, that was part of it, exploring along the area. So we always went around. Across the street here there was Times; it was Columbia Inn, but before Columbia Inn there was Times Grill -- it was a restaurant like Columbia Inn. When Columbia Inn shut down, I think that was like the greatest loss to us and now Servco Lexus owns that too -- they keep getting land all around here, you know. And all these buildings, you know, we watch these building come up. This new one here where OHA is, that's all new. It was actually a used car lot...there were cars, but they were in a window in the building. I don't know the name of it, but we have film from the 1930s of this area [Kanoe].

Places

[Ward's Estate] they actually had lagoons and ponds and wells and rivers [stream]. This is what Kamehameha IV wanted to sell him, land that was right next to the Palace. So where the City Hall is and all that area, all the way down to Waikiki he could have had. Then he says; okay it's all yours, I give to you. And so he stood right here at Kewalo and he looked up and he went right up to the foot of Diamond Head. So I said; too bad he didn't step to the side, he would have had it right to the Ko'olau [Poni].

King Street to Kapiolani and Ward to McKinley High School that big block was the Ward Estate, had a mansion in there...scary man. Had all the coconut trees; I think there's still some coconut trees, original trees up there..... I guess somebody bought them, the Ward property. Right across is Hawaiian Electric. Hawaiian Electric and Trader Vic's on the same street. So after they cleared up the place that's when Blaisdell came up; actually it was HIC to begin with and then it came to Neil Blaisdell--after he passed away I think they named the place after him.

When they went to dredge the island, Maka'uwea, Moku'oeo, Kahau'olana, 3 islands dredged the remaining they went dump all over here, the landfill [Poni].

To get to Waikiki, I'd get on the street car at McKinley on King Street, go to Pawaa, and then take a transfer and go across the swamp to Waikiki and to the Outrigger Canoe Club where I could surf. And all that area behind Waikiki was swamp. That swamp went right up to about where we have the big shopping center. Dillingham came in with a dredge and dug the canal and took all the coral and stacked it up for the shopping center. This must have been around 1927, something like that. And Ala Moana Park was created at that time. And then Kewalo Basin was created. When they put in Kewalo Basin that took away a lot of the small boats from Honolulu Harbor. Some twenty years ago Andy Andersen was smart when he picked John Dominis [restaurant] up. Then we had Fisherman's Wharf restaurant right on the street there. They had a chain of Spencer restaurants, there were two of them [Lex].

KAKA`AKO ACTIVITIES/LIFESTYLE

And we used to have this softball team -- we played for Kaka'ako Mission. We use to go Sunday Services 'cause after that was softball. We played in that Churchyard--they used to have a small yard--we use to practice and play there. We also use to play hockey on the street and the street we used to live on, wasn't paved -- was all dirt like, coral like. And we played marbles, tops and we use to make our own slingshots and climb the guava tree. We used this tobacco bag -- the Durham tobacco brand -- we used to fill it up with alave or something like that and we used to throw that thing up -- throw at each other -- now they have that dodge ball type; it's similar to that game. We used to make from the tire, the rubber we used to make a foot long and make knots and I forget what you used to call that. We used to do all dangerous stuff. At that time, we didn't think nothing yeah. And nobody got seriously hurt [Roy].

A lot of times we went to the Mission, the church--Kaka'ako Mission. Over there had that modernized pre-school [Mother Rice]. Most of the time we played there but my life style was that, you go to school, you come home, we use to have snack then we go to the Japanese school. And then you come home and that's it. You do your homework; you have dinner or whatever. Then weekend, we use to go to the Kewalo Theater to see movies--Cooke and Queen. And then every Sunday we use to go to the Kaka'ako Mission -- it was a Christian church. Then every so often the whole church would go down to Hanauma Bay on the bus and we use to have picnic. And most of our weekends on Saturday we use to go to Damien Track to visit my grandparents, my father's side. And then on Sunday we use to go my mother's side [Moili`ili and later Pauoa]. So that was more of our recreation, my recreation [Elaine].

We used to play in the back of Gold Bond Building. That's where had the football field and basketball courts were. We had a lot of good memories growing up, lots to do. And what was good is that the police officers there; do you remember the police pistol range, way in the back of the Gold Bond Building where they had the courts and everything? They used to sort of play with us ...so it was a very good relationship, with the police department [Neal].

We played a lot of baseball. I loved baseball so we played little league baseball and we also had basketball and football...we used to play football behind the Gold Bond Building. I think soccer growing up, maybe soccer. But that's what I miss the most, just playing, mostly baseball [Neal].

We had the Filipino group. What was her name, she's a very active lady. She used to teach the Filipino dance. They were very popular, the Filipino organizations. I can picture her, a very pleasant lady. That was the Filipino days where they all learned to dance the bamboo dance and they would entertain us, at the schools activities.... The Filipino were near the Kawaiahao Church, Punchbowl, in that area [Alice].

And we also use to use [Bull Durham bag] to stuff paper in it; wrap tape around and we used to play alavia. It's where you hit someone with it. One team and the other team. Once you get hit, you're out.... Let's say you are my opponent, if I [hit you with it], you dead. You have to give your alavia--one each team, to one of your other members. In the mean time, I'm going to pick up the one I hit you with. So you give it to the other guy and throw. I don't have enough time right, so they hit me with it. It's good, lots of fun, interesting game. And we used to play with the milk covers and marbles. And the girls used to play with jacks. It was kind of sissy for guys to do it, but when the girls were not looking, we used to practice. And I guess dodgeball [Neal].

We used to have those jumping jump ropes, and then the beanbag games. And we had the alavia game, that's the game you hit somebody with the beanbag. And we had this Hawaiian game that we dig a hole on the ground, and we use those broomsticks to make different kinds of shapes. That's what we used to do when we were growing up, more jumping ropes and beanbag things [Alice].

The Filipino's had their fiestas, but they're not like today's you know, where you go to Kapiolani Park--the Okinawa's. It was really small 'cause there was no place to hold anything. Like the Church, they had the Church ground. So it's just at someone's house you know, they would gather--that's the difference [Neal].

Japanese they had their Bon Dance [Neal].

We had the New Years--we make the sushi and all that--we celebrate the New Years. Sushi and like I said (fired) chicken was the delicacy so we had chicken with our food. And I remember my cousin really liked her chicken. We used to fry the chicken and we used to simmer it with mushroom, button mushroom, real tender [Alice].

I remember she [mom] always used to criticize that even in her Kimono, she had to wear nylons. I remember she always used to be critical about that. Why custom nylons because they used to wear *tabis* with the Kimonos. It was recommended that they had to wear nylons...the Government I guess. I know she used to criticize, we have to wear nylons with the *tabis* [Alice].

They also had Boy Scouts. They really kept us out of trouble, keeping us busy with Boy Scouts. Like I mentioned, woodcraft, making little chairs, tables things like that [Neal].

So, growing up there [Kaka`ako] was so simple. I remember we use to have the peddlers that come around. A man use to bring the fish and meat and we use to call this guy Clorox Man. He used to carry all the kind household, broom mops or whatever. And the milk

used to be delivered at the house and I remember at least every Saturday I used to go with my mom to what is that, the Farmers Market now. We use to go buy fruits and vegetables there...by Ward Warehouse, the Farmers Market right there. That hasn't really changed yeah, from before. It's almost the same. Only the buildings around it really changed--like the Ward Warehouse [Elaine].

The Peddlers used to come with the truck and they sell meat to whatever you need. And they didn't have money those days. They used to just put your name down, how much you owe and you pay later kind--you know, honor system. And they used to get this dry goods guy come -- Nanuwatame [??]. He used to have pastries and materials to sell to the housewives. Everything you need, they had it [Roy].

Transportation for school ... we used to walk to Pohukaina. It wasn't too far. Some days we used to walk to Washington and McKinley; we used to walk every day. Unless somebody had a car and then we used to ride. And transportation on a car, we used to not depend on our neighbors but they used to take us, I guess on emergency like that, take us where we want to go. I think the first automobile we had was, between Intermediate and High School I think my older brother brought a '39 Chevy. That was the first automobile we had. I used to drive it around Kaka'ako. Those days you cannot afford cars. I remember when my neighbor, they used to have nice brand new cars in those days...like Shimamoto, the dad used to work at the Post Office, so I guess the income was higher than my parents them. And they used to have some nice Fords, brand new Fords, and stuff like that [Roy].

And then, talking about utilities like telephone, we never had a phone till so many years after. We used to have our neighbor phone, and those days was all party line; like 2 party line, 3 party line, and 4 party line [Roy].

We used to practice Judo in one of the Gym like and also had that Kaka'ako Boxing Club; we used to train in the complex. And they used to show movies, Japanese movies and not Karaoke but its like...they use to sing the song--something like Little Gina.... We used to not fight each other, but play tag like. We used to own a B-B gun. I felt bad when I shot a bird down. After that I did not dare shoot a bird. I was in the judo, judo club at that Kaka'ako Japanese School. The highest I went was only white belt...that's as far as I went. I was pretty serious, but it's just that. And I really use to challenge all the clubs you know, like Shogotan and stuff like that. And I remember we had a tournament at the Civic Auditorium and this guy was so good he took down about, at least 15 guys. And I was one of them. And recreation, we used to go down that Mother Waldron Park -- they used to have basketball league there. But we used to go down the Police pistol range. I guess now is a Hato Warehouse, I think and we used to play basketball. The bunch was pretty big so we compose a team like, make a league. We used to hang out there on the weekends--Pistol Range we used to call that. A parent used to take care the place and we used to camp out, sleep overnight and stuff like that on weekends [Roy].

Every New Years Eve, my dad's parents and friends used to come over and they give us dollar apiece. In those days you get about 5 or 6 dollars, that's big money. And we used to go to the theaters, catch 2 shows in one day. Go to one restaurant eat hamburger steak for 50 cents. That's a treat for us boy]Roy].

The next camp used to have a fisherman, every time he comes back I remember he used to bring home the aku head. He used to cook one big pot and he used to share with neighbors, you know shoyu style. And if they have good catch, he would give some [ahu head] free. Even the eggs, the fish eggs sometimes they used to give out all free. You go to the fish market if you want they give it to you [Elaine].

Entertainment, we used to go to the theaters, pay 9 cents matinee. I think Kaka'ako was a Woody Wood Pecker Club. And we used to get contest and stuff like that. And I think when you reach the age of 12; you have to pay 40 cents nighttime movie. Those days were so convenient. You just walk to the theater; you walk back home, stop off for saimin or whatever. That's what we used to do. And then, after that you go to High School, you go to functions like that -- Teen club or stuff like that. We used to go to the YWCA -- that's where in high school we used to have a club. All sorts of social functions and stuff [Roy].

Bon Dance used to be held at Mother Walderin Park, I remember that. That was a big deal, the whole community and everybody participated, all the nationalities [Jean].

During the day, weekday, because I went to Japanese School too right after School then went to Japanese School. On weekends, it was usually Sunday School on Sunday. On Saturday, Woody Woodpecker Club. I didn't really get involved in baseball. My friend, the one I talked to you about, Mirrell, her dad would sometimes get the kids together to play baseball at Kaka`ako Mission. They had a big yard and there were some swings there too. So that's what we would be doing. I kept a lot of the boys out of trouble because of that. And in Kaka`ako, we never had to lock our doors. I mean, we could walk from where we lived on Ahui Street, walk to Kewalo Theaters. I would go with my mom to watch Japanese movies. They would have it on Friday nights or certain nights and so I would go to the movies with her and we would walk back with no problem. We also had on Ahui Street this guy named Fujiya; he had a repair shop and he was a mechanic. On the weekends, he would show movies and invite the whole neighborhood; all the kids would go [Jean].

Kamehameha Day Parade we would always have prime seats cause they use to come by Kapiolani Boulevard. And we use to take our church benches for Sunday school benches

and early in the morning and all that was reserved for the Bright family and church members if they chose to come down and have a big *paina* afterwards at the house [Joe].

Talk about termites, remember the DDT trucks? Oh god. On Sunday we used to go running for the pillows just to cover our faces. We use to run away from it because it was so....the smoke and the stench and we use want to put our faces into the pillows. The termites, you know people don't realize, Kaka'ako, the mosquitoes and termites...had plenty in that area. My uncle...well he was like our calabash uncle; he was kinda hanai -- adopted by my grandmother and he was like the yard keeper and he took care of the yard, the Church -- Uncle Sammy. And he would go and get mosquito punks and stuff; you know there was kind of a ritual in the mornings and put them different places. So, that's how it was growing up...was just part of it -- the termite season.... There was the big barrels that they use to mix poi in -- 50-gallon wooden barrels...they had the strapping around the end and everything. They filled that thing with boiling hot water and they had this big pot on the stove and boiled the water and kept pouring it in. And then he would put up a light right above it. And then all the termites would come in and the steam from it would catch the wings and they would all go into the hot water. And he would just scoop it up...[Joe].

One of the things that we always remembered, is we made up games. So we had games made out of nature things like the ti leaf- the coconut leaf – we'd roll it up as a whistle, the hibiscus flower--there's a little pointy thing we used to put on our nose. And the twig we used to put to make our eyes open, yeah? And we had, you've heard of it and I can't remember the name of it, it's a sticky substance that you rub on tin cans and you put your foot on and it gets stuck to it. So it was like our high heels to walk around. But we found things around the area to use for toys. And then there were always seasons for toys, based on what the stores sold. So it would be kite season for a month or so. And then spinning tops season. And then yo-yos, and of course agates. We had lots of agate games. And bean bag games. We had a lot of rhymes for it, and sequences of playing bean bags. Of course rope jumping was very popular [Lorraine].

We only went that side...you see our walking area was Cooke Street. We only went up Cooke Street if we were going to Kewalo Theater, or before Kewalo Theater was Aloha Theater. If we were going there, or we're going to Mother Waldron Park, or we were going to walk downtown to Kress store. We always walked to town, walked up and walked down, that was nothing to us, walking to town. And then going to school. And then to go shop; grocery shopping up there. But otherwise our whole playground was the street, and the park, because we had so much space, climb trees and everything [Lorraine],

The freedom to run and do whatever you wanted to do. And I appreciate the creativeness we were forced into because we didn't have toys. And we were all poor, but we didn't know we were poor until I went Kamehameha and saw what the other girls had, compared to what I had, or the homes they came from in Kaimuki, compared to my home in Kaka'ako which was just a kinda duplex. Most of us lived in duplexes -- half a house -- upstairs and downstairs. But it was just a fun time. And that's what we always talk about when we go to our reunions, the fun kind of things and the camaraderie, I guess, that we experienced with all races [Lorraine].

One of the things we did was collect bottles to sell. And we used to go to the rubbish dump. What they do is bring the rubbish. After they burn the rubbish the trucks would come and put heaps of the rubbish to cool off in this big vacant lot. So my brothers knew the time was, so we'd go early in the morning, just after they dumped it, and we'd wear like boots, big shoes, I remember, was a little kid, but boots and gloves, and a little rake. And we would rake through the rubbish trying to find anything that was copper, because those sold. Then we would pick those things up, and then bring it home and my brothers would sell it for money; was an extra way to make money. But we always used to go to the rubbish dump, the incinerator, and pick through the trash. We didn't think anything of it, but today it would be "Ooh going through the trash?" All we did was look for like copper, this reddish thing shining through [Lorraine].

Kaka`ako Flora and Fauna

Some consultants remembered the types of vegetation in the Kaka`ako area.

Those coconut trees, they still the same size as when I was there. But along this fence right here, where the white containers are, my father used to grow all his gourds and the gourds would cover that entire fence was all gourd vines, *ipu*s, all the *ipu*s. And they would grow good and the fruit flies wouldn't even sting them. The neat thing about it is that you grow your gourds down here by the seaside, the salt air, the fruit flies don't like the salt air. The gourds grow real big. So that's when I was doing the *mauka-makai* I said, what kind of plants you can grow very close to the sea? I said your gourds are one of the plants you can grow because the gourds were used for containers and much usage. Of course you didn't eat it because it was too bitter. But the Filipino's, they used to come and cut the gourds over here. In back of that where the Park is now used to be all little places, we used to live back there. We used to call it Cat Hill and were all trails that led down here to the surfing grounds [Poni].

Had a lot of mango's, good mango's, and common mangos, which you don't see anymore...was right in the yard. On Queen street, had a huge mango tree, right in our yard. And they had sour sap, five fingers; we used to call it star fruit [Neal].

Of course there were a lot of monkeypod trees all over, kiawe trees...but we don't see much anymore [Neal].

We had a small garden in the back of our house. We had flowers, not too many vegetables cause it's not a very big area...tomatoes, but we had more flowers. What is that, the lady slipper flower? When you choke on the bone of a fish, you swallow that and that's supposed to clear your throat [Alice].

And the most I remember is Ala Moana Shopping Center and that's just a big mound of coral. They use to have; I guess they put all the coral there yeah. Dredged, but before Ala Moana Center came up, it was just mountains, piles of coral. And we used to go there and they use to get the *koa* beans [*haole koa*], so we use to pick that and we used to do artwork at the church. We use to soak it in water so it gets soft, sew it and make lei's like that.... And then I guess we left it at the [Kaka`ako Mission] Church, I'm not sure because what they did was dry it back up and it shrinks and it gets hard again [Elaine].

We [at Coral & Kapiolani] had mango trees and coconut trees and we used to run down to the Ward Estate [Joe].

I used to climb the date tree...at the Kaka`ako Mission...when the dates are ripened [Elaine].

Well there was always guava, opuma -- it used to be green and then it would get red, and then it would pop open and there's white flesh inside. And we used to eat that. We used to go and eat sea grapes, which used to grow along the shore. And there used to be date trees; there aren't date trees any more -- date trees and plums. And tamarind was a favorite too [Lorraine].

Right back here was the King Theater, it got demolished, now a parking place. I don't remember what else was here. But this is all new. I remember when we were kids when the trolley ran right down here on King Street, all the way out to Waikiki and right around the Kapahulu Cleaners. Kapiolani branches off and then it went along the beach. And I could run over there on the weekends, pay seven and half cents in the trolley, you get two coupons for 15 cents...go down to Hale'au'au which was owned by Rudy Tong in those days and grab a surfboard and a towel and go out surfing. Come back, give them back the surfboard, shower up, towel off, brand new uniform, get in at the old street car – it was just a rail system, with a electric wire overhanging it. Had a horn that went "Clang, Clang, Clang, Clang." Chase people out of the way. We went through the old duck ponds which is today where the big developments are, where they have now Nauru Tower, Hawa`iki, which I got into, Hoku – Hokua, which is a new one being built, and Ko'olani which is the other one. And this is all built on the land that belonged one time to the tiny little nation of Nauru. They bought the land years ago. It was the duck ponds that were filled in with dredgings from the Ala Wai Canal Boat Harbor. When they dredged all of that and the Ala Wai Canal -- they took all the dredgings and poured it into the old taro patches and made it solid land. That's why you have there today the shopping center [Uncle Buzzy]

In that area, okay we used to have five fingers. We had five finger trees. Starfruit, mangos was mostly all common mangos. Sour sap and they used to have this green fruit called V. I wonder where that. We used to have that Vi-V. One of my friends used to raise grapes – Nakadomono -- we used to get grapes. And then get dates and tamarind, that brown looking thing. They used to have *jokura*, pomegranate [Roy].

Kaka`ako – War Period

Some of the consultants recalled things during the period of WWII.

We were called names all the time…by the other groups because we were Japanese. And they took over the sake brewery that they had on Queen and the Fuji Sake; the Government took it over – [the one on] Halekauwila between Koula and Cooke Street. We had a lot of the people relocated too; we had to go to relocation camp…. Like the fisherman, they think they were spies. Some of them, they were called in and they had to relocate. The principals of the Japanese Schools, some of the teachers, not all of them, some of them. And they were even going to take one of my brothers, but because he was going to be one of the church helper, the Methodist Church helper, he didn't have to go. We were fortunate. Can't forget the big gas mask; during the alert we had to carry it all the way to Queen Street [Jean].

You had to take it [the mask] to school, on the bus [Alice].

My mother and her group of Japanese people were at that International Theater getting their diploma [on December 7, 1941] [Jean].

There was a Shuman Carriage warehouse and the military took over that…because wartime, we needed medical store and the brewery -- they had refrigeration [Alice].

We used to, what we call, spark moon. This was during World War II; they put in bomb shelters in the park and soldiers used to take their girlfriends in the park or down in the shelter to make out and so we used go watch they were doing. So that was what they called spark moon. I don't know why [Lorraine].

December 7th I was a seventh grader at Kamehameha Schools cleaning the outside the dining room, the area overlooking Pearl Harbor, Kalihi Valley and we saw the planes diving in and out and the smoke. So we stopped to watch and the art teacher came out of her room, which was at that end, and we said to her "What's happening Miss Chapin?" And she says "Oh

their probably having military maneuvers." So, OK. So we kept sweeping and then finally we went back to the dorm. And when we got back to the dorm we were called to the lounge area and they announced that Hawai'i was being bombed by the Japanese and we all screamed. And to tell you the truth, we didn't know what we were really screaming about, but as young girls we all screamed. And that's where we had the news so we had lights out and we had to stay overnight. In the meantime, what they did was, they took a long piece of plaster, that's what we used to cover our wounds, but these came in long strips. So they cut a thin strip off and they wrote our name, address, phone number, next of kin and put it over the left shoulder on our body. So in case we were separated or we got hurt anybody could remove part of our clothing and see who we were and who we belonged to. That was instant identification. But when I used to come home to Kaka'ako we had blackout -- first we used tar paper to cover the windows. And then we had to use black paint to cover all the windows for blackout as we called it. And there was a curfew. My brothers used to sneak out after curfew but there was curfew. And there were always, I remember, lines. Line to buy one pound of pork, line to buy one pound of meat, line to buy a bag of poi. My sister used to go to town and stand in line for Kleenex, or for shoes, or other kind of personal items – soap, perfume, or whatever, powder. Lines, just lines and lines and lines, which was part of life [Lorraine].

I know once in the Park during World War II they had a huge army base right by the incinerator, and it was all blacks, a whole contingent of blacks [Lorraine].

I have to tell you this because it's kind of interesting. All the Japanese had Japanese names. So I knew Fumie, I won't say her last name. Fumie and Ichiro, and what-not. Now we all go our separate ways to high school, they go to McKinley, I go to Kamehameha. And then later on in life we meet. So I say "Oh Hi Fumie." "Oh no, my name is Violet." Because during the war they were all forced to, I guess in their own way change their names and get English names. So by the time I came back all my friends had English names, which were, which was very -- I felt very sorry 'cause I loved the flow of the old names, and no more [Lorraine].

Those of us who were here in the early 40s before World War II, we claim that we're true Kaka'ako-ites because we feel that after World War II, the whole area changed. After World War II the mama-papa-san concept of life changed. I don't know how to explain it. New industries came in, people tended to not be as open as they used to be. Of course the geography changed. That is one of the regrets I have, that I didn't take pictures of this camp, Ilalo Street Camp before it was razed. And what looked to us like huge play areas, were just small little plots [Lorraine].

We always had to go to sleep by this whistle that would blow over here at 8 o'clock at night and that curfew was because of the War. And the War was over in the 40s -- it was over before I was born, but it still seemed to guide our lives [Kanoe].

Water Resources & Uses

The Hawaiian word for fresh water is *wai;* the Hawaiian word for wealth is *wai wai.* This is because of the value the ancient Hawaiians placed on fresh water, which was crucial for growing taro, the staple of the Hawaiian people. Fresh water was also crucial in the lifecycle of stream inhabitants such as the *`o`opu* and *`opae*, as well as some of the marine life that depended on the benefits of brackish water areas. Fresh water was valuable in other ways such as natural springs, artesian wells and streams.

[Water] just came out of the pipe. The only thing I remember that Mom used to put that Bull Durham bag and used to be filled. It's a cloth bag that was filled with tobacco. You used to roll your own cigarettes; she used to tie it on the facet. And after a few weeks, the thing turned brown. Had a lot of rubbish in that...amazing Neal].

You know the Ward Estate used to be all fenced in where the arena is. We use to go in there and play, they had stream... we use to go in there and they use to chase us out all the time. [Joe].

Our water came from an Artesian well and in fact the water was so cold that our pipes use to frost. You know on warm weather days, the water, I never drank ice water. My uncle them always drank ice water but we always drank out of the tap. It was cold, cold water... [It was located] where we live, in that area, but they disconnected it and we're so, I don't know how long. I think my cousin Kanoe would know that--when they disconnected the connection to the Artesian well [Joe].

You're familiar with Kawaiahao Church...they have that artesian well over there [Kanoe].

In this area over here...we're on artesian wells...it was in this area, but 'cause the well was actually across the street and around in this area we had access to it too. But what they did was they came and paved over everything so we couldn't have access anymore. 'Cause before it was just -- we always had fresh water. We get cold water right under us... the water over here was really good. So I was thinking, Gee you're gonna go all the way up to the sea water, and over here got ice water right under us, but who knows what kind of stuff is under now.... But there's a lot of here because in front of the Board of Water Supply, which is right up over here, that's an artesian well that the pumping keeps coming out of. Every time I drive past I go Huh, wasting that artesian water, you know they keep doing that. This whole area was water; that's why we were here, you know [Kanoe].

[Drainage canal] there's the one goes into Kewalo Basin is through the Ward Street property. You know where the Blaisedell Center is? OK, that water is all underground. That source of water is still running and when you get a storm you see it boil out of the pipe down there, they have it all covered over. They had several, not only one [stream]. 'cause there's one more down I think by Honolulu Harbor, one more boils out to harbor, the pier going right out there. But I don't know the name of the stream. There's one from the spring in there at the Blaisdell Center [Uncle Buzzy].

Figure 35. Drainage Canal Ewa of the Park.

That's the wastewater pump, the new one. That's the one that goes out at Sand Island. But this is the old one here. So some days you come here when it's raining, and the water is backed up in the pipes, you get the sewage and it stinks up the whole place [Uncle Buzzy].

Marine Resources & Use

The sea is a great resource for people with access to its bounty. The residents of Kaka`ako sometimes took advantage of this resource, although probably not as much as pre-contact Hawaiians may have.

Fishing Practices

They were Hawaiian Fishermen; they were all working together and they would learn how to fish Hawaiian style--that was Hawaiian Fishermen. You didn't have to be a Hawaiian to be a Hawaiian fisherman. Just to add this note in because my father's crew was made up of all kind. My uncle's ship, I thought that was my uncle but he wasn't my uncle, he was Japanese. They were all Filipino and Japanese and then my Uncle Sammy was Chinese but they were all good fishermen. And they learned Hawaiian ways of fishing--so very *pili* everybody [Poni].

Kaka`ako would be the hangout or the place most of the fishermens would have come out of and then going to many parts...Nanakuli, Waianae, Waimanalo [Poni].

[The tako were] big, big and we had to clean it, a lot. And he used to make his own nets too. You know throw nets, he used to make his own. So he must have learned that from the Hawaiians in the community. I don't know if he did 'cause he's gone now. 'Cause my dad didn't know how to do that. He used to go out and throw net. I remember manini's, I remember red fish, menpache. What else did he catch? We're not fish eaters. We like aku fillet. My mom ate the head, the bones and all that. We only ate the fillet; she only gave us the fillet. I also remember times when we would have squid (*ika*). My brothers would catch it, bring it home and she would sugar shoyu it and it would even have some eggs in it. And that I used to love that [Jean].

We used to go down Ala Moana-Kewalo Basin sometime. Actually my grandfather was a fisherman; the base was in Kewalo Basin but they used to go out, just outside of Honolulu. I think he was on a two-man Sampan. They used to, all hand line yah. I see a lot of red fishes, but at that time we didn't know what kind of fish was that -- *menpachi*, *onaga* or whatever, you know. So long I can't remember [Roy].

We used to go spearing and fishing at Kewalo Basin and Ala Moana Park, all that area. So Kakaako was a very good place to grow up. Oh, we used to catch all kind, like *manini, menpachi* (that's the red), what do you call those stick fish...the bonefish, *kumu*, and *hinalea* and *oama, papio* too [Neal]

There was always fish that we could run down or limu that we could, augment. Reef fish, mostly different kinds of *manini*, and *weke*, I forget all the names. Not big fish, you know, all small reef fishes...we used to get *opelu*. Probably *aweoweo* too, but a lot of small fish. We had crab, raw and cooked crab...*a'ama* and other one, *alamihi* and Samoan or blue crab, they used to go crabbing and get for us to eat. Out here was lot of what we call mixed *limu amanawea* was one of the favorite. And then sometimes we had, further down, we used to get *limu 'ele 'ele*, the black, sometimes the green. And then we had, what are the names, *amananwea*, the one that's really very strong scented, small – not too much *limu kohu* out here. *Amanawea* and *ogo*, a lot of *ogo* out here. There's some other kind. We didn't see any *honu*. Maybe they did, but it was not a big thing. We never talked about the *honu* or anything. We got from my uncle, but it wasn't from here, it was from some other place. He would cook it, but he liked where the paws were, kinda green but it's supposed to have been fatty. No wonder he had gout, my poor uncle. He loved those things. I know we had sharks, but squid, a lot of squid out there -- we had raw and cooked, boiled, or my mother made raw [Lorraine].

We went fishing many times. In fact, you come over here and fish if you like; the *halalū* was running and the *aneu*. They were plenty down that end. But you know what comes in when get plenty of the *halalū*, is the barracudas that come in too, the *kākū*. Oh, they're mean. Between that and shark, I would rather run into a shark than one barracuda. The shark, they sensitive but the barracuda, they false crackers [Poni].

Figure 36. People still fish at Ka`akako Beach Park.

This is when you could watch the sharks come in and you would actually swim. They would ride surfs in like that and they would come right into the channel that's how they would come into the channel. And then they would come all the way in here and go around and just go in between all the ships and they were just scavengers looking for food. They would come over here but this is the part, on this side of it. This side was more and it ended right where John Dominis restaurant is. It ended right there because get one landfill over there. The water went in more this way and there were channels and these sharks would go underneath. And underneath were like Coral Sea caves and they would come out on the Ewa side. But I think with all this landfill they really went right down into it. So when we swam in here, we swam back and forth across the channel without regards of these *manō*'s. And even after we found out, there's a little pier thing over there [Poni].

Gathering Practices

Of course if the *limu ele'ele* is there, you know the spring waters are there and the *hehemanus*. So the fishermen always knew where they could find water to drink, drinking water [Poni].

You know further down, the *limu* started off right in the Iwilei area. That was the best *limu* area picking, right over here in Kaka`ako was very good limu, all the different varieties. According to my grandpa and father and even seeing it as a little child before they started building Ala Moana Center and Magic Island, the old Ala Moana, the old Kaka`ako. Beyond this point it was all reefs, there's nothing else beyond this point. Of course the rubbish place was there too and the pumping stations. That was all Fort Armstrong. Behind was just; it was just Coral Flats. And then you come back into your major harbors again like Honolulu Harbor. So this is your basin, then Honolulu would be your other basin and in between was all these little holes and these little groves. And then you would come back again where Honolulu Basin is turning up toward Iwilei, where the Salvation Army and K-Mart...all that was flats. All the way up to Salvation Army, all the way up to where K-Mart, all that area was all flats. I gave a picture of that to the Pacific Club in a grab bag gift. I had a picture of Iwilei with women picking *limu* [Poni].

I know Ala Moana, we used pick up *ogo* a lot and we had several parts of Kaka`ako had *limu'ele'ele*, especially where the spring waters were. You had most of your varieties. In those days, you had mostly all the varieties; *kohu, lehoa* [*lipoa?*]. You know you had all your varieties [Poni].

We used to go to Waikiki for the *limu kohu* but, we never [went to Kaka`ako area] 'cause you know that area was usually -- because of the tugboats and the fishing boats. When you went by because they had the icehouse down there, we use to go down there to get the ice for our parties and we use to go with my uncles, but all you smelt was fish over there. So if we wanted *limu*, my aunty would take us to Waikiki to get the *kohu*. That was nice, the smell of *limu kohu*; that's how we could tell -- as children we knew in Waikiki crossing, getting into the area because of the smell. We use to say ahhhhh. So we knew we were getting close. But no *limu* in Kakaako, because to me was too dirty, in that area. They didn't care about oil coming out of the boats and I remember if we went crabbing we were told cannot crab over there -- we'd go up to Kuapa Pond, Hawaii Kai or Ala Wai. Ala Wai was considered alright back then. I don't know why. You know to me that was worse than finding *tobao*. But yah, crabbing was we'd go out to Kuapa Pond, the best place. That was before it was called Hawaii Kai [Joe].

We used to go surfing right outside Gold Bond Building in the back, all the way down to the ocean. And they had good *limu, ogo* out there and what was good about those days; you just pick the amount that you want. And they tell us how to pick it; you don't pull it by the roots. You just pick the tops; you take the tops of it and put it in your bag so that you don't confuse. So, we always grew up with lots of limu. But they covered it all up; it's all waste fields now. But they are some surfers out there. I don't think you can find limu anymore out there [Neal].

My brothers, they used to; they would go to Kewalo Basin hang pole fishing…those small fish manini, but we did a lot of swimming that's for sure . And that brother that's gone now was a terrific tako fisherman. They would go out to Kewalo Basin and always come back with tako; they used to know all the holes [Alice].

I remember people bringing crab over and she [mother] would cook it and we would sit around on the big round table and everybody would eat -- regular crab. Sometimes you'll find the Samoan in there. You get it all at the beach by the stone wall. Stone Wall (Point Panic) is where Kakaako Park is [Jean].

I did do a little picking of *opihi* on the rocks, get rocks out there, but now it's all scaled clean, you know, so many people go. Some people go you know, they go out and pick. Oh shucks, it doesn't have a chance. They pick it when it's the size of a ten cent piece. We let it grow so it can reproduce more, then we had more; but when they pick 'em when they're babies and not ready to reproduce, oh shucks. And there's no control, never have been because of the State's kind of belief that now they've taken over, everybody has access, it's a public product. So, there's no real limit on bag limit,

Figure 37. Only a few *pipipi* left on rocks.

season, you know. Just go out and catch anything you want. So it's not that old system where you went when there was a season and everyone agreed this is the time to take the food. Because they had to live that way because when you did it wrong they was two thousand miles away, there wasn't any more food [Uncle Buzzy].

We used to go poke for *tako* at Ala Moana, the reef Ala Moana Park. [Neal]

[Off of where Kaka'ako Park is now…] we would catch what we call *gori*, small little fish and we would go get *limu* and crab, and that's where we all learned to surf, out there. And we learned the names of fishes and we went across picked the *lole* and *opihi* and lot of *pipipi*, and *ha'uke'uke*, lots of things we could get. Ha'uke'uke is flat, it's like *wana*. *Wana* has -- it's like with long thorns. We have another one called *kawai'i*, which is bigger but it has short thorns and it doesn't stick into people, but it's the same. Then we have another one that is flat, with huge round quills that go out to the side, and the *ha'uke'uke* -- it has these quills on the side like that. And what we do is we smash it and use the sauce inside mixed with fish and whatever. And then the lole -- sea cucumber -- the Japanese had a certain way. My mother didn't really like it because she didn't really eat it. But the lady next door would go catch it and she liked to just cut it up, slice it and eat it [Lorraine].

Reefs, Lagoons, Ponds

Where John Dominis is, all over there was lagoons and ponds and it's an inlets and coves all over there. They went throw all that, all the left over [dredging]. Left over of what they went go drag down to Ala Moana Center. This was a major basin area, this was major but all the rest was all flat, coral flats. It went all the way up that's why you drive to Ward Avenue and all over there, it's all coral flats. That's why my grandpa was on sand. Everybody that lived in that area was on sand [Poni].

Where Gold Bond Building, all the way to Fort Armstrong was beach, sand, and coconut trees. Families would go down there, pavilion little places they would go [Poni].

Right underneath here by Point Panic, stay right under here at the end of Kewalo there's an under reef. So a lot of people get drowned over here and you don't find the body, you have to dive under and go into the reef. They'd be lodged themselves, they can't go up anymore [Poni].

Figure 38. Old Sampan still in use.

Figure 39. View of Kewalo Basin.

Kewalo Boat Harbor Site Visit

These were all assigned berths; you don't have a berth, you can't come in. [My berth was] down here, I can show you. We get some sampan-style boats out there, but they're all synthetic fiber. Sampans are quasi-glass bar. We had this berth right here in this corner, for one boat. Over here was [my business], but I gave that up too. I used to run a third business.... So, in here I took over when they closed the tenant. I got all the tuna boats, twelve of them, like the tuna guy, operating out of here. Then when the tuna industry finished, it dried up, the aku -- we switched into other fish, into ahi, now they process fish. So I turned it over to them, but I can't do the job, it's too hard -- in the big building in the back there. And now they're putting all new reefers, full of reefers, all full of fish. They distribute in the mornings, during the day it's down time, you go and sleep, you get up midnight and you go hear the auction.... When I ran the boats, I ran all the way up the northwestern islands and brought the fish back here, called the dealers, select what you like, and take it out of the boat, put 'em in your trap, in your cans, and you take it and you process it. Takes a little over three days [to sail up to the Northwestern Islands and fish] maybe a week, but I used airplanes too, I bought airplanes, I bought DC3s. I bought all the equipment because it was cheap, and that was right after the war. They had so many airplanes they didn't know what to do with. So they were chopping them up for scrap and I was buying 'em for a scrap price, and they could fly. When I got out of the army I didn't go back to college, I had gone to Redlands and I took my GI Bill of Rights for education and became a pilot. I went to pilot flying school. So, we used to fly fish from the leeward islands. 'Cause they had built during the war emergency air fields down there to fight the Japanese. And I was able to lease the islands and do my thing. Now this is all national marine fisheries, Federal. This is the fish net repair house; the big nets gotta go in there and stretch 'em out, fix 'em, actually repair 'em. That's relatively new; within the last ten years. But you know, this is a popular place because look at the, the amount of people that live around here. This is big and heavy and used every day up to the hilt. Thousands of people coming in and out of here, surfing a lot of the time, fishing, and swimming, and you name it. This is the last of the old fleet that we used to operate, the Kulakai, hundred foot Japanese style sampan -- kind of graceful lines. They were made here by Japanese from Japan -- those that had the eye to build up by blueprint, but by line of sight, all in the head [Uncle Buzzy].

Swimming, Surfing and other Activities.

In fact we learned to swim at Kewalo. We were tossed. My mom used to say, yah tutu and papa tossed us off with a big towrope and the rope was so heavy, we almost drowned [Joe].

You know the streets between Ala Moana and back in there with Andy Anderson's operation, that whole area was chop suey. And they cleaned it up and you don't see too many people down there in that area. You can't swim in that area very well, you can't surf very well. At the Kewalo Bay, I did quite a bit surfing...[Lex].

Figure 40. People swim off Kaka`ako Park.

And there was a lot of bartering of business. Fishermen would go out to sea and come back in and bring fish and those of us who didn't fish would maybe give them saloon pilot crackers or if we had extra rice, you know, for the fish. Good bartering system. [It was] rocky with a little sand -- just rock and a little sand. And there was a stone wall that jutted into the ocean, so you could go along on the stone wall, and it even extended along the beach, for a long ways. And from there on you can jump into the sea, or crawl down, then go surfing out. And I guess the boys would remember the surfing names of long ago, I certainly don't remember them [Lorraine].

When I was in boarding school...see for 5 years, 7 years, 6 years others were still going around and they would know all the places. My brothers used to go when the Lurline used to come in, and go dive for money. They'd be coming out through the channel there, and they'd go there and dive for coins that the tourists would throw [Lorraine].

Figure 41. Parasailing off of Kaka`ako Park.

CULTURAL RESOURCES & PRACTICES

This category represents traditional Hawaiian cultural resources and practices and other ethnic resources and practices. The traditional Hawaiian cultural resources and practices, includes the pre-contact era, as well as cultural practices after contact. Cultural Resources can be the traditional *wahi pana* or sacred places, any cultural gathering place, or the tangible remains of the ancient past. One of the most significant traditional Hawaiian cultural resources is the *heiau* or places of worship. Other places of great significance for all cultures are the burial places of loved ones. Unfortunately with the massive transformation of the landscape as a result of the many western industries [i.e., provisioning, sandalwood, sugar, pineapple, tourism, urban development] coupled with the secretive nature of ancient burial practices, most of the ancient burial places are unknown or forgotten and are easily disrupted and disturbed by subsurface activity. However, one consultant in particular was raised in a relatively traditional manner and learned many unique things about Kaka`ako and vicinity.

Sacred Kaka`ako

Kaka`ako was very special. We were taught very ancient things, very old Hawaiian things of respect for the sea and we would dive off Kewalo basin and swim in the channel.... This is where they were in. Like the old section would be this pier right here and the new section would [be] where that landfill [is]. So, you take away Point Panic, John Dominis Restaurant, you take all that away, then you would have the lagoon. But if you go behind this Honolulu Marine and Kewalo Shipyard you going see the inwards part of it. And they had ponds -- they had fresh water ponds, because over there where the City and County has their building by Koula Street is a pond; you're going to see the *ali`i* coconut trees, the *niu*. You can see it today too; we passed it right over there. But it's all enclosed, and if you go in there, it's a pond. They went fill it all up. That's too bad. In those days when they were building things, they would fill up natural spring ponds. Actually, that was a *kapu* place over there...that's where they would prepare for the sacrifice. That was a *kapu* place by Koula. I bet they get some writings about it, about Koula, 'cause its so close to Coral Street anyway, Koula. It was a sanctuary. The sanctuary was the pond, the pond was the sacred. The *wahī pana* surrounded by *ali`i* coconuts. And that's where they would prepare, but you couldn't shed blood on the *heiau*. So they went through this *ia`u moe* or *moe...kai kai moe*....you know to flick or *wai moe*, to drown, you know to put them in there and they sleep. And then they took them up and they had the whole thing on the Pu`uowāina; the *heiau* was up actually... [Poni].

They were many super natural things that were on that property [Ward Estate]. There were several things and Aunty [I`olani] understood and she could see it. Mo'owahine ...kanakas would come out of nowhere and bring food [Poni].

Sacred Triangle

When you look at the Palace and you look at where it's at in Pu`uowaina and the neighboring Pohukaina, you're going to have to make sure that to Moanalua Valley all the way to Manoa Valley, from Manoa to Moanalua are the sacred hills. From those hills down to the ocean, that's your sacred grounds. From Manoa to Moanalua and within that vicinity you find the most sacred sites. I mean the most sacred of things. Most of them, you don't know where it is. [Merchant Street, Bishop Street, and Alakea Street] they were all the coral flats. Alakea was totally coral out but they were all in the vicinity of the Palace. Before it was all going into downtown Honolulu, they were already designated from Kamehameha's time. 'Cause wherever the Ali'is stepped and walked those were the sacred grounds.... So what we did; we forgot the sacred nest. If it was still a Kingdom it would be like this; they would be very modern, they would be living in very modern homes.... I think they would designate certain places and make it known as sacred sites. They would make sure the Four Corners were kept sacred and then these places would be places of protocol. Yes, they would save this place -- the corals and areas, I believe if it was still in the Kingdoms, the beaches would still be there.... In the conducting of business and other things, would be more in areas that would be on the outskirts. So you would probably find the city not in the City of Honolulu but on the outskirts where you would have all those other things. Within the Palace area it would totally be your Palace...and they would take it from Manoa up to Moanalua, they would keep that area. So that would be a very exclusive area, more park area; you would find the big parks and much more space. And then on the outskirts you would find cities. I think that's what would have happened [Poni]..

Kaka`ako Burials

You know they had buried on the side of their house...you know you're going to find remains [Poni].

There are burials right under this road. This is an encroachment on Kawaiahao's, this here, where they stuck this road in they didn't bother to fool with the burials [Queen Street] and nobody complained and they just went right over it [Uncle Buzzy].

Kawaiahao Cemetery came all the way down, where they had that major burial from the epidemic, the flu. They buried them all is this massive grave area...**b**efore the nineteen hundreds, the first one. And then there was a second one that came, but prior to nineteen hundred never had ____. So what happened was that when they started to build the streets, it went right over all these graves...from Queen Street all the down to the ocean. Halekauwila Street, we had a *hale ipo* on Halekauwila Street in the seventies before I left home [Poni].

[For burials] they should find a proper place. See, my mama felt, you know when you deal with progress, when these people laid at that place, it was an area that was apparently available. But because with progress, we are now invading all these areas that were once considered sacred or not necessary sacred but they became blessed however that person was interred. You know, it actually became a sacred area because of that particular burial. But because of progress, that's why she was called to that one site, that one, this one haole boy who found the bones who came upon it with his backhoe. He is afraid of ramifications to him and his family. My mother said no. She said it's not your fault. She says, this is all part of what you've been given as work to do and it's not your fault that this happened...so that's why I'm here to take care of whatever it is that may come from the disturbance. But that's all part of progress and she looked at it where, if the remains can be taken care of and they treated with respect and put into an area that is, so that the bones or remains she said -- because the soul has already gone to heaven -- what remains is what goes back to earth. So if it's taken and placed into an area where that the remains can be peacefully laid to rest for the rest of time, then fine. And she said that's all part of progress. And as long as they do it mindfully of that you know, she had no qualms about that occurring, she said because she went through many changes in that area from the time she was born. So I think the only reason why she was called because that area was looking for a Kahu that came from that area. So, that's why she was called. If they did find anything more, they didn't call her [Joe].

Kaka`ako Kahuna

Kaka`ako had so much *kahuna* living in homes that were just put together maybe with just boards and tin roofs and it looked very humble the way they lived. But they were these people. They practiced it, it was totally living in their time and that's how they could live the way they lived. They were there...they were behind walls like this.... Now they were certain kū`ahu's that was throughout the Kaka`ako area that was in designated area. Not only did Keahi them know about it, Aunty I`o knew about it. But the next generation, no. *Malia kau* was one of the last ceremonies that they were going to do for certain City and County and Territorial purposes, were all done at the house in Kaka`ako. It was always done at someone's house. Preparing the feast and the things that were needed for certain protocol and certain events that were going to come up. Dedication of different parks, they needed, if they did Kaka`ako again, they would meet and deposit all their greenery and left over foods and things right here at this point, right off Kaka`ako. They would deposit at P_____ [Poni].

Kaka`ako Menehune & Pohukaina Legend

Well, my father would tell us, we lived next to a Menehune family. I used to think they were just short or midgets. But he actually would say no, they were like regular people, they were just small. But they conducted things at unusual times. So there was one time when they

were going to watch, he was just a teenager. So by Pohukaina School they went hide to wait when the Menehune family was going come home. So they waited and waited and saw them and started chasing them. They chased them all around and all of a sudden they just disappeared. And that's when they went back and said they saw the Menehune's but they just kept to themselves. My father said; you better stop and leave them alone or you going end up chasing them down one road that you won't come back out from. So they never bothered. But when he told me that Menehune story, Rose Alii told me that same Menehune story. She even mentioned the same place by Po`kaina -- now Pohukaina, like Kaka`ako I don't know exactly how or what but it would consist of the Palace grounds, Kawaiahao Church and it's actually part of a larger triangle. Remember I was telling you from Kualoa to Makapuu, you come down Makapu`u to Kualoa, straight across those mountains heading towards the west side Makua, come straight back down to the Palace. And then Makapu`u to the Palace, you have this. So it's like this -- the imaginary triangle and then the Palace is a part of that southwest, looking south of the triangle. So it's pointing like this, south, cause it goes like that and comes back. And it's told about the place where Pohukaina being that, underneath is where you would go in times of friction. You would take to the crevice of the mountain or you would take to the underground and there's a cavern and that's where you would find your food and everything. The escape route was under the Barracks; I mean the Palace Barracks for the King. It was right into the lava tube. That lava tube was one of the main lava tubes that ended up becoming what is Pu'uowaina. So when you're looking at these reef lava tubes, they all have connections. So those are one of the neatest legends about Kaka`ako was the Pohukaina legend of what was there and cannot be seen. And certain times you see it and there was a tree by Pohukaina School that used to take the images of faces. I heard that from so many different stories. The tree is not there, it was cut down and I heard that back in the eighties or nineties when they cut it down, they had to do it because it was something to do with it being evil. There was somebody that was obsessed with it and that person that was obsessed with it actually came and told me. You know he was so obsessed with it, I don't know what happened to that guy right now but he was just off the wall. I knew him but I was also wondering what; at one time they're okay and all of a sudden their mind is somewhere else. Well, he would go to this tree and he would say this tree by Pohukaina -- now that tree has been there by Pohukaina when the old school was there. But the story about that tree goes back to the time of my father, even before that. But that Banyan tree was there. I go there and I pick things. This guy would gather throughout the city and I would do the same thing. But when I would gather, I would ask within myself I would ask, Tutu can we gather? I would ask and I would be okay. A lot of times, even Violet Makua would tell me, (because she would be a Security Guard for the Palace area and the State and all that) you better watch out what you go pick up around here. You know what this is? Your mother must have told you. This is Pohukaina, you know this? And I would turn around and go, yah little bit. You would even be walking down and all of a sudden you're going to end up somewhere else. So, that's primarily within that, you can cross over or you could just go to, or something there would make you enter it. Aunty Miriam would tell me its *kapua*.

Kapua means they will open up around, something will open up. I used to tell you the story, remember the story like Brigadoon? Oh, then you go down to this place that was there for three hundred years and it's still the same. Those kinds of stuff, so with the Menehune my father would say, leave them alone, leave them alone. You might chase them and they're going to let you chase them and you're going to end up where they came from. The Menehune's are with us till this very day. And not only Hawaiian's tell the story, everybody tells the story. That's why when Leiolani Pratt, Leiolani Pratt was the one that went validate the story of the Menehune too and I sat with her and talked with her and she looked at me and she said, do you understand what I'm saying? I said, Leiolani of course. You're a Kahu, you took over your grandma's profession to nurture people and comfort them and to do your grandmas works. She was also a healer and a medicine lady from Big Island from the Hilo area. So I said, I know what you're talking about. And she said, sometimes it's hard for people. I said, these are the *mo'olelo* we have to pass on, not the ones in books. It's these simple ones, there were just like, everyday like us. It was just that they were just from the past. They could be from the future and they could be from our time. They go in and out of all those times. Pohukaina is another dimension [Poni].

Wind & Sea of Kaka`ako

Now if you were just right on this side, this is Kewalo still yet, so we're going to take one step over. If you go Kaka`ako, 'cause Kewalo is in Kaka`ako, right over to that end where Honolulu Harbor around that and what is the name of the wind that is going to be there? The name of the wind is Kū'kalahale. Mamala is the seas of Kaka`ako. It was also known as Nihoa; to me during the time of Ka'ahumanu and Kou -- Honolulu being what it is now, Mamala ko Nihoa, Aloha, Nihoa E'kekahi Eha'eha (chanting), but that was when Ka'ahumanu was still here. The island Nihoa also the same name; we always going get one twin to every name in Hawaiian [Poni].

Shark Legend of Kaka`ako

What was the other legend of Kaka`ako? The shark one, my father just said that the Tutu man just placed him on the back of a shark, the shark brought him back around the cove and brought him back and told him to go *hele* back. But he was going to be there for a little while so my father didn't see the Tutu until the next morning. That's when my Grandpa was *huhū* at my father for doing that. He doesn't know, but I feel that I think when he sent me back as a little boy on the back of the *manō*, just tell the *manō* come in a little bit and then he was going to go back home. He himself went into becoming a *manō* and that's what Mailekini. I just remembered he must have just come and went swimming around. They were many people that did that in those days, Kaka`ako people. All generations, all ethnic groups--Japanese, Filipino. Many of them knew about these sharks and many of them would talk to them and the sharks

would come and talk to them. Some of the Japanese fisherman would say, don't eat the fish over there, I want to catch that fish. And they would just stare and look back at them. My father would say, yah that dumb ____ -- don't go catch that one over there, I need that for me, talking to the *manō* and the *manō* looked at him and said; yes I'm going to bring you. I bring you sushi. And the *manō* just goes right under and don't bother with the fish. They pick it up, up to Natsunoya Tea House, Alewa Heights -- that Tea House is still there. My father them had their boat parties up there. He never forgot, he grabbed everything they have and come back here to the ship and put it right inside here for the sharks. He never forgot. He brought them miso, tofu and all kinds of Japanese food [Poni].

Chief Kewalo

Chief Kewalo became a Pueo so he could come back and watch over the people; ahupua'a. And he told them to become good and to be constructive and to do things and to take care of your land and fishponds over here--because they were fishponds. They were all in this area. All over here, all the way down to the Airport, all the way down to Ewa were fishponds. It was so convenient because your reef volcano came up and added these coral inlets. So it was convenient to have, it was all naturally made. All you had to do was go _____ and it was already there. Keep up all of that and the people will eat, the people will have food. From the mountain to the sea Kewalo worked also in building. He was a good Chief; he was a very fashionable Chief so he took it that everyone that lived in his time was going make sure that everyone was going to be that. And everyone was that. So they were very, very *pono*, they were righteous people. And so they reap in the blessings of the righteous people. And they all lived very wealthy and very happy. From Waikiki and this whole area [Kewalo-Kaka`ako], they were like community of Chiefs, they would gather together and discuss and go back to their own *ahupua'a* [Poni]

Meaning of Kaka`ako

There are so many meanings, I don't know what the dictionary has. What Aunty Bertie had shared with me was it had to do with a shining. Something of a shining. Now Pauoa had to do...in the dictionary it said something to the fact that Pauoa was a fish. But according to Aunty Hale and others, especially the old people, Pauoa was a birthplace for the prism, within the crystal. So I realized Pauoa was a birthplace of the rainbow, the portal of this place. Now Pauoa, they went into the fish, they said it's a fish. Everyone was wondering what kind of a fish is a Pauoa fish. The Pauoa fish is an *o'opu* and what is an *o'opu*? It's a rainbow fish. So the *kaona* was so big that you would not have a clue about it being the birthplace of rainbow. And so the story is told; Kaka`ako is like the shining. It's so funny because you would feel like, where would you find the holy of holy or the scared of scared within the filth of the city. Where else would it be. It doesn't need to be where it's righteous. So when it was righteous it was there and then it became. Repetitious the history went, in and out, in and out in and out. But it still stays. So they would say *'ākoʻakoʻa*, to take in. That's what they were telling about, it was just a place that you could become .... I would say okay, so it's a place where you can become anything you want. So I guess that's what it is now, the business center. Do you want to become a business or you wanted to become something and everything just took place from here. It was like the center of Pohukaina or the piko, the *'ako*. But interesting because I don't see that. That's not what it means in place names. But that was interesting when she said that and broke off the word. Aunty Bertie kept on having me understand *'ākoʻakoʻa*. "You remember *'ako*" and I would say okay. You know what Aunty Bertie would do? She would write all my lessons on notepapers and when I would come, she would have it dated, written out and what we are going to cover. And I have that till this day, I have all her writings. They were four of us that went to her, not at the same time. All different and I don't know what everybody else is doing. I know who they are, but I don't know really what they are all doing. But she was from Kakaʻako, my parents was in Kakaʻako but she was a historian. And she also worked for Pan Pacific. Whenever the dignitaries would come in, the government officials would have her make the arrangements for the Maharaja and whoever--the President, Kings and Royal people that were coming in from all over the world. Aunty Bertie was the Executive Secretary for the Pan Pacific [Poni].

Kakaʻako Chants

There are chants for Kakaʻako. There's one for Koula that is poni moi chant. All the *poni mōi* chants were all the chants for the Royal families. That was all the chants that were chanted in the Royal area and all the chants that were recorded at the time of Kalākaua all became chants that were related to Kakaʻako. So primarily your entire *hula poni mōī* was basic to all your Kakaʻako chants. You actually can find that in the archives, because that's when Kalākaua divided the *hula* which was called *Hula Poni Mōī*, in the celebration of the King that crowned himself. And all the chants finally were taught when they came to the Palace grounds in Pohukaina and to this area. The chants were in regards to where the King was. No matter if they were coming from the Neighbor Island or whatever. Or even if the chant was regarded for a place in the Neighbor Island, the place became this place. When they did the *haku mele*, the *haku mele* became theirs. All the chants became Kakaʻako's. The chant became the Kings; the chant became a place where the King's island. So that was no longer a chant. That's why many of the chants, when you listen to them, giving the time of the different Royal families, all these chants was the same chants as you would do for many years. But then you have to look at the chant again very carefully because then there will be a part of the chant that's going to mention a place. And when you see that place, you'll say ah, this chant is for this place. It's like *Lili'ue no ho nani mai*. Before there was *Lili'ue* it was *Kina'ue*, so it was Na'us chant before it was Lili'ues chant, same thing. So same thing with the *mele*'s, the King. Then you would have private *mele*'s for Kakaʻako describing different things. The birth chant for Renown, Keahi's son

mentions Ilaniwai and Kakaʻako in the chant. It's a name chant. I can share that with you, I have it at home where it talks of Ilaniwai and Kakaʻako [Poni].

Japanese Culture

We had mixed culture. Now, the Japanese culture was very strong in our camp because they practiced their cultural things more than any other race. For example, every night they prayed to Buddha, because they had their temples or their shrines in the house. So we used to go with the kids and say "*Na a mi da Buddha*," you know, chanting with them, although we didn't know we were doing. They also had the *furo*, the outdoor bath. But I was one of the few commoners that was allowed in the *furo* bath. But that was because I helped the young girls make the fire for the bath. And we were always the last. 'Cause see, the Japanese men go first, and then like the older son, and then maybe the mother and young kids were last with the *furo*, but we were allowed. So they always had the *furo*. The Japanese always had in our camp a pail of water outside their front door. So before you go in the house, you step in the bucket and wash your feet, and then rub it off, and then go in the house. And then they also, when their kids got naughty, they gave them *yaito*, and *yaito* was this little incense stick you know that you see at funerals, but this was a long one and it has a smell, but they burn the end. And what they used to do if the kid was naughty, one of the clans used to burn the kids with *yaito*, seems crude but they shaped up [Lorraine].

Boy's Day Fest

I have seen almost everything 'cause Kewalo Basin in those days on what they call Boy's Day, you would have all the sampan's lined up on the bulkhead along Ala Moana Boulevard. All bows in, sterns out, with the anchor off the stern, the bow fastened to a bullhead on the pier. And it would all nested, side by side. And on Boy's Day, what shall I say, festival days for Japanese who were largely the most fisherman, you would have all the Rising Sun flags, if you'd never seen them before in Hawai'i, that's where you saw the whole fleet with Rising Sun flags flying above them. It was a strange experience. And of course these were the vessels that were, what shall I say, seized or commandeered by the military that then sold them off to the general public at public auction where my father bought some of them. Those years, like during the war years and after the war started, they [Japanese fishermen] were not allowed to go at sea at all. They had to find new occupations ashore. It was all wrapped with misguided imagination that these men might become spies or do something that's not good for wartime activity [Uncle Buzzy].

Japanese Culture-Bon Festival

And of course Bon Festival, like they do now with the lanterns, the Japanese used to have what they call a *ken*. Whatever province they came from in Japan, the families from that area would celebrate with a picnic in this park. And it was a wide open picnic with lanterns and everything and it was an open affair where if you lived nearby, you were around the area, you just came and joined the picnic. And I remember they always had races, and even us outsiders could go racing. And they would always give us tablets or pencils for prizes. And they always had watermelon at the end. But then in the evening, Bon Festival, they would send out these orange crates with *mochi* inside and oranges and a lantern burning inside, and send it out to the sea for the missing fishermen. 'Cause lot of fishermen around here. And some of my brothers and his friends used to swim out in the dark and go get the food from some of these crates to eat. But, that was a Japanese custom which they used to have every year, which we all joined in [Lorraine].

Chinese Culture

The Chinese, there was only one Chinese family, and the grandmother had bound feet. And that's the only thing I can remember about the Chinese. I'm sure they practice some cultural things, but I don't remember any of it except the bound foot [Lorraine].

Hawaiian Culture-Ukulele

There was a Hawaiian man who always had the *ukulele*, so he would gather all the kids in the evening -- Bobby was his name -- and he would play and have us sing, and he would show us how to play. So he taught us the *ukulele*. So we all could strum and played simple notes. And, but he would always conduct the singing. Anybody who came out like from 6:30 to 8 o'clock, then 8 o'clock the siren would go off. That was curfew. So all the kids scurried off to bed. [Lorraine].

Hawaiian Culture-Akuele

All of those Japanese practices we kind of, because we were always playing with their kids, kind of followed along. I'm trying to think of any Hawaiian practices that...well, we used to talk about *kahuna*. And we used to -- well the Japanese also and the Hawaiians in the camp used to see the *akulele* flying, and if it would land on some, like it landed on, I remember as a child, somebody's roof. And they said somebody going to die. And sure enough the young baby in that home passed on, and because somebody saw the *akulele* land on their roof. But the Japanese fishermen used to come back in and tell us about seeing the *akulele* out at sea at night. [Lorraine]

Ghosts Droppings

One of things we always used to have, I remember, is ghosts. There were always supposed be ghosts around. [Personal experience] -- not until later. But we always used to see what they called ghost doo-doo. Its round like a small pancake like this, and it always was light brown in color, and kind of soft. And almost round. And we would see it outside the yard, and my mother would say, "Ah!" Something, something, she would say in Hawaiian and we'd go and cover it. But that's about the only thing I know. But of course -- I guess maybe we were too young, so she didn't want to explain. But she probably talked about it with all the other ladies in the camp [Lorraine].

Old Taro/Duck Ponds

That used to be all duck ponds, well taro patches first, then neglected, and water polluted, so the Chinese went into rice and put plenty ducks inside the pond to, I don't know maybe fertilize it, and raise ducks at the same time and recycle like they do in China. They built their lavatories right over the water and people go to the lavatory over the water, and then drops in the water, and then it causes the – what is it – kelp -- algae to grow and the fish eat it and then so the Chinese recycle the whole thing in that system. Kind of interesting but it's kind of messy. But that's how they have to live. So they brought that system over here and that was really a mess! It was – when the street car went through you had hold your nose because the duck droppings were so powerful in that water. So finally they decided OK we'll fill it in. Dillingham was smart. He got the land for almost nothing and chased all the Hawaiians out. And it was the same thing like Schofield Barracks, every place that Hawaiians were they, they were tied to the land but they didn't realize that you needed a piece paper like a deed for it. And, so when they tell 'em to move out, go find other places, there's plenty of land they can move. But they would lose their home site. And they never could get back [Uncle Buzzy].

Project Concerns, Thoughts and Questions

Change often meets with resistance, especially change of lifestyle brought about by outside entities. People who grew up on the lands often don't want to see it changed, especially if it provided resources, recreation and respite. They also understand that things don't stay the same, and change could occur with cultural sensitivity. The consultants shared their *mana`o* about the future of this area; some of their thoughts are stated below.

Well, I look at it [HSWAC] as a step in the right direction because...renewable energy. And we wouldn't be so stuck on [fossil fuel]. And for that reason, I think it's a great thing. And in a way, we're saving more land. I have positive feelings about it [Jean].

It seems like going into recycling right? We're getting the water that would be much cheaper I would think. This electric bill going so high and the oil going high. In that sense, I would think it would be a good contract [Alice].

Did they develop the financial well being, the profitability of this operation? Do they have any numbers public? What's the history of this operation? If they've been doing a good job, maybe they'll continue to do a good job. They haven't gone kaput yet? How large a company is it? Any idea? Another question is – How much demand will there be for this? What's the energy load? How much energy is needed in that area where this can help? It shouldn't be too hard to compete against Hawaiian Electric; air conditioning is expensive [Lex].

We're only about five feet above the water. You see, there's not much to work with there...they're going to be in water. I would guess that they're going to try to avoid going under any buildings. They would have to stay near the highways, the roads. You've got the City Hall there, then you have the Legislature. They take a lot of that space down that area. When you start getting into Punchbowl, of course, you're going to get into different soil conditions too, you're going to get into cinder around Punchbowl, which is easy to work.... When you go makai, there's somewhat of a drop in elevation. And when you get to King Street, King all the way out to the water, I think is only five feet, four feet [Lex].

I know as a Hawaiian I'm glad that they [HSWAC] utilizing our resources to work with the environment. Because that's basically what that's going to do, to make working environment easier or more comfortable because of the air cooling system. But as far as it impacting, I'm just concerned that, with the impact of the ocean, that's number one. Because it takes so long for any injury to the coral reef and all that to make itself good, to repair. And then of course the streets, you know we just have to be mindful that this is, I guess for the good of the people that work there and hopefully it doesn't impact the daily life too much. Cause it seems awfully huge those pipes and having to dig up quite a bit of the ground. As long as it doesn't, cause in our area or cause where we're at for the most part of my life--you know the Artesian well [Joe].

I really don't see an issue...they're using water for a whole lot of other things, from the ocean. As far as I, being an ordinary citizen living here, I cannot at the moment envision anything that may go wrong or have an impact on the environment in an negative way, 'cause I really don't understand it. I mean I've heard them say something about bringing in things from the deep. They're doing something, somewhere on another island, and –they were bringing up water from the deep and bringing it up in this state.... They know what they're doing. Now, if they were going to pump it up, and it's free in the air or something, that might be another story.... I guess this would be the best area, 'cause it's the closest to town [Lorraine]

The last one [big project] was with MK, Marson-Knudsen who did the sewer pipe from right here, the new sewer pipe is right here. But it goes on down to Honolulu Harbor, then it goes back from St. Mariner. It goes out a couple miles...to do one. Marson-Knudsen did that and I know some of the divers that worked on that; was dangerous and some got hurt underwater. It was something like this. When the huge pipes went down there – they're huge – the sewer pipes they're much bigger than 40 inches. They're about maybe five, sixteen guy I think. And they were inside the aperture. And when they had to line 'em up under water, the barges be floating on the surface, but the surge on the surface is powerful, but it's so very slight that these tons and tons of pipe that are in a sling that are being lined up to fit took divers to handle the hand. But if you put the hand on the face of the pipe and the surface water just moves slightly by swell, if your hand was on that hand between the two pipes it'll be crushed forever. So they got hurt like that, having to line it up so concisely and the surge of the ocean created dangerous conditions. This is within the last I think 7, 8 years now. Marson-Knudsen did all that work 'cause we had the outfall, it was right out here before. And the old pumping station is right up here, which is a national treasure, national something. You know they put 'em on a Register, the national something. It's right up here, I can show you it. Because her [his wife] godfather ran the pump. He was the engineer running that pump way back. So the outfall used to come right here. But in the Kona weather blowing Wai'anae side let's say, all of the overflow that came out of the sewer pipe, 'cause it was only a couple hundred feet offshore, was shallow, only 25 feet deep I think, and it would float back to Waikiki. You'd get all kinds of debris coming out of there, sanitary pads, you'd get condoms, you get human excrement, you know solid stuff, it floated back to Waikiki beach. So they figured out they'd put it out of Sand Island, route it over to Pearl Harbor way, it goes out, then it legs out, then it's out at least a mile or two, at least. So, the guys had to use hard hats to work, which is very cumbersome. And you know, they're not able to move fast in these surges of the barges -- holding the lines and pipes underneath steady, they were awful slow moving, but powerful and hard to stop. That was my brother-in-law Richard who married her sister [wife in back seat], he worked on that project, Marson-Knudsen. And then my diving fishing buddy he worked on that project and he got hurt. So today when you see him he's kinda crippled. Some guys who have a hard hat out here who lay the pipe. But this [HSWAC project] is similar, this is very similar [Uncle Buzzy].

Anecdotal Stories

Often consultants share stories are not necessarily pertinent to the project area, but never-the-less should be shared as well.

December 7, 1941 – A Personal Experience

The December the 7th attack occurred when I was in Kamehameha -- 17 years old. And I got to see the whole thing. So this Colonel Mahikoa, he was a colonel then at Kamehameha, he issues over the P.A. system in the campus: "All of the senior boys please report to the assembly hall." So we all mosey on down and we sit down and standing at the podium he says, very emphatically and officially he says: "Men, I don't have to tell you this is war and there's a bus outside the door that is gonna take you to enlist in the corps to help fight the enemy if they attempt to land in these islands." So all the 17 year olds, we all look at each other, we're not out of high school yet. We look at each other, who gonna be chicken and not go enroll. So we kinda all to the man 'cause I didn't look in the back of me and he's looking at the front. And right there had this damn Colonel. I walked up the aisle and right into the bus and others guys went. All our thoughts are "Oh my gosh, now what?" So, I was taken down to the old Armory where the Capitol stands today -- the Armory was on Hotel Street. And we were given the oath of allegiance to the United States, which we all took, raise our right hand, swore allegiance, issued a rifle, there was a uniform -- we already had uniforms, but were issued another ill-fitting uniform, which is natural for the military -- it's either too short or too long. So then we were assigned to protect all vulnerable facilities like the water works in case saboteurs landing to poison the water, the electric company to disrupt electricity – protect it, the telephone company for communications – protect it. And there were a few other things, you know, big business things or anything that served the public and was vulnerable to some kind of sabotage. So few days after that -- I can't remember exactly so long ago – there was a call for all of the troops to fall out of their quarters and assemble on the floor. So we all fall out and then I see coming in the entrance of the Armory, I see a group of people. I guess I was curious, and pretty soon, hey I recognize some of them guys. They were Kamehameha School teachers. So they announced, they said "Well the following named individuals may please step out of the ranks. Come forward, step out of the ranks. And the rest of you troops are all dismissed." I was one of the names called. I stepped out. Oh they prefaced it with "who can type." "All the recruits here who can type please step forward out of the ranks. And the rest of you are dismissed." I say well, try step out. So I step out. I enlisted December the 8th, 1941, after the attack on Pearl Harbor. And this was about a week after that, when these -- what-you-call -- teachers came in and said "these boys are underage, the law does not permit them to be fighting." So, I had been sent to Pearl Harbor before that. I was still in that service when I got sent to Wahiawa to enlist. And I went back Pearl Harbor by the old fleet landing, if you're familiar with it. That's where all the launches, the Liberty launches come ashore with the sailors, ties up broadside to the road, and the troops jump out in the old Rosecran cabs and taxis, those Rosecran buses and those Rosecran taxis would pick up the sailors and bring them into town for R & R. And the place was busy loaded; the loads were all busted up by heavy trucks going back and forth. It was bloody and wet and all kinds of humbug. And then these launches were coming to the shore, this is about a week after those guys, and I remember some missioners volunteered to go get the print, and when he stepped out on the side of the road with the ____machine gun and he said "Stop!" So, "Halt! Halt! Who goes there? Step out of that vehicle." And he had his green uniform on with the red stripe, dress uniform. He says "Alright you men" (there's four of us in the jeep, a lieutenant, a driver, another voluntary, and me; two volunteers in the back of the

jeep). "Alright, you may step out." We step out and he says "You go over there and help those men." We don't ask questions because he's armed with a gun and telling us what to do. And so as we get closer we see the Liberty launches with ropes dragging behind them and you can see something in the water, but you don't know what it is. It's making ripples in the water. And as it came close, they didn't come closely to shore, they coil a rope and they threw it to the men standing on the shore who had black hoods on from the robe, black covered jacket on, high hip black rubber pants, and they would grab the ropes and then they slowly pulled the ropes. And as we got closer we got to see what they were pulling. These were the dead bloated bodies of the sailors that were killed in the attack. And they were now floating and they were you know bringing, gathering the bodies. So it was awful. You never smelled dead human beings. It was awful. So for a few days after that I couldn't eat…somehow the smell is planted in my brain. So anyway, I went to see the officers, "Hey lieutenant, you gotta tell the guy we been sent on a mission. We gotta go and we went sign a paper. You don't have rubber boots, rubber gloves, rubber jackets, or weapons. You cannot do this kind of work." So when we when tell the marine he's "Alright you guys, get outta here. Go on, get in your vehicle, get outta here." We got in and peel and burned rubber. Well, anyway, that was the experience. Then I came back, I think a day after that, then the teachers came in and then told the commanding officer Colonel Smith, that these people, these names are under the age of enlistment, and we got these letters assigned. So, I got to see it, I got work in it and so then being an eyewitness then, I wrote this book. And made thousands of copies and after the war, I became a tour boat operator. He was the Captain, narrator above these vessels. That is still working till today, some of then. So this Pacific Pearl, I copyrighted the book, I made thousands of them. I pay a tribute to those who died and I use the symbol of the Memorial…but in here I also talk about myself. This is the only one that I have left, I have a rough copy. I was gonna try and remake 'um. But I forget what he told me the price was. When I made these was inexpensive, was really inexpensive. This little booklet and I told them more or less attended Kamehameha Schools, witnessed the panorama of Hickam and Pearl Harbor in the attack. I remember the Japanese flying down Hickam, high altitude and from where I was looking the clouds of black were shot up in the air. They went right down the runway, bomb the runway, crippled the airplanes that they didn't shoot up. So they couldn't fly off the field. And of course, when they blew up the Arizona, I looked at that tremendous orange explosion, boiling black clouds among the red inside the explosion. And then you lose Silot and Lindbergh, few minutes later you heard it roaring across the landscape. Roar! The explosion finally reached the sound traveling slower. So I got to see all of that, my hair stood up on my head. What is this? And then we heard on the radio: "Take cover, take cover!" And there was a radio; it was in our recreation room. Sunday morning we were preparing for church at the Chapel. And the radio says "Take cover, take cover. This is the real McCoy. This is the Japanese attacking Pearl Harbor." Though our hair stand up on our head, we didn't know what to do. So we took best cover, and we quivered for the whole day as shells dropped around the island, inadvertently, because the guys who were flying the anti-aircraft things didn't set the proximity fuse – he slammed 'em in the breach and set the thing off. Boom!

But the altitude guessing 1000 feet, 1500 feet to explode to create shrapnel to drag down the planes was not done. He just slammed it in the breach, fired and dropped it in the city. So that killed a few people – civilians. The Japanese, of course, killed several of my machine gun friends, crazy. Especially the guys who were being called back to the yard by the radio to return to your station at Pearl Harbor, this is an attack, help is needed. Those guys getting on the [road] was her uncle…he and his children were machine gunned to death. That was in the…yeah these pictures of that in, I have the magazine at home, but I don't know where I put all the stuff I saved. And I save everything. Any scrap of paper, I get and save 'em. So, he died of critical wounds. But anyway it's her uncle. He worked in Pearl Harbor. And they were strafed by the Japanese, the Japanese were shooting up the cars [Uncle Buzzy].

`Ili`ili Hanau Pohaku

When you weed whacked our yard [in Kewalo/Papakole`a] you find shells and coral and *'ili'ili* because we had a birth stone at our house and we used to give birth to all the stones. Aunty I`o said; I want you to take these mama stones and take good care of it and make sure get clean water and watch it *hanau hanau*. So I did that for the longest time even in my highest grade. If you look at my Puna House, I was saying I used to go carnivals and I used to win all these huge glass bowls with red or whatever. And I remember putting the mama in this ruby red glass bowl that was like a big cup with a stand and putting it in the living room. People would come and say; what is that? I would say; that's a mama birth stone. That's a *pōhaku*, the birth stone going give birth. See all the little pukas, the *pōhaku* falls out I tell them. And they don't say anything. I still have the *pōhaku*, I have plenty different rock sets that used to belong to Aunty I`o. Kū'ulas too we have [Poni].

Kepelino and Court Intrigue

When the king died Queen Emma was supposed to be the next in line, but then Kalākaua went to go fight her over it and then basically Kalākaua became king. And there was a big riot in Honolulu. And then with the riot, there were some of people, they went inside, like the Legislature now, and they threw people out the window. Which is why now, in the State Capitol, when they meet, they meet in the basement 'cause this big riot, was a big riot. But Kalākaua blamed Kepelino for this riot and he was arrested for treason. And so you don't blame one person for this big riot. And really Kepelino was trying to write to the Queen of England, because we were really following England, but Kalākaua was following the United States. So anyway Kepelino was put into jail, and then he was tried in the court and he was sentenced to be hung by his neck 'til he died. But the thing you cannot touch is the hierarchy and even Kalākaua knew he couldn't touch Kepelino because if he did then there'd be no Kalākaua, you know, so they let him go. Which he went to Maui and he started our line on the Kepelino side. So when you ask our family about Kalākaua, we go yeah, yeah, you know Kalākaua. It was not

like a real big deal, oh Kalākaua you know. Like now, they call him the Merry Monarch and all that. Our family looked about him as not clean and he wasn't. And then when Liliuokalani, his sister, then they didn't have election, they just made Liliuokalani, you know. But none of them – they did not have the high royal blood and everybody knew it. Well, everybody who was Hawaiian knew it. So that's the Kepelino, that's our family…. She was Queen Liliuokalani because of King Kalākaua, but the way King Kalākaua did it, he was the postmaster at the time. Then when they were going to have these elections, he went to all the voting booths, he stood outside to make sure they would vote for Kalākaua, which is how, when he won, the people were so angry, there was a riot. But because the people were angry there was a riot, they blamed that riot on Kepelino, which is our family. So when they let him out of jail, he wasn't the same man anymore. But he was a very learned man and only the ali'is had the education, I mean at that time, you know and he was very learned man, he could speak several languages. He was one of the first converts because Kahiwakaneikopolei was one of the first converts to Catholic when they first came here. So they named her Regina, that's how she got the Regina name…it was the French. Because when Kepelino wrote this genealogy thing, and then he wrote his genealogy, it was all in French. So when the Catholic Church finally released it, 70 years after he wrote it, there was this lady Martha Beckwith that translated it from French. She knew nothing about the Kepelino guy, just through making translations. And then it came out that way. But the thing is, when you look into Kepelino, it's really French because his name was actually a long Hawaiian name meaning to be the chief of the nine districts on the Big Island of Hawai'i because of the rank, he was really high rank. When he became this Catholic, they named him Zephrin. And so from Zephrin it translated into French was Zeferino. And then from French to Hawaiian became the Kepelino…'cause the Catholics named him Zephrin, but that's how he got the Kepelino name. Has really nothing to do with Hawaiian because his name is the chief, it was Kahoali'ikumaieiwakamoku (to be the chief of the nine districts), something like this, 'cause he was chief of the nine districts on the Big Island of Hawai'i because that was his rank (Hilo, Puna, Ka`u, South Kona, North Kona, South Kohala, North Kohala, Hamakua, Mokuola) [Kanoe].

RECOMMENDATIONS

Based on the results of the historical, archaeological, and cultural impact studies, the following recommendations are made:

ARCHITECTURAL PROPERTIES

As outlined above, none of the architectural properties identified in this study will be adversely affected by installation of the HSWAC components, including the pipeline system. Nonetheless, Chapter 6E-10, HRS, requires that SHPD review and concur with any activity affecting historic properties owned by the State, particularly those on the Register. The relevant statute reads in part:

> **§6E-8 Review of effect of proposed state projects.** (a) Before any agency or officer of the State or its political subdivisions commences any project which may affect historic property, aviation artifact, or a burial site, the agency or officer shall advise the department and allow the department an opportunity for review of the effect of the proposed project on historic properties, aviation artifacts, or burial sites, consistent with section 6E-43, especially those listed on the Hawaii register of historic places. The proposed project shall not be commenced, or in the event it has already begun, continued, until the department shall have given its written concurrence.
>
> The department is to provide written concurrence or non-concurrence within ninety days after the filing of a request with the department....

Currently, none of the privately owned properties within the APE that are listed on the HRHP or NRHP are affected by HSWAC activities. Should any such properties be included in future planning for the project, they may fall under the jurisdiction of Chapter 6E-10, HRS, which governs SHPD review of activities affecting privately owned historic property on the HRHP:

> **§6E-10 Privately owned historic property.** (a) Before any construction, alteration, disposition or improvement of any nature, by, for, or permitted by a private landowner may be commenced which will affect an historic property on the Hawaii register of historic places, the landowner shall notify the department of the construction, alteration, disposition, or improvement of any nature and allow the department opportunity for review of the effect of the proposed construction, alteration, disposition, or improvement of any nature on the historic property. The proposed construction, alteration, disposition, or improvement of any nature shall not be commenced, or in the event it has already begun, continue, until the department shall have given its concurrence or ninety days have elapsed...

Thus, it is recommended that SHPD be given the opportunity to review and concur with any portions of the HSWAC that may affect privately- owned and State-owned historic properties on the HRHP. Finally, in order to ensure that no architectural properties are adversely affected by the HSWAC project, it is recommended that any ground surfaces and landscaping associated with any historic building will be restored to their original condition if they are disturbed by trenching or other activities.

ARCHAEOLOGICAL PROPERTIES

There is varied potential for encountering subsurface cultural sites within the APE, particularly during trenching for installation of the HSWAC distribution pipelines. A number of locations on the pipeline route have a low sensitivity of encountering subsurface sites; in these areas, the proposed undertaking will have no effect on significant archaeological sites, and no further measures are recommended at this time.

Along pipeline segments deemed to be of moderate and high sensitivity for encountering subsurface sites, the proposed HSWAC pipeline system may have an "adverse effect" on such sites. Consequently, it is recommended that the areas of moderate and high sensitivity for finding subsurface cultural sites undergo on-site archaeological monitoring during trenching done for the HSWAC.

TRADITIONAL CULTURAL PROPERTIES

Although extant traditional cultural properties were not identified during the CIA, with the exception of human burials potentially being present within the project area, the participating consultants clearly identified locales within the APE that are of ongoing cultural importance as seen through participants' beliefs. In such situations, it is difficult to recommend measures that can "protect" these places or "mitigate" accidental harm that might be done to them through project activities. Consequently, it is recommended instead that a proactive approach be taken to consulting with and involving concerned parties who have traditional and/or family ties to the Downtown and particularly the Kaka`ako areas. Our recommendations are as follows:

- Establish a cultural advisory group comprised of community members, particularly those who have long-standing religious and cultural ties to locales within the APE.
- Should archaeological monitoring be accepted as an appropriate mitigation measure, cultural monitors should also be retained to work with the archaeologists in any situation where monitoring is needed. The cultural monitors should be selected by the cultural advisory group and, ideally, would represent that group and other community members. Monitoring procedures and related activities carried out by the cultural monitors should

be developed in consultation with the advisory group and the State Historic Preservation Division.

- Given the possibility that human burials will be encountered during excavations conducted for HSWAC, it is recommended that a pro-active search be carried out before ground disturbance begins in order to identify individuals who may have family connections to burials found in the APE. This may be done by working with the cultural advisory group and with the History and Culture Branch of the State Historic Preservation Division.

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APPENDIX A

Sample of Consent/Release Form Provided To Consultants

Agreement to Participate in this Cultural Impact Study/Assessment

Project Title: ***Honolulu Sea Water Air Conditioning***
District of Kona; Ahupua`a of Kakaako-Honolulu
Pacific Consulting Services, Inc.; The Environmental Company;
HSWAC, LLC

Investigator: Maria E. Ka`imipono Orr, M.A.

You are being asked to participate in a cultural impact study and assessment [CIS/A] conducted by an independent investigator contracted by *Pacific Consulting Services, Inc.* (PCSI) as part of a larger Environmental Impact Study of the proposed *Honolulu Sea Water Air Conditioning* project, located in Kakaako-Honolulu, between Keawe Street to Fort Street. The investigator will explain the purpose of the study, the procedures to be used, the potential benefits and possible risks of participating. You may ask the investigator any question(s) in order to help you to understand the study or procedures. A basic explanation of the study is written below. If you then decide to participate in the study, please sign on the second page of this form. You will be given a copy of this form to keep.

I. Nature and Purpose of the Study

The purpose of this cultural impact study/assessment is to gather information about the project lands located in the *ahupua`a* of Kakaako-Honolulu, through interviews with individuals who are knowledgeable about this area, and/or about traditional and historic information such as legends, songs, chants or other information. The objective of this study is to facilitate in the identification and location of any possible pre-historic and/or historic cultural resources, or traditional cultural practices in the area mentioned above, in accordance with applicable historic preservation laws, regulations, and guidelines, including:

Office of Environmental Quality Control [OEQC] *Guidelines and Act 50 HB2895* [A.D.2000], *HRS Chapter 343*

II. Explanation of Procedures

After you have voluntarily agreed to participate and have signed the consent page, the investigator will tape record your interview and transcribe it later. Data from the interview [ethnographic research] will be used as part of the background historical summary for this project. The investigator may also need to take notes and/or ask you to spell or clarify terms or names that are unclear.

III. Discomforts and Risks

Foreseeable discomforts and/or risks may include, but are not limited to the following: having to talk loudly for the recorder; being recorded and/or interviewed; providing information that may be used in reports which may be used in the future as a public reference; knowing that the information you give may conflict with information from others; your uncompensated dedication of time; possible miscommunication or misunderstanding in the transcribing of information; loss of privacy; and worry that your comment(s) may not be understood in the same way you understand them. It is not possible to identify all potential risks, however reasonable safeguards have been taken to minimize risks.

IV. Benefits

This study will give you the opportunity to express your thoughts (*mana`o*), and your opinions will be listened to and shared; your knowledge may be instrumental in the preservation of significant resources and information.

V. Confidentiality

Your rights of privacy, confidentiality and/or anonymity will be protected **if you so desire**. You may request, for example, that your name and/or sex not be mentioned in write-ups, such as field notes, on tape, on files (disk or folders), drafts, reports, and future works; or you may request that some of the information you provide remain "off-the-record" **and not be recorded in any way.** In order to ensure protection of your privacy, confidentiality and/or anonymity, you should immediately advise the investigator of your desires. The investigator will ask you to specify the method of protection, and note it on this form below.

VI. Refusal/Withdrawal

You may, at any time during the interview process, chose to not participate any further and ask the investigator for the tape and/or notes. Please note that you will be given an opportunity to review your transcript, and to revise or delete any part of the interview.

VII. Waiver

Part I: Agreement to Participate

I, ______________________, understand that Maria E. Ka'imipono Orr, an independent investigator contracted by ***Pacific Consulting Services, Inc.*** *will be conducting oral history interviews with individuals knowledgeable about* ***Kakaako-Honolulu*** *lands within the project area. The oral history interviews are being conducted in order to collect information on possible pre-historic and/or historic cultural resources associated with these lands, as well as traditional cultural practices.*

I understand I will be provided the opportunity to review my interview to ensure that it accurately depicts what I meant to say. ***I also understand that if I don't return the revised transcripts after two weeks from date of receipt, my signature below will indicate my release of information for the CIS/A report. I also understand that I will still have the opportunity to make revisions during the report review process.***

______ *I am willing to participate.*
______ *I am willing to participate, under the following conditions:*

____
Consultant Signature **Date**

____
Print Name **Phone**

____
Address

MAHALO NUI LOA

Part II: Personal Release of Interview Records

I, ______________________, have been interviewed by Maria E. Ka'imipono Orr, an independent investigator contracted by ***Pacific Consulting Services, Inc.*** *I have reviewed the written transcripts of tape recordings of the interview, and agree that said documentation is complete and accurate except for those matters specifically set forth below the heading "CLARIFICATION OR CORRECTIONS."*

I further agree that Orr and ***Pacific Consulting Services, Inc.*** *may use and release my identity and other interview information, both oral and written, for the purpose of using such information in a report to be made public, subject to my specific objections, to release as set forth below under the heading "SPECIFIC OBJECTIONS TO RELEASE OF INTERVIEW MATERIALS."*

CLARIFICATION OR CORRECTIONS:

SPECIFIC OBJECTIONS TO RELEASE OF INTERVIEW MATERIALS:

Consultant Signature Date

Print Name Phone

MAHALO NUI LOA

APPENDIX B

Consent/Release Forms Signed by Consultants

IV. Benefits

This study will give you the opportunity to express your thoughts (*mana`o*), and your opinions will be listened to and shared; your knowledge may be instrumental in the preservation of significant resources and information.

V. Confidentiality

Your rights of privacy, confidentiality and/or anonymity will be protected **if you so desire**. You may request, for example, that your name and/or sex not be mentioned in write-ups, such as field notes, on tape, on files (disk or folders), drafts, reports, and future works; or you may request that some of the information you provide remain "off-the-record" **and not be recorded in any way**. In order to ensure protection of your privacy, confidentiality and/or anonymity, you should immediately advise the investigator of your desires. The investigator will ask you to specify the method of protection, and note it on this form below.

VI. Refusal/Withdrawal

You may, at any time during the interview process, chose to not participate any further and ask the investigator for the tape and/or notes. Please note that you will be given an opportunity to review your transcript, and to revise or delete any part of the interview.

VII. Waiver

Part I: Agreement to Participate

I, ____________________, understand that Maria E. Ka'imipono Orr, an independent investigator contracted by ***Pacific Consulting Services, Inc.*** *will be conducting oral history interviews with individuals knowledgeable about* ***Kakaako-Honolulu*** *lands within the project area. The oral history interviews are being conducted in order to collect information on possible pre-historic and/or historic cultural resources associated with these lands, as well as traditional cultural practices.*

I understand I will be provided the opportunity to review my interview to ensure that it accurately depicts what I meant to say. ***I also understand that if I don't return the revised transcripts after two weeks from date of receipt, my signature below will indicate my release of information for the CIS/A report. I also understand that I will still have the opportunity to make revisions during the report review process.***

_____ *I am willing to participate.*
_____ *I am willing to participate, under the following conditions:*

Louis K. Agard Jr. — ~~Sept~~ July 21 2005
Consultant Signature — Date

Louis K. Agard JR — 538 6677
Print Name — Phone

55 So. Kukui St. D-414
Address

MAHALO NUI LOA

IV. Benefits

This study will give you the opportunity to express your thoughts (*mana`o*), and your opinions will be listened to and shared; your knowledge may be instrumental in the preservation of significant resources and information.

V. Confidentiality

Your rights of privacy, confidentiality and/or anonymity will be protected **if you so desire**. You may request, for example, that your name and/or sex not be mentioned in write-ups, such as field notes, on tape, on files (disk or folders), drafts, reports, and future works; or you may request that some of the information you provide remain "off-the-record" **and not be recorded in any way**. In order to ensure protection of your privacy, confidentiality and/or anonymity, you should immediately advise the investigator of your desires. The investigator will ask you to specify the method of protection, and note it on this form below.

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VII. Waiver

Part I: Agreement to Participate

I, ____________________, understand that Maria E. Ka'imipono Orr, an independent investigator contracted by ***Pacific Consulting Services, Inc.*** *will be conducting oral history interviews with individuals knowledgeable about* ***Kakaako-Honolulu*** *lands within the project area. The oral history interviews are being conducted in order to collect information on possible pre-historic and/or historic cultural resources associated with these lands, as well as traditional cultural practices.*

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__X__ *I am willing to participate.*
_____ *I am willing to participate, under the following conditions:*

A.H. Brodie — 8-15-05
Consultant Signature — Date

Alexander H. Brodie (Lex) — 826.4526
Print Name — Phone

3792 Ahonui Pl. Princeville, HI 96722
Address

MAHALO NUI LOA

IV. *Benefits*

This study will give you the opportunity to express your thoughts (*mana`o*), and your opinions will be listened to and shared; your knowledge may be instrumental in the preservation of significant resources and information.

V. *Confidentiality*

Your rights of privacy, confidentiality and/or anonymity will be protected **if you so desire**. You may request, for example, that your name and/or sex not be mentioned in write-ups, such as field notes, on tape, on files (disk or folders), drafts, reports, and future works; or you may request that some of the information you provide remain "off-the-record" **and not be recorded in any way**. In order to ensure protection of your privacy, confidentiality and/or anonymity, you should immediately advise the investigator of your desires. The investigator will ask you to specify the method of protection, and note it on this form below.

VI. *Refusal/Withdrawal*

You may, at any time during the interview process, chose to not participate any further and ask the investigator for the tape and/or notes. Please note that you will be given an opportunity to review your transcript, and to revise or delete any part of the interview.

VII. *Waiver*

Part I: Agreement to Participate

I, H. Kanoekalani Cheek, understand that Maria E. Ka'imipono Orr, an independent investigator contracted by ***Pacific Consulting Services, Inc.*** *will be conducting oral history interviews with individuals knowledgeable about* ***Kakaako-Honolulu*** *lands within the project area. The oral history interviews are being conducted in order to collect information on possible pre-historic and/or historic cultural resources associated with these lands, as well as traditional cultural practices.*

I understand I will be provided the opportunity to review my interview to ensure that it accurately depicts what I meant to say. ***I also understand that if I don't return the revised transcripts after two weeks from date of receipt, my signature below will indicate my release of information for the CIS/A report. I also understand that I will still have the opportunity to make revisions during the report review process.***

✓ *I am willing to participate.*
______ *I am willing to participate, under the following conditions:*

H. Kanoekalani Cheek — 7-27-05
Consultant Signature — **Date**

H. Kanoekalani Cheek — 778-5598
Print Name — **Phone**

P.O. Box 107 Waimanalo HI 96795
Address

MAHALO NUI LOA

IV. *Benefits*

This study will give you the opportunity to express your thoughts (*mana`o*), and your opinions will be listened to and shared; your knowledge may be instrumental in the preservation of significant resources and information.

V. *Confidentiality*

Your rights of privacy, confidentiality and/or anonymity will be protected **if you so desire**. You may request, for example, that your name and/or sex not be mentioned in write-ups, such as field notes, on tape, on files (disk or folders), drafts, reports, and future works; or you may request that some of the information you provide remain "off-the-record" **and not be recorded in any way**. In order to ensure protection of your privacy, confidentiality and/or anonymity, you should immediately advise the investigator of your desires. The investigator will ask you to specify the method of protection, and note it on this form below.

VI. *Refusal/Withdrawal*

You may, at any time during the interview process, chose to not participate any further and ask the investigator for the tape and/or notes. Please note that you will be given an opportunity to review your transcript, and to revise or delete any part of the interview.

VII. *Waiver*

Part I: Agreement to Participate

I, ________________, understand that Maria E. Ka'imipono Orr, an independent investigator contracted by ***Pacific Consulting Services, Inc.*** *will be conducting oral history interviews with individuals knowledgeable about* ***Kakaako-Honolulu*** *lands within the project area. The oral history interviews are being conducted in order to collect information on possible pre-historic and/or historic cultural resources associated with these lands, as well as traditional cultural practices.*

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______ *I am willing to participate.*
______ *I am willing to participate, under the following conditions:*

Lorraine M. Kaina — 07/27/05
Consultant Signature — **Date**

LORRAINE M. KAINA — 531-6123
Print Name — **Phone**

1630 LIHOLIHO #1408 HON. HI 96822
Address

MAHALO NUI LOA

IV. Benefits

This study will give you the opportunity to express your thoughts (*mana`o*), and your opinions will be listened to and shared; your knowledge may be instrumental in the preservation of significant resources and information.

V. Confidentiality

Your rights of privacy, confidentiality and/or anonymity will be protected **if you so desire**. You may request, for example, that your name and/or sex not be mentioned in write-ups, such as field notes, on tape, on files (disk or folders), drafts, reports, and future works; or you may request that some of the information you provide remain "off-the-record" **and not be recorded in any way**. In order to ensure protection of your privacy, confidentiality and/or anonymity, you should immediately advise the investigator of your desires. The investigator will ask you to specify the method of protection, and note it on this form below.

VI. Refusal/Withdrawal

You may, at any time during the interview process, chose to not participate any further and ask the investigator for the tape and/or notes. Please note that you will be given an opportunity to review your transcript, and to revise or delete any part of the interview.

VII. Waiver

Part I: Agreement to Participate

I, ____________________, understand that Maria E. Ka'imipono Orr, an independent investigator contracted by ***Pacific Consulting Services, Inc.*** *will be conducting oral history interviews with individuals knowledgeable about* ***Kakaako-Honolulu*** *lands within the project area. The oral history interviews are being conducted in order to collect information on possible pre-historic and/or historic cultural resources associated with these lands, as well as traditional cultural practices.*

I understand I will be provided the opportunity to review my interview to ensure that it accurately depicts what I meant to say. ***I also understand that if I don't return the revised transcripts after two weeks from date of receipt, my signature below will indicate my release of information for the CIS/A report. I also understand that I will still have the opportunity to make revisions during the report review process.***

_____ *I am willing to participate.*
_____ *I am willing to participate, under the following conditions:*

Consultant Signature — Date: 8/12/2005
Print Name: Poni E. Kamau — Phone: 533-1492
Address: 2353 Kaululaau St, Hon Hi 96813

MAHALO NUI LOA

2

IV. Benefits

This study will give you the opportunity to express your thoughts (*mana`o*), and your opinions will be listened to and shared; your knowledge may be instrumental in the preservation of significant resources and information.

V. Confidentiality

Your rights of privacy, confidentiality and/or anonymity will be protected **if you so desire**. You may request, for example, that your name and/or sex not be mentioned in write-ups, such as field notes, on tape, on files (disk or folders), drafts, reports, and future works; or you may request that some of the information you provide remain "off-the-record" **and not be recorded in any way**. In order to ensure protection of your privacy, confidentiality and/or anonymity, you should immediately advise the investigator of your desires. The investigator will ask you to specify the method of protection, and note it on this form below.

VI. Refusal/Withdrawal

You may, at any time during the interview process, chose to not participate any further and ask the investigator for the tape and/or notes. Please note that you will be given an opportunity to review your transcript, and to revise or delete any part of the interview.

VII. Waiver

Part I: Agreement to Participate

I, Elaine Masuda, understand that Maria E. Ka'imipono Orr, an independent investigator contracted by ***Pacific Consulting Services, Inc.*** *will be conducting oral history interviews with individuals knowledgeable about* ***Kakaako-Honolulu*** *lands within the project area. The oral history interviews are being conducted in order to collect information on possible pre-historic and/or historic cultural resources associated with these lands, as well as traditional cultural practices.*

I understand I will be provided the opportunity to review my interview to ensure that it accurately depicts what I meant to say. ***I also understand that if I don't return the revised transcripts after two weeks from date of receipt, my signature below will indicate my release of information for the CIS/A report. I also understand that I will still have the opportunity to make revisions during the report review process.***

_✓_ *I am willing to participate.*
_____ *I am willing to participate, under the following conditions:*

Consultant Signature — Date: 7-25-05
Print Name: Elaine Masuda — Phone: 623-0840
Address: 94-357 Nahokupa St. Mil. Hi 96789

MAHALO NUI LOA

2

IV. *Benefits*

This study will give you the opportunity to express your thoughts (*mana`o*), and your opinions will be listened to and shared; your knowledge may be instrumental in the preservation of significant resources and information.

V. *Confidentiality*

Your rights of privacy, confidentiality and/or anonymity will be protected **if you so desire**. You may request, for example, that your name and/or sex not be mentioned in write-ups, such as field notes, on tape, on files (disk or folders), drafts, reports, and future works; or you may request that some of the information you provide remain "off-the-record" **and not be recorded in any way**. In order to ensure protection of your privacy, confidentiality and/or anonymity, you should immediately advise the investigator of your desires. The investigator will ask you to specify the method of protection, and note it on this form below.

VI. *Refusal/Withdrawal*

You may, at any time during the interview process, chose to not participate any further and ask the investigator for the tape and/or notes. Please note that you will be given an opportunity to review your transcript, and to revise or delete any part of the interview.

VII. *Waiver*

Part I: Agreement to Participate

I, Roy Masuda*, understand that Maria E. Ka'imipono Orr, an independent investigator contracted by* ***Pacific Consulting Services, Inc.*** *will be conducting oral history interviews with individuals knowledgeable about* ***Kakaako-Honolulu*** *lands within the project area. The oral history interviews are being conducted in order to collect information on possible pre-historic and/or historic cultural resources associated with these lands, as well as traditional cultural practices.*

I understand I will be provided the opportunity to review my interview to ensure that it accurately depicts what I meant to say. ***I also understand that if I don't return the revised transcripts after two weeks from date of receipt, my signature below will indicate my release of information for the CIS/A report. I also understand that I will still have the opportunity to make revisions during the report review process.***

✓ *I am willing to participate.*
___ *I am willing to participate, under the following conditions:*

Roy Masuda — Consultant Signature
7-26-05 — Date
Roy Masuda — Print Name
623-0840 — Phone
94-337 Nahokupa St. — Address

MAHALO NUI LOA

IV. *Benefits*

This study will give you the opportunity to express your thoughts (*mana`o*), and your opinions will be listened to and shared; your knowledge may be instrumental in the preservation of significant resources and information.

V. *Confidentiality*

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VI. *Refusal/Withdrawal*

You may, at any time during the interview process, chose to not participate any further and ask the investigator for the tape and/or notes. Please note that you will be given an opportunity to review your transcript, and to revise or delete any part of the interview.

VII. *Waiver*

Part I: Agreement to Participate

I, Neal Okamoto*, understand that Maria E. Ka'imipono Orr, an independent investigator contracted by* ***Pacific Consulting Services, Inc.*** *will be conducting oral history interviews with individuals knowledgeable about* ***Kakaako-Honolulu*** *lands within the project area. The oral history interviews are being conducted in order to collect information on possible pre-historic and/or historic cultural resources associated with these lands, as well as traditional cultural practices.*

I understand I will be provided the opportunity to review my interview to ensure that it accurately depicts what I meant to say. ***I also understand that if I don't return the revised transcripts after two weeks from date of receipt, my signature below will indicate my release of information for the CIS/A report. I also understand that I will still have the opportunity to make revisions during the report review process.***

✓ *I am willing to participate.*
___ *I am willing to participate, under the following conditions:*

Neal Okamoto — Consultant Signature
9/20/05 — Date
Neal Okamoto — Print Name
9/20/05 — Date
3310 Hualani Dr — Address
544-0544 — Phone

MAHALO NUI LOA

IV. Benefits

This study will give you the opportunity to express your thoughts (*mana`o*), and your opinions will be listened to and shared; your knowledge may be instrumental in the preservation of significant resources and information.

V. Confidentiality

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VII. Waiver

Part I: Agreement to Participate

*I, ____________________, understand that Maria E. Ka'imipono Orr, an independent investigator contracted by **Pacific Consulting Services, Inc.** will be conducting oral history interviews with individuals knowledgeable about **Kakaako-Honolulu** lands within the project area. The oral history interviews are being conducted in order to collect information on possible pre-historic and/or historic cultural resources associated with these lands, as well as traditional cultural practices.*

*I understand I will be provided the opportunity to review my interview to ensure that it accurately depicts what I meant to say. **I also understand that if I don't return the revised transcripts after two weeks from date of receipt, my signature below will indicate my release of information for the CIS/A report. I also understand that I will still have the opportunity to make revisions during the report review process.***

__✓__ *I am willing to participate.*
_____ *I am willing to participate, under the following conditions:*

Joseph P. Recca 7-26-05
Consultant Signature **Date**
Joseph P. Recca 2275376
Print Name **Phone**
1151 Wainiha St. #E Hon. 96825
Address

MAHALO NUI LOA

IV. Benefits

This study will give you the opportunity to express your thoughts (*mana`o*), and your opinions will be listened to and shared; your knowledge may be instrumental in the preservation of significant resources and information.

V. Confidentiality

Your rights of privacy, confidentiality and/or anonymity will be protected **if you so desire.** You may request, for example, that your name and/or sex not be mentioned in write-ups, such as field notes, on tape, on files (disk or folders), drafts, reports, and future works; or you may request that some of the information you provide remain "off-the-record" **and not be recorded in any way.** In order to ensure protection of your privacy, confidentiality and/or anonymity, you should immediately advise the investigator of your desires. The investigator will ask you to specify the method of protection, and note it on this form below.

VI. Refusal/Withdrawal

You may, at any time during the interview process, chose to not participate any further and ask the investigator for the tape and/or notes. Please note that you will be given an opportunity to review your transcript, and to revise or delete any part of the interview.

VII. Waiver

Part I: Agreement to Participate

*I, Jean Shitabata, understand that Maria E. Ka'imipono Orr, an independent investigator contracted by **Pacific Consulting Services, Inc.** will be conducting oral history interviews with individuals knowledgeable about **Kakaako-Honolulu** lands within the project area. The oral history interviews are being conducted in order to collect information on possible pre-historic and/or historic cultural resources associated with these lands, as well as traditional cultural practices.*

*I understand I will be provided the opportunity to review my interview to ensure that it accurately depicts what I meant to say. **I also understand that if I don't return the revised transcripts after two weeks from date of receipt, my signature below will indicate my release of information for the CIS/A report. I also understand that I will still have the opportunity to make revisions during the report review process.***

__✓__ *I am willing to participate.*
_____ *I am willing to participate, under the following conditions:*

Jean Shitabata 9-26-2005
Consultant Signature **Date**
Jean Shitabata 263-6151
Print Name **Phone**
1281 Kupau St. Kailua, 96734
Address

MAHALO NUI LOA

IV. Benefits

This study will give you the opportunity to express your thoughts (*mana`o*), and your opinions will be listened to and shared; your knowledge may be instrumental in the preservation of significant resources and information.

V. Confidentiality

Your rights of privacy, confidentiality and/or anonymity will be protected **if you so desire**. You may request, for example, that your name and/or sex not be mentioned in write-ups, such as field notes, on tape, on files (disk or folders), drafts, reports, and future works; or you may request that some of the information you provide remain "off-the-record" **and not be recorded in any way**. In order to ensure protection of your privacy, confidentiality and/or anonymity, you should immediately advise the investigator of your desires. The investigator will ask you to specify the method of protection, and note it on this form below.

VI. Refusal/Withdrawal

You may, at any time during the interview process, chose to not participate any further and ask the investigator for the tape and/or notes. Please note that you will be given an opportunity to review your transcript, and to revise or delete any part of the interview.

VII. Waiver

Part I: Agreement to Participate

I, Alice Nagato Watanabe understand that Maria E. Ka'imipono Orr, an independent investigator contracted by ***Pacific Consulting Services, Inc.*** *will be conducting oral history interviews with individuals knowledgeable about* ***Kakaako-Honolulu*** *lands within the project area. The oral history interviews are being conducted in order to collect information on possible pre-historic and/or historic cultural resources associated with these lands, as well as traditional cultural practices.*

I understand I will be provided the opportunity to review my interview to ensure that it accurately depicts what I meant to say. ***I also understand that if I don't return the revised transcripts after two weeks from date of receipt, my signature below will indicate my release of information for the CIS/A report. I also understand that I will still have the opportunity to make revisions during the report review process.***

______ *I am willing to participate.*
______ *I am willing to participate, under the following conditions:*

Alice M Watanabe 9/19/2005
Consultant Signature **Date**

Alice M. Watanabe
Print Name **Phone**

3254 Paliuli St
Address

MAHALO NUI LOA

LINDA LINGLE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
STATE HISTORIC PRESERVATION DIVISION
601 KAMOKILA BOULEVARD, ROOM 555
KAPOLEI, HAWAII 96707

November 10, 2008

Mr. Stephan D. Clark
Pacific Consulting Services, Inc.
720 Iwilei Road, suite 424
Honolulu, Hawai'i 96817

LOG NO: 2008-4720
DOC NO: 0811WT21
Archaeology

Dear Mr. Clark:

SUBJECT: **Compliance with Chapter 6E-48 and Hawaii Administrative Rules 13-13-279— Draft Archaeological Monitoring Plan in Support of the Honolulu Seawater Air Conditioning Project in Portions of Kaka'ako and Downtown Honolulu, Pauoa Ahupua'a, Honolulu (Kona) District, Island of O'ahu, State of Hawai'i**
TMK: (1) 2-1 various…

We are in receipt of your Archaeological Monitoring Plan dated October 22, 2008. This plan covers archaeological monitoring of construction activities throughout portions of downtown Honolulu and Kaka'ako related to development of infrastructure for the Honolulu Sea Water Air Conditioning Project, including intake and return piping, seawater pumps, freshwater pumps, heat exchangers and auxiliary chillers

This archaeological Monitoring Plan is acceptable under HAR 13-13-279 *Rules Governing Standards for Archaeological Monitoring Studies and Reports.*

This subject archaeological monitoring report has received final acceptance pursuant to HAR §13-276. Please send one hardcopy of the document, clearly marked FINAL, along with a copy of this review letter and a text-searchable PDF version on CD to the attention of "**SHPD Library**" at the Kapolei SHPD office.

Please contact Wendy Tolleson at t (808 692-8024) should you have any questions or concerns regarding this letter.

Aloha,

Nancy A. McMahon

Nancy McMahon, Deputy SHPO/State Archaeologist
and Historic Preservation Manager

FINAL REPORT

ARCHAEOLOGICAL MONITORING PLAN IN SUPPORT OF THE HONOLULU SEAWATER AIR CONDITIONING PROJECT IN PORTIONS OF KAKA`AKO AND DOWNTOWN HONOLULU, PAUOA AHUPUA`A, HONOLULU (KONA) DISTRICT, ISLAND OF O`AHU, STATE OF HAWAII

TMKs: (1) 2-1-various; 2-1-001:056; 2-1-002:009, 013, 016; 2-1-010:004; 2-1-011:009; 2-1-012: 004, 006; 2-1-013:006; 2-1-014:001, 004; 2-1-016:001, 011, 015; 2-1-017: 001, 003, 005, 008, 010, 011, 019; 2-1-018:001; 2-1-024: 001, 008; 2-1-025:001, 002, 004; 2-1-027:002; 2-1-029: 001; 2-1-030:003; 2-1-032:012; 2-1-033:007, 010, 025; 2-1-035:010; 2-1-042:004, 013; 2-1-059:012, 013.

Prepared for:

TEC, Inc.
1001 Bishop Street
American Savings Bank Tower
Suite 1400
Honolulu, HI 96813

Prepared by:

Pacific Consulting Services, Inc.
720 Iwilei Road, Suite 424
Honolulu, HI 96817

December 2008

FINAL REPORT
Archaeological Monitoring Plan In Support of
the Honolulu Seawater Air Conditioning Project
in Portions of Kaka`ako and Downtown Honolulu,
Pauoa Ahupua`a, Honolulu (Kona) District,
Island of O`ahu, State of Hawaii
TMKs: (1) 2-1-various; 2-1-001:056; 2-1-002:009, 013, 016; 2-1-010:004; 2-1-011:009; 2-1-012: 004, 006; 2-1-013:006; 2-1-014:001, 004; 2-1-016:001, 011, 015; 2-1-017: 001, 003, 005, 008, 010, 011, 019; 2-1-018:001; 2-1-024: 001, 008; 2-1-025:001, 002, 004; 2-1-027:002; 2-1-029: 001; 2-1-030:003; 2-1-032:012; 2-1-033:007, 010, 025; 2-1-035:010; 2-1-042:004, 013; 2-1-059:012, 013.

Prepared by
Sara L. Collins, Ph.D.
Maria Orr, M.A.
Valerie Park, M.A.

of

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December 2008

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INTRODUCTION

At the request of TEC, Inc. (TEC), Pacific Consulting Services, Inc. (PCSI) has prepared the following archaeological monitoring plan in support of the Honolulu Seawater Air Conditioning Project in Honolulu, Island of O`ahu, Hawai`I (Figure 1). This archaeological monitoring plan has been prepared in compliance with Hawaii Revised Statutes (HRS), Chapter 6e, and Title 13 of the Hawaii Administrative Rules (HAR), Subtitle 13 (State Historic Preservation Division Rules), Chapter 279 (Rules Governing Standards for Archaeological Monitoring Studies and Reports).

PROJECT DESCRIPTION

The Honolulu Sea Water Air Conditioning (HSWAC) project would provide 25,000 tons of centralized air conditioning for downtown Honolulu. The primary means of cooling would be through the circulation of deep, cold seawater accessed through a long offshore intake pipeline. The Area of Potential Effect (APE) for HSWAC includes the major system components are as follows:

- Seawater intake and return pipes extending between the on-shore cooling station and submerged offshore locations;
- On-shore seawater cooling station (cooling station) containing;

  Seawater pumps;

  Freshwater pumps;

  Heat exchangers;

  Auxiliary chillers;
- Chilled (fresh) water distribution system on land consisting of underground pipes connected to participating buildings in downtown Honolulu;
- A staging area for equipment and construction materials

Figure 1 shows the locations of these system components, as currently proposed, and Figure 2 shows the primary APE for this report and the proposed routing of the underground pipes on land that connect individual buildings to the system.

Figure 1. Project Area Showing Downtown Honolulu, Mamala Bay, and Sand Island Portions of the Project Area on a U.S.G.S. Quadrangle Map.

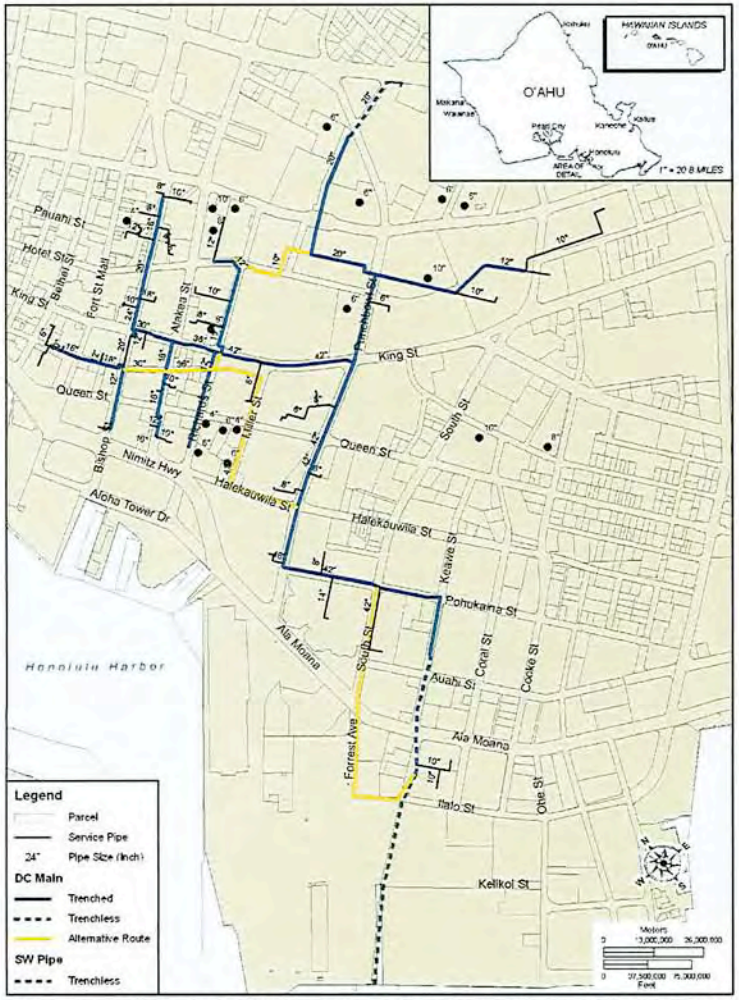

Figure 2. Location of Honolulu Seawater Air Conditioning Pipeline Route in the Area of Potential Effect.

Tax Map Key (TMK) parcels that are affected by the proposed undertaking include roadways (which do not have individual parcel numbers and are covered here by the designation "2-1-various") and many privately and publicly owned buildings in downtown Honolulu which will be connected to the HSWAC service. The following TMKs have been identified as affected by the subject monitoring plan: TMKs: (1) 2-1-various; 2-1-001:056; 2-1-002:009, 013, 016; 2-1-010:004; 2-1-011:009; 2-1-012: 004, 006; 2-1-013:006; 2-1-014:001, 004; 2-1-016:001, 011, 015; 2-1-017: 001, 003, 005, 008, 010, 011, 019; 2-1-018:001; 2-1-024: 001, 008; 2-1-025:001, 002, 004; 2-1-027:002; 2-1-029: 001; 2-1-030:003; 2-1-032:012; 2-1-033:007, 010, 025; 2-1-035:010; 2-1-042:004, 013; 2-1-059:012, 013.

While exact depths of trenching are not known for all locations within the APE, current plans envision that roadway and connection excavations will range from a minimum depth of about 4 feet below surface (which includes 3 feet of cover plus a 6 inch pipe plus 6 inch "bedding") to a possible maximum of 14.5 feet below surface, where excavations will have to go deeper in order to avoid other, existing utilities (10 feet cover plus 48 inch pipe plus 6 inch "bedding").

ENVIRONMENTAL BACKGROUND

CLIMATE & RAINFALL

Annual rainfall averages less than 760 millimeters (ca 30 inches) per year (Giambelluca et al. 1988). There are currently no natural drainages within Kewalo although Manoa and Makiki Streams are on the east, and Nuuanu Stream is to the west. Judging from observations made in the early 19th century, the wetlands of Kewalo were drained by small streams and rivulets that flowed through the marshes; fishponds were also prominent features of the traditional Kewalo landscape (Bingham 1981).

SOILS

There are a variety of soil regimes in the project area. Figure 3 is roughly based on Foote et al. (1972: Map 62), and shows the project area and APE with the location and boundaries of the various soil series present. Based on Foote et al. (1972) and Figure 3, there are four soil series present in the APE. From seaward areas towards the

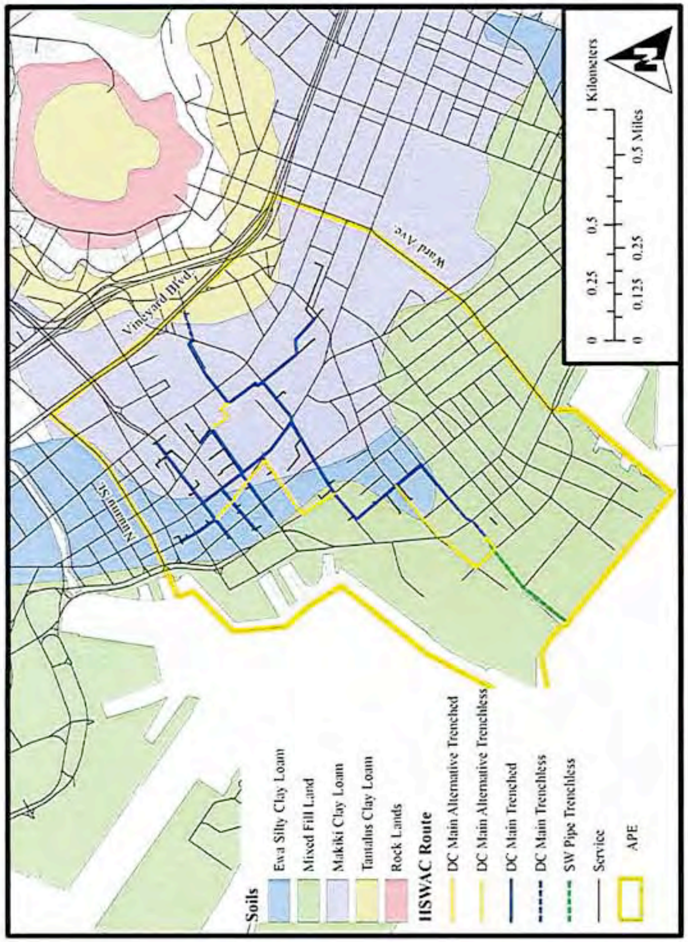

Figure 3. Location of Soil Types in the Area of Potential Effect and Adjacent Areas.

mountains, these soils include Mixed Fill Lands (FL), Ewa silty clay loam (EmA), Makiki clay loam (MkA), and Tantalus silty clay loam (TCC). These soil series are described below.

Mixed fill lands are found in Pearl Harbor and in Honolulu adjacent to the ocean. In the APE, the mixed fills consist of materials dredged from the ocean, garbage and construction debris, and general materials from other sources (Foote et al. 1972: 31). Lands containing this soil type are used in urban development including airports, housing areas, and industrial facilities. It should be noted that this soil type is often found seaward of nineteenth century coastlines (see Figure 3).

Mixed fill lands occur in seaward portions of the APE, including areas immediately *mauka* and *makai* of Ala Moana Boulevard, seaward portions of Keawe, further inland south of the APE (see Figure 3). A majority of the mixed fill lands in the South, and Punchbowl Streets, as well as portions of Pohukaina Street. The fills were created during the 1930s in an effort to drain wetland areas along the southern coast of Oahu. Based on Foote et al. (1972), and on previous archaeological studies in the APE, these soils range in thickness from about 20 inches (50 centimeters-cm) to about 6.5 feet (2.0 meters-m).

Just inland of the mixed fill lands in the APE, a relatively narrow band of Ewa silty clay loams (EmA) are encountered (see Figure 3). These soils are moderately shallow and are present in areas with 0 to 2% slopes. Ewa silty clay loams are well-drained soils occurring in basins and on alluvial fans and have developed in alluvium derived from basalts.

Ewa silty clay loams occur only in seaward portions of the APE. Streets identified as having underlying Ewa silty clay loams include portions of Keawe, Pohukaina, South, Punchbowl, Alakea, Merchant, Richards, and Bishop Streets. Based on Foote et al. (1972), and on previous archaeological studies in the APE, Ewa silty clay loams average about 20.0 inches (about 50 cm) in thickness.

Inland of the Ewa silty clay loams in the APE Makiki clay loam (MkA) soils are encountered (see Figure 3). Makiki clay loams are somewhat similar to Ewa silty clay loams. These soils occur on 0 to 2% slopes, and consist of well-drained soils on alluvial fans and terraces in the city of Honolulu. The soils were formed in alluvium mixed with volcanic ash and cinders, and are used almost entirely for urban purposes.

Makiki clay loams occur in central and inland (*mauka*) portions of the APE. Streets identified as having underlying Makiki clay loams include portions of Punchbowl, Alakea, Merchant, Richards, Hotel, Miller, and Bishop Streets. Based on the Foote et al. (1972), and on previous archaeological studies in the APE, Makiki clay loams range in thickness from about 20.0 to 30.0 inches (50.0 to 75.0 cm).

The fourth soil series located within the APE includes Tantalus silty clay loam (TCC). Tantalus silty clay loams occur inland of Makiki clay loams in the APE (see Figure 3). Tantalus soils occur on 8 to 15% slopes, and consist of well-drained soils on upland areas (foothills) of Oahu. The soils were formed in volcanic ash and materials weathered from cinders, and are used for urban purposes such as home sites, water supply and recreation.

Tantalus clay loams occur only in the inland-most (*mauka*) portion of the APE. The only street where these soils may be encountered is along the upper reaches of Miller Street. Based on the Foote et al. (1972), Tantalus clay loams range in thickness from about 20.0 to 30.0 inches (50.0 to 75.0 cm).

CULTURAL & HISTORICAL BACKGROUND

Legendary History and Place Names Associations

The seawater APE includes two sections of the urban center of Honolulu, Downtown Honolulu and Kaka`ako, both of which are within the traditional *ahupua`a* of Pauoa (Figure 4). More recent shifts in land boundaries as established through the tax map system have resulted in parcels within the APE variously designated as being in Honolulu, Nu`uanu, and Waikīkī *ahupua`a*, as seen in a number of reports consulted for this study. Downtown Honolulu comprises the area of land bounded by Nu`uanu Stream on the west, Vineyard Boulevard on the north, Ward Avenue on the East, and Honolulu Harbor on the south. Kaka`ako lies immediately to the east of the Downtown area includes portions of what were formerly known as Kewalo, Kukuluāe`o, and Ka`ākaukukui (Pukui et al. 1974). There are previous studies for these areas that provide a comprehensive review of historical and archaeological data (Griffin et al. 1987;

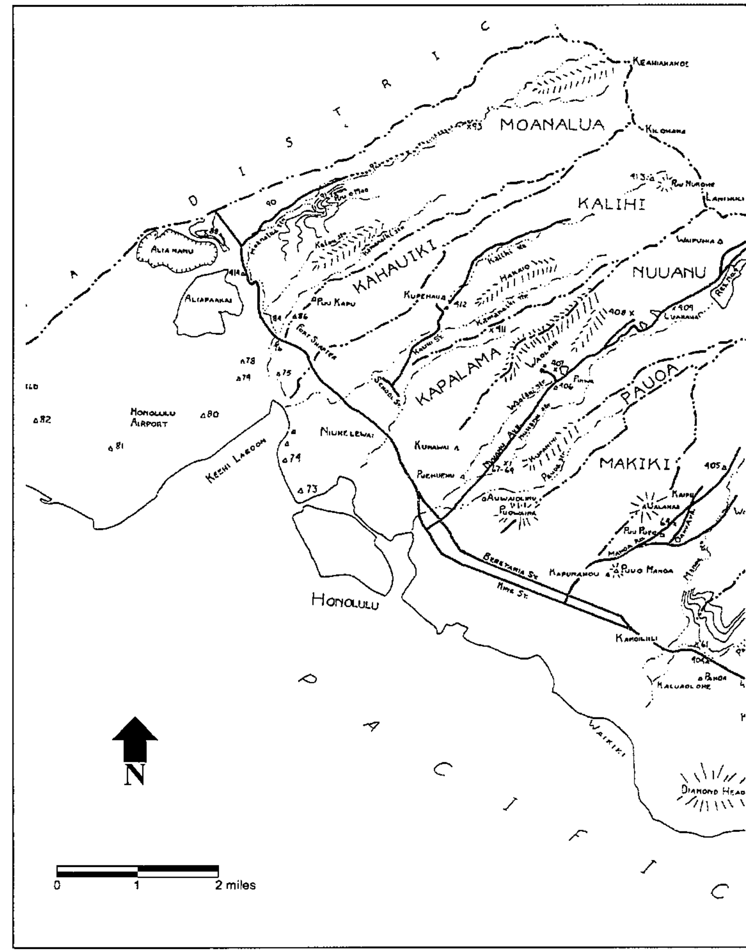

Figure 4. Location of Pauoa Ahupua`a (Adapted from Summers & Sterling 1970)

O'Hare et al. 2008; McElroy et al. 2008). Consequently, a briefer overview for Downtown Honolulu and Kaka`ako will be presented here.

In pre-Contact times, the Downtown area was not heavily populated, with the exception of small Hawaiian settlements such as the one at Kou. In the Kaka`ako area, settlement was also sparse, with a small group of fishermen living on the shoreline (Ii 1959). The landscape was generally level, sloping down from the *mauka* areas to the ocean on the south and towards drainages such as Nu`uanu Stream on the west (Daws 2006). Taro complexes or *lo`i* stretched *mauka* along the stream into the valley. Elsewhere in Honolulu and Kaka`ako, the dry leeward climate meant that only crops like sweet potato – tolerant of intermittent rainfall -- could be grown away from permanent water sources like the stream. The *makai* portions of both areas had natural features such as tidal mudflats in addition to sandy shoreline. In pre-Contact times, people made use of the natural features to construct fishponds or salt pans to enhance access to preferred resources.

The legendary histories contained in secondary sources such as Westervelt's work do not include many events that took place within the downtown Honolulu or Kaka`ako areas. Instead, the *mauka* portions of Nu`uanu Valley – particularly Waolani Stream – are the primary settings for a number of stories (Westervelt 1987). In *Myths and Legends of Hawaii*, Westervelt (1987) refers to several locales within or near the current APE that played a role in the region's legendary history.

Kou was the principal place name for what became Honolulu. Kou was named for the chief Hono-kau-pu, an *`ilāmuku* or executive officer of Kākuhihewa, the ruling chief of O`ahu in the 16th century A.D. Kou lay between Hotel Street and the ocean, and between Nuuanu Avenue and Alakea Street (Westervelt 1987; Pukui et al. 1974). Kou was known for its proximity to the harbor, as this *`ōlelo noe`au* (proverb) says: *Ke awa la`i lulu o Kou* (The peaceful harbor of Kou) (Pukui 1983).

Māmala or ***Ke Kai O Māmala*** was the surf at the entrance to the natural harbor at Kou, named for the chiefess Māmala, a renowned surfer. Māmala was married first to the shark man Ouha and then to the chief Hono-kau-pu, to whom Kakūhihewa gave the land named for him at Kou (Westervelt 1987). Several *`ōlelo noe`au* refer to the surf of Māmala such as this saying: *Na `ale kuehu o Māmala* (The billows of Māmala with wind-blown sprays) (Pukui 1983)

Pākākā was the name of a landing and a *heiau* located at what became the *makai* end of Fort Street. Thrum (1907) called it a *heiau* of the "pookanaka" (sacrificial) class but did not provide a location. Built before Kakuhihewa's time (in the 16th century A.D.), the *heiau* was established by the King of O`ahu to house the powerful god Ku-hoo-nee-nuu he had brought from Maui (Westervelt 1987).

Kawaiaha`o was a freshwater spring (*wai*) that belonged to the Chiefess Hao that was located on what became the church grounds near the intersection of King and Punchbowl Streets.

Kewalo was known as the place where slaves (*kauwā*) were put to death by drowning. Also, the owl at the center of a battle between the owls of O`ahu and Kaua`i and the chief Kakūhihewa had its nesting area in Kewalo. An *`ōlelo noe`au* associated with Kewalo describes the fresh-water springs the area that many once went to: *Ka wai huahua`i o Kewalo* (The bubbling water of Kewalo) (Pukui 1983). Participants in the CIA recalled such fresh water sources from their own childhood days in Kewalo in the first half of the 20th century; by this time, the actual springs had been covered over but the consultants remembered the clear, cold, refreshing water that came from artesian wells sunk into the aquifer.

As seen above, the place names formerly given to locales in the Nu`uanu-Downtown and the Kaka`ako regions provide information on past land uses; a number of the old place names still appear on government maps and other documents. Many of these places appear on Figures 5 and 6; although both are schematic maps, they provide some insight into the former locations of now-vanished place names. Figure 5 is taken from a map of Honolulu in 1810, issued by Bishop Museum in conjunction with its publication of John Papa `I`i's *Fragments of Hawaiian History* (1957). Figure 6 is a schematic map prepared by Bruce Cartwright (n.d.) and included in an appendix on historical background data for the Harbor Court Parking archaeological data recovery report (Kalima & Maly 2002, Appendix A in Lebo 2002).

HISTORIC AND RECENT LAND USE HISTORY

The place name of "Honolulu" has various meanings. Pukui et al. (1974) give a meaning of "protected bay" while Westervelt (1987) suggests that the place name actually referred to a locale near the present-day intersection of Liliha and School

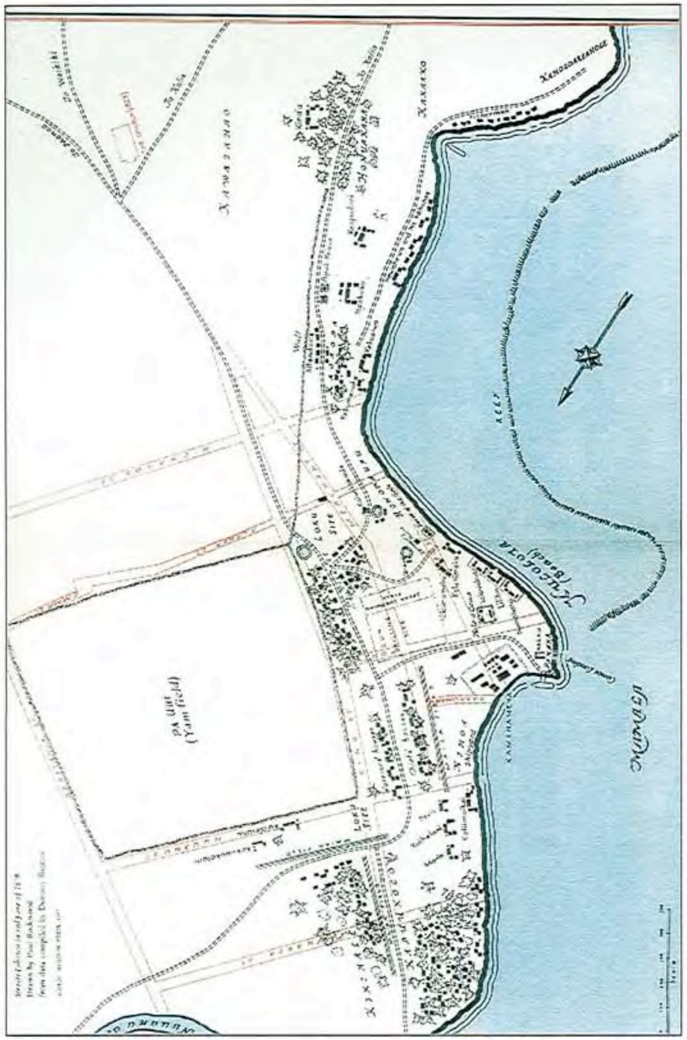

Figure 5. Honolulu in 1810 (from Rockwood 1957)

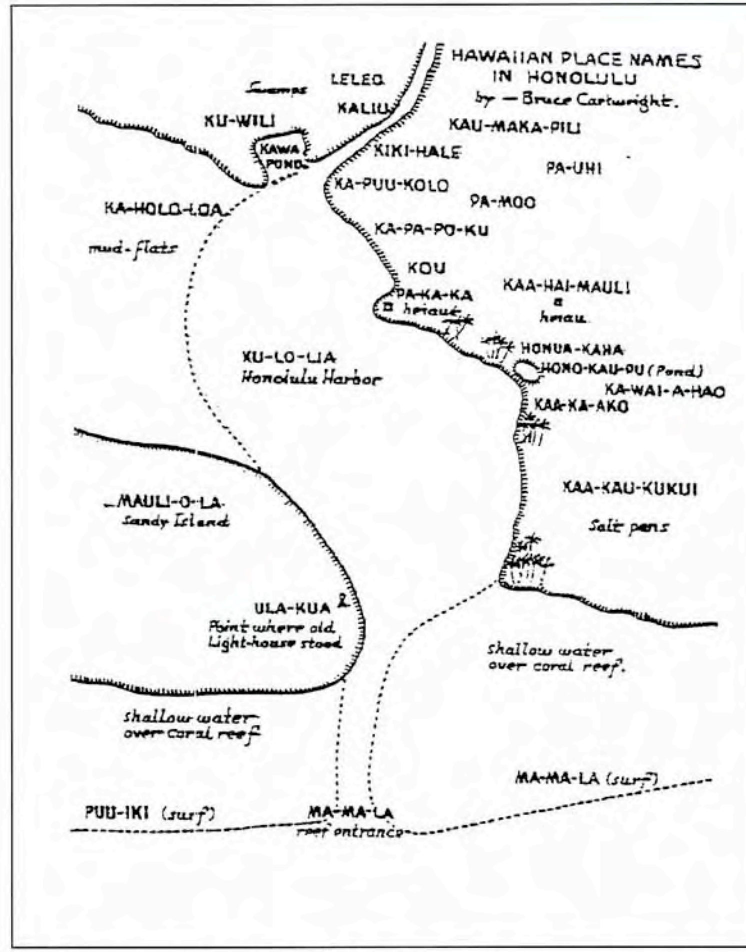

Figure 6. Place Names of the Legendary Period in Kou and Honolulu (Cartwright, n.d.)

Streets that belonged to a chief named Honolulu, one of Kakuhihewa's high chiefs in the 16th century A.D. Until the early 19th century, what is now called downtown Honolulu was known as the location of smaller settlements such as Kou which existed between the ocean and the *mauka* farming areas, the barren Makiki plain, and the ocean. The area was not as desirable a location as the sand berms along Waikīkī's shores, where *ali`i* dwelled, or the well-watered flats adjacent to Nu`uanu Stream. An *`ōlelo noe`au – Ho'a ke ahi, ko'ala ke ola. O na hale wale no ka i Honolulu; o ka 'ai a ka i'a i Nu'uanu* (Light the fire for there is life-giving substance. Only the houses stand in Honolulu; the vegetable food and meat are in Nu'uanu) (Pukui 1983) – alludes to the primary use of Honolulu for residential purposes.

Westervelt (1987), in retelling the legends of the owls, describes the Honolulu area as follows, as seen from Kahehuna (near the modern-day intersection of Fort and Beretania Streets):

> "…the seacoast was a place of growing rushes and nesting birds. A dry, heated plain, almost entirely destitute of trees, extended up to the foothills. Taro patches and little groves of various trees bordered each watercourse. The population was small and widely scattered…"

The place name of "Honolulu" only came to be identified with a permanent settlement in the late 18th and early 19th centuries. The western sailing ships arriving at this time found safe anchorage within the relatively deep Honolulu Harbor (Daws 2006). Before the advent of western shipping, Hawaiian *ali`i* preferred to live in the Waikīkī area. The composite map of Honolulu in 1810, drawn by Paul Rockwood (Rockwood 1957) from John Papa `Ī`ī (1959) shows a traditional settlement pattern, with the chiefly residential compounds (including recreational and religious precincts) and agricultural areas, and the beginnings of western land use, such as the shipyard near Pākākā (see Figure 5).

The first western map of Honolulu Harbor and environs was drafted by the Russian Otto Von Kotzebue in 1816; Figure 7 is a later adaptation of this map (Moffat & Fitzgerald 1986), with English translations for the various features Von Kotzebue labeled in Russian. As can be seen, Kou, and the Kewalo or Kaka`ako areas are still pretty much as John Papa `Ī`ī described them in 1810; while the fort has been constructed and a powder magazine established, the region is still very much a royal residential compound with traditional gardens nearby.

Within a few years, growing western maritime traffic attracted more permanent settlement in the immediate vicinity of the harbor, including Hawaiian monarchs, *ali`i*,

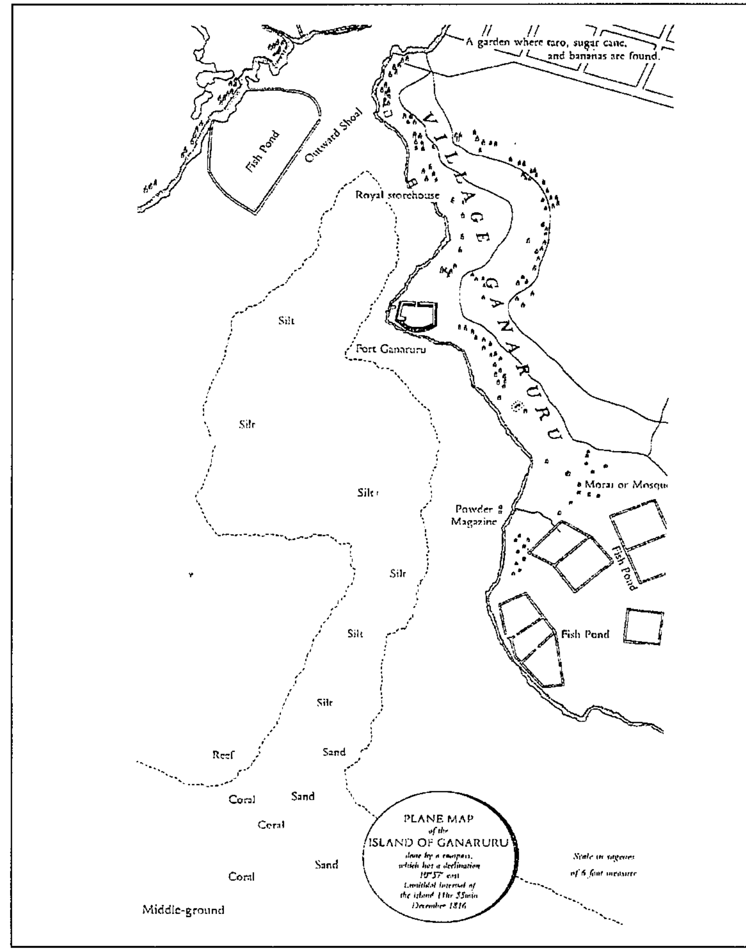

Figure 7. Portion of Otto Von Kotzebue's Map of Honolulu Harbor in 1816.

and their families, as well as Euro-Americans who built commercial and residential structures nearby (Judd 1975). A map of Honolulu Harbor and its environs, drafted in 1825 by Lieutenant Malden (from Simpson 1843, cited in Judd 1975), shows the juxtaposition of western development such as the wharf, fort, and westerners' residentces with traditional features such as the fishponds (Figure 8). It appears that the Kaka`ako area was still largely unsettled during the first quarter of the 19th century as the Malden map shows. The Māhele data presented below also shows that Kaka`ako was considerably less settled – indeed parts of it were referred to as "waste lands" – even at the mid-19th century.

Within 20-30 years of Lt. Malden's visit, Honolulu had become an urban center, with varied commercial, residential, and other interests reflected in its buildings. Figure 9 is taken from a map drafted in 1855 by LaPasse (Moffatt 1986). The area immediately surrounding Honolulu Harbor has established streets in addition to the government and commercial structures constructed there, but nearby Nu`uanu Stream is still a major agricultural area, with many *lo`i kalo* shown. The coastal portion of Kaka`ako is still largely unsettled, and is shown as having marshes (*marais*) as well as its fishponds.

By 1887, the government survey map prepared by W.D. Alexander (Figure 10) depicts an essentially modern layout for Downtown Honolulu. Landmarks such as `Iolani Palace are present; major religious, commercial, and other government buildings are also shown on this map. The Kaka`ako area in 1887 is still largely unsettled and appears to have little construction apart from the immigration station and Fort Armstrong battery along the shoreline. Shortly after this map was drafted, however, a massive reclamation project began in Kaka`ako with the infilling of the marshes and lowlands that characterized the region. The area filled with dredge coral extended from near the intersection of Punchbowl and Halekauwila Streets northeast to the vicinity of the intersection of Ward and King Streets, and east to Cooke Street and Kapi`olani Boulevard, including the land under McKinley High School (Hirata 1979). The extensive infilling created an area suitable for industrial, commercial, and residential development.

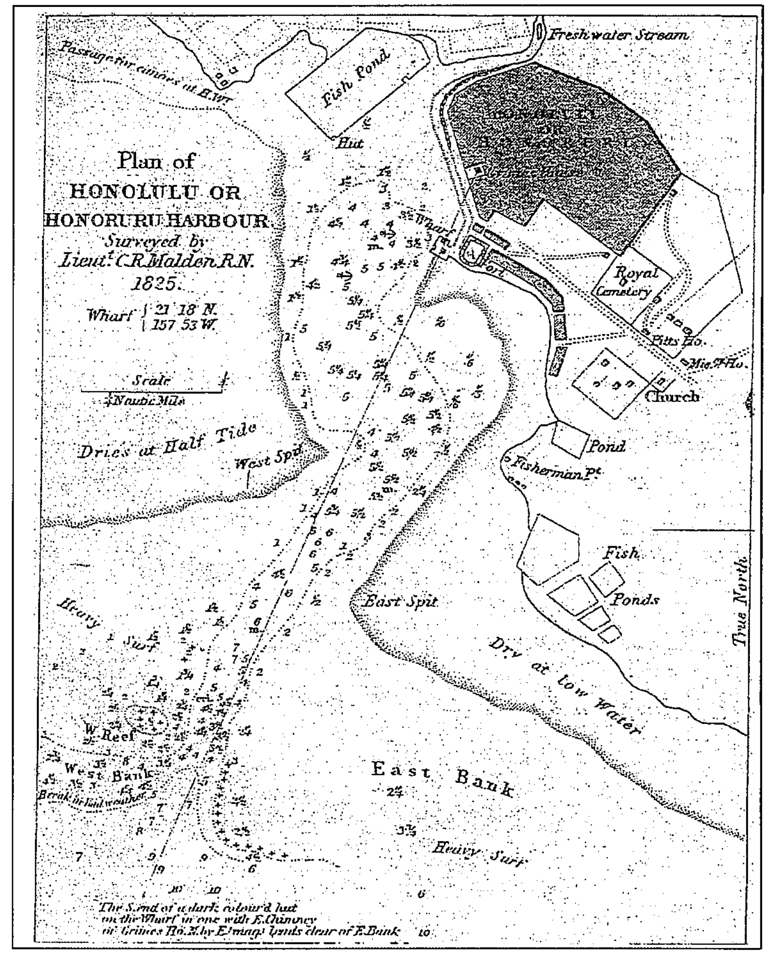

Figure 8. Plan of Honolulu Harbor in 1825 by Lt. Malden.

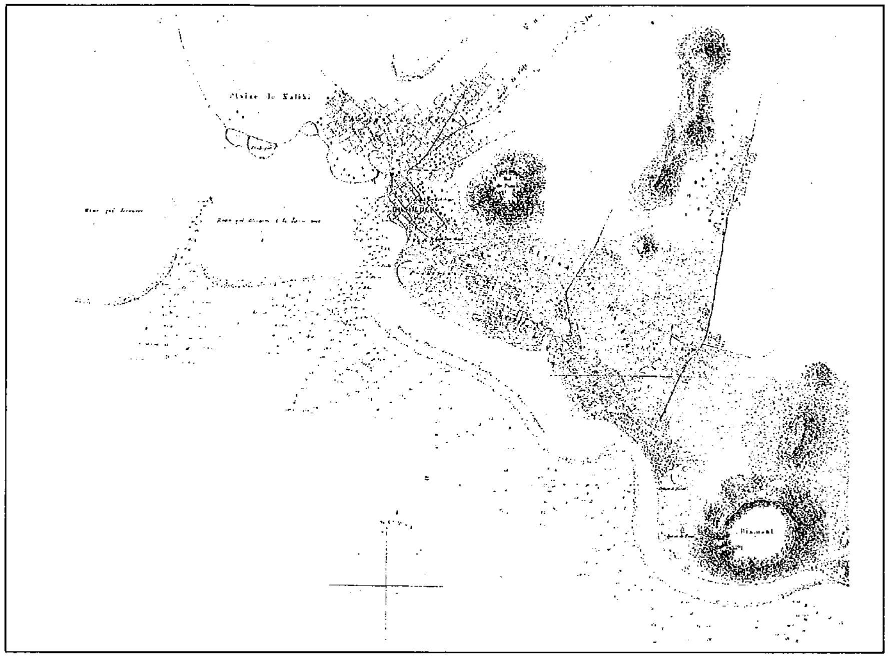

Figure 9. Honolulu in 1855 by LaPasse.

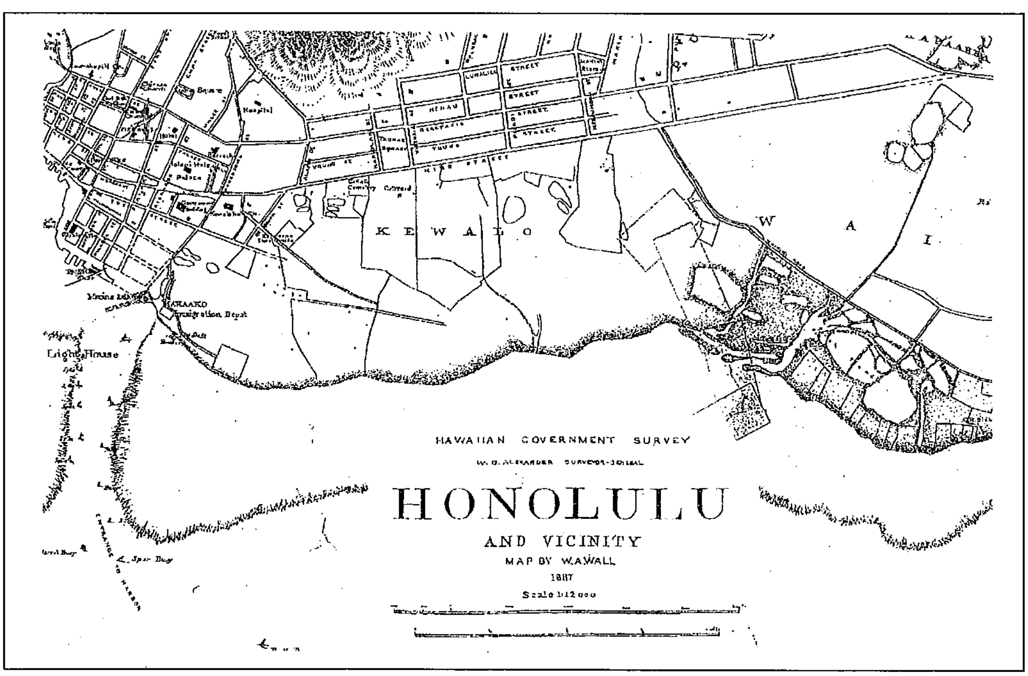

Figure 10. Honolulu and Vicinity in 1887 by Wall (Hawaii Government Survey).

Within 25 years of the Alexander survey map of 1887, a street grid is laid out in Kaka`ako amidst the property of private and public landowners, as shown on the government survey map prepared by G. Podmore in 1911 (Figure 11). By 1927, the Kaka`ako area is home to a robust, multi-cultural community who live in clearly defined settlements, as seen in this composite map drafted for the 1978 University of Hawaii (UH) oral history study of Kaka`ako residents (Figure 12). Kaka`ako businesses catering to particular ethnic groups existed alongside their respective residential communities; consulting parties in a Cultural Impact Assessment (CIA; below) emphasized this factor and also described the various institutions (religious and educational) that served the Kaka`ako neighborhoods.

Both the Downtown and Kaka`ako areas underwent substantial changes from about 1950 onwards. In the Downtown area, a number of new commercial buildings replaced older structures or were constructed in available vacant spaces (Ames 1996). The mix of residences and commercial establishments that existed from the early 19th century through the first half of the 20th century gave way to a Downtown comprising commercial and government buildings, interspersed with some public spaces such as parks or squares. In Kaka`ako, residents moved out and were replaced by businesses that could not afford to lease or buy commercial space in the more expensive Downtown area. By the late 1970s, in response to multiple issues – the need to upgrade infrastructure, the need for affordable commercial and residential space near the Downtown area – the Hawai`i Community Development Authority (HCDA) was established as a state agency in 1976. Responsible for all future activities in the Kaka`ako area, the HCDA commenced a multi-year planning program for the region based on the vision of a "mixed use" plan including commercial and residential development in accordance with publicly approved plans (HCDA 1979). The ensuing Kaka`ako redevelopment has radically changed the appearance of the area, with many new high-rise residential towers and commercial-retail centers constructed where the low-rise stores and houses once stood. The consulting parties in the Cultural Impact Assessment (below) prepared for the HSWAC study all noted the massive scale of this change, and how their old neighborhoods have virtually disappeared except for a few locations and historic buildings.

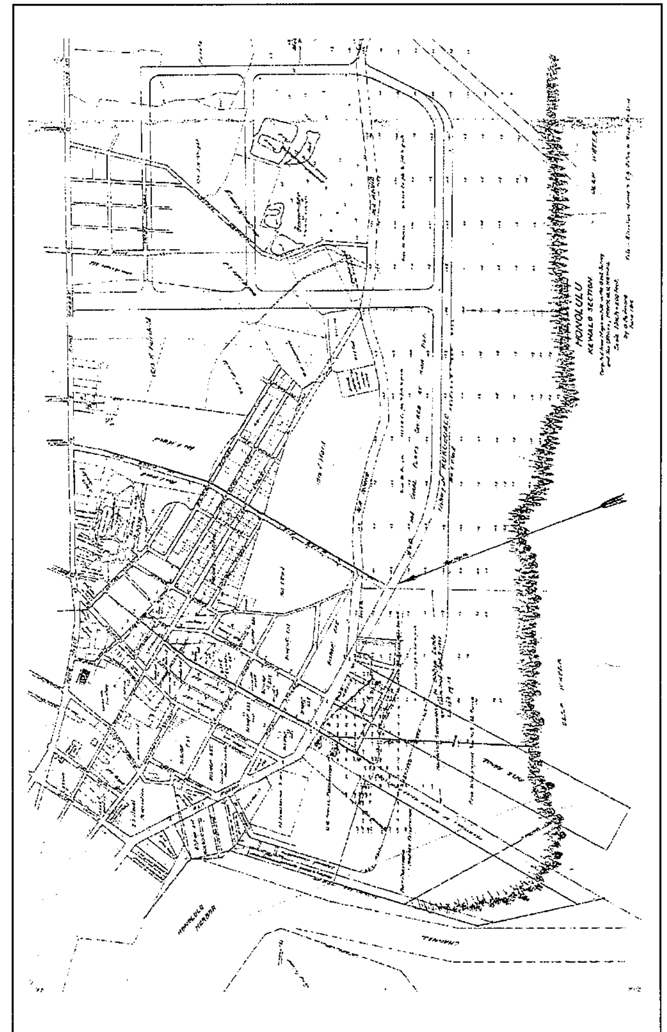

Figure 11. Kewalo in 1911 by Podmore (Hawaii Government Survey).

Figure 12. Kaka`ako in 1927 (UH Oral History Program).

THE GREAT MĀHELE: LAND COMMISSION AWARDS (LCAs)

During the period between 1839 to 1855, several legislative acts transformed the centuries-old Hawaiian traditions of *ali'inui* land stewardship to the western practice of fee simple or private land ownership. Traditionally, each island was divided into *moku* or districts that were controlled by an *ali'i 'ai moku.* Within each of the *moku* on each island, the land was further divided into *ahupua'a* and controlled by land managers or *konohiki.* The boundaries of the *ahupua'a* were delineated by natural features such as shoreline, ridges, streams and peaks, usually from the mountain to the sea, and ranged in size from less than ten acres to 180,000 acres (Moffat and Kirkpatrick, 1995:24-29, see also Chinen 1958:3; Gay 1965:50). "The principal tax levied on an ahupua`a were hogs. *Ahu* [altar] is a place where things were brought in and stored or piled up, and *pua`a* is hog or pig. Hence the name *ahupua`a*" (Gay 1965:49).

Each *ahupua'a* was often divided and sub-divided several times over (i.e., *ili, kuleana, mo'o, pauka, koele, kiha pai*), with each subdivision answerable to the *ali'i* where the lesser division was located. However the *ili kupono* or the *ili ku* was "completely independent of the *ahupua'a* in which it was situated… [and] tributes were paid directly to the king himself" (Chinen 1958:4). Rights to lands were mutable or revocable. A ruling chief or any "distributor" of lands could change these rights if displeased with the recipient(s), or redistribute lands as favors–usually after a victorious battle, and after the death of the *ali'inui* (Chinen 1958:5).

Kamehameha III, in his mid-thirties, was persuaded by his *kuhina nui* and other advisors to take a course that would assure personal rights to land. In the first stage King Kamehameha III [Kauikeaouli] divided up his lands among the highest ranking *ali'i* (chiefs), *konohiki* (land managers), and favored *haole* (foreigners) (Chinen 1958:7-14; Moffat and Fitzpatrick, 1995:11, 17). One-third of all lands in the kingdom would be retained by the king; another one-third would go to *ali`i* as designated by the king; and the last one-third was supposed to go the *maka`āina na.* In 1846 he appointed a Board of Commissioners, commonly known as the Land Commissioners, to "confirm or reject all claims to land arising previously to the 10th day of December, AD 1845." Notices were frequently posted in *The Polynesian,* a widely distributed local newspaper (Moffat and Kirkpatrick, 1995). The legislature did not acknowledge this act until June 7, 1848 (Chinen 1958:16; Moffat and Kirkpatrick, 1995:48-49), known today as *The Great*

Mahele.

The *mahele* did not actually convey title to the various *ali'i* and *konohiki*; it essentially gave them the right to claim the lands assigned to them--these lands became known as the *konohiki* lands. They were required to present formal claims to the Land Commission and pay a commutation fee, which could be accomplished by surrendering a portion of their land to the government (Chinen 1958:20). The government could later sell these lands to the public. Upon payment of the commutation fee, the Minister of Interior issued a Royal Patent to the chief or *konohiki*. The last one-third was originally designated to the *maka`āinana* , but not acted on--instead it was set aside to the government, "subject always to the rights of the tenants" (Moffat and Kirkpatrick, 1995:41-43; see also Chinen 1958:15-21). *Ili kupono* were the only *ili* [parcel] recognized in this process, all the *ili* and lesser divisions were absorbed into the *ahupua'a* claim (Chinen 1958:20). In 1892 the legislature authorized the Minister of Interior to issue Royal Patents to all *konohiki* or to their heirs or assignees where the *konohiki* had failed to receive awards for their lands from the Land Commission. The Act further stipulated "that these Royal Patents were to be issued on surveys approved by the Surveyor General of the kingdom..." (Chinen 1958:24; Moffat and Fitzpatrick 1995:41-43).

Kamehameha III formalized the division of lands among himself [one-third] and 245 of the highest-ranking *ali'i* and *konohiki* [one-third] between January 27 to March 7, 1948. He acknowledged the rights of these individuals to various land divisions in what came to be known as the *Buke Mahele* or 'sharing book.' Many *ali`i* were awarded portions of or entire *ahupua`a*. Many *ali`i*, especially descendants of the royal line, inherited very large land awards on all the islands, including Ni`ihau. This occurred because the royal children of Kamehameha I did not leave any immediate descendants. Their lands were subsequently awarded to descendants from lesser lines.

Table 1 (below) lists a number of Māhele awards and grants made for properties within the Downtown portion of the APE. While many of the awardees listed in Table 1 were members of or politically connected to the Hawaiian royal families, the types of properties claimed illustrate the considerable growth of an urban center in less than 75 years after the first known Western contact. It also shows that much of Honolulu was still a residential area where people had their homes and gardens, as well as their businesses. In addition, by the mid-19th century there had already been considerable

turnover in some properties, affecting both commoners and royalty. For example, Ka`ahumanu's residential compound on the shoreline at Kou, called Nihoa, had been acquired by the English Counsel in 1843, just prior to the Māhele. The development of the growing urban center also affected landowners through the alteration of boundaries or even truncation of property due to roadways. Figures 13 and 14 which follow Table 1 show the location of many of the Māhele awards and grants listed in Table 1 in the Downtown area. Figure 13 shows the *mauka* portions of the HSWAC pipeline route in the Downtown area superimposed on a Government Survey map titled "Original Titles Honolulu of unknown date and author while Figure 14 shows the *makai* portions in conjunction with recorded LCAs.

Table 1. Māhele Awards & Grants in the Downtown Portion of the APE

LCA#	Awardee	Associated Street or Place	Associated Structures & Resources
18	Geo Wood	Union Street	Land given by Boki; fenced; Garden Lane; house
19	Naehu/Naahu (w)	Queen/Kaoaopa	Fenced house lot; house
21	Nakookoo	Merchant/Mililani Streets	House lot
33	Thos Cummins	Fort/Merchant Streets	Fenced house lot (from father-in Keauiaole)
36.1	Poeha & Napoeha (husband of Charles 2nd wife)	Merchant & Richards Streets	2 houses & a fence
56	Eliab Grimes	Union/Adams Lane	Large grass house on fenced lot (Wm French sold to Capt. Grimes; property given to his daughter by Opunui)
62	John Reeves (Rives)	Hotel Street off Bishop Street	Large house-hotel. In 1823, John Reeves went with Liholiho to Britain and bequeathed the property to his 3 children: John, George, and Kahoa Pearse-Tolman
62B	Kaahoa/Kahoa (w) Pearse-Tolman	Hotel Street off Bishop Street	House; (daughter of John Rives, sister of John & George Reeves)
63	Namaau	Honuakaha (*makai* side of Queen between Richard & Punchbowl)	2 house lots, total of 16 houses; school house for foreigners; canoe landing (disputed)
65	Wm. Bacle	Beretania	Fenced house lot with frame house; land from Kamehameha

			I
73	Unauna	off Punchbowl	House lot; taro patches
97B	Kaohipau	Merchant/Alakea	2 houses; road/path; from mother Sally White
113	A. Paki	King/Bishop	House lot with several houses
115	A. Paki	Alakea/Queen	House; fence (Kinau once lived here)
119	A. Paki	Punchbowl	Fence
128	Kahikona & Kekoa (Haia's 2nd wife)	On King Street near Richards Street	Adobe fenced lot with 6 houses; kukui trees; path/road
131	Eli Jones	Merchant / off Fort	
137	Wm Summer	Hotel/Richards	House; well; former *kapu* lands; grass hut; storehouse
155	Wm Sumner	Richards Street	House lot; fence
157	Wm Sumner	Richards Street	Several houses; fence
159	M. Kekuanaoa	Queen & Merchant Streets	Fence; house lot
161	M. Kekuanaoa for V. Kamamalu	Merchant	Fenced house lot with 2 houses; former playground (Kekuanaoa lives there – father of V. Kamamalu and husband of Kinau)
164	V. Kamamalu	*Makai* side of Queen (on the shoreline)	Road; house lot
177	V. Kamamalu	Richards	"Improved" – no other details
184	M. Kekuanaoa	Merchant/Richards	Vacant or "idle" land
189	H.S. Davis	Bishop	House lot; fence; road; hotel formerly on land
191	Kekauonohi/Haalelea	Hotel	5 house lots; store house; former *kapu* lands
191B	Kapule	Punchbowl at Palace Walk (Hotel Street0	Fenced houselot
221	Kekuaiaea	Merchant	3 houses; fence
226	Keauiaole	Merchant & Fort Streets	Fenced house lot; 2 houses; well; milo & pandanus trees
247	Wm. Lunalilo	12 apana at various locations: Beretania, Queen, King, Fort, Merchant & Punchbowl Streets; Printer's Lane; Kaka`ako	House lots with dwellings, including royal residences; commercial buildings (including Hudson's Bay Co., shoe store)
280	Kaaha & Kamaile	Punchbowl/Printers Lane	5 houses; fence; trees; well; taro patch; road
387.2	A.P. Mission	Punchbowl & King (Kawaiaha`o & Kukula`aeo)	Mission buildings; adobe schoolhouse
561	Kalei	Hotel & Cross Streets	Fenced house lot with 2 houses & a well
570	Amow	Hotel & Richards	House lot; formerly owned by

		Streets	watch maker
577	Kalaimoku	Merchant-King	From father Kapelepele; houses; fence
611	Leoiki (w)	Fort Street	2 pili grass houses; 2 adobe houses; road; (from George Wood; wife of Capt. Buckle)
626	S. Reynolds	Hotel & Merchant Streets, `*ewa* of govt wharf	House; hotel; canoe landing; livestock (turkeys & pigs)
628	S. Reynolds	King – off Merchant	House & livestock enclosure
681	M. Kekuanaoa	*Makai* side of Queen Street at Kaahumanu Street (formerly Nihoa)	Formerly a residential compound for Kaahumanu mā, with houses & fence; acquired by English Consul in 1843
721	Mahuka & Kaai	Merchant/Bishop/King	Fenced house lot with 5 houses
786	Robinson & Lawrence	King/Nuuanu	Public house (Ship & Whale); 4 houses (from Capt. Dowsett)
801	A. Adams	Bishop/Hotel	Several houses & fence (from Kamehameha I)
814	Kepahukepau	Hotel/Richards	7 houses; fence
816	A. H. Fayerweather (attorney)	Garden Lane – Bishop – Adams	2 houses; cook house; fencec (from Gov. John Adams Kuakini)
971	Isaac Harbottle	Hotel/Bishop	2 houses; fenced; from his wife Kauluha on her death
1003	Koiamai, Mark	King/Alakea	1 house lot with 4 houses; another house lot with 3 houses; fenced lots; road (from Kaleohano; claimant is husband of Kahiaonui Wahne-sister of Kaleohano)
1026	Mary Dowsett	Bishop/Garden Lane or Union Street	Sold to her by Capt. Alexander Adams who recd from Kamehameha I in 1815 for services rendered
1802	Jose Nadal (Spaniard)	Merchant/Richards	3 houses; fence; from Kekauonohi for Kinau as a relative by marriage – Kekuanaoa's first child
1975	Robert W. Wood	Hotel/Bishop	2 house lots; enclosure
2019	Pupule	Mililani	House lot; road; fence; the land came from Kaheana, his mother; after the war on Kaua`I she came back and built a house
3322	Tute	Richards Street & Palace Walk (present-day Capitol Grounds)	3 houses; stone wall (Tute or Kuke, named after Capt. Cook, came from Borabora and given several lands by Kaahumanu; he as a missionary and chaplain

			to Kamehameha III)
3658	Charlotte A. Hooper	Hotel (*mauka*) near Richards	Widow of Wm C. Little; house lot
3708.8	Gov. Barracks	Palace Walk (Hotel Street – present-day Capitol Grounds)	Royal school; land known as Pahukaina; once owned by Kaahumanu; later owned by Kinau
4883	Wm French	Alakea, *mauka* of Hotel	House lot; residence; fenced. Paid $4,600 at auction in 1838 after death of John Ebbets who got the land from Kalaimoku
5166	Keikenui	Merchant/King	From Kekuanaoa in 1844; house; enclosure; road
5527	John Duke	Hotel/Bishop	House lot; road; fence; from Boki for services
5573	Kualii	Merchant Street between Fort & Alakea Streets	3 houses; wife of Kaua
6506	Ahu (Pake/Ahpong)	Queen/Alakea	House lot; land given by Kamehameha III
8515	Keoni Ana	Mililani & Queen Streets	House lot
10806	Kamehameha III	Alakea-Queen-Richards to the sea	Occupied by the King's people since the war (1826) on Kaua`i: Imilealani lived with `ohana under King's mother since the time of Liholiho; occupied by King's retainers

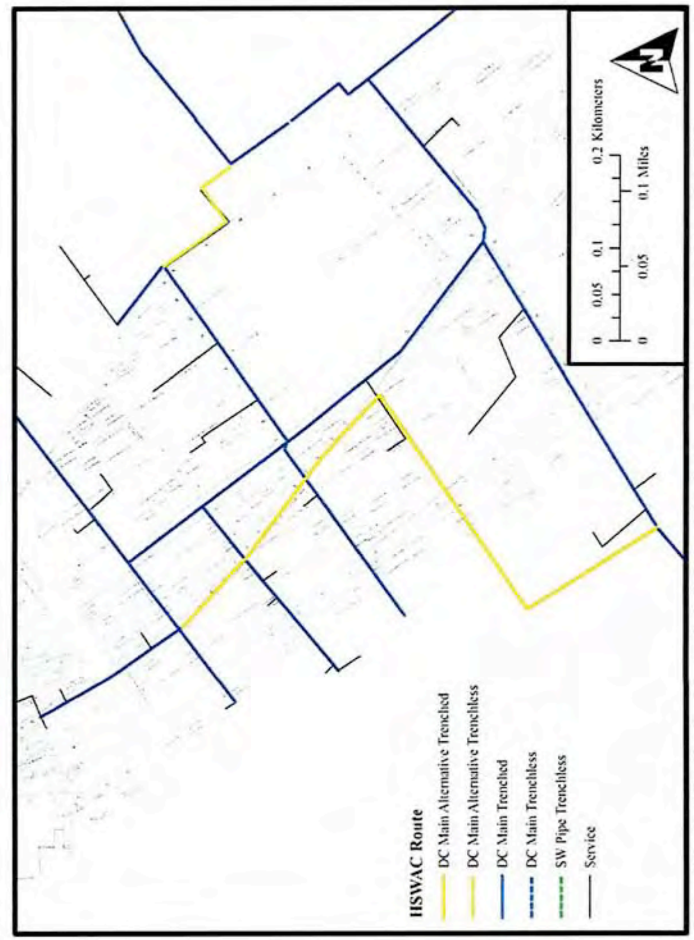

Figure 13. HSWAC Pipeline Route in Relation to Māhele Awards & Grants in Downtown Honolulu.

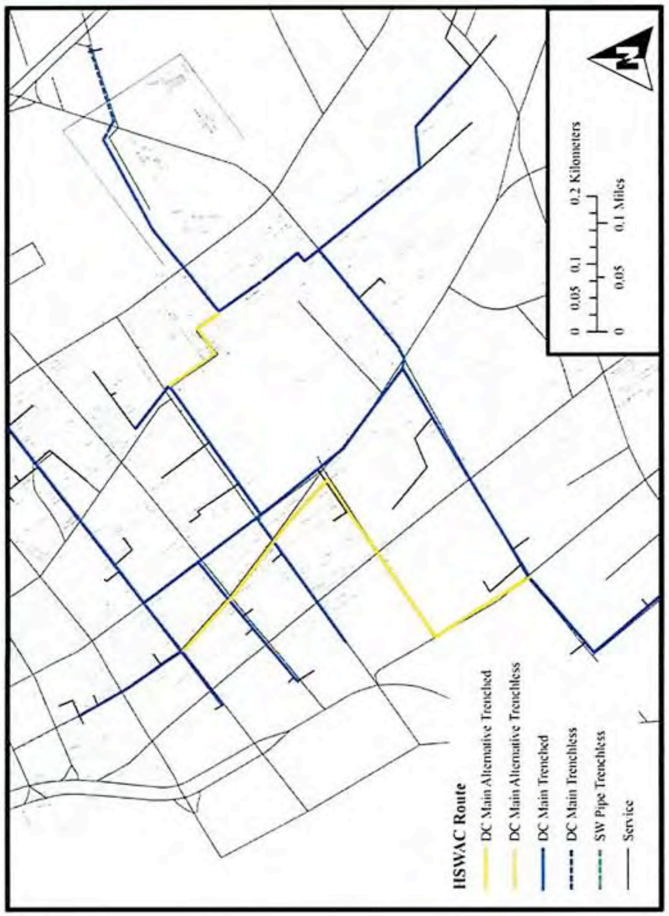

Figure 14. HSWAC Pipeline Route in Relation to Māhele Awards & Grants in Downtown Honolulu.

Māhele awards and grants made for the Kaka`ako portion of the APE are much less numerous than those for the Downtown area. This is partly because a particularly large award recorded for property within the APE – LCA 7713 – went to Victoria Kamamalu; this LCA comprised much of the *makai* portion of Kaka`ako with its fishponds and coastal marshes. Figure 15 shows the locations of the Kaka`ako awards and grants in conjunction with the proposed HSWAC pipeline routes through this portion of the APE; the base map is the 1884 government survey map of the Kewalo section of Honolulu by S.E. Bishop. Table 2 (below) lists the Mahele and LCA awards for the Kaka`ako portion of the APE.

Table 2. Māhele Awards & Grants for the Kaka`ako Portion of the APE

LCA#	Awardee	Associated Street or Place	Associated Structures & Resources
129.1	Kinimaka	Queen & Punchbowl Streets	Fenced house lot with house
677	Kekuanaoa for V. Kamamalu	Honuakaha	Fenced lot with 2 houses; *mauka* of salt ponds; a portion later became Honuakaha Smallpox Cemetery
729	Kekuhaupio	Queen Street	Fenced house lot with 3 houses
735	Kaahumanu	Honuakaha	Partly fenced house lot with 2 houses
805	Kaaluea	Honuakaha	Fenced house lot with 1 house
1082	Kekuanui no Kahakai	Honuakaha	Partly fenced house lot with 2 houses; 40 *lo`i kalo*
6489	Kaihiwa	Honuakaha (Kawaiahao)	House lot
7713	V. Kamamalu	Ka`ākaukukui (Ft. Armstrong)	Kawa fishpond, later partially dismantled to construct sea wall

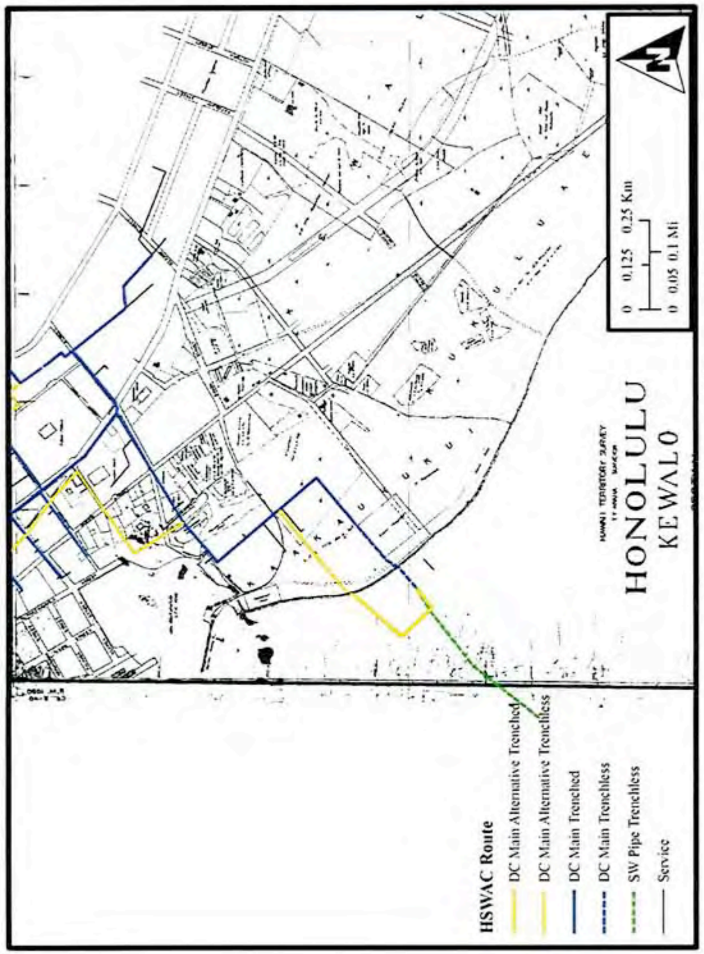

Figure 15. HSWAC Pipeline Route in Relation to Māhele Awards & Grants in Kaka`ako.

PREVIOUS ARCHAEOLOGY

PREVIOUS ARCHAEOLOGICAL STUDIES

The APE lies mostly within the Downtown and Kaka`ako sections of modern-day Honolulu. Although these areas are extensively developed, and indeed are undergoing continuous development, they are rich in historic and cultural resources, as evinced by the summary data in Table 3 (below). Table 3 lists selected archaeological projects and findings made over the last 35 years within the APE. Included in Table 3 are brief descriptions of the project areas, the nature of work, general age of findings, the State Inventory of Historic Places (SIHP) or site number (if known), and whether or not human burials were found during a specific project. Figure 16 shows the locations of these previous project sites within and near the APE. Figure 17 shows the locations of some previous burial finds in and near the APE.

One of the earlier sources of information on known historic and cultural sites is J. Gilbert McAllister's work, *Archaeology of Oahu*, published in 1933. McAllister traveled the length and breadth of O`ahu in 1930, working with Native Hawaiian informants to identify the then-present and former locations of historic sites and cultural places. McAllister states that at the time of his field investigations (ca 1930), none of the previously known historic sites were extant in the Honolulu area, nor did his informants know of any remaining sites. Figures 5 and 6, above, show the locations of some of the sites recorded by McAllister (1933).

Archaeological properties within the APE have been documented primarily through work done in the last 35 years. Although significant sites were known from early surveys of traditional properties (cf. McAllister 1933), the bulk of our knowledge on archaeological sites is derived from a variety of projects that included subsurface testing and monitoring of construction work in the Downtown and Kaka`ako areas. A brief synthesis of these archaeological reports follows, outlined according to their geographical locale.

Table 3. Selected Archaeological Projects Within the APE

Source	Project Location	Procedure	Findings	General Age	SIHP No 50-80-14	No. of Burials
Seelye 1968	Hale Akala, `Iolani Palace	Monitoring	Structural elements, artifacts	Historic	-9912	-
Seelye 1969	Hawaiian Mission Houses	Subsurface testing	Artifacts	Historic	-9991	-
Pearson 1970, 1980	Hawaiian Mission Houses	Subsurface testing	Artifacts	Historic	-9991	-
Altonn 1971	Kekela Building at Queen's Medical Center	Inadvertent Find	Five burials interred in traditional matter found during construction	Unknown	?	5
Fairfax 1971	`Iolani Palace –moat & carriage road	Subsurface testing	Structural elements, artifacts	Historic	-9912	-
Rosendahl 1971	`Iolani Palace – carriage road	Subsurface testing	Structural elements, artifacts	Historic	-9912	-
Spilker 1974	`Iolani Palace – moat	Monitoring	Artifacts	Historic	-9912	-
Luscomb & Reeve 1976	`Iolani Palace	Monitoring	Artifacts	Historic	-9912	-
Sinoto 1977	`Iolani Palace Barracks	Monitoring	Features, artifacts	Historic	-9912	-
Ota & Kam 1982	State Office Bldg No. 2	Monitoring	Artifacts, burials	Unknown		6
Han 1980	Royal Queen Emma	Inadvertent Find	Burials	Unknown	?	2
Tomonari-Tuggle 1983	Block J, Downtown Honolulu	Assessme nt; Subsurface testing	Artifacts	Historic		-
Kennedy 1984	Hotel & Bethel Streets	Subsurface testing	Artifacts	Historic		-
Yent 1985	Honolulu Iron Works	Monitoring; Data recovery	Features, artifacts, burials	Historic		7
Athens 1986	Judiciary Parking Garage	Monitoring	Feature, artifacts	Historic	-3984	-
Clark 1987	Makai Parking Garage, Punchbowl & Halekauwila	Monitoring	Features, artifacts, burials	Prehistoric, Historic	-2963	6

Table 3. Selected Archaeological Projects Within the APE

Source	Project Location	Procedure	Findings	General Age	SIHP No 50-80-14	No. of Burials
	Streets					
Leidemann 1988	Judiciary Parking Garage	Monitoring	Feature, artifacts	Historic	-1973	-
Pantaleo 1989	Chinatown Gateway Plaza	Monitoring	Artifacts	Historic	-2142	-
Bordner 1990	Kawaiha`o Church	Subsurface Testing	Artifacts	Historic		-
Chiogioji et al. 1991	Hawaii State Public Library	Subsurface Testing; Monitoring	Features, artifacts	Historic	-9959	-
Simons et al. 1991	Armed Forces YMCA	Monitoring	Features, artifacts	Historic	-1307	-
Douglas 1991	Human Remains from the Honolulu Iron Works	Monitoring	Analysis of burials found during monitoring	?Historic		6
Hurst & Cleghorn 1991	Kekaulike Parking Lot (Chinatown)	Inventory Survey	Artifacts	Prehistoric, Historic		-
Hurst & Allen 1992	Ka`ahumanu Parking Structure	Inventory Survey	Structural elements, features, artifacts	Historic	-2456	-
Landrum & Dixon 1992	River-Nimitz Redevelopment	Monitoring; Data recovery	Features, artifacts, burial	Prehistoric, Historic		1
Dunn & Rosendahl 1993	Nuuanu Court (a.k.a. Harbor Court)	Inventory Survey	Features, deposits, artifacts, burials	Prehistoric, Historic	-2456	6
Denham & Kennedy 1993	State Capitol Complex Conduits	Monitoring	Features, artifacts, burial	Prehistoric & Historic	-4605 & -4606	1
Avery & Kennedy 1993	South Street Building Complex	Monitoring	Features, artifacts, burials	Historic	-3712	4
Pfeffer et al. 1993	Kaka`ako Improvement District 1 (Queen Street Widening; South, Punchbowl & Halekauwila Streets)	Monitoring	Features, artifacts, burials	Historic	-4531 – -4534	149
Cultural Surveys Hawaii, 1993	Honuakaha Elderly Housing Project	Inventory Survey	Features, artifacts, burials	Historic	-3712	11
Athens et al.	Kapi`olani Blvd & Pi`ikoi St	Inadvertent	Burial, wetland deposits	Prehistoric	-4847	1

Table 3. Selected Archaeological Projects Within the APE

Source	Project Location	Procedure	Findings	General Age	SIHP No 50-80-14	No. of Burials
1994		Discovery Data recovery				
Athens & Ward 1994	Kekaulike – Diamond Head (Chinatown)	Data Recovery	Wetland/fishpond deposits	Prehistoric		-
Erkelens et al. 1994	Kekaulike – Diamond Head (Chinatown)	Inventory Survey	Structural elements, features, deposits, artifacts, burials	Historic	-4875	3
Kennedy et al. 1994	Kekaulike - `Ewa Block (Chinatown)	Inventory Survey	Fishpond, features, deposits, artifacts	Prehistoric & Historic	-4587 & -4588	3
Anderson & Williams 1995	King Street between Cooke & Ward	Backgroun d Assessme nt	Historic cultural resources likely	Historic		-
Anderson 1995	King Street between Cooke & Ward	Inventory Survey	Artifacts	Historic	-5373	-
Carpenter & Yent 1995	Washington Place – Kennel	Monitoring	Artifacts	Historic		-
Riley et al. 1995	Kekaulike - `Ewa Block (Chinatown)	Data recovery	Features, deposits, artifacts, burials	Prehistoric & Historic	-4587 & -4588	5
Garland 1996	Hawaiian Mission Houses	Data recovery	Features, artifacts	Historic	-9991	-
Goodwin et al. 1996	Marin Tower Development (Chinatown)	Inventory Survey	Structural elements, features, deposits, artifacts, burials	Prehistoric & Historic	-4494	15
Winieski et al. 1996	Honuakaha Elderly Housing Project	Monitoring	Features, artifacts, burials	Historic	-3712	14
Allen & Williams 1997	Kapi`olani Boulevard & Ward Avenue	Inventory Survey	Paleoenvironmental data from geoarchaeological coring	Prehistoric		-
Anderson 1997	King Street between Cooke & Ward	Monitoring	Artifacts, trash pits; coffin burials	Historic	-5455	30

Table 3. Selected Archaeological Projects Within the APE

Source	Project Location	Procedure	Findings	General Age	SIHP No 50-80-14	No. of Burials
Goodwin 1997	Kekaulike – Diamond Head (Chinatown)	Data recovery	Structural elements, features, artifacts, burial	Prehistoric & Historic	-4875	1
Hammatt & Chiogioji 1998	Pali Hwy & Beretania	Assessme nt	Historic cultural resources likely			-
Lebo & McGuirt 2000	800 Nuuanu Avenue	Inventory Survey	Structural elements, features, artifacts	Prehistoric & Historic	-5496	-
Major & Carpenter 2000	Washington Place	Monitoring	Artifacts	Historic		-
Perzinski et al. 2000	Block "J" Redevelopment Project	Inventory Survey	Structural elements, features, artifacts, isolated human remains	Historic	-5760	3
Winieski & Hammatt 2000	Pohulani Housing Development	Monitoring	Features, artifacts, burials	Historic	-4380 & -5820	20
Lebo & McGuirt 2001	800 Nuuanu Avenue	Data recovery	Structural elements, features, artifacts	Historic	-5496	-
Elmore & Kennedy 2001	King Street	Monitoring	Artifacts, burial	Historic		1
Winieski & Hammatt 2001	Nimitz Highway Reconstructed Sewer	Monitoring	Structural elements, artifacts	Historic	-5942	-
Lebo et al. 2002	Harbor Court	Data recovery	Features, deposits, artifacts	Prehistoric & Historic	-2456	-
Mann & Hammatt 2002	King Street Rehabilitation Project	Monitoring	Features, artifacts, burial	Historic	-6371	1
Souza et al. 2002	Kaka`ako Improvement District 7	Monitoring	Features, artifacts, burials	Historic	-6376 – -6378	3
Dockall 2003	Washington Place – New Residence	Inventory Survey; Monitoring	Features, artifacts	Historic	-9907	-
Clark & Gosser 2005	Public Storage Property	Inventory Survey	Pond deposits, artifacts	Prehistoric, Historic	-6636	-
Perzinski et al. 2005	Queen and South Streets Intersection	Inventory Survey	Burials, historic features & artifacts	Historic	-1604 & -6766	2

Table 3. Selected Archaeological Projects Within the APE

Source	Project Location	Procedure	Findings	General Age	SIHP No 50-80-14	No. of Burials
Carney et al. 2005	Block "J" – Capital Place Development	Data Recovery	Historic artifacts	Historic	-5760	
Leu Cordy & Hammatt 2005	Punchbowl Street Improvements	Monitoring	No cultural resources found		-1321	-
McIntosh et al., 2006	Smith-Beretania Parking Lot	Inventory Survey; Data recovery; Monitoring	Structural elements, features, artifacts, deposits, burials	Prehistoric & Historic	-6722	26
Perzinski et al. 2006	Kewalo HECO Dispatch Center	Inventory Survey	Two historic coffin burials, artifacts	Historic	-5455	2
Bush & Hammatt, 2006	(HECO) Hokua Tower	Monitoring	No cultural resources found.			-
Hammatt et al. 2006	Kawaiaha`o Church	Monitoring Plan	Numerous previously-documented burials, mostly cemetery interments, within project area			-
O'Hare et al. 2006	Queen Street Extension: Kaka`ako I.D. 10	Monitoring	Features	Historic burials & trash pits	-6658 to -6660	30
O'Hare et al. 2007	Alapai Transit Center	Inventory Survey	Features, artifacts, burials	Historic & Unknown	-6901 & -6902	3
Bell et al. 2006	Ward Village Shops	Inventory Survey	Subsurface cultural layer, burials	Prehistoric & Historic	-6854 to -6856	11
Rainalter et al. 2006	Washington Place	Monitoring	No cultural resources found		-9907	-
Stein et al. 2007	Kaka`ako Fire Station	Monitoring	No cultural resources found			-
Cultural Surveys Hawaii, n.d.	Queen Street Extension	Monitoring	Features, artifacts, burials	Historic		30

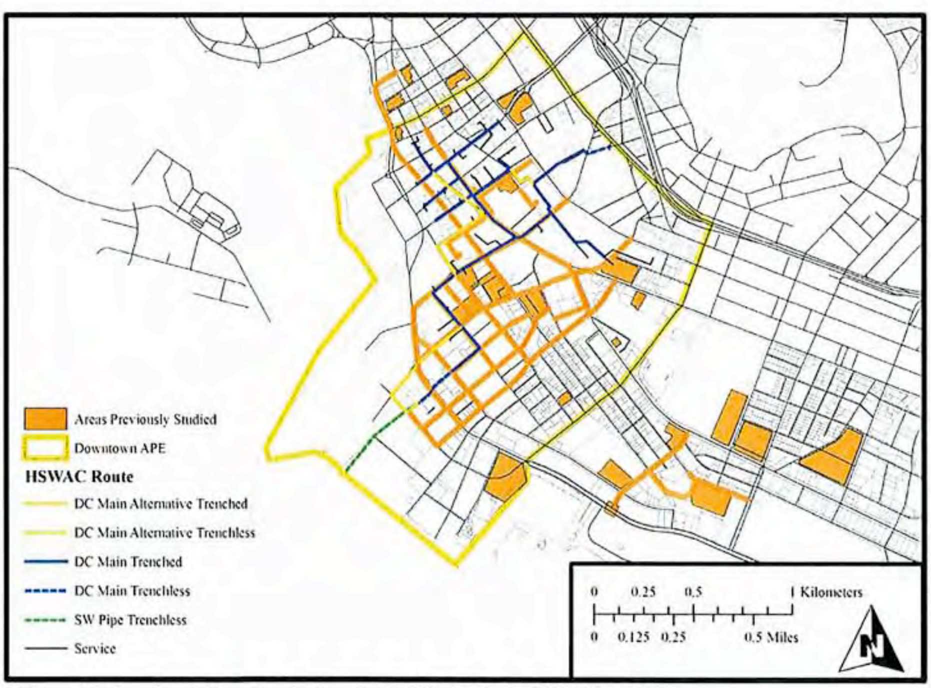

Figure 16. Location of Previous Archaeological Studies In and Near the APE.

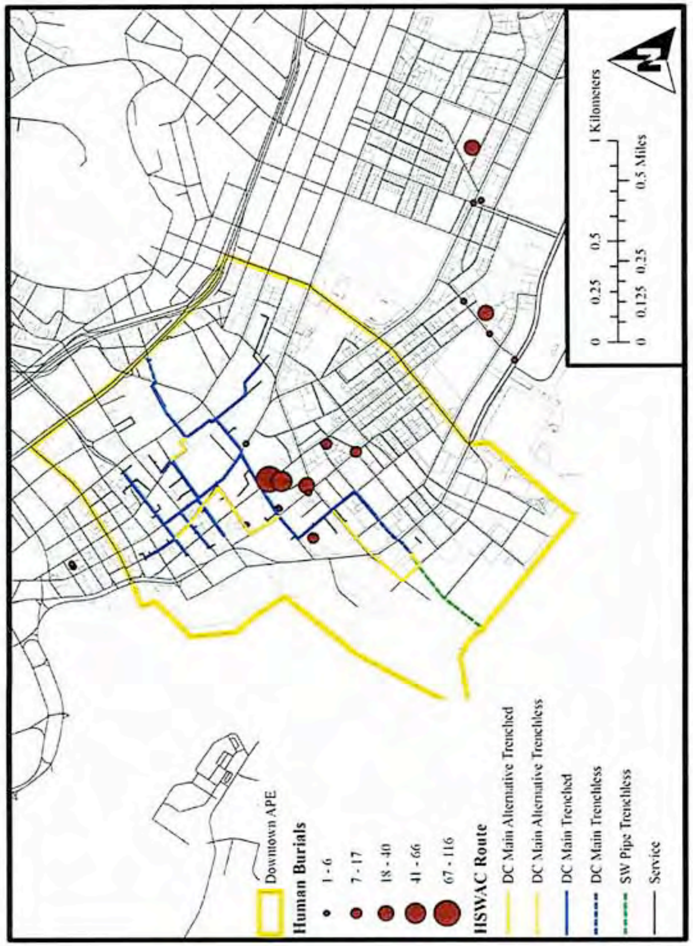

Figure 17. Location of Previous Burial Finds Within and Near the APE.

Downtown – Capital Historic District

Numerous investigations within the Capital District (Site -1321) have occurred, predominately within the Washington Place and `Iolani Palace areas, which document development from pre-Contact settlement into a burgeoning historic-period residential, political, and commercial area. Four studies in Washington Place have resulted in the observation of typical 19th and 20th century historic artifacts like glass, ceramic, metal, architectural items, and faunal remains, etc (Carpenter & Yent 1995; Dockall et al. 2003; Major & Carpenter 2000; Rainalter et al. 2006).

In the `Iolani Palace vicinity, historic features such as a carriage road, coral foundation remnants of the Royal Bungalow, and a Palace Walk gate pier foundation associated with the late Monarch period, as well as historic trash pits and privies with associated artifacts have been identified, dating from the late 19th-20th centuries (Chiogioji et al. 1991; Fairfax 1971; Rosendahl 1971; Seelye 1968; Sinoto 1977). During monitoring of moat wall waterproofing surrounding the Palace, Spilker observed 4 former road surfaces including a portion of an old carriage road, 14 anchors, a coral block foundation, and several trash pits with numerous glass, ceramic, bone, coin, clay pipe, buttons, marbles, etc. artifacts (1974). Further monitoring in the `Iolani Palace area allowed Luscomb & Reeve to observe a portion of the old carriage road, a brick beehive-shaped cesspool, cement blocks possibly used as gunnery mounts, and several trash pits, as well as one traditional Hawaiian artifact, a coral abrader (1976).

Two sites are identified within the State Capitol Complex area: Site -4606 consists of 9 historic trash pits and Sites -4605 contains a historic-period burial, a ditch, pit, and trash pit, as well as a firepit that dates between 1390-1700AD and six postholes, one of which produced a date of 860-1330AD (Denham & Kennedy 1993). Finally, across from the Palace grounds and on Richards Street, Site -1307 consists of a trash pit containing glass, ceramics, metal, bone, and stone dating from 1790 to 1880, which is associated with the first Royal Hawaiian Hotel and nearby residential dwellings and a doctor's office (Simons et al. 1991).

The Hawaii State Capitol and Grounds are contributing properties to the Hawai`i Capitol Historic District, although they are not historic in age. The Capitol was constructed in the mid-1960s and dedicated in 1969. At the time of its construction, the entire parcel upon which it sits was excavated in order to accommodate both the capitol building and the underground parking areas that were planned (Belt et al. 1961). The entire area impacted by the HSWAC installation was previously and extensively disturbed during the construction the Capitol building and associated parking areas.

Honolulu Hale was originally constructed in 1929; the building and its grounds are contributing properties to the Hawai`i Capitol Historic District. Designed by renowned Hawai`i architects C.W. Dickey, Hart Wood and others, the California-Spanish style building was dedicated in 1929 (City & County of Honolulu, 1982). The original building underwent a planned expansion in 1951 with the addition of two three-story wings on the *mauka* side of the existing structure (City & County of Honolulu, 1982). Through the 1960s, Hotel Street continued to exist as a vehicular route; its right of way overlaps with what is now a pedestrian walkway on the *mauka* side of Honolulu Hale, extending from Punchbowl Street towards the Honolulu Municipal Building, a 15-story office tower constructed to the east of Honolulu Hale and the Kalanimoku Building in 1975. At this time, the walkways and lawn areas between these government buildings were modified into the configuration seen today (City and County of Honolulu 2982; Belt et al. 1961).

Downtown – Chinatown Historic District

Archaeological investigation within the Chinatown Historic District has revealed a Native Hawaiian presence, yet emphasizes the overwhelmingly Chinese residential and commercial development in the historic era. In addition, site areas identified with renowned historic personage Don Francisco de Marin, an early non-native settler, are documented. Early archaeological investigations within the Chinatown District illustrated the presence of disturbed historic artifacts within fill soils (Pantaleo 1989) and six incomplete burials (Douglas 1991). In 1989, inadvertent discovery of a human burial at the River-Nimitz Redevelopment Project led to emergency mitigation of Site -4192 (Landrum & Dixon 1992). In addition to the well-preserved *in situ* skeletal and soft tissue (brain) remains, which were located in a flexed position within an estuarine, marsh, or lagoon environment and thought to be of Hawaiian descent, four historic-period artifact deposits and one remnant structural feature were observed during the mitigation efforts. These artifact deposits consist of two intact refuse pits and two refuse areas of secondary deposition. The historic debris dates between the 1840s and the 1920s and the intact nature of the two pit deposits point to a lack of organized garbage disposal or

general sanitation practices in Honolulu during this period. The partially intact brick, mortar/concrete, and coral foundation supporting a 6" pipe is speculated to have been a part of sewage infrastructure developed in the project area in 1929.

An inventory survey for Ewa Block of the Kekaulike Revitalization Project bounded by Kekaulike, Hotel, River, and King Streets revealed two sites: Site -4587 consists of Pehu's Pond, a small fry fishpond; Site -4588 represents various periods of occupation and use, from pre-Contact to the modern era, consisting of walls, crushed coral foundations, burn layers, trash pits, postholes, pits, firepits, and 3 human burials (Kennedy & Riley 1993; Kennedy et al. 1994).

An inventory survey for the Diamond Head Block of the Kekaulike Revitalization Project bounded by Kekaulike, Maunakea, King, and Hotel Streets documented Site -4875, which includes 3 incomplete burials in a secondary context, theorized to be a family buried together following either an epidemic or the Chinatown fire, as well as the incomplete remains of a 6-7month fetus within a historic refuse deposit (Erkelens et al. 1994). The inventory survey with subsurface testing also identified habitation sites spanning the Pre-Contact era into the historic Chinese occupation period (Goodwin 1997). The Pre-Contact archaeological features include house and fence line postholes, living surfaces, fire pits, cellars, trash pits, and sheet midden. The historic Chinese features consisted of structural remains, privies/wells, trash pits, and cellars.

In 1994, further data recovery efforts for Site -4875 resulted in the observation of features and artifacts associated with four house compounds and a blacksmith's shop that span the late pre-Contact period through the modern era. Over 1000 features were identified, including postmolds, firepits, and trash deposits (Goodwin & Allen 2005). Inventory survey for the Marin Tower development located between King, Smith, and Maunakea Streets and the Nimitz Highway identified household remains dated between 1810-1860 associated with the Don Francisco de Marin family, in the form of postholes, cooking areas, trashpits, a privy, a coral block wall and a small family cemetery (Goodwin et al. 1996). Other later occupation phases within this site (Site -4494) consist of remains from the Honolulu Iron Works and various, but predominately Chinese, mercantile establishments and residences in the form of kitchen areas, privies, and sheet middens. Inventory survey with test excavations within a parking lot on the corner of Smith and Beretania Streets yielded (Site -6772) trash pits, cooking features, building foundations and an European and Asian artifactual assemblage dating between 1850-

1900 (McIntosh et al. 2006). As well, some deposits may be associated with early 19th century Hawaiian settlement and with the pre-Contact period – traditional artifacts observed included poi pounder fragments, an `ulumaika, cowrie shell lures, a stone adze and a complete conch shell trumpet.

Downtown – Merchant Street Historic District

The archaeology in the Merchant Street District has revealed a wealth of data spanning 1250 – 1955 A.D within the Harbor Court Tower property, illuminating the area's transition from Native Hawaiian settlement into a commercial center. The first monitoring and subsurface testing effort within Harbor Court occurred in 1991 and led to site recordation (Site -2456) of exposed building foundations, some of which predated 1850, as well as the observation of pre-Contact and early-Contact period cultural deposits. Artifact classes included basalt flakes and debitage, cut shell, glass bottles, ceramic sherds, clay pipe fragments, metal, and building materials (Hurst & Allen 1992).

Another inventory survey of the property in 1993 resulted in the identification of features and artifacts that span the Late Prehistoric, Transitional, and Historic periods. Features identified consist of a basin-shaped pit, prehistoric and historic postholes, and a historic pipe trench, ash lens, walls and floors (Dunn & Rosendahl 1993). In 1997, data recovery expanded the record of Site -2456, as remains from the following occupations were recorded: multiple Native Hawaiian house structure living surfaces predating 1820, followed by the remains of a 1820s warehouse and the post 1858 Janion Green building which are indicative of the area's transition into a commercial center (Lebo, ed. 1997).

Subsequent data-recovery efforts in 2002, which focused upon pre-1850 features and artifacts (Site -2456), continue to document habitation within the Pre-Contact, Transitional – Late-Contact, and Transitional periods. A total of 450+ post molds, 120+ in-filled pits, and 18 fire pits were documented spanning the three periods. As well, numerous faunal taxa and traditional Hawaiian artifacts such as basalt flakes and tools, volcanic glass flakes, modified bone and shell, bone net gauges, and abraders were present in the Pre-Contact era. The Transitional – Late-Contact and Transitional periods are evidenced in traditional Hawaiian artifacts, like basalt cores, adzes, hammerstones, and slingshots, volcanic glass tools and flakes, and perforated shells, along with

numerous faunal remains, in combination with non-traditional historic period artifacts such as glass, metal, and ceramics (Lebo et al. 2002).

Downtown - General

Several investigations within the Downtown area, which do not fall within the bounds of the Capital, Chinatown, or Merchant Street Districts, have produced a burial, as well as historic-period features and artifacts. In 1984, studies within a parking lot bounded by Nu`uanu, Hotel, & Bethel Streets produced evidence of only modern refuse (Kennedy 1984). In the early 1980s, test borings within Block J of Downtown, where the Pali Highway and Beretania intersect, produced various glass, ceramic, metal, and faunal artifacts from the historic period (Tomonari-Tuggle 1983).

Further investigation of Block J led to the observation of Site -5760, which consisted of trash-filled pits, probable privies, and utility installation trenches, yielding historic artifacts that included glass, ceramics, marine shell, and faunal remains (Perzinski et al. 2000). Still further data recovery within Block J resulted in the observation of more historic glass bottles, ceramic vessels, personal items, and household goods dating between the early 19th and early 20th centuries, and one isolated polished basalt adze , all assigned as part of Site -5760 (Carney et al. 2005).

Monitoring of sewer improvements resulted in the observation of a remnant of light gauge trolley rail (Site -5942) and a brick-lined manhole at the intersection of Queen Street and the Nimitz Highway (Winieski & Hammatt 2001). In addition, a brick alignment was found at the Queen & Punchbowl Streets intersection and a historic rubbish scatter in fill was seen at Maunakea Street & Nimitz Highway (Winieski & Hammatt 2001).

During King Street rehabilitations, in the project's Richards Street intersection, a pit feature with butchered animal bones was observed (Mann & Hammatt 2002). Finally, data recovery within the 800 Nuuanu Block resulted in the identification of Site -5694, which consists of three cultural zones. The first cultural zone (1810-1860s) contains postmolds and a living surface that attest to traditional activities, which transition towards Western land use strategies, as evidenced by the incorporation of boundary walls, residential and commercial structures and inner yard areas, as well as historic products found in trash pits. The second cultural zone (1860s-1890s) contains evidence of a loss of traditional Hawaiian activities and the use of the block for residential purposes, giving over entirely to commercial business housed in wood-framed structures. The third cultural zone (1890s-present) contains evidence of the removal of the wood-framed buildings, followed by the construction of the Honolulu Iron Works and later an auto garage, as well as infrastructural improvements like sewer lines and a parking lot (Lebo & McGuirt 2000).

Kaka`ako

Through University of Hawaii-sponsored Archaeological Field Schools at the Mission Houses site (-9991), 30 features including earthen floors, privy holes, and sheet middens were documented that reveal transitional post-Contact artifact deposition, with research focus on the site's ceramic tablewares and faunal remains assemblage. The site catalog lists the following ceramic types: creamwares, pearlwares, whitewares, ironstones, earthenwares, porcelains, porcellaneous stonewares, redwares, yellowwares, and refined stonewares. The site catalog also details chicken, pig, dog, bovine, fish, and mollusk faunal remains (Garland 1996).

Numerous human burials have been recorded within Kaka`ako, most of which are associated with historic-period cemetery interments dating from the post-Christianity era (post-1820). Isolated burials have also been recorded in Kaka`ako, some of which may be pre-contact and not associated with cemetery interment. Additionally, a variety of archaeological features and artifacts have been observed in this portion of Honolulu.

From 1986 through 1988, monitoring for the Kaka`ako Improvement District 1 Project resulted in the discovery of four burial site areas located below the Queen Street and South Street/Quinn Lane roadways. It was determined that a total of 116 burials were once a part of Kawaiaha`o Cemetery (Site -4534) and 31 burials were once a part of Honuakaha Cemetery (Site -3712), as well as two isolated burials identified as Sites -4532 and -4533 (Pfeffer et al. 1993). In 1993, an additional 3 in-situ human burials were reported near the intersection of South and Halekauwila Streets, thought to be associated with the 1853 smallpox epidemic and lying within the historic Honuakaha Cemetery (Avery & Kennedy 1993). A multicomponent site (Site -2963) was observed within a parking lot at the Punchbowl and Halekauwila Streets that consisted of 6 human

burials, trash pits, animal bones, pits, a posthole, a buried surface, a burned soil area, and several foundations (Clark 1987).

Archaeological inventory survey conducted at the development of a condominium on King Street between Cooke and Ward yielded historic artifacts; monitoring work for the same project resulted in the discovery of 30 historic burials during the monitoring phase (Anderson 1997). All burials were determined to be associated with the adjacent Roman Catholic Cemetery and reinterred in the area. Testing within a condo parcel at the intersection of Queen & South Streets also revealed two sites: Site -6766, consisting of a historic garbage pit, a post hole, and a slab and wall remnant, all of which date to the mid- to late-1800s; and Site -1604: 2 isolated bones (Perzinski et al. 2005). Monitoring in the vicinity of the project listed above, at the current Kaka`ako Fire Station location revealed historic materials like glass, ceramic, and cut bone, but these were not considered significant (Stein et al. 2007).

During King Street rehabilitations a previously-disturbed and incomplete human burial (Site -6371) was observed at the Punchbowl Street intersection (Mann & Hammatt 2002). Examination of test trenches within the Alapai Transit Center at the corner of King and South Streets revealed two sites: Site -6901 consisted of 4 historic trash pits dating between 1820-1920, containing refuse suggestive of the affluent consumption patterns of the Cooke & Atherton families, who resided in the project area; and Site -6902: 3 burials, of which two are coffin interments (O'Hare et al. 2007).

Within the present-day Judiciary complex, two separate monitoring efforts for a parking garage led to the observation of historic-period soda, beer, champagne, liquor, perfume, medicine, and food/condiment glass bottles, and porcelain, whiteware, stoneware, earthenware, and terra cotta ceramic vessels, as well as metal items. It is speculated that these artifacts, which represent American, Asian, and European imports were deposited as refuse by area residents, but the site itself is heavily disturbed (Athens 1986; Leidemann 1988).

Monitoring and testing within improvements on Keawe, Coral, and Halekauwila Streets and in the present-day locations of Pohulani Elderly Rental Housing and Mother Waldron Park, a total of 20 human burials were revealed that span pre-Contact into post-Contact times. Site -4380 consists of 9 burials found in the housing facility portion of the project area, while Site -5820 consists of the remainder of the burials (2 on Keawe Street, 4 at Halekauwila & Coral Streets, and 1 at Halekauwila & Keawe Streets). In addition, a buried 'A' horizon was observed that contained a historic trash pits, scattered traditional and historic artifacts, and a probable outhouse feature filled with refuse (Winieski & Hammatt 2000).

Inventory survey for the present Public Storage Facility, at the corner of Kamake`e and Kapi`olani Streets resulted in the observation of gleyed deposits containing freshwater snail remains, representing an un-named freshwater fishpond's sediments, which are included in Site -6636 (Clark & Gosser 2005). An earlier investigation – at the Symphony Park property at the *mauka-`ewa* corner of Kapi`olani Boulevard and Ward Avenue – did not yield evidence of cultural sites but provided solid data on the marshy, pre-Contact environment.

Most recently, there have been discoveries of multiple burials. Although technically outside the current APE, information pertaining to these projects is included here since similar types of environments exist within the APE. During monitoring of improvements on Kamake`e Street between Queen Street and Ala Moana Boulevard and in a section on Ala Moana Boulevard, despite previous extensive disturbance, pockets of undisturbed beach sands and 3 burials were discovered (Sites -6376, -6377, and -6378). Only one of the burials was found located in-situ beach sand matrix (Souza et al. 2002). In 2003, archaeological monitoring of the construction of the Queen Street Extension resulted in the discovery of 30 human burials; 28 of the burials appeared to belong to a historic cemetery and two burials were each an isolated find (O'Hare et al 2006). In 2004, archaeological monitoring of the construction of the Ko`olani Condominium project along Auahi Street resulted in the discovery of 18 burials; 16 burials may have been part of a historic cemetery, and two burials were each isolated finds (Hammatt 2007).

From 2006 to the present, archaeological inventory survey and monitoring work, conducted at Ward Villages near the intersection of Kamake`e and Queen Streets led to the discovery of at least 60 burials, a number of them apparently part of one or more burial grounds (Cultural Surveys Hawaii, in prep.). Eleven burials were documented during the inventory survey phase, and the remaining burials were found during monitoring of construction.

CULTURAL IMPACT ASSESSMENT :
IDENTIFICATION OF HISTORIC SITES AND CULTURAL PROPERTIES

The HSWAC Cultural Impact Study/Assessment was conducted in 2005 and 2008; the study's participants focused primarily on the Kaka`ako portion of the project area. The study consisted of three phases: (1) cultural and historical archival research (literature review); (2) ethnographic survey (oral history interviews), transcribing taped interviews, analysis of ethnographic data (oral histories) and (3) report writing. The cultural impact study/assessment is based on two guiding documents: Act 50 and the Office of Environmental Quality Control Guidelines, as well as the criteria for determining the significance of historic sites, given in Hawaii Administrative Rules Chapter 13-275 and 13-284.

Consulting parties in the CIA provided a great deal of information on Kaka`ako's past and the communities who lived there. They also identified several concerns with regard to the potential for finding or disturbing cultural sites during the HSWAC project, including the discovery of human burials. In general, consulting parties acknowledged that former burial locations are now largely unknown, thus it is difficult to predict where they might be encountered. One participant noted that in the old days people generally buried their dead "on the side of their house." Another participant also mentioned the previous find of numerous burials associated with Kawaiaha`o Cemetery when Queen Street underwent improvements in the 1980s.

Participants in the CIA identified sacred places and precincts within the APE. A *heiau* (name unknown) was formerly in the vicinity of Point Panic, and a sacred pond (now filled in) was in the vicinity of Koula and Auahi Streets. The pond, according to the CIA participant, was a place for *ali`i* to prepare for ritual sacrifices. These places and others were part of what one CIA participant called a Sacred Triangle that extended from Moanalua on the west to Mānoa on the east *makai* to the coral flats underlying `Iolani Palace and nearby properties. This view of the landscape is still held by project participants and others; while they do not necessarily object to modern changes, they do not believe such change has eliminated the sacred and traditional realities of the landscape that they were taught to respect.

ARCHAEOLOGICAL MONITORING PLAN

(1) **Anticipated Finds**: In view of the prior archaeological work and findings as well as the results of the cultural impact assessment discussed above, the current project area is anticipated to contain a moderate to high potential for discovery of intact human burials and subsurface cultural layers at a number of locales.

(2) **Extent of Monitoring**: Most of the archaeological monitoring work taking place under the subject plan will be within existing roadways. The exceptions will be short segments that connect specific buildings to the HSWAC pipeline system. In reviewing the data provided above, monitoring requirements for the project are shown on Figure 18 and have been defined as follows:

a) Areas of low sensitivity for finds (color-coded green on Figure 18): The archaeologist(s) will conduct periodic monitoring of ground disturbing activities in portions of the APE that are deemed to have a low probability for encountering subsurface deposits. A low probability of encountering intact subsurface deposits and cultural materials may be due to or more of several factors: prior fill events; the depth of proposed trenching in the current undertaking; extensive and repeated development activities; and a lack of finds made during previous archaeological work. Periodic monitoring consists of the following activities. The archaeologist(s) will contact the construction foreman to determine when construction excavations will extend below the current roadway and sidewalk base course and into soil layers. When construction activities extend into the soil layer, the archaeologist(s) will conduct periodic (weekly or bi-weekly) on-site visits to spot-check the ground disturbing excavations to examine the stratigraphic sequence and evaluate the likelihood of encountering cultural deposits in the vicinity. In the event that cultural materials are observed, the archaeologist(s) will determine the nature of the deposit, and if intact, proceed to treat the deposits. In addition, if cultural resources are found during excavations while the monitor is not on-site, it is the construction contractor's responsibility to *immediately* notify the archaeological monitor. The areas within the APE requiring periodic archaeological monitoring include:

- All segments excavated by the trench-less method. Trench-less excavations generally occur at depths well below those where cultural resources, including burials, are found. The only portions of trench-less excavations that may require monitoring are the jacking and receiving pits needed for the drilling equipment if they fall within areas of moderate or high sensitivity. Exact locations of jacking and receiving pits are not yet known for this project.
- Trenching for the pipeline segment between the cooling station and the *makai* (southwest) side of Ala Moana Boulevard is an area of low sensitivity for subsurface finds since this is filled land, all excavation will take place within fill, and there is no history of prior finds in this part of Kaka`ako.
- Portions of the Bishop, King, and Merchant Street corridors, as shown on Figure 18, and the entire Miller Street corridor between the State Capitol and the Queen's Hospital complex.
- Trenching on the grounds of the Capitol and Honolulu Hale. In view of the multiple episodes of relatively recent construction in these areas (summarized above), and the lack of any evidence for subsurface cultural deposits being present in these locations, it is believed that the HSWAC pipeline installations will have no effect on Honolulu Hale or the State Capitol and their grounds

b) Areas of Moderate Sensitivity of Finds (color-coded orange on Figure 18) in the APE include the following:

- The connecting pipeline for the Honolulu Emergency Operations Center at King and Alapai Streets;
- Portions of Merchant and Bishop Streets on either side of that intersection;
- The portion of Alakea Street *makai* (southwest) of the intersection with Queen Street;
- The portion of Richards Street from Hotel Street *makai* (southwest) to the intersection with Merchant Street;
- The connecting trenches to the US Post Office, Custom House, and Court House, Ali`iolani Hale, the Hawaiian Electric, Kekuanaoa and Kapuaiwa Buildings,
- Pipeline segments through the Honuakaha section of Kaka`ako, from the intersection of Pohukaina and Punchbowl Streets, east along Pohukaina Street to Keawe Street;

- Areas of trenchless excavations between Auahi Street and Ala Moana Boulevard where jacking and receiving pits will be located.

c) The area of high sensitivity for encountering subsurface finds (color-coded red on Figure 18) is believed to be Keawe Street from its intersection with Auahi Street to Ala Moana Boulevard.

(3) **Treatment of Historic Sites and Deposits Encountered:** If any archaeological materials are encountered during the monitoring of construction of ground-disturbing activities, work will be stopped immediately in that area, and the monitoring archaeologist will investigate the nature of the discovery. If an intact cultural layer, living surface, structural components (e.g., foundations), archaeological subsurface features (e.g., hearths, pits, postholes, etc.), artifacts, charcoal or midden deposits or trash pits are encountered, then the following actions will be taken:

- Selected, sorted charcoal samples will be collected for the possibility of radiocarbon analysis (particularly if the charcoal appears in a prehistoric context).
- Bulk samples of midden material will be collected
- All prehistoric artifacts will be collected
- All historic artifacts will be collected unless large trash or refuse pits are encountered in which case only diagnostic samples will be taken
- Standard documentation will be carried out, including scale maps, profiles, photographs, detailed soil and provenience descriptions, and interpretation
- Photographs of excavations will be included in the monitoring report even if no historically significant sites are documented during the monitoring field work.

(4) **Treatment of Historic Human Burials Encountered**: If historic human remains are identified, work will immediately stop in that locale, and SHPD/DLNR will be notified immediately of the find. No further work will take place in that locale -- including screening of back dirt, cleaning and/or excavation of the burial area, and exploratory work of any kind -- unless explicitly requested by the SHPD.

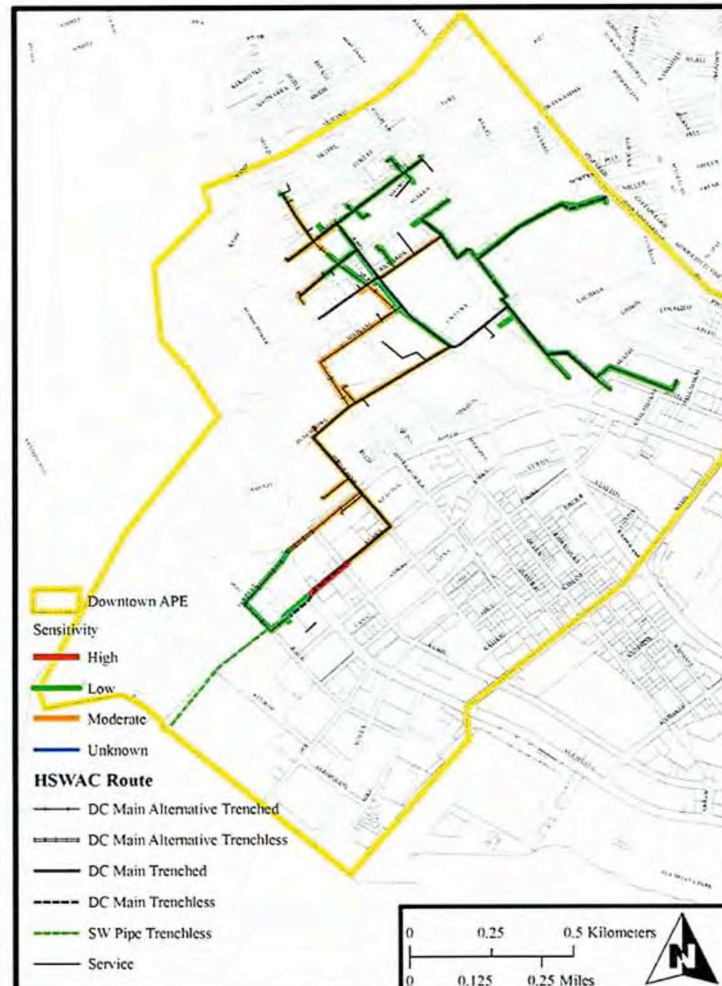

Figure 18. Distribution of Archaeological Probability Zones in the APE.

(5) **The monitoring archaeologist has the authority to halt construction in the vicinity of the find in order to carry out the provisions of this plan**. The consulting archaeological firm will make it clear to the construction personnel that the archaeologist has the authority to halt work when it is deemed appropriate.

(6) **Pre-construction conference between the archaeologist and the construction crew**. Before works begins on the project, the on-site archaeologist will explain to the entire construction crew what materials may be encountered and the procedures to follow if archaeological materials are found, as well as the role of the archaeological monitor. At this time it will be made clear that the archaeological monitor will be making periodic on-site visits for all ground disturbing activities below base course, and that the archaeologist has the authority to stop work ***immediately***, if necessary.

(7) **Laboratory work to be performed on collected material**: Artifacts will be catalogued and analyzed along with any samples of midden materials collected. Charcoal and other datable materials will be submitted for dating, if in situ, well-documented samples are obtained from a clearly prehistoric context which has not mixed with historic materials. If human remains are encountered, all work will stop in the vicinity, until SHPD/DLNR authorizes resumption of activity. SHPD/DLNR, in consultation with the landowner and the O`ahu Island Burial Council, will determine if it is appropriate to remove and relocate any human remains encountered during the construction work. If SHPD/DLNR authorizes removal of human remains, the consulting archaeologist will remove and inventory the remains in accordance with Hawaii Administrative Rules 13-300, and the remains will be stored temporarily at the SHPD/DLNR until reinterment plans are finalized.

(8) **Schedule for reports**: The archaeological monitor will compile daily monitoring logs. These logs will minimally include a description of daily activities, sites (or features) cleared, personnel on-site, problems encountered, and corrective action taken. Monthly reports will be filed with the SHPD detailing any new sites or features identified within the project area boundaries. A draft archaeological monitoring report

will be submitted to SHPD/DLNR for review and approval within 90 days of completion of the monitoring fieldwork. The consulting archaeological firm will submit a final archaeological monitoring report within 30 days after receiving any comments on the draft report. Should burials and/or human remains be identified, other letters, memos, and/or reports may be requested by the Burial Sites Program, and will be provided in accordance with applicable statute and regulation, and as contractual obligations permit.

(9) **Archiving of collections**: All burial remains and associated materials will be given to SHPD/DLNR for curation until reinterment plans are finalized. Non-burial materials will be stored temporarily at the consulting archaeologist's firm until an appropriate curation facility is available on O`ahu.

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APPENDIX C
PRELIMINARY MARINE BIOLOGICAL OBSERVATIONS OFFSHORE OF THE KAKA‘AKO LANDFILL

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PRELIMINARY MARINE BIOLOGICAL OBSERVATIONS OFFSHORE OF THE KAKAAKO LANDFILL IN SUPPORT OF THE HONOLULU SEAWATER AIR CONDITIONING CONCEPTUAL DESIGN

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Purpose

Honolulu Seawater Air Conditioning, LLC proposes to bring deep cold seawater ashore via a pipeline and use this seawater to cool office buildings in downtown Honolulu. If this project comes to fruition, the use of an alternative means of air conditioning many of Honolulu's office buildings will realize a substantial savings in electricity (i.e., oil). The project proposes to have this pipeline enter the ocean along the Kakaako Shoreline Park and either be (1) placed in a trench and backfilled, with the pipe daylighting at a depth of about 24 m (80 feet) about 900 m (3,000 feet) offshore. A second option would be to tunnel beneath the shallow limestone reef platform (where the coral reefs are best developed; see below) and where the limestone/coral reef ends and dredge tailings commence, trench, deploy the pipe and backfill again with the pipe emerging or daylighting at a depth of about 60 feet. In both scenarios from that point seaward, the pipe would be exposed lying on the substratum which is primarily a mix of sand and coralline rubble from 24 to at least 33 m (110 feet) in depth. The proposed route includes a combination of tunneling and trenching across the near shore reef platform. Because the trenching alternative could impact near shore coral reef resources, this short field survey was undertaken to (1) determine the local extent of these resources and (2) examine the potential for impact to these resources with these two deployment scenarios were to be used.

Background

Honolulu Harbor lies just west of the Kakaako Shoreline Park and has been the primary commercial port for the State of Hawaii since before the turn of the century (Scott 1968). The harbor is the result of dredging what was originally the drainage basin of Nu'uanu Stream. Dredging began before 1900, and periodic maintenance dredging still occurs. Until about 1960, spoils were dropped at a variety of locations outside of the harbor and in the early years apparently just east of the Waikiki Entrance Channel of the Harbor fronting the Kakaako Shoreline Park. Besides shipping, the Harbor is ringed with industry; pineapple canneries, gas and oil storage, and numerous other businesses have operated or are still operating here. Storm drainage into the Harbor and nearby Ke'ehi Lagoon carries runoff from Honolulu's streets and suburbs into the ocean. Pollution is well known in the Harbor; conditions are described as early as 1920 in references cited by Cox and Gordon (1970). Sewage has been pumped into the ocean offshore of the Kewalo Shoreline Park and Sand Island since the 1930's . The early inputs were all raw sewage released in water not exceeding 20 m in depth. The actual points of release varied through time as different pipes were constructed and used. The multitude of perturbations that occurred in shallow water (less than 20 m) from these early sewage inputs continued until the construction of the present deepwater outfall in 1978 (Brock 1998).

The present-day Kewalo Shoreline Park is built on a former Honolulu dump that was closed in the early 1960's. The seaward (or makai) side of the landfill is contained by placement of a boulder riprap which was constructed on a limestone bench in water from 2 to 5 m in depth. As noted above, the eastern entrance to Honolulu Harbor lies just west of the Kakaako Park and just east of the Park is the entrance to Kewalo Harbor which was constructed in the 1920's and 1930's to serve Honolulu's fishing fleet and only commercial tuna cannery (built in 1917). Water circulation seaward of the old Kewalo landfill is good with waves breaking directly on the boulder riprap during periods when surf is emanating out of the SE through SW directions. Surfers utilize the breaking waves in the eastern portion of the limestone platform offshore of the Kakaako Shoreline Park. While in operation, the dump received both burned and unmodified wastes from urban Honolulu (personal observations) at a period of time when concern over pollution from anthropogenic sources was less than now; since the landfill filled in a section of old coastline to a point greater than 100 m seaward, the landfill materials along the seaward side are exposed to seawater with possible potential leaching of pollutants.

Methods

Coral reef communities usually show some zonation that is related to physical characteristics of the given area. Some of the parameters that affect this zonation are exposure to wave energy, freshwater, depth, substratum type, etc. The waters offshore of the Kakaako Shoreline Park have a typical zonation; the zones or biotopes recognized here include the biotope of scoured limestone which is located close to the boulder riprap shoreline, the biotope of scattered corals seaward of the biotope of scoured limestone and is best developed in waters from about 4 to 12 m depth, the biotope of dredged rubble which is located seaward of the biotope of scattered corals and was created by the deposition of dredge spoils at depths from about 10 to 20 m and the biotope of deep sand which is seaward of the biotope of dredged rubble at depths generally greater than 20 m. Other than the biotope of dredged rubble, these biotopes are also present in the waters fronting the Sand Island Beach Park which is west of the Waikiki Entrance Channel of Honolulu Harbor.

Since the objective of this study is to qualitatively examine the status of marine communities in the waters fronting the Kakaako Shoreline Park, considerable effort was made to delineate the major ecological zones or biotopes present as well as determine the degree of development of coral communities in these biotopes. To achieve this, several methods were used including towing a diver behind the support vessel over much of the study area. Where water clarity would permit, this diver made observations from the surface and verbally reported these observations to personnel on the vessel who noted these comments and also marked the location of these observations using a hand-held GPS. This exercise allowed a rough delineation of benthic communities and ecological zonation in the path of the diver.

The primary choice for a point of departure from land is just west of an open drainage canal that lies along the western boundary of the Kakaako Shoreline Park. This point of departure defined the primary study area in an approximate equilateral triangle with the apex at the boulder riprap and the base offshore at roughly the 20 m (60-foot) isobath. This rough triangle enclosed a study area of about 17 hectares (42 acres). A second possible route examined here commenced on the shoreline about 183 m (6+00 feet) east of the first. To obtain data at a finer scale, a 730-meter (2,400-foot) line was laid from the 20 m isobath toward the shore using the two shoreline entry points as target endpoints. These lines ended in water from 8 to 12 feet (2.4 to 3 m) in depth close to the shoreline. The coral and benthic communities were examined by scuba diving along these lines to provide data on the status of these communities at those points.

Construction of a subtidal trench for the deployment of the pipe(s) will create turbidity plumes. Turbidity may impact sessile corals if it occurs at high concentration or if the exposure is for extended periods of time. In general, currents offshore of the Kakaako Shoreline Park flow towards the southwest which is similar to the tradewind flow (personal observations). Because coral communities are known to occur along the west side of the Waikiki Entrance Channel of Honolulu Harbor (personal observations), two divers examined the coral communities on the western side in proximity to the entrance channel. Other than the towing a diver behind the support vessel, all diving was done using scuba. Coral community development was assessed by determining species present and estimating their coverage on the bottom. Photographs were taken of representative sections of the substratum.

Results

As noted above there are four biotopes recognized in the waters offshore of the Kakaako Shoreline Park; these are the biotope of scoured limestone, the biotope of scattered corals, the biotope of dredged rubble and the deep offshore biotope of sand. The general characteristics of each biotope are described below.

The Biotope of Scoured Limestone

The biotope of scoured limestone is present along the entire length of the boulder riprap fronting the Park and commercial area to the west. The width of this biotope varies considerably from about 40 to more than 100 m with the widest area being in the far western part of the Kakaako limestone platform. In the far west near shore area, the scoured limestone is highly irregular comprising old spur and groove formations (Figure 1) which are typically found along the seaward side of the reef crest on most Hawaiian reefs. Other than this far western area, the biotope of scoured limestone is relatively flat and smooth with little topographical relief present (Figure 2). Also present in this biotope are areas of sand and coralline rubble; these materials are moved about by impinging waves that create the scouring action which inhibits the successful establishment and growth of corals. High surf is most common during the summer months when swells arrive from the south. In the biotope of scoured limestone, fish communities are best developed in the far western area probably due to the greater cover (shelter) afforded by the spur and groove formations (Figure 3). These fish communities are dominated by surgeonfishes (family Acanthuridae) triggerfishes (family Balistidae) and damselfishes (family Pomacentridae).

Coral cover is very low in the biotope of scoured limestone biotope (much less than 0.1%) which, as noted above, is probably due to the scouring created by occasional high surf events that commonly impact this coastline during the summer months. Coral species seen in this biotope include the cauliflower coral (*Pocillopora meandrina* - see Figure 4) and rarely, the lobate coral (*Porites lobata* - see Figure 5). At the time of our survey, the edible seaweed or limu kohu (*Asparagopsis taxiformis*) was seen in this biotope as were several small octopus or he'e (*Octopus cyanea*). The diversity of diurnally-exposed macroscopic species (i.e., greater than 2 cm in some dimension) is low in this biotope. Probably the most common species include sea urchins (*Echinometra mathaei* and *Tripneustes gratilla*), sea cucumbers (*Holothuria atra*) and a few cone shell species (*Conus lividus, Conus ebreus*).

The Biotope of Scattered Corals

This biotope is situated seaward of the biotope of scoured limestone from about 50 to over 100 m from the shoreline at depths commencing in 4 to 6 m and ending in depths from about 12 to 18 m. This biotope is the most common feature of the Kakaako limestone platform and occupies a band about 330 m in width and about 900 m in length between the Waikiki Entrance Channel and the abandoned sewer line near the Kewalo Harbor Entrance Channel. Thus the biotope encompasses about 30 ha or 75 acres.

The smooth limestone of the shallower, more inshore areas transitions to a series of limestone ridges (or spurs) separated by channels (or grooves). The spurs may rise as much as 1.5 m above the general substratum and are separated by sand/coralline rubble-filled channels. These spurs and grooves have a general orientation that is perpendicular to shore and the ridges or "spurs" are from 2 to 15 m in width, up to 1.5 m in height and have lengths up to about 60 m. Channels are from 1 to about 10 m in width and are up to 40-50 m in length (Figure 6).

Along the shallower inner reaches of this biotope corals are scattered (Figure 7) but with increasing depth (i.e., 8 to 12 m), corals and their coverage increases such that over areas of 20 to 150 m^2, coverage may approach 75% (Figures 8, 9 and 10). A gross overall mean estimate of coral coverage in this biotope is 5%. Corals are commonly seen on the ridges which lie above the sand-scour that occurs during periods of high surf. Common species include the cauliflower coral (*Pocillopora meandrina*), lobate coral (*Porites lobata*), rice corals (*Montipora verrucosa, M. patula*) as well as other less dominant species (*Porites compressa, Monitpora verrilli, Pavona varians, Leptastrea purpurea, Porites rus,* etc). Most of the other invertebrates and fishes seen in this area are all species common to Hawaii's reefs. Diurnally-exposed macroinvertebrates seen include the pearl oyster or pa (*Pinctada margaritifera*, Figure 11), octopus or he'e (*Octopus cyanea*), sea cucumbers (*Holothuria atra, H. edulis, Actinopyge mauritana*), starfishes (*Linckia multifora, L. diplax, Acanthaster planci*), cone shells (*Cone imperialis, C. leopardus, C. lividus, C. ebraeus, C. miles* and *C. distans*), cowry (*Cypraea maculifera*), spindle shell (*Latirus nodus*), christmas tree worm (*Spirobranchus gigantea*), polychaete (*Loimia medusa*), boring bivalve (*Arca ventricosa*), mantis shrimp (*Gonodactylus* sp.), occasional ula'papa (*Paribaccus antarcticus*) and small xanthid crabs. Fishes commonly seen include surgeonfishes (manini - *Acanthurus triostegus,* na'ena'e - *A. olivaceus,* pualo - *A xanthopterus,* palani - *A. dussumieri,* maikoiko - *A leucoparieus*, ma'i'i'i - *A. nigrofuscus,*, kole - *Ctenochaetus strigosus*, lau'ipala - *Zebrasoma flavescens,* kala - *Naso unicornis*, umaumalei - *N. lituratus*, kihikihi - *Zanclus cornutus,* lauwiliwili - *Chaetodon miliaris*, *C. multicinctus, C. ornatissimus,* lauhau - *C. quadrimaculatus,* lauwiliwili nukunuku'oi'oi - *Forcipiger flavissimus*, mamo - *Abdufeduf abdominalis*, piliko'a - *Paracirrhites arcatus*, toby - *Canthigaster jactator* and damselfishes (*Chromis hanui, C. vanderbilti, C. agilis*). Fish species of commercial importance that are seen include moanos - *Parupeneus multifasciatus* and *P. pleurostigma*, weke - *Mulloidichthys flavolineatus*, roi - *Cephalopholis argus*, po'opa'a - *Cirrhitus pinnulatus*, rarely the omilu - *Caranx melampygus*, opelu - *Decapterus pinnulatus*, palukaluka - *Scarus rubroviolaceus*, and uhu - *Scarus sordidus*.

The Biotope of Dredged Rubble

Seaward of this the spur and groove formations that are common elements of the biotope of scattered corals become less obvious with the ridges or spurs often appearing as relatively flat limestone with little coral present; the intervening channels are filled in with coral rubble. Much of this rubble appears to be quite angular and ranges from several centimeters to about 0.75 m in diameter, but the majority of it is small. This coral rubble is what remains of the dredging activities in Honolulu Harbor and these tailings were deposited in the area (Figure 12) probably from about 1920 through about 1960. With time and sufficient material, the old seaward face of the limestone platform was extended seaward probably adding anywhere from 10 to 40 m on to the outer edge of the platform (Figure 13). This biotope is recognizable at depths from about 9 to 12 m and extends seaward sometimes as a relatively steep slope or otherwise as a gentle slope from 20 to 60 m in width and at its deepest point is found at depths up to about 24 to 29 m where a sand/rubble bottom is encountered. The distance between the most seaward obvious spur and groove formations with reasonable coral coverage occurs to the top of the more offshore rubble slope ranges from 20 to over 50 m.

In the zone of coral rubble dredge tailings, benthic and fish communities are not well-developed. The relatively unstable nature of the substratum does not promote coral growth; most corals seen in this biotope (zone) are small. Coral species seen include the cauliflower coral (*Pocillopora meandrina*), lobate coral (*Porites lobata*), and rice corals (*Montipora verrucosa and M. patula*). Corals are best developed on the larger pieces of limestone (Figure 14). Mean coral coverage in this biotope is less than 0.1% (overall mean estimated cover is 0.01% in this biotope) and species commonly seen include the cauliflower coral (*Pocillopora meandrina*), the lobate coral (*Porites lobata*) and rice corals (*Montipora verrucosa* and *M. patula*).

Fishes met with in this area are small (either juveniles) or species that do not attain large sizes (gobies, etc) probably due to the lack of shelter. Where larger coral pieces or metal/concrete debris are found, the fish communities are better developed probably due to the shelter afforded by these materials. Most fishes encountered in this biotope are around available shelter; species commonly seen include the moano (*Parupeneus multifasciatus*), lauwiliwili (*Chaetodon miliaris*), butterfly fish (*Chaetodon kleini*), mamo (*Abudefduf abdominalis*), alo'ilo'i (*Dascyllus albisella*), dartfish (*Ptereleotris heteroptera*), piliko'a (*Paracirrhites arcatus*), toby (*Canthigaster jactator*), puhi laumilo (*Gymnothorax undulatus*), 'o'opu hue (*Arothron hispidus*), ala'ihi (*Sargocentron xantherythrum*), surgeonfishes (pualo - *Acanthurus blochii, A. xanthopterus*, palani - *A. dussumieri*), ma'i'i'i (*A. nigrofuscus*), kala holo (*Naso hexacanthus*), kala lolo (*Naso brevirostris*), humuhumu lei (*Sufflamen bursa*), humuhumu mimi (*Sufflamen fraenatus*) and wrasses, the a'awa - *Bodianus bilunulatus*, hinalea 'i'iwi - *Gomphosus varius*, small wrasses - *Macropharyngodon geoffroy, Pseudocheilinus octotaenia, Pseudocheilinus evanidus, Cheilinus bimaculata* as well as the 'omaka - *Stethojulis balteata*, and hinalea lauwili - *Thalassoma duperrey*.

Diurnally-exposed macroinvertebrates seen in this biotope include sea urchins (*Echinothrix diadema, E. calamaris, Diadema paucispinum, Tripneustes gratilla*), boring bivalve (*Arca ventricosa*), rock oyster (*Spondylus tenebrosus*), sponges including *Mycale armata, Suberites zeteki, Chondrosia chucalla, Spirastrella coccinea, Tethya diploderma, Mycale cecilia, Halichondria coerulea, Iotrochota protea, Halichondria dura* and *Tedania macrodactyla,* sea cucmbers (*Holothuria atra, H. hilla, H. verrucosa*) and the polychaete (*Loimia medusa*), he'e (*Octopus cyanea*), and cushion starfish (*Culcita novaeguineae*).

The Biotope of Sand

Below the rubble slope, the substratum flattens and is comprised of sand and coral rubble. Offshore (within 100 m of the rubble slope), there are several mounds of coral rubble that rise up to 5 m above the surrounding substratum that probably represent one or more barge loads of dredge tailings. The diversity of marine life on the sand/rubble plain seaward of the 30 m isobath is not well-developed and was not examined in this study due to depth and bottom time constraints.

Coral Communities on the Western Side of Honolulu Harbor Entrance Channel

Alongside and within 80 m of the western edge of the Waikiki Entrance Channel to Honolulu Harbor there is a relatively well-developed coral community at depths from about 7 to 12 m. This community is dominated by the cauliflower coral (*Pocillopora meandrina*, Figure 15). Mean coverage is about 25% through much of this area. At depths below about 12 m the bottom topography flattens out such that the channel merges with the flat and featureless sand/limestone substratum that dominates the bottom to the west of the entrance channel. This area of barren sand/limestone flats (Figure 16) continue west but inshore of this are areas where limestone ridges or spurs are again encountered with some coral community development present (Figure 17).
Common species in this area include *Porites lobata* and *Pocillopora meandrina* and local coverage (over areas from 10 to 100 m^2) may be up to 30%. These more coral rich areas are broken by extensive sand flats so that overall mean coral coverage through much of the area is estimated to be less than 5%. The first of these ridges is found about 200 m west of the harbor entrance channel and lie primarily inshore of the 12 m isobath.

Impact of Pipe Deployment On Coral Communities

1. Trenching Across the Limestone Platform

Focusing on the area between the Waikiki Entrance Channel of Honolulu Harbor to the old sewer pipe just east of the Kewalo Basin entrance channel we may make some rough approximations of the area occupied by the three pertinent biotopes fronting the Kakaako Shoreline Park. These areas are: biotope of scoured limestone = 13.5 ha, the biotope of scattered corals = 30 ha and the biotope of dredged rubble = 13.5 ha. Again making a rough estimate of coral coverage in each biotope, coral coverage in the biotope of scoured limestone is assumed to be zero, in the biotope of scattered corals it is about 5% and in the biotope of dredged rubble it is about 0.01%. In the area directly along the western side of the Waikiki Entrance Channel for Honolulu Harbor, the coral community occupies an area of about 1.2 ha and has a mean coverage of about 5%. The total live coral coverage in these areas is: biotope of scattered corals = 15,000 m^2 of live coral, in the biotope of dredged rubble it is 135 m^2 and along the western edge of the entrance channel it is 600 m^2. If the proposed trench is located about one third of the distance along the shoreline from the Honolulu Harbor entrance channel, and if the currents run completely WSW (which is not entirely correct) corals in the area west of the trench would be exposed to turbidity. (Open trenching across limestone or unconsolidated material (sand, coralline rubble) in subtidal environments will generate turbidity.) Under these circumstances it is estimated that about 5,600 m^2 of live coral would be exposed to the turbidity generated by the construction of the trench.

2. Combination Tunneling/Trenching Deployment Across the Limestone Platform

As noted above, the biotope of dredged coralline rubble is the result of dropping dredge tailings primarily just east of the Waikiki Entrance Channel for Honolulu Harbor. These materials appear to have been deposited along the seaward edge of the limestone platform where a natural break occurs from about 12 to 21 m. The area of dredge tailings is best developed close to the Honolulu Harbor Entrance Channel. Because there are concerns over impacting coral communities with the construction of this proposed pipeline, a second deployment scenario is examined here. This scenario would tunnel from the shoreline seaward to a point where the dredge tailings are first encountered (about 11 m deep) about 615 m (2,020 feet) from shore. At that point and seaward, an open trench would be constructed, the pipe placed in this trench and covered. The pipe would daylight at about a 20 m depth and thus would have an approximate length of 146 m (480 feet). Using this construction/deployment scenario, turbidity plumes would only be generated in the section where trenching occurs (i.e., through the biotope of dredged rubble). Assuming that the prevailing currents move to the southwest, only corals present south and west of the proposed trench would be exposed to the turbidity plumes.

Rough estimates suggest that about 6.56 ha of the biotope of dredge rubble between the proposed trench and the Honolulu Harbor Entrance Channel would be exposed to the transitory turbidity plumes. If mean coral coverage is 0.01% in the biotope of dredged rubble, about 7 m^2 of coral is present in this area and would be exposed to the turbidity plumes. Turbidity plumes carried across the Honolulu Harbor Entrance Channel would lie seaward of the well-developed coral communities present along the western edge of the channel (from depths of about 7 to 12 m, above). These plumes would encounter and cross (in a SW direction) the extensive sand and limestone flats that are present from depths of 12 to more than 25 m depths offshore of Sand Island. This construction/deployment scenario is not expected to impact any coral west of the Honolulu Harbor Entrance Channel under normal tradewind (southwest) current flow.

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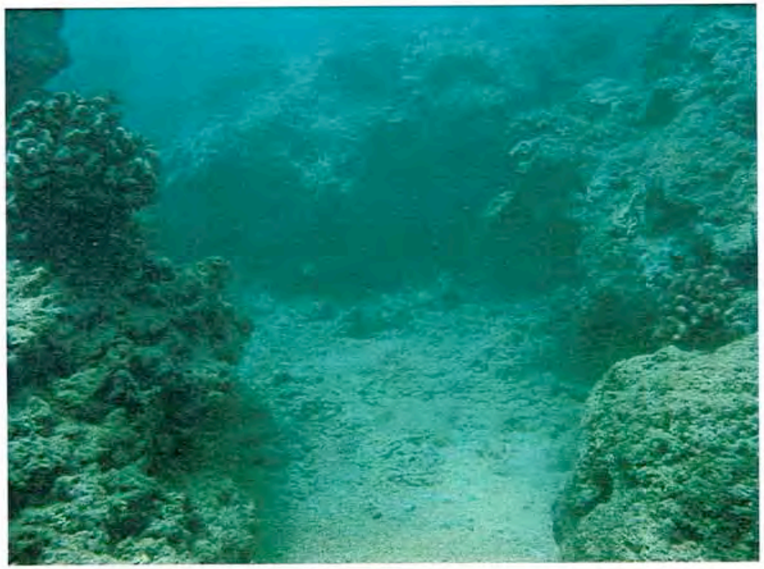

Figure 1. Example of old spur and groove formations cut into the limestone by wave action. Channel bottoms typically are sand-filled and limestone ridges or spurs often rise 1.5 m or more. Area is west of the proposed canal alignment; depth 4.5 m.

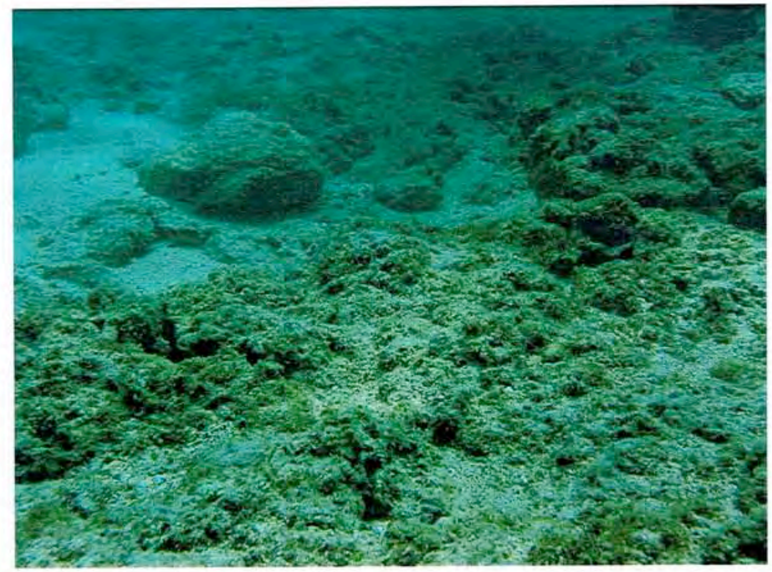

Figure 2. Photo showing flat limestone with rubble and sand in the biotope of scoured limestone west of the canal alignment. Note the lack of corals; depth 4 m.

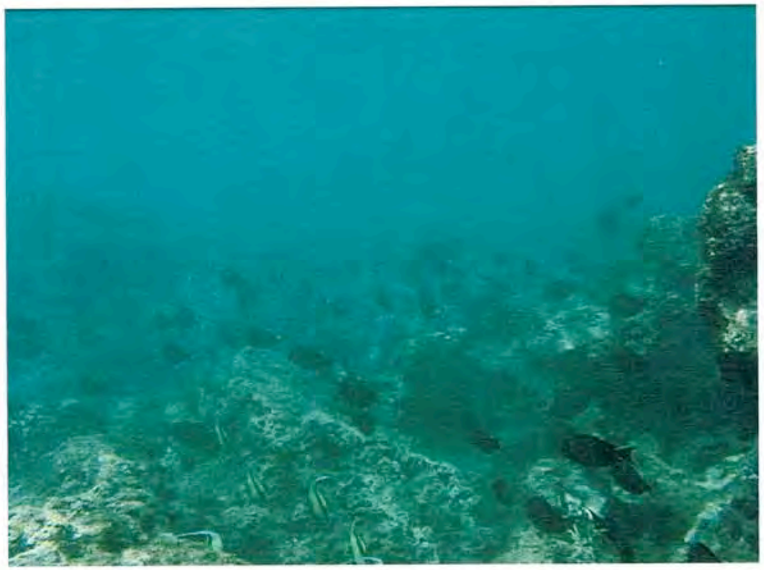

Figure 3. Surgeonfishes and moorish idols in the topographically complex spur and groove area just west of the canal alignment; depth 5 m.

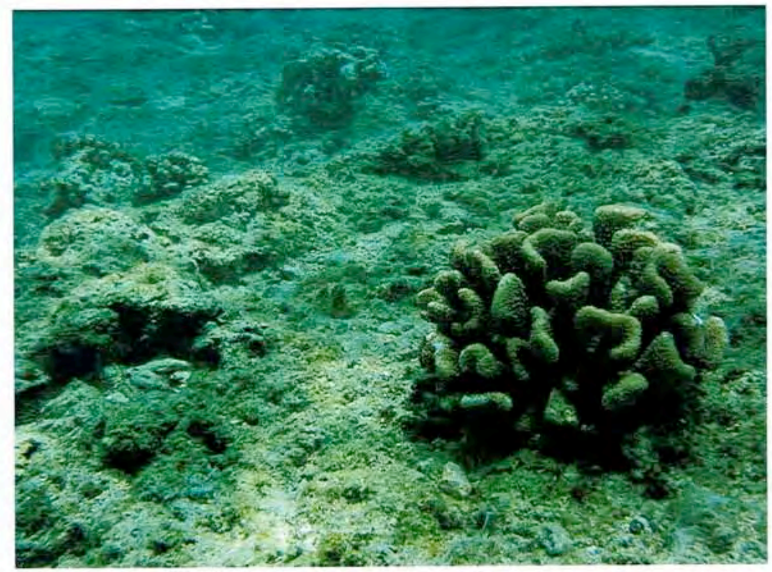

Figure 4. Example of *Pocillopora meandrina* in the biotope of scoured limestone. Depth 4.5 m fronting the canal alignment.

Figure 5. Example of a *Porites lobata* colony (diameter 25 cm) at 3 m depth about 30 m from the boulder riprap fronting the canal alignment.

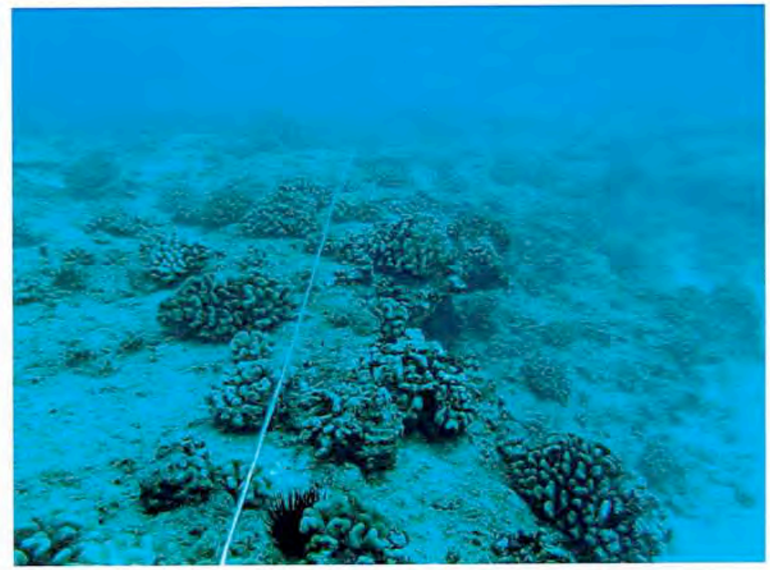

Figure 6. Photo showing the edge of a limestone ridge or spur on the left with *Pocillopora meandrina* colonies and on the right dropping away into a sand-filled channel. Depth 10 m.

Figure 7. Photo taken in the shallow portion (~7 m) of the biotope of scattered corals showing the lower density of coral colonies (*Pocillopora meandrina*) across the limestone.

Figure 8. Photo showing the typical maximum coral coverage in the biotope of scattered corals. Photo taken just west of the proposed canal alignment; most obvious corals are *Porites lobata* and *Pocillopora meandrina.* Depth 7 m.

Figure 9. Another example of high coverage by *Porites lobata* and *Pocillopora meandrina*; small sand pocket to the right. Location is offshore of the canal alignment, 8 m deep.

Figure 10. *Pocillopora meandrina* colonies on limestone, depth 8 m. Local coverage is about 25%.

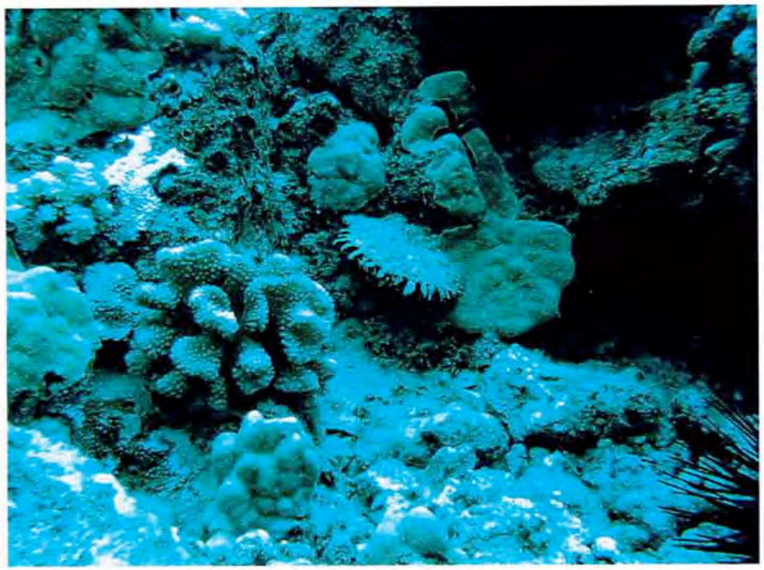

Figure 11. Photo of a pearl oyster (*Pinctada maragaritifera*) in the center of the photo attached to the basal portion of a *Porites lobata* colony. Depth 9 m offshore of the canal alignment.

Figure 12. Zone of transition (or ecotone) between the biotope of dredged rubble (at left) and the biotope of scattered corals (on limestone at the right). Corals present are *Pocillopora meandrina*. Also present are black sea urchins or wana (*Echinothrix diadema*). Depth 11 m.

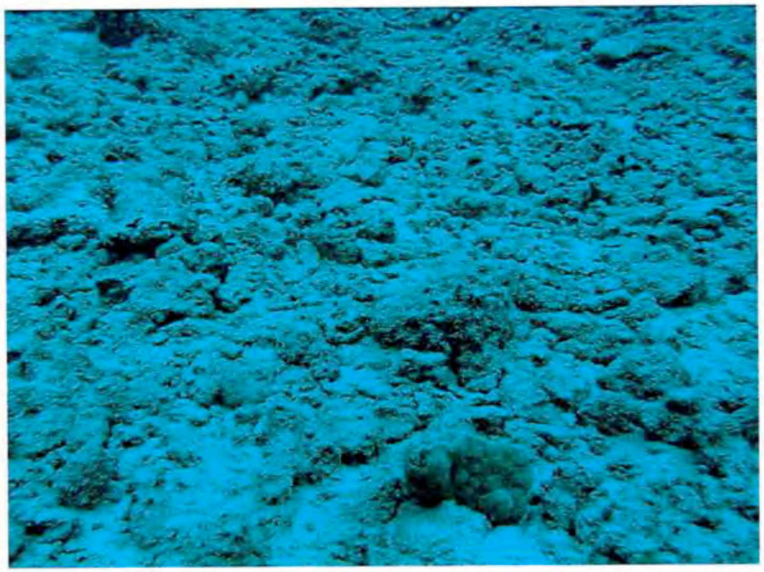

Figure 13. Dredge tailings at 12 m depth; in the foreground is a small (~8 cm diameter) *Porites lobata* colony.

Figure 14. Corals (*Pocillopora meandrina* and *Porites lobata*) in the biotope of dredged rubble growing on a larger piece of limestone presumably generated by maintenance harbor dredging. Depth 13 m.

Figure 15. Cauliflower coral (*Pocillopora meandrina*) with local coverage of about 50% along the western side of the Waikiki Entrance Channel to Honolulu Harbor. Depth 12 m.

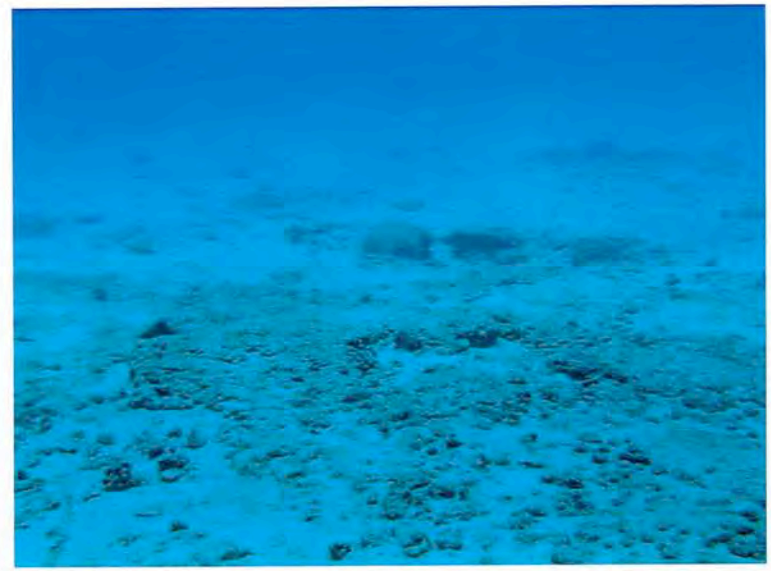

Figure 16. Barren limestone and sand about 100 m west of the Waikiki Entrance Channel for Honolulu Harbor. Depth 14 m.

Figure 17. Example of a typical coral community found on elevated limestone about 250 m west of the Waikiki Entrance Channel for Honolulu Harbor. Depth 13 m.

APPENDIX D
IMPACT OF HSWAC PIPELINE DEPLOYMENT AND OPERATION ON AQUATIC RESOURCES

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IMPACT OF HSWAC PIPELINE DEPLOYMENT AND OPERATION ON AQUATIC RESOURCES

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Environmental Assessment, LLC
30 September 2008

Abstract

The deployment of the HSWAC pipeline offshore of the Kakaako Landfill will emerge from a microtunnel at a depth of 35 feet and continue seaward above the substratum on concrete trestles. The footprint of these trestles will cover an estimated 3,713 ft^2 of substratum between the breakout point to the 100-foot isobath (the lower limit of this study). However, the trestles and pair of HDPE pipes will provide an estimated 107,600 ft^2 of hard substratum available for recruitment by corals and other sessile benthos which is an increase of more than 28 times over what is available for recruitment at present. The proposed pipeline alignment will cross five recognized ecological zones between the 35-foot and 100-foot isobaths fronting the Kakaako Landfill. Using field estimates of coral coverage, deployment of the pipeline will impact (cover) an estimated 182 ft^2 of living coral between the 35-foot and 100-foot isobaths. Because much of the hard substratum (a prerequisite for the recruitment of corals) is flat and featureless thus is subject to sand scour during seasonal high waves, existing coral communities are relatively depauperate. If just 1% of the new substratum created by the deployment of the HSWAC pipeline is colonized by coral, the resulting coral community will be 17 greater in coverage than exists presently in the area today.

Since shelter space is important to the development of coral reef fish communities, the deployment of the HSWAC pipeline will result in significantly greater shelter and thus standing crop and diversity of fishes than presently exists in the pathway of the pipeline today. Utilizing data from the Barbers Point deep ocean outfall (a similar pipeline), the standing crop of resident fish communities can be expected to increase on the order of 14 times over present (very low) standing crops in the proposed pathway of the HSWAC pipeline. In summary and from the perspective of aquatic species, the deployment of the HSWAC pipeline offshore of Kakaako will create an artificial reef with substratum that is superior to that existing in the area for the recruitment of corals, simply due to the greater vertical profile which puts the substratum above the scouring that occurs with surf. Furthermore, this structure will provide habitat for a variety of fishes that will result in a fish community that is significantly more diverse and with higher standing crops.

Introduction

This short analysis considers the impact to aquatic resources on the proposed deployment and operation of the HSWAC pipeline which is to be deployed offshore of the old Kakaako Landfill. In the deployment, microtunneling will be used from a point on the shoreline to a depth of ~35 feet approximately 2,075 SSE from the shoreline entry point. The seaward terminus of the microtunnel is situated approximately 1,330 feet from the Kakaako shoreline and from that point seaward, a pair of HDPE pipes emerge and travel seaward; one of these serves as an intake for deep cold seawater and the other serves as the seawater return which discharges used seawater at a depth of ~150 feet. These HDPE pipes have two diameters: the intake is 63 inches and the discharge is 54 inches. These pipes will be held to the substratum through the use of concrete trestles.

Microtunneling in proximity to the shoreline avoids impact to the marine communities in this area. However from the point where the HDPE pipes emerge from the substratum and travel seaward, sessile benthic marine species such as corals in the footprint of this pipeline alignment could be impacted both during the construction process as well as during the operation of the system. Accordingly, a field survey was carried out in the waters offshore of the Kakaako Landfill, to examine the status of the marine communities in the proposed alignment and assess the impacts that may occur with the HSWAC project moving forward.

Methods

Visual observations of the various habitats present in the waters from the shoreline to a depth of 100 feet were made using SCUBA and either having the diver swim or be towed between points. Observations of substratum type (e.g., sand, coral rubble, coral or limestone), depth and biological diversity are noted both by the diver and person on board the surface vessel who geo-referenced each waypoint using a hand held global positioning system.

A number of assumptions were made in determining the impact of the proposed HSWAC pipeline deployment and operation on the shallow marine communities. These are given below and data cited from past work in the ocean fronting the Kakaako landfill are referenced.

Results and Discussion

Table 1 presents the calculations for the amount of substratum directly impacted (covered) by the deployment of the HSWAC pipeline from the point of breakout (from the microtunnel) to the 100-foot isobath. Since each trestle sits on a pair of circular 50-inch diameter concrete pads, the actual bottom occupied (covered) by a trestle is approximately 27.3 ft^2 and there are 136 trestles used between the breakout and the 100-foot isobath, thus 3,713 ft^2 of substratum will be covered by the deployment of the trestles.

Also given in Table 1 is a summary of the estimated surface area of the pair of HDPE pipes and the 136 trestles to be used from the breakout at 35 feet of depth to the 100-foot isobath. In total, the concrete trestles and pipes provide approximately 107,600 ft^2 of substratum available for recruitment by benthic invertebrates. About 55% of this substratum is comprised of concrete and the remaining 45% is made up of HDPE pipe material. The ratio of substratum "lost" (i.e., covered) by the trestle pads to the total amount of hard substratum "gained" by the deployment of the pair of HDPE pipes and concrete trestles is for every square foot of bottom covered, there is a gain of almost 29 square feet of hard substratum available for benthic recruitment.

Table 2 presents the results of field studies carried out along the proposed pipeline alignment both for this proposed project as well as incorporating results from other earlier studies. Since the proposed alignment crosses substratum that has been previously studied over a nine-year period (Brock 1998), these data are also incorporated into Table 2. The proposed HSWAC pipeline alignment crosses five recognized ecological zones; these zones have a general orientation that roughly parallel the shoreline and vary in their widths along the coastline fronting the Kakaako Landfill. Table 2 presents estimates on the distance traversed by the proposed pipeline alignment from the breakout point at 35 feet of depth to the 100-foot isobath (the depth limit of this analysis). The 100-foot isobath was selected because the growth and development of coral communities along Oahu's south shore are best developed in waters less than 100 feet in depth (40 years of personal observations) and only so on hard substratum. In the vicinity of the proposed pipeline alignment offshore of the Kakaako Landfill, hard substratum appropriate for coral growth is most prevalent at depths less than 60 feet where the typical fore-reef spur and groove formations are best developed. In this setting, coral communities are best developed on the tops of the spurs or ridges and less so in the adjacent grooves or channels because of the impact that seasonal high surf has on their development (Dollar 1982). High surf can result in breakage to coral colonies and scour by moving sand and rubble negatively impact the growth and success of corals. Thus if colonies are situated on the tops or sides of ridges and not in the adjacent channels, the impact of scour is lessened. If hard substratum is found seaward of the 60-foot isobath offshore of Kakaako, the limestone usually has little vertical relief present thus any corals recruiting to this smooth substratum will be subject to scour when high wave events occur, thus coral communities in this more seaward area are poorly developed.

Referring to Table 2, the proposed HSWAC pipeline traverses five recognized ecological zones or biotopes present between the breakout point (at 35 feet depth) to the 100-foot isobath. Besides the distances traversed by the pipeline, Table 2 presents estimates of the overall mean coral coverage found in each of the five zones along the proposed alignment. Table 3 presents the estimates of direct impacts to coral cover by the deployment of the HSWAC pipeline across these five ecological zones. In summary, the direct impact to corals (i.e., covered by the trestle pads) is estimated at 182 ft^2. In contrast and as noted above, deployment of the HSWAC pipeline will provide almost twenty-nine times more hard substratum surface area for recruitment by benthic species than is the substratum being covered. In reality, the substratum created by the pipeline is far superior to most if not all of the natural substratum being covered. First and foremost, the greater vertical relief afforded by the pipeline (height = 74 inches) is far greater than found on existing hard substratum in the pathway. This greater vertical relief translates into greater vertical distance of recruiting corals and other invertebrates from the scour caused by the movement of sand and rubble during periods of high surf. The impact of scouring is clearly evident along the Barbers Point ocean outfall (operated by the City and County of Honolulu) where mean coral coverage adjacent to the discharge pipe at a 60-foot depth over a 17-year period (1991-2008) is 8.5% on the relatively smooth limestone whereas on the outfall armor

stone located 20 m away and having heights between 4 to 7 feet above the surrounding substratum, the mean coral coverage is 28% over the same period (Brock 2008). These differences are attributed to sand scour on the flats and the absence of it on the hard substratum rising above it (Brock 2008). These same principles apply offshore of Kakaako.

The question, "Are the two substratum types used by the HSWAC pipeline (here HDPE pipe and concrete trestles) appropriate for the settlement and growth of Hawaiian sessile benthic species?" should be addressed. Experimental studies in Hawaiian waters have found and recommended that concrete be used in any artificial reef construction because of its superior qualities as a substratum for the recruitment of corals. Concrete as a recruitment surface was almost as good as natural coralline substratum for the recruitment of corals, bryozoa, tunicates and other sessile coral reef species and far superior to other substrata tested (Fitzhardinge and Bailey-Brock 1989). At the Natural Energy Laboratory Authority at Keahole Point, West Hawai'i, HDPE pipe has been extensively used for carrying deep, cold seawater ashore for numerous experimental and commercial purposes since the mid-1980's. The author has monitored fish community structure at Keahole Point since that time for the State of Hawai'i and observations on the recruitment and growth of corals to HDPE pipe has noted that may corals recruit and grow on this substratum type in the Keahole setting. Overall coverage on HDPE pipe that has been immersed for 10 to more than 15 years is estimated to be close to 20%. Thus, the concrete and HDPE pipe proposed for use in the HSWAC pipeline provide substratum types appropriate for the settlement and growth of corals and other sessile benthic species.

Finally, it is estimated that 182 ft^2 of coral will be lost by the deployment of the HSWAC pipeline. If just one percent of the substratum made available by this deployment (here 107,600 ft^2 between the 35- and 100-foot isobaths) is colonized by corals, these corals will occupy 1,076 ft^2 which is almost 17 times greater coverage than was lost by deployment. Thus the greater percent coverage will result in significantly greater coral community development than presently exists in the area if the HSWAC deployment occurs.

Shelter space and cover are important agents governing the distribution of coral reef fishes (Risk 1972, Brock *et al.* 1979, Alevizon *et al.* 1985). Similarly the standing crop of fishes on a reef correlates with the degree of vertical relief of the substratum. Thus Brock (1954), using visual census techniques on Hawai'i reefs estimated the standing crop of fishes to range from 4 g/m^2 on sand flats to 186 g/m^2 in an area of considerable vertical relief. If structural complexity or topographical relief is important to coral reef fish communities, then the addition of materials to increase this relief in otherwise barren areas may serve to locally enhance the biomass of fish present. Such manipulations are well-known and usually take the form of artificial reefs. Artificial reefs in Hawaiian waters may serve to increase fish standing crops to more than 1 kg/m^2 (Brock and Norris 1989).

Again examining the Barbers Point Ocean Outfall as an example of the impact of pipe deployment on Hawaiian coral reef species, the pipeline is covered with graded armor rock in depths from about 45 feet to the outfall terminus at more than 200 feet deep. This armor rock is placed to protect the pipe from movement during period of storm surf. Besides monitoring benthic communities on and adjacent to the Barbers Point Ocean Outfall, Brock (2008) annually monitors the fish communities on the discharge pipe at a depth of 60 feet as well as at a station located 20 m east and parallel to the discharge pipe. Because the discharge pipe has large graded sizes of armor stone at the 60-foot depth (sizes range from about 2 to 4 feet in any single dimension) and this armor stone often nearly covers the pipe creating a habitat full of crevices that rises up to seven feet above the substratum and may be up to 30 feet wide, considerable shelter is present for fishes. As a result, the fish community is well-developed on the discharge pipe transect and not nearly so at the parallel transect carried out on the flat limestone substratum 20 m to east. Over the 1991-2008 period, the mean standing crop of fishes on the discharge pipe is 841 g/m^2 which is significantly greater than the standing crop found on the adjacent flat hard substratum (overall grand mean = 115 g/m^2 but removal of a random encounter with a single large shark in 1997 brings the mean standing crop down to a more realistic 60 g/m^2; Brock 2008). Thus pipelines across otherwise flat and featureless substratum in Hawaiian waters effectively create an artificial reef and the deployment of the HSWAC pipeline can be expected to do the same thing.

Literature Cited

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TABLE 1. Information on HSWAC pipeline design pertinent to potential impacts on marine communities.

Shallow water anchor collars which are used to hold the exposed (i.e., above the substratum) pair of HDPE pipes in place are constructed of concrete and have the following footprint:

Overall:

1. Each trestle has as greatest dimensions 4 ft width and 28 ft length having a contact footprint with the substratum of 27.3 ft^2 (trestle sits on a two 50" diameter concrete pads - one on each end of the trestle).
2. In the middle of each trestle is a collar perpendicular to the long axis and is the cradle to hold each of the two pipes (intake pipe diameter = 63", discharge pipe = 54").
3. Spacing between collars is from 13 to 15 feet; assume 14 feet is the average over the shallow range of the deployment (i.e., from 35-foot depth at breakout to 150 feet depth at the discharge diffusers.
4. Length of exposed pipe from breakout to the 100-foot depth = 1,900 feet
5. Over the 1,900 foot length with spacing of 14 feet, 136 trestles will be used having a collective total footprint of (27.3 ft^2 x 136 =) 3,713 ft^2

6. Calculation of pipe and trestle surface area available for marine benthic recruitment:
A. Approximate trestle outer surface area: 465 ft^2 (Note that each trestle occupies 28 inches of the linear length of each HDPE pipe so collectively the 136 trestles occupy 317 feet of the linear length of each of the two pipes; this has been accounted for in the calculations below)
B. Total length of the intake and discharge pipes between breakout and the 100-foot isobath = 1,900 feet therefore for purposes of calculating the pipe surface area each pipe length is 1,900' - 317' = 1,583 feet;
C. Therefore between the breakout and the 100-foot isobath, the 63" diameter pipe provides 26,093 ft^2 of surface area and the 54" diameter pipe provides 22,368 ft^2 of surface area.
D. Thus the total surface area created by the deployment of the HSWAC pipe system between the breakout point to the 100-foot isobath is:

Trestles (465 ft^2 x 136 trestles)	= 59,160 ft^2
63" diameter pipe	= 26,093 ft^2
54" diameter pipe	= 22,368 ft^2
Total surface area	107,621 ft^2

NOTE: 55% of the substratum available for benthic recruitment is concrete and 45% is comprised of HDPE pipe.

TABLE 2. Estimates of distances traversed by the HSWAC pipeline through the major ecological zones or biotopes within the 100-foot isobath that would be affected by the deployment and operation of the HSWAC pipeline. Also given is the estimated mean coral coverage in each of the affected zones.

1. This analysis examines the substratum type and ecological zone traversed by the exposed HSWAC pipeline over an estimated 1,900-foot pathway from the microtunnel breakout point at 35 feet to the 100-foot depth contour.

2. Breakout from microtunnel is at 35' depth in a sand patch which continues approximately 100 feet seaward; seaward of this the exposed pipeline will cross the biotope of scattered corals for a distance of 275 feet (to a depth of 40+ feet). The overall coral coverage in this biotope is 5%.

3. Seaward of the biotope of scattered corals is the biotope of shallow sand and rubble where overall mean coral coverage is 0.1% and the pipeline alignment will traverse across approximately 375 feet of this biotope. Depth ranges from about 40 feet to close to 50 feet.

4. The biotope of high coral cover is found as a narrow band at a depth from about 52-55 feet to 60 to 62 feet. This narrow biotope is 150 feet wide where the pipeline crosses it.

5. Deeper sand/rubble biotope is found just seaward of the biotope of high coral cover at depths commencing at about 60 feet and continuing seaward to well beyond the 100 foot depth which is the limit of this analysis. Mean coral coverage in the biotope of deeper sand/rubble is 0.001% .

TABLE 3. Estimate of impact to coral cover by ecological zone by the deployment of the HSWAC pipeline offshore of Kakaako Landfill. Estimates use assumptions and data as given in Tables 1 and 2.

A. Direct Impacts:

Direct impacts are defined as loss of sessile benthic species (primarily corals) due to direct covering by trestle deployment.

1. Biotope of sand (at breakout): coral cover = 0%, traverse = 100 ft; 7 trestles used covering 191 ft^2 of sand substratum but since coral cover is zero, there is no impact to corals.

2. Biotope of scattered corals: coral cover = 5%, traverse = 275 feet; 20 trestles used covering 546 ft^2. Impact is loss of 27.3 ft^2 of coral.

3. Biotope of shallow sand and rubble: coral cover = 0.1%, traverse = 375 feet; 27 trestles used covering 737 ft^2. Impact is loss of 7.4 ft^2 of coral.

4. Biotope of high coral cover: coral cover = 49%, traverse = 150 feet, 11 trestles used covering 300 ft^2. Impact is loss of 147 ft^2 of coral.

5. Biotope of deeper sand and rubble: coral cover = 0.001%, traverse = 1,000 feet, 71 trestles used covering 1,938 ft^2. Impact is loss of 0.2 ft^2 of coral.

6. Total loss of coral by the deployment of the HSWAC system between the 35-foot breakout and the 100-foot isobath is:

Biotope of sand	= 0
Biotope of scattered corals	= 27.3 ft^2
Biotope of shallow sand and rubble	= 7.4 ft^2
Biotope of high coral cover	= 147.0 ft^2
Biotope of deeper sand and rubble	= 0.2 ft^2
Total loss of coral by deployment	181.9 ft^2

APPENDIX E
EISPN COMMENTS AND RESPONSES

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DEPARTMENT OF PARKS AND RECREATION

CITY AND COUNTY OF HONOLULU

KAPOLEI HALE • 1000 ULUOHIA STREET, SUITE 309 • KAPOLEI, HAWAII 96707
TELEPHONE: (808) 692-5561 • FAX: (808) 692-5131 • INTERNET: www.honolulu.gov

MUFI HANNEMANN
MAYOR

LESTER K.C. CHANG
DIRECTOR

DANA TAKAHARA-DIAS
DEPUTY DIRECTOR

August 31, 2007

Mr. Ingvar Larsson
Honolulu Seawater Air Conditioning, LLC
7 Waterfront Plaza, Suite 400
500 Ala Moana Boulevard
Honolulu, Hawaii 96813

Dear Mr. Larsson:

Subject: Honolulu Seawater Air Conditioning
Environmental Impact Statement Preparation Notice

Thank you for the opportunity to review and comment at the preparation notice stage of the Environmental Impact Statement relating to the Honolulu Seawater Air Conditioning project.

The Department of Parks and Recreation has no comment and as the subject project will not impact any program or facility of this department, you are invited to remove us as a consulted party to the balance of the EIS process.

Sincerely,

LESTER K. C. CHANG
Director

LKCC:mk
(223992)

cc: Office of Environmental Quality Control
Ms. Debra Mendes, Office of Planning, Coastal Zone Management Program
Mr. George Krasnick, TEC, Inc.

Honolulu Seawater Air Conditioning, LLC

Managed by Renewable Energy Innovations, LLC, the COOL GREEN & CLEAN℠ Company

7 Waterfront Plaza, Suite 407, Box 124, 500 Ala Moana Boulevard, Honolulu HI 96813
Tel 808.531.SWAC (7922) Fax 808.531.7923 www.honoluluswac.com

February 25, 2008

Lester K. C. Chang
City and County of Honolulu
Department of Parks and Recreation
Kapolei Hale
1001 Uluohia Street, Suite 309
Kapolei, HI 96707

Dear Mr. Chang:

Thank you for your review of the Environmental Impact Statement Preparation Notice for the Honolulu Seawater Air Conditioning Project. We understand that this project will not affect any program or facility of the Department of Parks and Recreation of the City and County of Honolulu and the Department will be removed from the list of consulted parties for this proposed action.

Sincerely,
Honolulu Seawater Air Conditioning, LLC

Ingvar Larsson
Ingvar Larsson
Vice President of Engineering

c: Ms. Debra Mendes, Office of Planning, Coastal Zone Management Program
Mr. George Krasnick, TEC Inc.
Office of Environmental Quality Control

FILE COPY

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

LINDA LINGLE, GOVERNOR
THEODORE E. LIU, DIRECTOR
MARK K. ANDERSON, DEPUTY DIRECTOR

STRATEGIC INDUSTRIES DIVISION
235 South Beretania Street, Leiopapa A Kamehameha Bldg., 5th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

Telephone: (808) 587-3807
Fax: (808) 586-2536
Web site: www.hawaii.gov/dbedt

September 13, 2007

Honolulu Seawater Air Conditioning, LLC
7 Waterfront Plaza, Suite 400
500 Ala Moana Boulevard
Honolulu, Hawaii 96813

Attn: Ingvar Larsson

Re: Environmental Impact Statement Preparation Notice (EISPN)
Honolulu Seawater Air Conditioning Project
TMK: 2-1-1, 2, 10-14, 16-18, 24-27, 29, 30, 32, 33, 35-37, 40, 42, 46, 47, 54, 55, 59 & 60: various parcels (por.)

In response to your August 10, 2007, notice, thank you for the opportunity to provide comments on the Honolulu Seawater Air Conditioning Project. Our comments are addressed to: 1) State energy conservation goals and 2) recycling and recycled-content products. We would encourage the developers to include requirements that would reduce energy use in the served buildings.

1. **State energy conservation goals.**
Project buildings, activities, and site grounds should be designed with energy saving considerations. The mandate for such consideration is found in Chapter 344, HRS ("State Environmental Policy") and Chapter 226 ("Hawaii State Planning Act"). In particular, we would like to call to your attention HRS 226 18(c) (4) which includes a State objective of promoting all cost-effective energy conservation through adoption of energy-efficient practices and technologies.

2. **Recycling and recycled-content products.**
   a. Develop a job-site recycling plan for the construction phase of the project and recycle or otherwise provide for beneficial use for as much construction and demolition waste as possible;
   b. Incorporate provisions for recycling into the project – a collection system and space for bins for recyclables;

   c. Specify and use products with recycled-content such as: steel, concrete aggregate fill; and
   d. Specify and use as appropriate, locally produced products such as hydro-mulch and soil amendment.

If you need clarification of any of the above, please do not hesitate to contact me.

Sincerely,

Elizabeth Corbin

for Maurice H. Kaya
Chief Technology Officer

c: OEQC
Office of Planning, Coastal Zone Management Program
TEC, Inc.

Honolulu Seawater Air Conditioning, LLC
Managed by Renewable Energy Innovations, LLC, the COOL GREEN & CLEAN™ Company

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February 25, 2008

Maurice H. Kaya
Department of Business, Economic Development and Tourism
Strategic Industries Division
235 South Beretania Street
Leiopapa A. Kamehameha Bldg., 5th Floor
Honolulu, HI 96813

Dear Mr. Kaya:

Thank you for your review of the Environmental Impact Statement Preparation Notice for the Honolulu Seawater Air Conditioning (HSWAC) Project. We respond to your comments as they are numbered.

1. **State energy conservation goals.**

   The conceptual basis for the HSWAC project is to conserve energy, in particular, to reduce the volume of imported fuel oil required to electrically air condition downtown Honolulu buildings. At full build out the project is expected to reduce Hawaii's crude oil imports by 174,000 barrels per year. For our customers' buildings, connection to the HSWAC system will not only replace electrical chillers and cooling towers, but will also significantly reduce potable water demands and greenhouse gas emissions. The HSWAC Project will do more to further the State's energy saving goals than any other single project now in place or currently contemplated. Furthermore, connection to the HSWAC project will allow the State of Hawaii and the Federal government to meet more than 80% of their mandated goals for energy efficiency and renewable energy use.

   State energy conservation goals will be considered in design of the cooling station. However, it will be up to the owners and management of our customers' buildings to determine what if any other energy saving practices and technologies they might choose to implement in their buildings.

2. **Recycling and recycled-content products.**

   a. The proposed site for the cooling station is currently used for parking. Demolition waste will be limited to asphalt paving. The contractor's bid specifications will specify that construction and demolition waste shall be recycled to the extent practicable.

   b. The HSWAC cooling station will include a small office staffed by about six people. Although waste volumes will be small, provisions for recycling appropriate materials will be instituted. While the potential volumes of recyclables in our customers' buildings are much larger, we cannot control their operational practices.

   c. The contractor's bid specifications will specify use of recycled-content products to the extent practicable.

   d. The contractor's bid specifications will specify use of locally produced products such as hydro-mulch and soil amendment to the extent appropriate and practicable.

Sincerely,
Honolulu Seawater Air Conditioning, LLC

Ingvar Larsson

Ingvar Larsson
Vice President of Engineering

c: Ms. Debra Mendes, Office of Planning, Coastal Zone Management Program
Mr. George Krasnick, TEC Inc.
Office of Environmental Quality Control

DEPARTMENT OF FACILITY MAINTENANCE

CITY AND COUNTY OF HONOLULU

1000 Uluohia Street, Suite 215, Kapolei, Hawaii 96707
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MUFI HANNEMANN
MAYOR

LAVERNE HIGA, P.E.
DIRECTOR AND CHIEF ENGINEER

GEORGE "KEOKI" MIYAMOTO
DEPUTY DIRECTOR

IN REPLY REFER TO:
DRM-828

September 17, 2007

Mr. Ingvar Larsson
Honolulu Seawater Air Conditioning, LLC
500 Ala Moana Boulevard
Honolulu, Hawaii 96813

Dear Mr. Larsson:

Subject: Honolulu Seawater Air Conditioning Project
Environmental Impact Statement Preparation Notice

Thank you for the opportunity to provide comments to the Environmental Impact Statement Preparation Notice dated August 2007 for the subject project.

We support micro tunneling and directional drilling methods for the installation of the air conditioning distribution pipes within the project roadways. To lessen the impact on the roadway pavements, we request that open trench construction be kept to a minimum and utilized only where less destructive methods may not be feasible.

A problem inherent with open trench construction is adequate compaction and backfill. Therefore, we request that flowable fill or Controlled Low Strength Material be evaluated and/or considered for use as backfill material where the distribution pipes are located within roadway pavement areas.

Should you have any questions, please call Charles Pignataro of Division of Road Maintenance, at 768-3697.

Sincerely,

Laverne Higa

Laverne Higa, P.E.
Director and Chief Engineer

c: Office of Environmental Quality Control
Office of Planning, Coastal Zone Management Program
Attention: Debra Mendes
TEC, Inc
Attention: George Krasnick

Honolulu Seawater Air Conditioning, LLC

Managed by Renewable Energy Innovations, LLC, the COOL GREEN & CLEAN℠ Company

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February 25, 2008

Craig Nishimura
City & County of Honolulu
Department of Facility Maintenance
1000 Uluohia Street
Suite 215
Kapolei, HI 96707

Dear Mr. Nishimura:

In reply to the letter dated September 17, 2007 from your predecessor, Ms. Higa, we thank you for your review of the Environmental Impact Statement Preparation Notice for the Honolulu Seawater Air Conditioning (HSWAC) Project. Where technically and economically feasible, our intention is to use micro tunneling or directional drilling to install distribution pipes beneath roadways where disruption of traffic flow from trenching would be severe. This is anticipated especially for transverse crossings of major thoroughfares. Where pipes will be installed by trenching, standard mitigation measures will be employed to minimize impacts to traffic and return the pavement surface to a condition equal to or better than what existed previously.

Specifications for backfill material for the distribution pipes will require appropriate granular material for bedding, pipe zone and cover. Appropriate compaction will be required to support the roadway, but also to protect the insulated pipes from damage. Our interest, like yours, is to not have any roadway settlement.

Sincerely,

Honolulu Seawater Air Conditioning, LLC

Ingvar Larsson

Ingvar Larsson
Vice President of Engineering

c: Ms. Debra Mendes, Office of Planning, Coastal Zone Management Program
Mr. George Krasnick, TEC Inc.
Office of Environmental Quality Control

LINDA LINGLE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O. Box 3378
HONOLULU, HAWAII 96801-3378

CHIYOME L. FUKINO, M.D.
DIRECTOR OF HEALTH

In reply, please refer to:
EPO-07-172

September 18, 2007

Mr. Ingvar Larsson
7 Waterfront Plaza, Suite 400
500 Ala Moana Boulevard
Honolulu, Hawaii 96813

Mr. Larsson:

SUBJECT: Environmental Impact Statement Preparation Notice for Honolulu Seawater Air Conditioning
Honolulu, Oahu, Hawaii
TMK: (1) 2-1-001: various parcels

Thank you for allowing us to review and comment on the subject application. The document was routed to the various branches of the Department of Health (DOH) Environmental Health Administration. We have the following Wastewater Branch, Clean Air Branch, and General comments.

Wastewater Branch

All of the areas by this proposed project are served by the City's sewer system. Therefore we have no objections to the development

All wastewater plans must meet Department's Rules, HAR Chapter 11-62, "Wastewater Systems." We do reserve the right to review the detailed wastewater plans for conformance to applicable rules. If you have any questions, please contact the Planning & Design Section of the Wastewater Branch at 586-4294.

Clean Air Branch

Control of Fugitive Dust

Fugitive dust emissions occur during all phases of construction and operations. Activities close to existing residences, businesses, public areas or thoroughfares can cause dust problems. For cases involving mixed land use, we strongly recommend that buffer zones be established, wherever possible, in order to alleviate potential nuisance problems. We recommend that the contractors operate under a dust control management plan. The plan does not require the Department of Health approval, however it will help with identifying and minimizing the dust problems from the proposed project.

Examples of measures that can be included in the dust control plan are:

a) Planning the different phases of construction, focusing on minimizing the amount of dust-generating materials and activities, centralizing on-site vehicular traffic routes, and locating potential dust-generating equipment in areas of the least impact;
b) Providing an adequate water resource at the site prior to start-up of construction activities;
c) Landscaping and providing rapid covering of bare areas, including slopes, starting from the initial grading phase;
d) Minimizing dust from shoulders and access roads;
e) Providing adequate dust control measures during weekends, after hours, and prior to daily start-up of construction activities; and
f) Controlling dust from debris being hauled away from the project site.

All activities must comply with the provisions of Hawaii Administrative Rules, §11-60.1-33 on Fugitive Dust. If you have any questions, please contact the Clean Air Branch at 586-4200.

General

We strongly recommend that you review all of the Standard Comments on our website: www.state.hi.us/health/environmental/env-planning/landuse/landuse.html. Any comments specifically applicable to this project should be adhered to.

If there are any questions about these comments please contact Jiacai Liu with the Environmental Planning Office at 586-4346.

Sincerely,

KELVIN H. SUNADA, MANAGER
Environmental Planning Office

c: EPO
WWB
CAB
Ms. Debra Mendes, Office of Planning, Costal Zone Management Program
Mr. George Krasnick, TEC. Inc.

Honolulu Seawater Air Conditioning, LLC

Managed by Renewable Energy Innovations, LLC, the COOL GREEN & CLEAN™ Company

7 Waterfront Plaza, Suite 407, Box 124, 500 Ala Moana Boulevard, Honolulu HI 96813
Tel 808.531.SWAC (7922) Fax 808.531.7923 www.honoluluswac.com

February 25, 2008

Kelvin H. Sunada
State of Hawaii
Department of Health
P.O. Box 3378
Honolulu, HI 96801-3378

Dear Mr. Sunada:

Thank you for your review of the Environmental Impact Statement Preparation Notice for the Honolulu Seawater Air Conditioning (HSWAC) Project. We respond to your comments in the order in which they appear in your letter.

Wastewater Branch

The main connection to the City's wastewater system will be at the cooling station, at which only about six people will be employed. Connections are also anticipated for draining sections of the on-shore distribution system when connecting new customers or for maintenance work. The connections will be made according to applicable regulations.

Clean Air Branch

The HSWAC cooling station may be located within a parking structure. No additional land will be available to or controlled by HSWAC for creation of a buffer zone. Such a zone could be created by the landlord, however. Standard dust mitigation measures such as watering exposed ground, covering dust generating truck loads, etc. will be required to be employed by the contractor.

Sincerely,
Honolulu Seawater Air Conditioning, LLC

Ingvar Larsson

Ingvar Larsson
Vice President of Engineering

c: Ms. Debra Mendes, Office of Planning, Coastal Zone Management Program
Mr. George Krasnick, TEC Inc.
Office of Environmental Quality Control

HAWAII COMMUNITY DEVELOPMENT AUTHORITY

KAKAAKO KALAELOA

Linda Lingle
Governor

Michael Goshi
Chairperson

Tenoy K. Takahashi
Interim Executive Director

677 Ala Moana Boulevard
Suite 1001
Honolulu, Hawaii
96813

Telephone
(808) 587-2870

Facsimile
(808) 587-8150

E-Mail
contact@hcdaweb.org

Web site
www.hcdaweb.org

Ref. No.: PL EIS 6.6

September 21, 2007

Mr. George Krasnick
TEC, Inc.
1001 Bishop Street, ASB #1400
Honolulu, Hawaii 96813

Dear Mr. Krasnick:

Re: Environmental Impact Statement Preparation Notice ("EISPN") for the Honolulu Seawater Air Conditioning

We have reviewed the subject EISPN and have the following comments to offer.

- Section 3.6, Alternative Cooling Station Locations, should include a site map of the "potentially available sites". Impacts relating to the Cooling Station facility should be addressed in the Draft EIS.
- The 'Kewalo Shoreline Park' identified in Section 4.6.2.1 Coral Reefs, is the Kakaako Waterfront Park.
- Figure 5-6, *Hawaii Community Development Authority Kakaako Zoning Districts*, does not reflect the correct zoning designations for the Makai Area. Please refer to the Kakaako Community Development District Makai Area Plan Land Use Plan dated November 2005.
- The proposed project would appear to have significant impacts on the existing underground infrastructure system (sewer, drain, water, electric, telephone and cable). Specifically with respect to siting of the piping system within the public rights-of-way. The impacts, mitigation measures and alternatives should be clearly addressed in the Draft EIS.
- It is our understanding that the project will utilize the existing drainage canal located adjacent to the west boundary of the Kakaako Waterfront Park. Use of the drainage canal should be discussed and any impacts disclosed in the Draft EIS.

Mr. George Krasnick
Page Two
September 21, 2007

- If possible, information on project scheduling should be provided in the Draft EIS.

Should you have any questions please call Mr. Deepak Neupane, P.E., AIA, Director of Planning and Development at 587-2870.

Sincerely,

Teney K. Takahashi
Teney K. Takahashi
Interim Executive Director

TT/ST:ll

c: Office of Environmental Quality Control

Honolulu Seawater Air Conditioning, LLC
Managed by Renewable Energy Innovations, LLC, the COOL GREEN & CLEAN™ Company

7 Waterfront Plaza, Suite 407, Box 124, 500 Ala Moana Boulevard, Honolulu HI 96813
Tel 808.531.SWAC (7922) Fax 808.531.7923 www.honoluluswac.com

February 25, 2008

Anthony Ching
Hawaii Community Development Authority
677 Ala Moana Blvd.
Suite 1001
Honolulu, HI 96813

Dear Mr. Ching:

In reply to the letter dated September 21, 2007 from your predecessor, Mr. Takahashi, we thank you for your review of the Environmental Impact Statement Preparation Notice for the Honolulu Seawater Air Conditioning (HSWAC) Project. We will respond to your comments in the order in which they appear in your letter.

- We will include a location map of the potentially available sites that were evaluated in the site screening process. Impacts of the cooling station will be addressed in appropriate sections throughout the draft EIS.
- Kakaako Waterfront Park will be correctly named throughout the document.
- Figure 5-6 will be updated to reflect the current HCDA zoning designations.
- Routing of the distribution pipes is being undertaken with consideration of the existing buried infrastructure. Interviews with responsible agency and utility personnel, inspection of as-built drawings, and physical inspections of alternative routes will be completed prior to route finalization. Avoidance of existing infrastructure is an important criterion for route selection. The draft EIS will summarize the results of these efforts and provide contingency plans that will be employed in the event infrastructure is damaged during construction.
- The potential use of the drainage canal area as a site for the cooling station will be discussed as an alternative in the draft EIS.
- A project schedule will be provided in the draft EIS.

Sincerely,
Honolulu Seawater Air Conditioning, LLC

Ingvar Larsson

Ingvar Larsson
Vice President of Engineering

c: Ms. Debra Mendes, Office of Planning, Coastal Zone Management Program
Mr. George Krasnick, TEC Inc.
Office of Environmental Quality Control

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
INTERIM CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

August 24, 2007

RECEIVED
LAND DIVISION
2007 AUG 31 A 10 36
DEPT OF LAND & NATURAL RESOURCES STATE OF HAWAII

MEMORANDUM

TO: **DLNR Agencies:**
x ~~Div. of Aquatic Resources~~
x Div. of Boating & Ocean Recreation
x ~~Engineering Division~~
__Div. of Forestry & Wildlife
x Div. of State Parks
X Commission on Water Resource Management
x Office of Conservation & Coastal Lands
x Land Division – Oahu District/Morris Atta

FROM: Russell Y. Tsuji
SUBJECT: Environmental Impact Statement Notice for installing seawater intake and return pipes offshore of Honolulu; constructing a pumping station on shore; and installing a system of distribution pipes beneath the streets of downtown Honolulu
LOCATION: Honolulu, Oahu, Tax Map Key: (1) 2-1-1; 2, 10-14, 16-18, 24-27, 29, 30, 32, 33, 35-37, 40, 42, 46, 47, 54, 55, 59 & 60
APPLICANT: Honolulu Seawater Air Conditioning, LLC

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by September 20, 2007.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact my office at 587-0433. Thank you.

Attachments

(X) We have no objections.
( ) We have no comments.
( ) Comments are attached.

Signed: [signature]
Date: 8/30/07

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
INTERIM CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

August 24, 2007

MEMORANDUM

From! ~~TO:~~ **DLNR Agencies:**
x Div. of Aquatic Resources
x Div. of Boating & Ocean Recreation
x Engineering Division
__Div. of Forestry & Wildlife
x Div. of State Parks
X Commission on Water Resource Management
x ~~Office of Conservation &~~ Coastal Lands
x ~~Land Division – Oahu District~~/Morris Atta

To: ~~FROM:~~ Russell Y. Tsuji
SUBJECT: Environmental Impact Statement Notice for installing seawater intake and return pipes offshore of Honolulu; constructing a pumping station on shore; and installing a system of distribution pipes beneath the streets of downtown Honolulu
LOCATION: Honolulu, Oahu, Tax Map Key: (1) 2-1-1; 2, 10-14, 16-18, 24-27, 29, 30, 32, 33, 35-37, 40, 42, 46, 47, 54, 55, 59 & 60
APPLICANT: Honolulu Seawater Air Conditioning, LLC

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by September 20, 2007.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact my office at 587-0433. Thank you.

Attachments

( ) We have no objections.
( ) We have no comments.
(X) Comments are attached.

Signed: [signature]
Date: 8/30/07

LINDA LINGLE
GOVERNOR OF HAWAII

ALLAN A. SMITH
INTERIM CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

August 31,2007

M E M O R A N D U M

To: Russell Y. Tsuji
Administrator

Through: Steve Molmen
Supervising Land Agent

From: Steve Lau *Steve Lau*
Land Agent

Subject: Environmental Impact Statement Notice for installing seawater intake and return pipes offshore of Honolulu; constructing a pumping station on shore; and installing a system of distributing pipes beneath the streets of downtown Honolulu, Honolulu, Oahu, Tax Map Key:(1)2-1-1; 2, 10-14, 16-18, 24-27, 29, 30, 32, 33,35-37, 40, 42, 46, 47, 54, 55, 59 & 60.

The above project, which includes installing a system of distributing pipes beneath the streets of Honolulu into the submerged lands (to three miles offshore), will require a land disposition from the Land Division.

Thank you for allowing us the opportunity to review and comment on the above project.

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
INTERIM CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

RECEIVED
07 AUG 27 AM 11 : 19
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

August 24, 2007

MEMORANDUM

TO: **DLNR Agencies:**
x Div. of Aquatic Resources
x Div. of Boating & Ocean Recreation
x Engineering Division
_ Div. of Forestry & Wildlife
x Div. of State Parks
X Commission on Water Resource Management
x Office of Conservation & Coastal Lands
x Land Division – Oahu District/Morris Atta

FROM: Russell Y. Tsuji
SUBJECT: Environmental Impact Statement Notice for installing seawater intake and return pipes offshore of Honolulu; constructing a pumping station on shore; and installing a system of distribution pipes beneath the streets of downtown Honolulu
LOCATION: Honolulu, Oahu, Tax Map Key: (1) 2-1-1; 2, 10-14, 16-18, 24-27, 29, 30, 32, 33, 35-37, 40, 42, 46, 47, 54, 55, 59 & 60
APPLICANT: Honolulu Seawater Air Conditioning, LLC

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by September 20, 2007.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact my office at 587-0433. Thank you.

Attachments

( ) We have no objections.
( ) We have no comments.
(x) Comments are attached.

Signed: ________
Date: 9/13/07

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
INTERIM CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

August 24, 2007

RECEIVED
'07 AUG 27 PM 03:15 ENGINEERING DIVISION

2007 SEP 20 P 2:10

DEPT. OF LAND & NATURAL RESOURCES STATE OF HAWAII

MEMORANDUM

TO: **DLNR Agencies:**
x Div. of Aquatic Resources
x ~~Div. of Boating & Ocean Recreation~~
x Engineering Division
__Div. of Forestry & Wildlife
x Div. of State Parks
X Commission on Water Resource Management
x Office of Conservation & Coastal Lands
x Land Division – Oahu District/Morris Atta

FROM: Russell Y. Tsuji
SUBJECT: Environmental Impact Statement Notice for installing seawater intake and return pipes offshore of Honolulu; constructing a pumping station on shore; and installing a system of distribution pipes beneath the streets of downtown Honolulu
LOCATION: Honolulu, Oahu, Tax Map Key: (1) 2-1-1; 2, 10-14, 16-18, 24-27, 29, 30, 32, 33, 35-37, 40, 42, 46, 47, 54, 55, 59 & 60
APPLICANT: Honolulu Seawater Air Conditioning, LLC

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by September 20, 2007.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact my office at 587-0433. Thank you.

Attachments

( ) We have no objections.
( ) We have no comments.
(X) Comments are attached.

Signed: [signature]
Date: 9/20/07

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

LD/RYT

Ref.: DEAStateCivilDefenseRadioStation
Oahu.574

COMMENTS

(X) **We confirm that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Zone X and in seawater. The Flood Insurance Program does not have any regulations for developments within Zone X and in seawater.**

( ) Please take note that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Zone.

( ) Please note that the correct Flood Zone Designation for the project site according to the Flood Insurance Rate Map (FIRM) is ___.

( ) Please note that the project must comply with the rules and regulations of the National Flood Insurance Program (NFIP) presented in Title 44 of the Code of Federal Regulations (44CFR), whenever development within a Special Flood Hazard Area is undertaken. If there are any questions, please contact the State NFIP Coordinator, Ms. Carol Tyau-Beam, of the Department of Land and Natural Resources, Engineering Division at (808) 587-0267.

Please be advised that 44CFR indicates the minimum standards set forth by the NFIP. Your Community's local flood ordinance may prove to be more restrictive and thus take precedence over the minimum NFIP standards. If there are questions regarding the local flood ordinances, please contact the applicable County NFIP Coordinators below:

( ) Mr. Robert Sumitomo at (808) 768-8097 or Mr. Mario Siu Li at (808) 768-8098 of the City and County of Honolulu, Department of Planning and Permitting.
( ) Mr. Kelly Gomes at (808) 961-8327 (Hilo) or Mr. Kiran Emler at (808) 327-3530 (Kona) of the County of Hawaii, Department of Public Works.
( ) Mr. Francis Cerizo at (808) 270-7771 of the County of Maui, Department of Planning.
( ) Mr. Mario Antonio at (808) 241-6620 of the County of Kauai, Department of Public Works.

( ) The applicant should include project water demands and infrastructure required to meet water demands. Please note that the implementation of any State-sponsored projects requiring water service from the Honolulu Board of Water Supply system must first obtain water allocation credits from the Engineering Division before it can receive a building permit and/or water meter.

( ) The applicant should provide the water demands and calculations to the Engineering Division so it can be included in the State Water Projects Plan Update.

( ) Additional Comments: ____________________

( ) Other: ____________________

Should you have any questions, please call Ms. Suzie Agraan of the Planning Branch at 587-0258.

Signed: [signature]
ERIC T. HIRANO, CHIEF ENGINEER
Date: 9/20/07

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON

MEREDITH J. CHING
JAMES A. FRAZIER
NEAL S. FUJIWARA
CHIYOME L. FUKINO, M.D.
DONNA FAY K. KIYOSAKI, P.E.
LAWRENCE H. MIIKE, M.D., J.D.

KEN C. KAWAHARA, P.E.
DEPUTY DIRECTOR

RECEIVED
LAND DIVISION
2007 SEP 20 P 3:17

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

September 14, 2007

REF:

TO: Russell Tsuji, Administrator
Land Division

FROM: Ken C. Kawahara, P.E., Deputy Director
Commission on Water Resource Management

SUBJECT: EIS notice for Honolulu Seawater Air Conditioning, LLC

FILE NO.:

Thank you for the opportunity to review the subject document. The Commission on Water Resource Management (CWRM) is the agency responsible for administering the State Water Code (Code). Under the Code, all waters of the State are held in trust for the benefit of the citizens of the State, therefore, all water use is subject to legally protected water rights. CWRM strongly promotes the efficient use of Hawaii's water resources through conservation measures and appropriate resource management. For more information, please refer to the State Water Code, Chapter 174C, Hawaii Revised Statutes, and Hawaii Administrative Rules, Chapters 13-167 to 13-171. These documents are available via the Internet at *http://www.hawaii.gov/dlnr/cwrm*.

Our comments related to water resources are checked off below.

☐ 1. We recommend coordination with the county to incorporate this project into the county's Water Use and Development Plan. Please contact the respective Planning Department and/or Department of Water Supply for further information.

☐ 2. We recommend coordination with the Engineering Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan.

☐ 3. There may be the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.

Permits required by CWRM: Additional information and forms are available at *www.hawaii.gov/dlnr/cwrm/forms.htm*.

☒ 4. The proposed water supply source for the project is located in a designated ground-water management area, and a Water Use Permit is required prior to use of ground water.

☒ 5. A Well Construction Permit(s) is (are) required before the commencement of any well construction work.

☒ 6. A Pump Installation Permit(s) is (are) required before ground water is developed as a source of supply for the project.

DRF-IA 03/02/2006

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

KEN C. KAWAHARA
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAI'I
DEPARTMENT OF LAND AND NATURAL RESOURCES
Office of Conservation and Coastal Lands
POST OFFICE BOX 621
HONOLULU, HAWAI'I 96809

SEP 24 2007

REF:OCCL:MC

Correspondence OA-08-40

RECEIVED
LAND DIVISION
2007 SEP 25 A 10:29
DEPT. OF LAND &
NATURAL RESOURCES
STATE OF HAWAII

MEMORANDUM:

TO: Russell Tsuji, Administrator
Land Division

FROM: Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Lands

SUBJECT: Environmental Impact Statement Preparation Notice
Honolulu Seawater Air Conditioning

TMKs: Submerged lands offshore of (1) 2-1-15:9

LOCATION: Kaka'ako Kai, Honolulu, O'ahu

The Office of Conservation and Coastal Lands has reviewed the Environmental Impact Statement Preparation Notice for the Honolulu Seawater Air Conditioning. The project involves land uses on submerged lands which are in the Resource Subzone of the State Land Use Conservation District.

OCCL concurs that the portions of the project occurring on submerged lands will require a Conservation District Use Permit.

The proposed use is an identified land use in the Resource subzone of the Conservation District, pursuant to Hawai'i Administrative Rules (HAR) §13-5-22, P-6 PUBLIC PURPOSE USES, D-2 *Transportation systems, transmission facilities for public utilities, water systems, etc., which are undertaken by non-governmental entities which benefit the public and are consistent with the purpose of the conservation district.* **The final authority to grant or deny the permit rests with the Board of Land and Natural Resources (BLNR).**

Please contact Michael Cain at 587-0048, should you have any questions on this matter.

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
INTERIM CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

September 24, 2007

Honolulu Seawater Air Conditioning, LLC
7 Waterfront Plaza Suite 400
Honolulu, Hawaii 96813

Attention: Mr. Ingvar Larsson

Gentlemen:

Subject: Environmental Impact Statement Notice for installing seawater intake and return pipes offshore of Honolulu; constructing a pumping station on shore; and installing a system of distribution pipes beneath the streets of downtown Honolulu, Honolulu, Oahu, Tax Map Key: (1) 2-1-1, 2, 10-14, 16-18, 24-27, 29, 30, 32, 33, 35-37, 40, 42, 46, 47, 54, 55, 59 & 60: various parcels

Thank you for the opportunity to review and comment on the subject matter. The Department of Land and Natural Resources' (DLNR) Land Division distributed or made available a copy of your report pertaining to the subject matter to DLNR Divisions for their review and comment.

Other than the comments from Engineering Division, Division of Boating & Ocean Recreation, Commission on Water Resource Management, Land Division – Oahu District, the Department of Land and Natural Resources has no other comments to offer on the subject matter. Should you have any questions, please feel free to call our office at 587-0433. Thank you.

Sincerely,

Russell Y. Tsuji
Administrator

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
INTERIM CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

September 27, 2007

Honolulu Seawater Air Conditioning, LLC
7 Waterfront Plaza Suite 400
Honolulu, Hawaii 96813

Attention: Mr. Ingvar Larsson

Gentlemen:

Subject: Environmental Impact Statement Notice for installing seawater intake and return pipes offshore of Honolulu; constructing a pumping station on shore; and install a system of distribution pipes beneath the streets of downtown Honolulu, Honolulu, Oahu, Tax Map Key: (1) 2-1-1, 2, 10-14, 16-18, 24-27, 29, 30, 32, 33, 35-37, 40, 42, 46, 47, 54, 55, 59 & 60

Thank you for the opportunity to review and comment on the subject matter. The Department of Land and Natural Resources' (DLNR) Land Division distributed or made available a copy of your report pertaining to the subject matter to DLNR Divisions for their review and comment.

Other than the comments from Office of Conservation & Coastal Lands, the Department of Land and Natural Resources has no other comments to offer on the subject matter. Should you have any questions, please feel free to call our office at 587-0433. Thank you.

Sincerely,

Charlene E. Unoki
for Russell Y. Tsuji
Administrator

Honolulu Seawater Air Conditioning, LLC
Managed by Renewable Energy Innovations, LLC, the COOL GREEN & CLEAN™ Company
7 Waterfront Plaza, Suite 407, Box 124, 500 Ala Moana Boulevard, Honolulu HI 96813
Tel 808.531.SWAC (7922) Fax 808.531.7923 www.honoluluswac.com

February 25, 2008

Russell Y. Tsuji
State of Hawaii
Department of Land and Natural Resources-Land Division
P.O. Box 621
Honolulu, HI 96809

Dear Mr. Tsuji:

Thank you for your review of the Environmental Impact Statement Preparation Notice for the Honolulu Seawater Air Conditioning (HSWAC) Project. We respond to the substantive comments by respective agency.

Office of Conservation and Coastal Lands
We understand that the marine portion of the project involves uses on submerged lands which are in the Resource Subzone of the State Land Use Conservation District, and that final authority to grant or deny a Conservation District Use Permit rests with the Board of Land and Natural Resources.

Sincerely,
Honolulu Seawater Air Conditioning, LLC

Ingvar Larsson

Ingvar Larsson
Vice President of Engineering

c: Ms. Debra Mendes, Office of Planning, Coastal Zone Management Program
Mr. George Krasnick, TEC Inc.
Office of Environmental Quality Control

Honolulu Seawater Air Conditioning, LLC
Managed by Renewable Energy Innovations, LLC, the COOL GREEN & CLEAN™ Company
7 Waterfront Plaza, Suite 407, Box 124, 500 Ala Moana Boulevard, Honolulu HI 96813
Tel 808.531.SWAC (7922) Fax 808.531.7923 www.honoluluswac.com

February 25, 2008

Russell Y. Tsuji
State of Hawaii
Department of Land and Natural Resources - Land Division
P.O. Box 621
Honolulu, HI 96809

Dear Mr. Tsuji:

Thank you for your review of the Environmental Impact Statement Preparation Notice for the Honolulu Seawater Air Conditioning (HSWAC) Project. We respond to the substantive comments by respective agency.

Engineering Division
Thank you for confirming the Flood Insurance Rate Map designation for the cooling station.

Commission on Water Resource Management
There may be some misconception about the HSWAC project. We do not intend to use groundwater. No groundwater wells will be constructed; no groundwater pumps will be installed. Therefore, the listed permits will not be required.

Land Division
We have discussed with your division requirements for and timing of the acquisition of a submerged lands easement for installation of the offshore intake and return pipes. This information will be summarized in the draft EIS.

Sincerely,
Honolulu Seawater Air Conditioning, LLC

Ingvar Larsson

Ingvar Larsson
Vice President of Engineering

c: Ms. Debra Mendes, Office of Planning, Coastal Zone Management Program
Mr. George Krasnick, TEC Inc.
Office of Environmental Quality Control

DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 3RD FLOOR
HONOLULU, HAWAII 96813
Phone: (808) 768-8305 • Fax: (808) 523-4730 • Internet: www.honolulu.gov

MUFI HANNEMANN
MAYOR

MELVIN N. KAKU
DIRECTOR

RICHARD F. TORRES
DEPUTY DIRECTOR

TP8/07-223924R

September 26, 2007

Mr. Ingvar Larsson
Honolulu Seawater Air Conditioning, LLC
7 Waterfront Plaza, Suite 400
500 Ala Moana Boulevard
Honolulu, Hawaii 96813

Dear Mr. Larsson:

Subject: Honolulu Seawater Air Conditioning Project

Thank you for the August 10, 2007 letter from the Department of Business, Economic Development and Tourism, Office of Planning, requesting our review of and comments on the Environmental Impact Statement (EIS) Preparation Notice for the subject project.

In addition to the traffic impacts of the project during the construction phase, the draft EIS should address the effects of the construction work on existing public transit operations and pedestrian movements.

Should you have any questions regarding this matter, please contact Ms. Faith Miyamoto of the Transportation Planning Division at 768-8350.

Sincerely,

Melvin N. Kaku

MELVIN N. KAKU
Director

cc: Mr. Laurence Lau
Office of Environmental Quality Control

Ms. Debra Mendes
Office of Planning, Coastal Zone Management Program

✓Mr. George Krasnick
TEC, Inc.

Honolulu Seawater Air Conditioning, LLC
Managed by Renewable Energy Innovations, LLC, the COOL GREEN & CLEAN™ Company

7 Waterfront Plaza, Suite 407, Box 124, 500 Ala Moana Boulevard, Honolulu HI 96813
Tel 808.531.SWAC (7922) Fax 808.531.7923 www.honoluluswac.com

February 25, 2008

Wayne Yoshioka
City & County of Honolulu
Department of Transportation Services
650 South King Street, 3rd floor
Honolulu, HI 96813

Dear Mr. Yoshioka:

In reply to the letter dated September 26, 2007 from your predecessor, Mr. Kaku, we thank you for your review of the Environmental Impact Statement Preparation Notice for the Honolulu Seawater Air Conditioning (HSWAC) Project. The draft EIS will contain an assessment of the effects of project construction on public transit operations and pedestrian movements.

Sincerely,
Honolulu Seawater Air Conditioning, LLC

Ingvar Larsson

Ingvar Larsson
Vice President of Engineering

c: Ms. Debra Mendes, Office of Planning, Coastal Zone Management Program
Mr. George Krasnick, TEC Inc.
Office of Environmental Quality Control

DEPARTMENT OF PLANNING AND PERMITTING
CITY AND COUNTY OF HONOLULU
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MUFI HANNEMANN
MAYOR

HENRY ENG, FAICP
DIRECTOR

DAVID K. TANOUE
DEPUTY DIRECTOR

2007/ELOG-2367 (TH)

September 26, 2007

Mr. Ingvar Larsson
Honolulu Seawater Air Conditioning, LLC
7 Waterfront Plaza, Suite 400
500 Ala Moana Boulevard
Honolulu, Hawaii 96813

Dear Mr. Larsson:

Subject: Environmental Impact Statement Preparation Notice (EISPN) for the Honolulu Seawater Air Conditioning Project, Kakaako, Oahu, Hawaii

We have reviewed the subject EISPN and offer the following comments.

1. The DEIS should include information about how many people will be staffed onsite; who will own, operate and maintain the system; and if a maintenance yard is required, whether it will be located on the same site as the pump station.

2. On Page S1, Determination, this section should discuss the applicability of Chapter 343 HRS to this project in addition to the current discussion on the significance criteria for an environmental impact statement.

3. Figure 2-14 of the DEIS should show the route and direction of the intake pipe and return pipe.

4. Section 3.0 of the DEIS should include the use of solar and photovoltaic systems as another alternative to reduce energy consumption for the proposed project.

5. Paragraph 2 on Page 68 of the DEIS should be revised to say "Honolulu is the capital of the State of Hawaii," not the Primary Urban Center.

   The DEIS' discussion of the Development Plans should be expanded by discussing how the proposed project conforms to the PUC's vision, and applicable objectives, policies, and guidelines.

6. Section 5.4.1.3 (Coastal Zone Management) of the EISPN indicates that the State Office of Planning will administer the Special Management Area permit. The DEIS should clarify whether the State Office of Planning will administer the Shoreline Setback permit.

7. Figures 5-4 through 5-7 of the EISPN should be revised to identify the approximate service area of the proposed project. The maps should also identify the boundary between the Hawaii Community Development Authority's Kakaako Community Development District's Makai and Mauka Area Plan areas.

8. Section 7.0 of the Draft EIS should list all required City permits and approvals, including but not limited to: grading, building, trenching permits, etc.

9. The DEIS should explain how the project will comply with Section II (Storm Water Quality) of the Rules Relating to Storm Drainage Standards.

10. The DEIS should explain what the estimated life cycle cost is for the proposed project.

11. The DEIS should discuss whether contaminants could enter the distribution system and describe any mitigation measures to prevent possible discharge of pollutants into the ocean.

12. A construction management plan should be prepared as part of this project that identifies various incremental phases of work. The incremental phases should specify the required work area on each street that is open to the public and include the sequencing of work. Traffic control plans for all work within or affecting City streets are required to be submitted to the Department of Planning and Permitting for review and approval.

13. The project will require the applicant to submit a Site Development Master Application for Sewer Connection to the Department of Planning and Permitting for review and approval. Additionally, the DEIS should disclose how wastewater will be discharged from the project into the City's existing wastewater system.

14. The electronic version of the Honolulu Star-Bulletin (Vol. 12, issue 266, Sunday September 23, 2007) contained an article entitled: "The Drowning of Hawaii" (attached). The article discussed how Hawaii's coastline would be impacted by a possible 39-inch rise in sea level brought on by climate change within the next 100 years.

The DEIS should discuss the possible long-term impacts to the proposed project based on the possibility of a rise in the sea level along the south shore of Oahu.

Thank you for the opportunity to comment on this matter. Should you have any questions, please contact Tim Hata of our staff at 768-8043.

Very truly yours,

Henry Eng, FAICP, Director
Department of Planning and Permitting

HE:js

Attachment

cc: Office of Environmental Quality Control
Office of Planning, Coastal Zone Management Program, Attn: Ms. Debra Mendes
TEC, Inc., Attn: Mr. George Krasnick

P:DivFunction\EA-EIS\2007\HSWACPEIS\2007ELOG-2367

Star Bulletin .com

80°F / Partly Cloudy

Vol. 12, Issue 266 - Sunday, September 23, 2007

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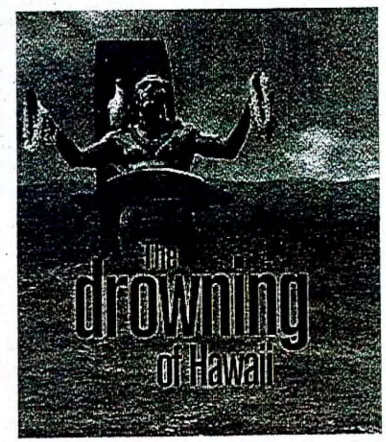

Warmer waters. Melting ice caps. Disappearing glaciers. They are all expected to raise ocean levels by 39 inches in the next century, forever reshaping Hawaii.

STORY SUMMARY »

Top photo illustration by Kip Aoki
kaoki@starbulletin.com

Oceanfront property in Honolulu, about the year 2100:

» McKinley High School.

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Hawaii News
» The drowning of Hawaii
» Favela's widow perseveres
» Tailgate turf war
» Clearing the pas
» Hawaii in 2050
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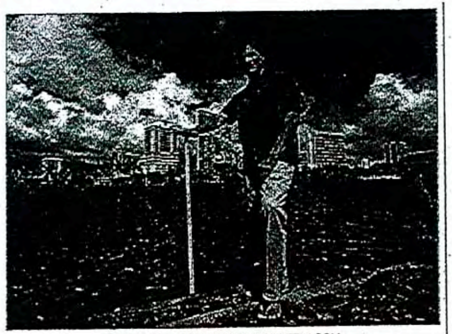
» Iolani School.

» Honolulu Stadium park in Moiliili.

That's using the projection of one meter, or 39 inches, of sea level rise, a figure many scientists and planners who have reviewed global climate change predictions say is likely for Hawaii.

Specific projections for areas less populated than urban Honolulu haven't been made, but every island would be affected by climate change in one way or another.



DENNIS ODA / DODA@STARBULLETIN.COM
Marine geologist Charles "Chip" Fletcher uses a yardstick to show what could be the approximate sea level at the Ala Wai Canal in 100 years. "I think this is a slowly emerging catastrophe," Fletcher said. "I think it's going to slowly dawn on us."

Generally, the more gently sloping land is, the farther inland the new sea level will reach, said Mike Field, a U.S. Geological Survey marine geologist.

"I think 1 meter is a reasonable number," Field said. "Most people agree there is an increase in rise now and that the rate of rise is going to increase over the next century -- conservatively half a meter, more realistically half a meter to a meter."

Said Douglas Tom, manager of the state Coastal Zone Management Branch: "It's a subject that's been on the minds of many different people in many different agencies."

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COURTESY UH-MANOA SCHOOL OF OCEAN AND EARTH SCIENCE AND TECHNOLOGY
In the next 100 years ocean levels are expected to rise 39 inches due to global warming. Here is what Waikiki could look like, according to researchers at the University of Hawaii-Manoa.

FULL STORY »

DENNIS ODA / DODA@STARBULLETIN.COM
Chip Fletcher is a marine geologist at UH who studies coastal changes caused by climate change. Projections show the ocean water level will rise about three feet in the next 100 years. Fletcher places a meter stick at about the high water mark on Waikiki Beach to illustrate the eventual water level, which would submerge this beach scene.

By Diana Leone
dleone@starbulletin.com

It doesn't have the sudden terror of a tsunami or a hurricane. But the

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sea level around Hawaii is expected to rise 39 inches by the end of the century.

It will come slowly. And once it comes, the water will stay a long, long time.

It will submerge the Ala Wai Boat Harbor, the Hilton Hawaiian Village Lagoon, the banks of the Ala Wai Canal and most of the Ala Wai Golf Course.

Magic Island will be an actual island.

Industrial sites at Campbell Industrial Park will have water lapping at their foundations.

Beaches will be going, going and gone.

Coastal communities throughout the state will be forced to move, raise and abandon buildings and roads that are too close to the rising waters.

"I think this is a slowly emerging catastrophe," geologist Charles "Chip" Fletcher said. "I think it's going to slowly dawn on us."

And this amount of sea level rise is coming, Fletcher said, even if the world takes quick action to slow global warming, because the climate changes are already in motion.

With worldwide action to slow global warming, "I think the potential exists for us to stop it at a meter or a meter and a half," he said.

Fletcher's University of Hawaii research team has created aerial maps that depict downtown Honolulu, Waikiki and Kalaeloa as they would look with a one-meter rise in sea level.

The first signs of the change are already here.

During a monthly high tide, "go to Coral Street or Mapunapuna or in Waikiki and pull up a manhole cover and you'll see salt water less than a foot below," Fletcher said.

On Nov. 23, the highest tide of the year, Fletcher predicts sea water will flow out of storm drains on the sides of Ala Wai Boulevard.

"That's going to be the first sense of sea level rise that most people have, pools of water pool around storm drains," Fletcher said. "And if it rains on top of that, rainwater has nowhere to go, so it will puddle."

COURTESY UH-MANOA SCHOOL OF OCEAN AND EARTH SCIENCE AND TECHNOLOGY
A view of downtown Honolulu in 100 years when ocean levels are expected to be 39 inches higher.

Like the low spot on Mapunapuna Road that periodically floods when high tides and heavy rains converge.

Unless there are engineering projects to avert it, such places will become what Fletcher calls "urban wetlands" in coming decades.

"If you look at this map of Waikiki, it's quite obvious that Waikiki at high tide, several decades from now, or at end of the century can't exist the way it is right now," Fletcher said.

Ditto for coastal highways in places where they have been flooded by high surf every couple of years. That will start happening several times a year, agreed Cheryl Anderson, director of the Hazards, Climate and Environment Program at the UH's Social Science Institute.

Government agencies are in the early stages of "working with development plans to think about what these changes might mean," Anderson said.

The 2007 draft revision of the state's Hazard Mitigation Plan, a document required by the Federal Emergency Management Agency to get federal disaster aid, has a new section on climate change, including sea level changes, Anderson said.

In addition to speeding beach erosion, the higher ocean could also more frequently overtop protective reefs during storms – making wave run-ups go even higher.

"The good news is that it's still a ways off," said Bruce Richmond, U.S. Geological Service specialist in coastal hazards. "We can start to plan for this when we build new highways and construction."

"We're looking at a long-term phased retreat from the coastline," Richmond said. "It starts with zoning and setbacks, so that large expensive public buildings are not put right on the water's edge." Insurance policies that allow rebuilding of damaged structures will have to be re-examined.

"There's plenty of time to adjust to this," Fletcher said. "If we are proactive, we can really begin to get a handle on this problem."

Fletcher suggests that:

» Waikiki hotels include sea level rise countermeasures when major renovations are undertaken.

» Somebody drill dozens of test wells in downtown Honolulu and Waikiki to locate the water table and forecast where its rise with the ocean level will cause problems.

» Too-close-to-the-ocean highways be shifted mauka to avoid the rising water.

The state Transportation Department is aware of the sea level rise trend, but is dealing with it by addressing coastal highways that are suffer from high surf erosion now, spokesman Scott Ishikawa said.

What's in store for Hawaii

What would a 39-inch rise in sea level mean for Hawaii? Charles "Chip" Fletcher from the University of Hawaii-Manoa's School of Ocean and Earth Science and Technology predicts:

» In the coming decades, the rising water table will form permanent wetlands, including in urban areas, from which rainfall and storm runoff will not drain.

» Heavy rain, such as in the winter of 2006, will cause flooding lasting weeks.

» Erosion of beaches and other non-rocky shorelines will accelerate.

» High waves will increasingly damage roads and communities near the coast.

» Sea level rise will magnify the effects of storm surge, hurricanes and tsunamis, causing more damage farther inland.

A recent example of a fix was the Kalanianaole Highway at Makapuu. On the drawing board for possible movement inland are the Laniakea area on Oahu's North Shore, the Honoapiilani Highway south of Lahaina, and the Hilo Bayfront Highway, Ishikawa said.

The department also is studying trouble spots on the Kamehameha Highway on Oahu's Windward side, he said.

Hilo's pull-back from the ocean after the 1960 tsunami exemplifies changes that eventually might have to be made at vulnerable spots, Anderson said.

Eileen Shea, director of the NOAA (National Oceanic and Atmospheric Administration) Integrated Data and Environmental Applications Center, praised Fletcher's map as a "a first blush snapshot" that should lead to more in-depth study.

"You and I aren't going to feel the average sea level rise," Shea said. "What we're going to see is how they're going to affect extreme events," because even a few inches of higher sea level can magnify the bad effects of hurricanes and high surf.

"We don't want to create a panic, but we need to make everyone aware that it's something we need to plan for in the future," said Sam Lemmo, administrator of the state Office of Conservation and Coastal Lands.

Some signs that Hawaii government officials are beginning to take action:

» Studies of coastal erosion trends have been completed on Maui and are ongoing on Oahu and Kauai. These are used to determine how close to the coast new buildings are allowed.

» The U.S. Geological Survey could begin new studies soon on the effect of sea level rise on coastal areas, including Hawaii.

» Congress will consider requiring states to conduct climate change planning.

» State and federal agencies have jointly printed several books that include information about sea level rise, such as coastal hazard mitigation, coastal erosion and what to look for when buying coastal real estate. (Call Lemmo at 587-0381 for books.)

On the Net

Web sites rising seas predicted and global warming.

The U.S. Environmental Protection Agency on sea level:
tinyurl.com/2df72n

The U.S. Geological Survey on sea level rise and global warming:
woodshole.er.usgs.gov/project-pages/cvi/

University of Arizona's interactive maps on sea level rise:
tinyurl.com/ca73h

Climate Appraisal Services' sea level rise map for individual addresses:
www.climateappraisal.com/index.aspx/Scene_1

Architecture 2030 study on one-meter sea level rise and cities:
www.architecture2030.org/current_situation/coastal_impact.html

BACK TO TOP

Honolulu Seawater Air Conditioning, LLC

Managed by Renewable Energy Innovations, LLC, the COOL GREEN & CLEAN™ Company

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Tel 808.531.SWAC (7922) Fax 808.531.7923 www.honoluluswac.com

February 25, 2008

Henry Eng, FAICP
City & County of Honolulu
Department of Planning and Permitting
650 South King Street, 7th Floor
Honolulu, HI 96813

Dear Mr. Eng:

Thank you for your review of the Environmental Impact Statement Preparation Notice for the Honolulu Seawater Air Conditioning (HSWAC) Project. We respond to your comments in the order in which they appear in your letter.

1. The requested information regarding staffing, ownership, operation, and maintenance will be included in the draft EIS. At this time we anticipate that about six on-site staff will be required to operate and maintain the system. HSWAC will own, operate and maintain the system. The cooling station will be located within a parking structure. No maintenance yard will be required, although large pieces of equipment (pumps, heat exchangers, chillers, etc.) occasionally may have to be moved in or out of the structure. Spare parts will be held in suppliers' yards until needed.

2. The Determination section on page S1 will be augmented to include information relative to the applicability of HRS Chapter 343.

3. Figure 2-14 shows the potential route of the distribution system, i.e., the terrestrial portion of the system. That is already an 11"x17" fold-out sheet. To show the marine portion of the system on the same figure would render the details of the distribution system unreadable. The routes of the seawater intake and return pipes will be shown on Figure 1-1 of the draft EIS after detailed oceanographic and marine biological surveys identify the precise routes.

4. The HSWAC cooling station will require electricity to run the pumps and other equipment. However, the cooling station may be located within the lower floors of a parking structure developed by another firm, in which case HSWAC, LLC will not have the option to install solar or photovoltaic systems on the roof. In any event, the ultimate configuration of the development and the anticipated adjacent developments may well result in the cooling station being shaded for much of the day. Even if the site is not shaded, the small footprint of the building would provide space for a very limited amount of solar or photovoltaic systems.

5. The paragraph will be reworded as suggested, and the section expanded to describe how the proposed project conforms to the Primary Urban Center's vision, objectives, policies and guidelines.

6. Section 5.4.1.3 will be augmented to clarify that the State Office of Planning will administer the Shoreline Setback Permit in addition to the Special Management Area Use Permit.

7. Figures 5-4 through 5-7 will be modified as suggested.

8. The list of discretionary permits and approvals required for implementation of the proposed action will be augmented to include ministerial permits such as grading, building, etc.

9. The DEIS will address compliance with storm drainage standards.

10. Life-cycle cost analysis is required for federal building construction projects. The technique is also often used to evaluate alternative choices of equipment such as HVAC systems, and inform the investment decision. The HSWAC system will be privately owned, and investment decisions may be based on life-cycle costs, or on other economic measures such as rate-of-return on investment, net savings (net benefits), savings-to-investment ratio or payback period. The appropriate place for a detailed discussion of the system costs, potential returns, risks, and uncertainties is in the business plan or the investment prospectus, rather than the EIS. For the HSWAC system, equipment choices have been based on both technical and economic engineering evaluations that will be presented in the draft EIS. The EIS will also contain a summary of the system costs and an analysis of economic benefits to system customers and the community.

11. The distribution system is physically isolated from the seawater circulation system. Nothing is added to the seawater portion of the system. Molybdate may be added to the distribution system as a corrosion inhibitor. Molybdate is used throughout the industrial water treatment and power generation industries as a corrosion inhibitor in both open and closed loop cooling water systems. In solution, molybdate anions react with oxidized iron to form a protective film of molybdate and ferric-oxide. Molybdate is considered an effective, environmentally acceptable alternative to chromate treatment. It exhibits low to negligible toxicity. In seawater, molybdate is an important micronutrient. Molybdenum is a central component of several enzymes essential to bacterial nitrogen metabolism, including nitrogen fixation. In the HSWAC system, the only way molybdate could reach the ocean would be through a leak in the heat exchanger that allows fresh water containing molybdate to enter the return seawater flow, where it would quickly be diluted to undetectable levels. A leak in a heat exchanger would be detected through either water loss or a pressure drop in the distribution system. A maintenance program will be implemented to periodically inspect and pressure test the heat exchangers for leaks.

12. We agree that the sequencing of work on the distribution system will require effective communication with the public, and intend to establish a means to accomplish this. We are evaluating internet, email and telephone hotline solutions, any or all of which may be implemented for this purpose. Interaction with the City & County of Honolulu's traffic information website, www.driveakamai, is also envisioned to be a part of the communication with the public. Traffic control plans, including all mitigation measures attached to street usage permits, will be prepared and implemented.

13. Requirements for a sewer connection will be complied with. The cooling station will only house about six employees, so the daily volume of wastewater effluents generated there will be lower than from a typical single family residence. Connections are also anticipated for draining sections of the on-shore distribution system when connecting new customers or for maintenance work.

14. Elevation at the cooling station site is about seven feet. A 39-inch rise in sea level would not directly affect cooling station operations. Such a rise in sea level however, would be accompanied by a rise in the groundwater table which could make repair of distribution pipes more difficult.

Sincerely,

Honolulu Seawater Air Conditioning, LLC

Ingvar Larsson

Ingvar Larsson
Vice President of Engineering

c: Ms. Debra Mendes, Office of Planning, Coastal Zone Management Program
Mr. George Krasnick, TEC Inc.
Office of Environmental Quality Control

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

HRD07/3186

September 27, 2007

Ingvar Larsson
Honolulu Seawater Air Conditioning, LLC
7 Waterfront Plaza, Suite 400
500 Ala Moana Boulevard
Honolulu, Hawai'i 96813

RE: Environmental Impact Statement Preparation Notice, Honolulu Seawater Air Conditioning, LLC, Honolulu, Hawai'i.

Dear Mr. Larsson,

The Office of Hawaiian Affairs (OHA) is in receipt of the above referenced request for comments concerning an Environmental Impact Statement Preparation Notice for Honolulu Seawater Air Conditioning, LLC located in Honolulu, Hawai'i. We offer the following comments.

OHA has concerns regarding the seawater intake and return pipe systems, and the high density polyethylene (HDPE) pipes themselves. While the Environmental Impact Statement Preparation Notice on page nine states that the design life of the pipeline would be 75 years, no maintenance plan is provided. OHA is concerned about the HDPE material that the pipes themselves are made of. Constant use over 75 years will result in some breakdown of the material over time and we seek assurances that no chemical leaching will be discharged into the marine environment from these pipes over time and use.

While the project area may be "among the most historically degraded coastal habitats in the state" (Environmental Impact Statement Preparation Notice, page 49), OHA realizes that all Hawai'i state waters are classified as Class A or Class AA, which have strict pollution discharge regulations to protect them for recreational and aesthetic enjoyment. Any project and its potential impacts to State waters must meet the anti-degradation policy (HAR, Section 11-54-1.1), which requires that the existing uses and the level of water quality necessary to protect the existing uses of the receiving State water be maintained and protected.

OHA appreciates that existing coral formations will be avoided, but we also note that the intake may not have a screen. OHA urges that an appropriately-sized mesh screen be used along with an appropriate velocity governed by variable speed pumps all be used to minimize impacts on marine biota. We have concerns with the location of the seawater return pipe as well as the ambient conditions of the area. We also look forward to an analysis of the quantity, quality, and condition (including, but not limited to, temperature and turbidity) of the water being discharged into State navigable waters.

Further, OHA would like to point out that at least part of the project falls on ceded lands because all submerged lands, and the water column above them, are ceded lands. As such, we request that they be treated with the respect due to them as they are part of the 1.8 million acres of land that belongs to the Hawaiian monarchy that were transferred to the state when Hawai'i became a U.S. state. Also, OHA notes and does appreciate that an effort will be made to assess the impact on cultural resources, as required under Hawaii Revised Statutes, chapter 343, and that work will stop and the State Historic Preservation Division will be contacted should iwi kūpuna or cultural artifacts be uncovered.

OHA realizes that this is a preliminary document for a very large, important and timely project. As such, we look forward to working with you and participating in further consultation as more information becomes available. Thank you for the opportunity to comment. If you have any further questions or concerns, please contact Grant Arnold at (808) 594-0263 or granta@oha.org.

Sincerely,

Clyde W. Nāmu'o
Administrator

C: Office of Planning, Coastal Zone Management Program
P.O. Box 2359
Honolulu, Hawai'i 96804

C: Office of Environmental Quality Control
235 S. Beretania St., Suite 702
Honolulu, Hawai'i 96813

Honolulu Seawater Air Conditioning, LLC

Managed by Renewable Energy Innovations, LLC, the COOL GREEN & CLEAN™ Company

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February 25, 2008

Clyde W. Nāmu'o
State of Hawaii
Office of Hawaiian Affairs
711 Kapiolani Blvd.
Suite 500
Honolulu, HI 96813

Dear Mr. Nāmu'o:

Thank you for your review of the Environmental Impact Statement Preparation Notice for the Honolulu Seawater Air Conditioning (HSWAC) Project. We respond to your comments in the order in which they appear in your letter.

The HSWAC seawater pipes will be periodically inspected using divers and a submersible or remotely operated vehicle, particularly after strong storm events. Maintenance will entail repair or replacement of broken sections, should that be necessary. The historical performance of HDPE pipelines in deep seawater applications such as at Keahole Point indicates that other types of maintenance will be unnecessary. Contingency plans for continuing operation of the cooling system during repairs will be developed and described in the draft EIS.

High density polyethylene (HDPE) is a petroleum-based plastic used for piping and containers for consumer products. Piping applications include drainage, sewage and potable water. Also known as plastic #2, HDPE is the second most used bottle plastic behind polyethylene terephthalate (PET or plastic #1). HDPE can be found in milk jugs, detergent bottles, medicine bottles, motor oil bottles, shampoo bottles, frozen juice containers, coffee containers and baby bath bottles. A 2006 study found that HDPE drainage pipes leached volatile organic carbons (VOCs) that could contaminate groundwater. Volatile organic compounds are hydrocarbons (excluding methane) which are capable of forming oxidants (particularly ozone) by reactions with nitrogen oxides in the presence of sunlight. Major sources of VOC's are vehicles, solvents and process industry emissions. The HDPE pipes will be tunneled and trench-buried to a depth of about 80 feet, reducing their exposure to sunlight. Additionally, HDPE pipes in the HSWAC system will carry cold seawater rather than freshwater. The low temperature and the tendency of microbiological biofilms to form on structures in seawater will both retard diffusion of VOCs from the pipes. VOCs are ubiquitous in the marine environment; some, including formaldehyde, are produced and utilized in situ by phytoplankton. All are subject to bacterial degradation. Quantities potentially leaching from the HSWAC pipes and passing the air-water interface will be miniscule and insignificant compared with those from vehicular emissions.

HSWAC project staff has consulted with the State Department of Health regarding maintenance of receiving water quality. The draft EIS will disclose potential water quality impacts and identify the permitting requirements for the return seawater flow. A Zone-of Mixing will be sought for the area immediately surrounding the return flow diffuser.

Intake screens were evaluated in preliminary engineering design, but were not recommended because of the potential for clogging. Clogging at the 1,600 foot intake depth would create a major maintenance problem. The seawater intake system will incorporate redundant screens near the intake pumps in the cooling station so that the system can maintain flow during cleaning of one screen. Intake water velocities are slow enough that most fish will be able to avoid entrainment. On the other hand, some fish may swim into the pipe, and their eventual impingement on the screen will be an unavoidable impact.

The draft EIS will describe the location of the return seawater pipe, the return seawater quality and the characteristics of the receiving water.

Offshore operations will be designed to minimize impacts to the marine environment and conducted under strict pollution control protocols. A cultural impact assessment will be completed as part of the EIS process and mitigation measures will be identified in the event artifacts or human remains are uncovered in the excavations for the cooling station and distribution pipes.

HSWAC, LLC fully intends to treat all land and marine environments with the utmost respect during project construction and operation. All statutory and regulatory requirements will be complied with, and the State Historic Preservation Division will be immediately contacted if remains or cultural artifacts are uncovered.

Sincerely,
Honolulu Seawater Air Conditioning, LLC

Ingvar Larsson

Ingvar Larsson
Vice President of Engineering

c: Ms. Debra Mendes, Office of Planning, Coastal Zone Management Program
Mr. George Krasnick, TEC Inc.
Office of Environmental Quality Control

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843

October 3, 2007

Mr. Ingvar Larsson
Honolulu Seawater Air Conditioning, LLC
7 Waterfront Plaza, Suite 400
500 Ala Moana Boulevard
Honolulu, Hawaii 96813

Dear Mr. Larsson:

Subject: Your Letter Dated August 10, 2007 Regarding the Environmental Impact Statement Preparation Notice for Honolulu Seawater Air Conditioning

Thank you for the opportunity to comment on the proposed project.

The existing water system is presently adequate to accommodate the proposed development. However, please be advised that this information is based upon current data and, therefore, the Board of Water Supply reserves the right to change any position or information stated herein up until the final approval of your building permit application. The final decision on the availability of water 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.

The on-site fire protection requirement should be coordinated with the Fire Prevention Bureau of the Honolulu Fire Department.

The construction drawings should be submitted for our review and approval.

If you have any questions, please contact Robert Chun at 748-5440.

Very truly yours,

K Shida

KEITH S. SHIDA
Principal Executive
Customer Care Division

cc: Mr. George Krasnick, TEC, Inc.
Ms. Debra Mendes, Office of Planning, Coastal Zone Management Program
Office of Environmental Quality Control

Honolulu Seawater Air Conditioning, LLC

Managed by Renewable Energy Innovations, LLC, the COOL GREEN & CLEAN™ Company

7 Waterfront Plaza, Suite 407, Box 124, 500 Ala Moana Boulevard, Honolulu HI 96813
Tel 808.531.SWAC (7922) Fax 808.531.7923 www.honoluluswac.com

February 25, 2008

Keith S. Shida
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, HI 96843

Dear Mr. Shida:

Thank you for your review of the Environmental Impact Statement Preparation Notice for the Honolulu Seawater Air Conditioning (HSWAC) Project. We respond to your comments in the order in which they appear in your letter.

We understand that the determination of the adequacy of the potable water system to support the project will be made at the time of building permit application and that when water is made available, the applicant will be required to pay the Water System Facilities Charges.

On-site fire protection requirements will be coordinated with the Fire Prevention Bureau of the Honolulu Fire Department during facility design.

Construction drawings will be submitted to the Board of Water Supply for review and approval.

Sincerely,
Honolulu Seawater Air Conditioning, LLC

Ingvar Larsson

Ingvar Larsson
Vice President of Engineering

c: Ms. Debra Mendes, Office of Planning, Coastal Zone Management Program
Mr. George Krasnick, TEC Inc.
Office of Environmental Quality Control

APPENDIX F
DEIS COMMENTS AND RESPONSES

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BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843

December 1, 2008

Mr. Frederic Berg
Honolulu Seawater Air Conditioning, LLC
7 Waterfront Plaza, Suite 407
500 Ala Moana Boulevard
Honolulu, Hawaii 96813

Dear Mr. Berg:

Subject: Your Letter Dated October 27, 2008 on the Draft Environmental Impact Statement for Honolulu Seawater Air Conditioning

Thank you for the opportunity to comment on the proposed project.

The existing water system is presently adequate to accommodate the proposed development. However, please be advised that this information is based upon current data and, therefore, the Board of Water Supply reserves the right to change any position or information stated herein up until the final approval of your building permit application. The final decision on the availability of water 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.

The on-site fire protection requirement should be coordinated with the Fire Prevention Bureau of the Honolulu Fire Department.

The construction drawings should be submitted for our review and approval.

If you have any questions, please contact Robert Chun at 748-5443.

Very truly yours,

KEITH S. SHIDA
Program Administrator
Customer Care Division

cc: Office of Environmental Quality Control
Mr. Shichao Li, Office of Planning
Mr. George Krasnick, TEC, Incorporated

Honolulu Seawater Air Conditioning, LLC
Managed by Renewable Energy Innovations, LLC, the COOL GREEN & CLEAN™ Company

7 Waterfront Plaza, Suite 407, Box 124, 500 Ala Moana Boulevard, Honolulu HI 96813
Tel 808.531.SWAC (7922) Fax 808.531.7923 www.honoluluswac.com

August 28, 2009

Mr. Keith S. Shida, Program Administrator
City and County of Honolulu
Board of Water Supply
Customer Care Division
630 South Beretania Street
Honolulu, Hawaii 96843
Attn: Mr. Robert Chun

Dear Mr. Shida:

Subject: Draft Environmental Impact Statement
Honolulu Seawater Air Conditioning

Thank you for your letter dated December 1, 2008. We address your comments in order below. Please note that your comments may have been paraphrased here for brevity.

a. The water system is presently adequate for the proposed development. A final decision on availability will be made at the time of building permit application.

Response: Acknowledge

a. The Applicant must pay the Water System Facilities Charge.

Response: Acknowledge

b. The applicant should coordinate on-site fire protection with the Fire Protection Bureau of the Honolulu Fire Department.

Response: Acknowledge

c. Construction drawings should be submitted for BWS review and approval.

Response: Acknowledge

Sincerely,

Frederic Berg
Project Director
Honolulu Seawater Air Conditioning, LLC

LINDA LINGLE
GOVERNOR

RUSS K. SAITO
COMPTROLLER

BARBARA A. ANNIS
DEPUTY COMPTROLLER

(P)1385.8

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P.O. BOX 119, HONOLULU, HAWAII 96810

DEC 16 2008

Mr. Frederic Berg
Honolulu Seawater Air Conditioning, LLC
7 Waterfront Plaza, Suite 407
500 Ala Moana Boulevard
Honolulu, Hawaii 96813

Dear Mr. Berg:

Subject: Honolulu Seawater Air Conditioning Project, Draft Environmental Impact Statement

Thank you for the opportunity to review the Draft Environmental Impact Statement (DEIS) for the Honolulu Seawater Air Conditioning project. The DEIS was reviewed and comments are attached.

If you have any questions, please have your staff call Mr. Clarence Kubo of the Planning Branch at 586-0488.

Sincerely,

ERNEST Y.W. LAU
Public Works Administrator

CKK:vca
Attachment
c: OEQC
Mr. Shichao Li, Office of Planning, Coastal Zone Management Program
Mr. George Krasnick, TEC, Inc.
DAGS CSD

DIVISION OF PUBLIC WORKS

NOTE: Architect/Engineer shall return this form, noting action taken.

PLANS SPECIFACTIONS REVIEW COMMENTS:	Pre-Sch	Sch	Prelim	Pre-final	Final
			X		

PROJECT	Honolulu Seawater Air Conditioning Draft Environmental Impact Statement (October 2008)		
DAGS JOB NO.			
CONSULTANT	Tec Inc.		
PROJ COORD.	Clarence Kubo / Reviewed by R. Tanaka	DATE	11-18-08

ITEM NO. DWG. NO. PAR. NO.	COMMENTS	ACTION TAKEN (If none, state reason why)
Page 2-6	1. Fig 2-2: Sketch shows approx. 45°F temp at intake of seawater pipeline. Is the estimated temperature increase from point of intake to cooling station (4 miles) insignificant such that it is not of any importance to mention?	
Page 2-57	2. Para 2.5.5 Chilled Water Dist System: It appears that the chilled water distribution piping is not insulated. Is it stated somewhere in the report that pipe insulation does not provide enough benefit for the cost?	
Page 2-67	3. Para 2.5.7.2 Schedule: This draft EIS was recently completed but has statements "Final design is expected to be completed in 2008; "Plans & specs... for bid in 2008; etc. ". Are these statements true for certain portions of the project as there appears to be some pipe routing and other issues that need to be resolved first?	
	End of comments	

PM Form 41 (1/99)w
PGC/FORMS/PM FORM 41 (TEMPLATE).DOC

DIVISION OF PUBLIC WORKS

NOTE: Architect/Engineer shall return this form, noting action taken.

PLANS/SPECIFACTIONS REVIEW COMMENTS:	Pre-Sch	Sch	Prelim	Pre-final	Final

PROJECT	Honolulu Seawater Air Conditioning Draft Environmental Impact Statement (October 2008)		
DAGS JOB NO.			
CONSULTANT	Tec Inc.		
PROJ COORD	Clarence Kubo / Reviewed by Jeyan Thirugnanam	**DATE**	11/19/08

ITEM NO. DWG. NO. PAR. NO.	COMMENTS	ACTION TAKEN (If none, state reason why)
General	Several figures in the study show a 20" pipeline going through the State Capitol. What is the reason for this routing? Did the state approve this alignment?	
	(end of comments)	

Honolulu Seawater Air Conditioning, LLC
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August 28, 2009

Mr. Ernest Y.W. Lau, Public Works Administrator
State of Hawaii
Department of Accounting and General Services
P.O. Box 118
Honolulu, Hawaii 96810
Attn: Mr. Clarence Kubo

Dear Mr. Lau:

Subject: Draft Environmental Impact Statement
Honolulu Seawater Air Conditioning

Thank you for your letter dated December 16, 2008. Our responses to your comments are below. Please note that the comments may have been paraphrased here for brevity.

a. What is the significance of the temperature increase from intake to cooling station?
Response: The temperature increase associated with flow through the intake pipe is less than one degree Fahrenheit and has been considered in system design, as has natural temperature fluctuations at the intake site. The cooling station would contain auxiliary chillers to ensure water is delivered to customers at 44°F.
b. Is insulation of the water distribution system cost effective?
Response: Yes. Insulation for various distribution pipe materials will be designed to deliver 44°F cooling water to each served building. Insulation will be shown on the construction plans where appropriate for specific piping materials.
c. Is the schedule realistic for completion of design and potential unresolved routing and other issues?
Response: The schedule will be revised in the FEIS. The proponent recognizes that routing and other issues affecting the schedule must be finalized prior to completion of design.
d. What is the purpose of routing through the State Capitol?
Response: This routing is to accommodate service to State offices. We acknowledge that approval by the State is required prior to finalizing plans and submitting permit applications. Easements will be obtained for all locations as required prior to construction.

Sincerely,

Frederic Berg
Project Director
Honolulu Seawater Air Conditioning, LLC

LINDA LINGLE
GOVERNOR
THEODORE E. LIU
DIRECTOR
MARK K. ANDERSON
DEPUTY DIRECTOR
ABBEY SETH MAYER
DIRECTOR
OFFICE OF PLANNING

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

OFFICE OF PLANNING
235 South Beretania Street, 6th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

Telephone: (808) 587-2846
Fax: (808) 587-2824

Ref. No. P-12366

Received 12/23/08

December 19, 2008

Mr. Frederic Berg
Honolulu Seawater Air Conditioning, LLC
7 Waterfront Plaza, Suite 407
500 Ala Moana Boulevard
Honolulu, Hawaii 96814

Dear Mr. Berg:

Subject: Draft Environmental Impact Statement (EIS) for the Honolulu Seawater Air Conditioning Project

We completed our review of the draft EIS for the Honolulu Seawater Air Conditioning Project in accordance with Chapter 343, Hawaii Revised Statutes (HRS), and Chapter 11-200, Hawaii Administrative Rules (HAR). We have identified the following items in the draft EIS that need to be corrected in the final EIS before a finding of acceptance can be made.

1) The draft EIS does not adequately identify the possible project alternatives nor describe the environmental impacts associated with them. This is a requirement of the EIS statute and its administrative rule. Hence, the final EIS will have to incorporate this information. For specific guidance, you should consult HAR 11-200-17.

2) There needs to be sufficient information on ocean currents and waves. The ocean currents for Mamala Bay in Section 3.7.1.4 Tides and Currents, are only based on 1994 data. More recent and longer trend data on ocean currents and waves at the project site need to be provided in the final EIS.

3) There is no assessment of the proposed project to each of the coastal zone management objectives and their supporting policies set forth in Chapter 205A, HRS. Simple statements such as, "The proposed cooling station, the only visible part of the HSWAC system, would have no effect on views in any direction" (page 4-31), do not adequately respond to the legal requirement.

4) There is no discussion about the potential operational impacts of the proposed project on water quality and marine biota in Section 5.8 Unavoidable Adverse Impacts.

Similarly, the statement, "Once operational, the system would impact water quality and marine biota within a defined Zone of Mixing" (page 5-2), does not adequately respond to the legal requirement.

5) More information is needed for Section 4.8.1 Topography, Geology and Soils, about the potential environmental consequences of the hazardous waste contained in the former landfill. We are aware that hazardous materials have migrated from the landfill site as evidenced during the development of the Children's Discovery Center. Soil borings and testing for contaminants need to be conducted and the information reported in the final EIS. We are concerned that microtunneling and the installation of the pipelines can create a pathway for hazardous substances to enter the environment and cause adverse effects. The consequences of environmental and human exposure to hazardous substances must be disclosed in the final EIS.

6) Pursuant to §11-200-17(g), the final EIS must have a separate section to discuss and assess the population and growth characteristics of the affected area, and any population and growth assumptions used to justify the action and determine secondary population and growth resulting from the proposed action and its alternatives.

7) Pursuant to §11-200-17(h), the final EIS must describe the status of each identified approval and permit in sufficient detail, and update Section 2.5.7.2 Schedule, accordingly. The proposed Sand Island pipeline staging area is in the special management area (SMA) and is subject to the requirements of Chapter 25, Revised Ordinances of Honolulu. The final EIS needs to identify the requirements of obtaining a SMA permit and Shoreline Setback Variance from the City and County of Honolulu for the proposed pipeline staging, assembly, and storage area. The incomplete list of required permits, licenses, and approvals (Table 5-1) must be corrected.

8) As the boundary of the Kakaako Community Development District (CDD) makai area has been changed, the maps depicting the Hawaii Community Development Authority Kakaako CDD makai area on page 3-92, Figure 3-34; page 3-93, Figure 3-35; and page 3-94, Figure 3-36, need to accurately reflect the current boundary. The description in Section 3.9.8, that submerged lands out to three miles are owned by the State of Hawaii and managed as part of the Conservation District by the Board of Land and Natural Resources, and that submerged lands seaward of three miles are owned by the federal government is not supported by State statutes. This inaccurate description needs to be corrected in the final EIS.

9) The draft EIS does not provide data, documentation, or references as required by

Mr. Frederic Berg
Page 3
December 19, 2008

§11-200-17(g), to justify statements about impacts or benefits. Three examples of this deficiency are referenced here: (1) There is a lack of data sources substantiating section 1.2 SWAC Benefits; (2) No data, documentation or references are provided to substantiate the statement in section 4.7 Marine Resources (page 4-18) that, "The No Action Alternative negatively affects marine resources through the disposal of electrical generating station cooling waters in coastal receiving waters."; and (3) A single general statement of the environmental consequences in Section 4.9.5 for the State Conservation District is not substantiated by any data, documentation, or references and is not sufficient in explaining why there would not be a substantial adverse impact. These deficiencies must be corrected in the final EIS.

10) The unresolved issues such as (1) the depth of the seawater intake; (2) the microtunnel route from the cooling station to an offshore breakout point; (3) the location of a jacking pit; and (4) the route of the distribution system, with updated information, will need to be adequately discussed in the final EIS.

Should you have any questions, please contact Shichao Li of our Coastal Zone Management Program at 587-2841.

Sincerely,

Mary Lou Kobayashi for

Abbey Seth Mayer
Director

c: Mr. George Krasnick, TEC, Inc.
Office of Environmental Quality Control
Mr. Bryan C. Yee, Department of the Attorney General

Honolulu Seawater Air Conditioning, LLC
Managed by Renewable Energy Innovations, LLC, the COOL GREEN & CLEAN™ Company
7 Waterfront Plaza, Suite 407, Box 124, 500 Ala Moana Boulevard, Honolulu HI 96813
Tel 808.531.SWAC (7922) Fax 808.531.7923 www.honoluluswac.com

August 28, 2009

Mr. Abbey Seth Mayer, Administrator
State of Hawaii
Department of Business, Economic Development and Tourism
Office of Planning
P.O. Box 2359
Honolulu, Hawaii 96804
Attn: Mr. Shichao Li

Dear Mr. Mayer:

Subject: Draft Environmental Impact Statement
Honolulu Seawater Air Conditioning

Thank you for your letter dated December 19, 2008. In an effort to clearly understand and respond to your comments, we met with you and staff on January 13, 2009. The following responses represent our understanding of the conclusions of that meeting. Please note that your comments may have been paraphrased here for brevity.

1. Final EIS must incorporate adequate identification and description of project alternatives and their environmental impacts (HAR 11-200-17).

Response: To satisfy this requirement, the tables at section 2.7 (page 2-69 of the DEIS) and section 4.11 (page 4-37 of the DEIS) will be expanded to summarize the environmental impacts associated with another alternative.

2. More recent (than 1994) and longer trend ocean currents and waves data must be provided in the final EIS (Section 3.7.1.4)

Response: Additional information on currents and waves is provided in Section 3.6.3.

3. Assess each of the coastal zone management objectives and supporting policies in HRS Chapter 205A.

Response: The applicable objectives and policies of the Coastal Zone Management Program are assessed in Section 4.9.2 and its subsections.

4. No discussion about operational impacts on water quality and marine biota in Section 5.8 Unavoidable Adverse Impacts.

Response: Section 5.8 will be modified to include additional details relative to the impacts of operations on water quality and marine biota, and will cite the sections of the EIS where supporting analyses may be found.

5. Add information in final EIS in Section 4.8.1 Topography, Geology and Soils about consequences of hazardous waste in the former landfill. Microtunneling and pipelines may create pathway(s) for substances to enter the environment.

Response: After numerous requests to various agencies, we have received no information with which to characterize the soils beneath the landfill. In the interim, it has become a moot point, as the eastern alternative microtunneling route has been eliminated from consideration both because of the unknown extent of subsurface contamination and the potential interference with the Kilo Nalu Observatory.

6. Add separate section re: population and growth characteristics of affected area (11-200-17(g)).

Response: In our meeting, we explained that the proposed project has no population growth inducing implications. It was clarified that we should have a section that discusses the impact of the project on the capacity of existing utility systems, which may indirectly affect population growth.

7. The final EIS must include the status of each indentified approval and permit (11-200-17(h). Update the schedule (section 2.5.7.2). The final EIS must identify the requirement for an SMA permit and Shoreline Setback Variance from the City and County of Honolulu at the staging area. Update Table 5-1

Response: The project schedule will be revised and Table 5-1 will be revised to include the permits for the staging area and current status of all permits.

8. Update maps on pages 3-92, 3-93, 3-94 to accurately reflect boundary of the Kaka'ako Community Development District makai area. Correct statements in section 3.9.8 regarding ownership of submerged lands out to, and seaward of three miles. The current statement is not supported by State statutes.

Response: The maps on pages 3-92, 3-93 and 3-94 will be revised as appropriate. The State of Hawaii's claim of archipelagic status and the contravening opinion of the Federal government will not be resolved in this document. We will include HRS Chapter 190's definition of "State marine waters" in Section 3.9.

9. DEIS does not provide data, documentation or references to justify statements about impacts or benefits (three specific instances included).

Response: References on the effects of generating station cooling water discharges will be added. Section 4.9.5 will be augmented. Other sections identified in our meeting will be augmented as necessary; these include sections 3.7.1.4, 3.8.1, 4.2.1, 4.7, 4.9.5. Figures and tables will be checked for references and the literature cited section will be updated.

10. Final EIS must adequately discuss unresolved issues: 1. Depth of seawater intake, 2. Offshore microtunnel route, 3. Jacking pit location, 4. Route of distribution system.

Response: The preferred locations and routes will be identified in the final EIS.

Sincerely,

Frederic Berg
Project Director
Honolulu Seawater Air Conditioning, LLC

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

STRATEGIC INDUSTRIES DIVISION
235 South Beretania Street, Leiopapa A Kamehameha Bldg., 5th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

LINDA LINGLE
GOVERNOR
THEODORE E. LIU
DIRECTOR
MARK K. ANDERSON
DEPUTY DIRECTOR

Telephone: (808) 587-3807
Fax: (808) 586-2536
Web site: www.hawaii.gov/dbedt

November 21, 2008

Honolulu Seawater Air Conditioning, LLC
7 Waterfront Plaza, Suite 400
500 Ala Moana Boulevard
Honolulu, Hawaii 96813

Attn: Frederic Berg

Re: Draft Environmental Impact Statement (DEIS)
Honolulu Seawater Air Conditioning Project
TMK: 2-1-1, 2, 10-14, 16-18, 24-27, 29, 30, 32, 33, 35-37, 40, 42, 46, 47, 54, 55, 59 & 60: various parcels (por.)

In response to your October 27, 2008, notice, we have no further comments on the Honolulu Seawater Air Conditioning Project than those submitted in our letter of September 13, 2007, on the Environmental Impact Statement Preparation Notice (EISPN). We do note, however, that the DEIS lists the significant economic, environmental, and energy benefits of Seawater Air Conditioning (SWAC) in Chapter 1.2.

Sincerely,

Theodore A. Peck
Administrator

c: OEQC
Office of Planning, Coastal Zone Management Program
TEC, Inc.

Honolulu Seawater Air Conditioning, LLC
Managed by Renewable Energy Innovations, LLC, the **COOL GREEN & CLEAN™** Company
7 Waterfront Plaza, Suite 407, Box 124, 500 Ala Moana Boulevard, Honolulu HI 96813
Tel 808.531.SWAC (7922) **Fax** 808.531.7923 www.honoluluswac.com

August 28, 2009

State of Hawaii
Department of Business, Economic Development and Tourism
Strategic Industries Division
ATTN: Theodore A. Peck, Administrator
P.O. Box 2359
Honolulu, Hawaii 96804

Dear Mr. Peck:

Subject: Draft Environmental Impact Statement
Honolulu Seawater Air Conditioning

Thank you for your letter dated November 21, 2008. In reference to the comments in the letter dated September 13, 2008 over the signature of (for) Maurice H. Kaya, we trust that the responses in our letter dated February 25, 2008 continue to adequately address your comments. The content, intent and expected actions stated in our earlier letter remain current and applicable.

Please contact us should you have any further questions.

Sincerely,

Frederic Berg
Project Director
Honolulu Seawater Air Conditioning, LLC

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

December 18, 2008

Received
12/23/08

Honolulu Seawater Air Conditioning, LLC
7 Waterfront Plaza Suite 407
Honolulu, Hawaii 96813

Attention: Mr. Frederic Berg

Ladies and Gentlemen:

Subject: Honolulu Seawater Air Conditioning Project

Thank you for the opportunity to review and comment on the subject matter. The Department of Land and Natural Resources' (DLNR), Land Division distributed or made available a copy of your report pertaining to the subject matter to DLNR Divisions for their review and comment.

Other than the comments from Division of Aquatic Resources, Engineering Division, Office of Conservation & Coastal Lands, Land Division, the Department of Land and Natural Resources has no other comments to offer on the subject matter. Should you have any questions, please feel free to call our office at 587-0433. Thank you.

Sincerely,

Charlene E. Unoki
for Morris M. Atta
Administrator

Cc: Office of Planning, Coastal Zone Management
TEC, Inc.

1932

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

November 12, 2008

RECEIVED
LAND DIVISION
2008 DEC 17 A 10: 06
DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

MEMORANDUM

TO: DLNR Agencies:
x Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
x Engineering Division
__Div. of Forestry & Wildlife
x Div. of State Parks
__Commission on Water Resource Management
x Office of Conservation & Coastal Lands
x Land Division – Oahu District

FROM: for Morris M. Atta
SUBJECT: Draft environmental impact statement for Honolulu Seawater Air Conditioning Project
LOCATION: Kakaako, Oahu
APPLICANT: Honolulu Seawater Air Conditioning LLC

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by December 15, 2008.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact my office at 587-0433. Thank you.

Attachments

( ) We have no objections.
( ) We have no comments.
(X) Comments are attached.

Signed:
Date: 16 Dec. 08

RECEIVED
NOV 13 2008
AQUATIC RESOURCES

State of Hawaii
Department of Land and Natural Resources
DIVISION OF AQUATIC RESOURCES

Date: 12/15/2008

MEMORANDUM

TO: Bob Nishimoto, Program Manager
FROM: Jason Leonard, Aquatic Biologist
THRU: Alton Miyasaka, Aquatic Biologist
SUBJECT: Draft Environmental Impact Statement for Honolulu Seawater Air Conditioning Project

Comment	Date	Request	Receipt	Referral
		12/15/2008	11/13/2008	11/20/2008

Requested by: Morris M. Atta
Department of Land and Natural Resources, Land Division

Summary of Proposed Project

Title: Honolulu Seawater Air Conditioning Project.

Project by: Honolulu Seawater Air Conditioning, LLC

Location: Kakaako, Oahu

Brief Description: The applicant proposes to construct a seawater air conditioning system in downtown Honolulu. Our comments are restricted to the potential marine resources impacts associated with this large scale project. The system would consist of a 63-inch seawater intake pipe extending offshore approximately four miles to approximately 1,770 feet deep and a 55-inch seawater return pipe extending offshore approximately 2,000 feet to 150 feet deep off Kakaako. A staging area for pipe assembly is proposed for an area along the western shore of Sand Island and in the adjoining channel in Keehi Lagoon.

Comments: Overall, we have some concerns regarding how it will affect aquatic marine resources and lack of permitting for coral and live rock which are protected species. Specific comments are highlighted below:

1. Coral and live rock are fully protected under State law, take of such fully protected resources will require signing off by the Division of Aquatic Resources (DAR) and mitigation for loss of ecological services that these protected species provide.

2. Exact location and size of break out area (including jacking pit) and path of pipes are needed to determine extent of resources that will be directly affected by project. The survey of the proposed breakout point and pipe path show low coral percent coverage but coral growth in this area is very patchy and there are areas with substantially higher coral coverage. DAR will need to know the exact size and type of corals that will be taken, out to 120 feet as well as photos and GPS to determine the range of mitigation necessary.

3. Proposed break out for the pipe to emerge at 35 feet depth may be too shallow to avoid direct and indirect impacts to protected coral and live rock, as areas with high coral coverage are know to occur out to 70 feet. Indirect incidents that could cause problems include side to side movement of pipeline before anchors are set it, cables and anchor line damage from tugs and barges, and impact of turbidity to near by coral reef communities.

4. There are concerns that the cold water discharge is too shallow and could cause thermal pollution problems for near shore ecosystems, especially with the variability of ocean current in that area. Having the discharge deeper than 150 and farther away from shore would lessen this risk.

5. Every effort should be taken to reduce turbidity at all marine phases of this project. Extra precaution should be taken at deployment of pipeline into water, excavation and work done at the breakout point, offshore installation of pipelines and setting of anchors.

6. The marine area near the proposed construction site is one of the most frequented areas on Oahu for recreational scuba divers and commercial tour operators. The Kakaako pipeline and coral reef habitat offer scuba divers a unique and easily accessible dive experience. How will recreational divers and commercial dive business be affected by construction, or if bottom habitat is destroyed? How will construction affect on-going marine research projects by National Oceanic and Atmospheric Administration's Pacific Marine Environmental Laboratory near the Kakaako pipeline?

7. Unsure if there will be any actions to maintain and clean the insides of the pipes, and what type of discharge will occur from such actions, and how this will affect state aquatic resources.

Major concerns from the original proposal for the staging and pipeline assembly area by our Division have been addresses in this version of the Draft Environmental Impact Statement. This review represents the division's comments but do not necessarily represent the department's comments.

LINDA LINGLE
GOVERNOR OF HAWAII

'08 NOV 13 AM08

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

November 12, 2008

MEMORANDUM

TO: **DLNR Agencies:**
x Div. of Aquatic Resources
__ ~~Div. of Boating & Ocean Recreation~~
x Engineering Division
__ ~~Div. of Forestry & Wildlife~~
x Div. of State Parks
__ Commission on Water Resource Management
x Office of Conservation & Coastal Lands
x Land Division – Oahu District

RECEIVED
LAND DIVISION
2008 DEC 11 A 11: 50
DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

FROM: for Morris M. Atta
SUBJECT: Draft environmental impact statement for Honolulu Seawater Air Conditioning Project
LOCATION: Kakaako, Oahu
APPLICANT: Honolulu Seawater Air Conditioning LLC

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by December 15, 2008.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact my office at 587-0433. Thank you.

Attachments

( ) We have no objections.
( ) We have no comments.
(✓) Comments are attached.

Signed:
Date: 12/10/08

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

LD/MMA
REF: DEISforHonoluluSeawaterAirConditioningProject
Oahu.007

COMMENTS

(X) **We confirm that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Flood Zone X. The National Flood Insurance Program (NFIP) does not regulate developments within Zone X.**

( ) Please take note that the remainder of the project site according to the Flood Insurance Rate Map (FIRM), is located in Zones ___.

( ) Please note that the correct Flood Zone Designation for the project site according to the Flood Insurance Rate Map (FIRM) is ___.

( ) Please note that the project must comply with the rules and regulations of the National Flood Insurance Program (NFIP) presented in Title 44 of the Code of Federal Regulations (44CFR), whenever development within a Special Flood Hazard Area is undertaken. If there are any questions, please contact the State NFIP Coordinator, Ms. Carol Tyau-Beam, of the Department of Land and Natural Resources, Engineering Division at (808) 587-0267.

Please be advised that 44CFR indicates the minimum standards set forth by the NFIP. Your Community's local flood ordinance may prove to be more restrictive and thus take precedence over the minimum NFIP standards. If there are questions regarding the local flood ordinances, please contact the applicable County NFIP Coordinators below:

( ) Mr. Robert Sumimoto at (808) 523-4254 or Mr. Mario Siu Li at (808) 523-4247 of the City and County of Honolulu, Department of Planning and Permitting.
( ) Mr. Kelly Gomes at (808) 961-8327 (Hilo) or Mr. Kiran Emler at (808) 327-3530 (Kona) of the County of Hawaii, Department of Public Works.
( ) Mr. Francis Cerizo at (808) 270-7771 of the County of Maui, Department of Planning.
( ) Mr. Mario Antonio at (808) 241-6620 of the County of Kauai, Department of Public Works.

( ) The applicant should include project water demands and infrastructure required to meet water demands. Please note that the implementation of any State-sponsored projects requiring water service from the Honolulu Board of Water Supply system must first obtain water allocation credits from the Engineering Division before it can receive a building permit and/or water meter.

( ) The applicant should provide the water demands and calculations to the Engineering Division so it can be included in the State Water Projects Plan Update.

( ) Additional Comments: ______

( ) Other: ______

Should you have any questions, please call Mr. Dennis Imada of the Planning Branch at 587-0257.

Signed:
ERIC T. HIRANO, CHIEF ENGINEER
Date: 12/10/08

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

November 12, 2008

MEMORANDUM

TO: FR: **DLNR Agencies:**
x Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
x Engineering Division
__Div. of Forestry & Wildlife
x Div. of State Parks
__Commission on Water Resource Management
x Office of Conservation & Coastal Lands
x Land Division – Oahu District

FROM: for Morris M. Atta
SUBJECT: Draft environmental impact statement for Honolulu Seawater Air Conditioning Project
LOCATION: Kakaako, Oahu
APPLICANT: Honolulu Seawater Air Conditioning LLC

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by December 15, 2008.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact my office at 587-0433. Thank you.

Attachments

( ) We have no objections.
( ) We have no comments.
(X) Comments are attached.

Signed: Barry Cheung
Date: 11/14/08

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

November 14, 2008

Ref: 08od-064

MEMORANDUM

TO: Morris M. Atta, Administrator
Land Division

FROM: Barry Cheung, District Land Agent
Oahu District Land Office

SUBJECT: Draft environmental Impact Statement for Honolulu Seawater Air Conditioning Project

A land disposition from BLNR pursuant to applicable sections in the statues, likely in the form of a non-exclusive easement, for the pipelines laid on the State submerged lands and fast lands, e.g. State Capitol, Kalanimoku Building, is required. (pages 2-59 & 3-85).

Further, a revocable permit issued by BLNR could be appropriate for the proposed staging area. Prior to the execution of such easement and revocable permit, BLNR could issue construction right-of-entry to allow the applicant commence its activities.

In addition, we note the said easement and revocable permit are not included in Table 5-1. Thank you.

Honolulu Seawater Air Conditioning, LLC
Managed by Renewable Energy Innovations, LLC, the COOL GREEN & CLEAN™ Company
7 Waterfront Plaza, Suite 407, Box 124, 500 Ala Moana Boulevard, Honolulu HI 96813
Tel 808.531.SWAC (7922) Fax 808.531.7923 www.honoluluswac.com

August 28, 2009

State of Hawaii
Department of Land and Natural Resources
Land Division
ATTN: Morris M. Atta
P.O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Atta:

Subject: Draft Environmental Impact Statement
Honolulu Seawater Air Conditioning

Thank you for your letter dated December 18, 2008, with attached comments from the Division of Aquatic Resources, the Engineering Division and the Office of Conservation and Coastal Lands, Land Division. Our responses to those comments are below. Please note that the comments may have been paraphrased here for brevity.

Division of Aquatic Resources memo dated 12/15/08:

1. Take of coral and live rock require sign off by DAR and mitigation for loss.

Response: We understand the requirements and will work with your office to comply. As explained in the DEIS, the siting and routing of offshore facilities and operations has been done with minimization of impacts to coral as a primary criterion. Once the pipes are installed, the concrete collars will provide excellent stable porous surfaces for coral recruitment, and will provide both a much greater quantity of surfaces for coral settlement and growth, but also better quality surfaces than the typical rubble covering much of the bottom in the area.

2. Provide exact location and size of break out area and path of pipes to determine extent of affect on resources. Inform DAR of exact size and type of corals to be taken, out to 120 feet [depth?]. Provide photos and GPS to determine range of necessary mitigation.

Response: The final location and size of the breakout and path of the pipes, including coordinates, will be specified in the FEIS. HSWAC, LLC is in the process of videotaping the route to at least 120 feet deep. We will be happy to share the videos or still photos with you when they are available.

3. Proposed breakout at 35' depth may be too shallow to avoid direct and indirect impacts to coral and live rock (pipe movement, cable and anchor tie damage, turbidity).

Response: The locations of all permanent structures and temporary attachments to the bottom have been and would continue to be sited to avoid areas of high coral density. Turbidity generated by deployment operations would be localized and transient. The project area is occasionally affected by storm surge and seasonally affected by high surf and associated resuspension of bottom sediments. The benthic community is held in an early stage of succession by these high energy events. The proposed action would not create conditions of excessive turbidity.

4. Cold water discharge may be too shallow; could cause thermal pollution for near shore ecosystems.

Response: Modeling of the return seawater plume using the EPA-approved CORMIX model shows that the state water quality standard for temperature would be met within about 27 feet of the diffuser centerline. As the diffuser is designed to direct the flow upward, it further mixes and is diluted prior to impacting the bottom. It is possible that organisms more tolerant of reduced temperatures will ultimately become more common in a limited area downstream of the diffuser.

5. Make every effort to reduce turbidity during marine phases of the project.

Response: All marine operations would be designed and conducted with turbidity minimization a significant criterion.

6. How will recreational divers and commercial dive businesses be affected by construction, and if bottom habitat is destroyed, how will construction affect the Pacific Marine Environmental Laboratory?

Response: For safety reasons, divers would be excluded from the immediate area during construction operations. Fortunately, the most actively used area, that around an abandoned sewer pipe, is far enough to the east that it would not be affected by the proposed action. Once operational, the HSWAC system would provide a significant diving attraction. It is expected that the pipes and concrete collars would function much like an artificial reef, and that marine community development on and around the structure would be many times greater than what might be lost by deployment. The HSWAC system would have no effect on the Marine laboratory.

7. Will the insides of the pipes be cleaned? If so what types of discharge will occur and how will it affect state aquatic resources?

Response: The pipes would not be cleaned and no discharges would be necessary.

Engineering Division memo dated 12/10/08:

a. Cooling station site is in FEMA Zone X; not regulated by the NFIP.

Response: Thank you for the confirmation.

Land Division memo dated 12/10/08:

a. A non-exclusive easement is required for State submerged and fast lands (pages 2-59 & 3-85). Add these requirements to Table 5-1. A right-of-entry could be issued to start work.

Response: Thank you for your review. These requirements will be added to Table 5-1.

b. A revocable permit issued by BLNR may be required at the staging area. Add this requirement to Table 5-1. A right-of-entry could be issued to start work.

Response: Thank you for your review. These requirements will be added to Table 5-1.

Sincerely,

Frederic Berg
Project Director
Honolulu Seawater Air Conditioning, LLC

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

December 22, 2008

Received 12/23/08

Honolulu Seawater Air Conditioning, LLC
7 Waterfront Plaza Suite 407
Honolulu, Hawaii 96813

Attention: Mr. Frederic Berg

Ladies and Gentlemen:

Subject: Honolulu Seawater Air conditioning Project

Thank you for the opportunity to review and comment on the subject matter. The Department of Land and Natural Resources' (DLNR), Land Division distributed or made available a copy of your report pertaining to the subject matter to Division of Boating & Ocean Recreation for their review and comment.

The Department of Land and Natural Resources has no other comments to offer on the subject matter. Should you have any questions, please feel free to call our office at 587-0433. Thank you.

Sincerely,

Charlene E. Unoki
Morris M. Atta
Administrator

Cc: Office of Planning, Coast Zone Management
TEC, Inc.

Myles N Nakamura/DLNR/StateHiUS
12/19/2008 01:09 PM

To Barry W Cheung/DLNR/StateHiUS@StateHiUS
cc Ed R Underwood/DLNR/StateHiUS@StateHiUS, Eric T Yuasa/DLNR/StateHiUS@StateHiUS, Meghan L Statts/DLNR/StateHiUS@StateHiUS, Martha E
bcc
Subject DOBOR Comments on the Draft EIS for the Honolulu Seawater Air Conditioning Project

Mr. Cheung,

I am forwarding comments from DOBOR regarding the HSWAC Draft EIS. We have coordinated within DOBOR on these comments:

1. The Draft EIS, Section 2.5.3.6, Item No. 12 on Page 2-37 indicates that the deployment of the floating pipe segments would require 36 to 48 hours and multiple barges and work boats working in Channel D, Kalihi Channel and the open ocean. This may or may not require closure of Kalihi Channel to all but emergency vessel traffic.

The closure of the Kalihi Channel would negatively impact the Keehi Small Boat Harbor and Sand Island Boat Ramps; Keehi, Ala Wai Marine and LaMariana Small Boat Harbor, as vessels utilize the Kalihi Channel to access the open ocean. Commercial parasailing vessels in the open waters off Keehi Lagoon and Kakaako may also be impacted during deployment of the pipeline. These impacts should be addressed in the Draft EIS and mitigation discussed with the State of Hawaii, Department of Land and Natural Resources, Division of Boating and Ocean Recreation and U.S. Coast Guard.

2. The Draft EIS Section 2.5.3.6, Page 2-30 indicates that the adjoining waters (Channel D), designated as the in-water pipe staging site would be closed for ten (10) months.

This will negatively impact recreation users of this area, including canoe paddlers, kayakers and boaters. The Draft EIS should describe recreational use of the staging site in Section 3.3.3 Ocean Recreation on page 3-13 and impacts should be addressed in Section 4.3.3 Ocean Recreation.

Please call me at 587-3256 or e-mail me if you have any questions on the above.

Myles Nakamura
DOBOR Engineering

Honolulu Seawater Air Conditioning, LLC
Managed by Renewable Energy Innovations, LLC, the COOL GREEN & CLEAN™ Company
7 Waterfront Plaza, Suite 407, Box 124, 500 Ala Moana Boulevard, Honolulu HI 96813
Tel 808.531.SWAC (7922) Fax 808.531.7923 www.honoluluswac.com

August 28, 2009

State of Hawaii
Department of Land and Natural Resources, Land Division
ATTN: Morris M. Atta
P.O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Atta:

Subject: Draft Environmental Impact Statement
Honolulu Seawater Air Conditioning

Thank you for your letter dated December 22, 2008 and the attached memo of December 19 transmitting comments from the Division of Boating and Ocean Recreation (DOBOR). In an effort to better understand DOBOR's concerns and identify potential ways to mitigate impacts on their operations and constituents, HSWAC and DOBOR representatives met on January 28, 2009. Our responses below represent the solutions to the concerns as developed at that meeting. Please note that the comments may have been paraphrased here for brevity.

1. Re: Page 2-37, Section 2.5.3.6 Item 12: A 36 - 48 hour closure to Keehi Channel would negatively impact several facilities and user types. Impacts should be addressed in the Draft EIS, and mitigation discussed with DLNR Division of Boating and Ocean Recreation and with the US Coast Guard.

   Response: The contractor would be required to establish a vessel traffic management plan, so that vessels could continue to use the channel during the pipeline deployment. A system of escort vessels may be required to accomplish this. The contractor also would be required to notify major harbor tenants prior to the deployment operation. Appropriate modifications to the deployment plan will be made in the FEIS.

a. Re: Page 2-30, Section 2.5.3.6: The in-water staging site would be closed for 10 months negatively affecting recreational users of the area. The DEIS should describe recreational uses of the water staging site, and should address the impacts in Section 4.3.3 Ocean Recreation.

   Response: Better descriptions of the recreational uses of the potentially affected areas will be added to the FEIS, and potential impacts more fully disclosed in Section 4.3.3.

Sincerely,

Frederic Berg
Project Director
Honolulu Seawater Air Conditioning, LLC

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
OFFICE OF CONSERVATION AND COASTAL LAND
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

REF:OCCL:TM

Correspondence: OA 09-98

DEC 17 2008

Frederic Berg
Honolulu Seawater Air Conditioning, LLC.
7 Waterfront Plaza, Suite 407
500 Ala Moana Boulevard
Honolulu, HI 96813

Dear Mr. Berg,

SUBJECT: Draft Environmental Impact Statement (EIS) for the Honolulu Seawater Air Conditioning Project

The Office of Conservation and Coastal Lands (OCCL) is in receipt of the Honolulu Seawater Air Conditioning Draft Environmental Impact Statement. According to your information, the proposal shall contribute to meeting State, County and Federal goals and mandates for energy efficiency and renewable energy use.

According to the information presented, The HSWAC seawater circulation system would consist of parallel seawater intake (63-inch) and return (55-inch) pipelines extending from the cooling station to their respective terminal points offshore between Honolulu Harbor and Kewalo Basin. Micro tunneling is proposed behind the shore to about the 35-feet depth, approximately (≈) 2000-feet offshore. An offshore receiving pit to recover the micro tunneling machine and a deep jacking shaft at the cooling plant (diffuser?) site would be required. The seawater return pipe would terminate in a diffuser extending from 120 to 150 feet deep. Beyond that point, the intake pipe would be held in place by gravity anchors with an effective weight of 10,300 pounds each when submerged. The length of the pipe from shore to the intake location would be 4-miles. Water depth at the intake point would be ≈ 1770-feet deep.

Please describe the 25 port diffuser facility located offshore in more detail. Please describe how the location of the anchors would be adjusted in waters beyond 150-feet deep during deployment. An ocean site plan that would include the breakout point, the diffuser, pipe segments, various anchoring mechanisms and the intake would be very helpful to adequately describe what will be situated in the ocean.

Section 2.5.3.9-Repair, does not describe repair in depths beyond human diving capabilities. As a large number of businesses and agencies are proposed to utilize the Honolulu Seawater Air Conditioning, a monitoring/maintenance/management plan should be in place for the entire system to anticipate challenges that may occur such as system failure, storm/hurricane event, tsunami, earthquake and sea-level rise.

Section 3.7.3 states, "*complex marine ecosystems occur in Hawaiian waters to depths of 16,500 feet…*" and then states, "*The diversity of marine life on the sand/rubble plain seaward of the 100-foot isobath is not well-developed, and was not examined in this study due to depth and bottom time constraints.*" If there are complex marine ecosystems that occur to depths of 16,500 feet then this needs to be described in the draft EIS document.

Should power/system failure occur, how will marine species be prevented from swimming up the near shore return pipe?

According to the document, an intake screen was not recommended because the potential for clogging at 1600-foot depth would create a "major maintenance problem." Recent studies of the critically endangered Monk Seal indicate that foraging at this depth may take place. Mitigative action(s) should be proposed to attempt to prevent marine species from entering the intake pipe.

Please insure that Section 3.9-Land Use Plans, Policies and Controls is consistent with the definition of "State marine waters" pursuant to 190D, HRS, that states, "all waters of the State, including the water column and water surface, extending from the upper reaches of the wash of the waves on shore seaward to the limit of the State's police power and management authority, including the United States territorial sea, not withstanding any law to the contrary."

All illustrations within the document should be legible. Section 2.5.7.2 Schedule should be updated. Reference to Figure 2-24 on page 2-31 needs to be corrected.

The OCCL looks forward to your future Conservation District Use Application (CDUA). Should you have any questions regarding this correspondence, contact Tiger Mills of our Office at 587-0382.

Sincerely,

Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Lands

c: Chairperson
ODLO/DAR/DOBOR
OEQC/OP-Shichao Li
TEC, Inc.-George Krasnick

Honolulu Seawater Air Conditioning, LLC
Managed by Renewable Energy Innovations, LLC, the COOL GREEN & CLEAN™ Company
7 Waterfront Plaza, Suite 407, Box 124, 500 Ala Moana Boulevard, Honolulu HI 96813
Tel 808.531.SWAC (7922) Fax 808.531.7923 www.honoluluswac.com

August 28, 2009

Mr. Samuel J. Lemmo, Administrator
State of Hawaii, Department of Natural Resources
Office of Conservation and Coastal Land
P.O. Box 621
Honolulu, Hawaii 96809
Attn: Tiger Mills

Dear Mr. Lemmo:

Subject: Draft Environmental Impact Statement
Honolulu Seawater Air Conditioning

Thank you for your letter dated December 17, 2008. Our responses to your comments are below. Please note that your comments may have been paraphrased here for brevity.

a. Describe the 25 port diffuser in more detail.

Response: The design of the diffuser is shown on the attached figure. This will be further described in the FEIS and in the Conservation District Use Application.

b. How will anchors be adjusted in waters beyond 150 feet deep during deployment?

Response: The position of the anchors would be fixed in the final design because they would have to be attached to the pipes prior to deployment.

c. Request an ocean site plan [with all elements shown].

Response: Final positions of all marine elements will be specified in the FEIS and in the Conservation District Use Application. Figures will be included to show positions of all elements.

d. Monitoring / maintenance / management plan should be in place for the entire system for failure [and other natural occurrences].

Response: The system would undergo routine periodic inspection, or after a significant natural event such as a hurricane or earthquake. Repair procedures for the most likely areas of failure are provided in Section 2.5.3.9 of the DEIS.

e. Describe complex marine ecosystems to depths of 16,500 (see section 3.7.3)

Response: The questioned statement is a general one. The wording of the section will be revised. Additional detail will be added to the FEIS regarding deep ocean marine ecosystems.

f. During power failure, how will marine species be prevented from swimming up shore return pipe?

Response: A backup power generator would be included in the system to maintain flow during commercial power failures.

g. Propose mitigative action to prevent marine species (such as the endangered monk seal) from entering the intake pipe.

Response: Larger motile organisms will be able to feel the suction and avoid the intake well before they are inextricably entrained in the flow.

h. Insure Section 3.9 - Land Use Plans, Policies and Controls is consistent with the definition of "State marine waters" pursuant to 190D, HRS.

Response: We will Include HRS 190D's definition of "State marine waters" in Section 3.9.

i. All illustrations should be legible

Response: We will review all illustrations for legibility.

j. Update Section 2.5.7.2 Schedule

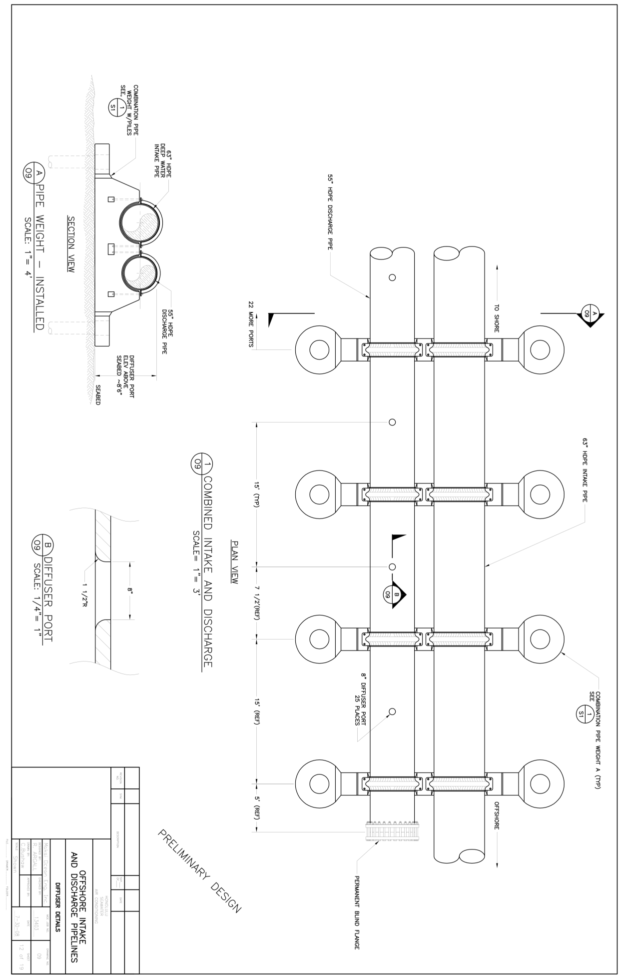
Response: The project schedule will be updated in the FEIS.

k. Correct reference to Figure 2-24 on page 2-31.

Response: This will be corrected in the FEIS.

Sincerely,

Frederic Berg
Project Director
Honolulu Seawater Air Conditioning, LLC



LINDA LINGLE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

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

December 10, 2008

Ms. Abbey Seth Mayer, Director
Office of Planning
Department of Business, Economic Development & Tourism
235 South Beretania Street
6th Floor
Honolulu, Hawai'i 96813

LOG NO: 2008.5141
DOC NO: 0812AL26
Architecture

Dear Ms. Mayer:

SUBJECT: Chapter 6E-8 (HRS) Review
Draft Environmental Impact Statement
Honolulu Seawater Air Conditioning Project
Honolulu, Island of O'ahu
TMK: (1) 2-1-1, 2, 10-14, 16-18, 24-27, 29-30, 32-33, 35-37, 40, 42, 46-47, 54-55, 59, and 60: various

This is in regards to the submittal received by the State Historic Preservation Division on November 13. The subject of the transmittal is the draft Environmental Impact Statement for proposed construction of a centralized seawater air conditioning system in downtown Honolulu, consisting of: a 63" seawater intake pipe extending four miles offshore; a 55" seawater return pipe extending offshore; construction of a pump station in the *makai* district of Kaka'ako; and a network of cold water distribution pipes.

"Chapter 3: Affected Environment" addresses impacts to historic structures in downtown Honolulu. The area of potential effect is characterized as including: sites currently listed on the State or National Registers of Historic Places; districts currently listed on the State or National Registers; sites deemed eligible for listing by the Keeper of the National Register; buildings and structures that are historic (50 years old or more); and, finally, buildings and structures younger than 50 years that may be culturally significant.

The SHPD Architecture Branch has the following comments:

·We suggest that the description of state and federal preservation laws be further elaborated to include the potential applicability of Section 106 of the National Historic Preservation Act and Chapter 6E-42 of the Hawai'i Revised Statutes. Page 5-7 indicates the potential necessity for a Department of the Army permit; please clarify this point, as Federal permitting may necessitate NHPA consultation.

·Has a comprehensive reconnaissance-level survey of all structures over 50 years old or those potentially eligible under Criteria G, that of exceptional significance, been prepared? How many total properties were surveyed? Have the eligibility determinations been formalized?

·Page 4-3 indicates that the proposed pipelines will connect to three significant architectural properties and pass near six of 72 identified in the APE. By contrast, the draft Archaeological and Cultural Impact Assessment Study (p. 56) indicates that 9 properties will be directly accessed and that pipelines will pass near 19 of 74 historic properties. Please clarify.

·The SHPD will look forward to receipt of additional information regarding the means of connection to eligible and listed historic properties for consideration as to whether or not that work will be in accordance with the Secretary of the Interior's Standards for Rehabilitation, unless, as stated, all work is subsurface. If so, there should be no material or visual impact. Indication is given that distribution pipes will connect to existing utility systems and that no additional permanent appurtenances would be required. Please verify that no interior upgrades to buildings would be required.

·Please verify that the proposed new pump station is not located in a registered or eligible historic district. We note the inclusion of *Makai* Area Design Guidelines (Section 3.9.3.3).

The draft Archaeological and Cultural Impact Assessment Study presents the project as not having the potential to adversely affect listed or eligible architectural properties through the installation of HSWAC components, including the pipeline system (p. 145). Further indication is given that SHPD shall be consulted under Chapter 6E-10 of the Hawai'i Revised Statues. Clarification should read that consultation may be applicable under Chapters 6E-8 and 6E-42 and potentially under Section 106 with due consideration of the above.

Thank you for the opportunity to comment. Should you have any questions regarding architectural concerns, please call Dr. Astrid Liverman at (808) 692-8015.

Sincerely,

Nancy A. McMahon
Deputy State Historic Preservation Officer

c: Honolulu Seawater Air Conditioning, LLC, 7 Waterfront Plaza, Suite 407, 500 Ala Moana Boulevard, Honolulu, Hawai'i 96813 Attn: Frederic Berg
Office of Planning, Coastal Zone Management Program, P.O. Box 2359, Honolulu, Hawai'i 96804 Attn: Shichao Li
TEC, Inc., 1001 Bishop Street, ASB #1400, Honolulu, Hawai'i 96813 Attn: George Krasnick

Honolulu Seawater Air Conditioning, LLC

Managed by Renewable Energy Innovations, LLC, the **COOL GREEN & CLEAN™** Company

7 Waterfront Plaza, Suite 407, Box 124, 500 Ala Moana Boulevard, Honolulu HI 96813
Tel 808.531.SWAC (7922) **Fax** 808.531.7923 www.honoluluswac.com

August 28, 2009

Ms. Nancy A. McMahon
State of Hawaii, Department of Land and Natural Resources
State Historic Preservation Division
Deputy State Historic Preservation Officer/State Archaeologist,
and Historic Preservation Manager
601 Kamokila Boulevard, Room 555
Kapolei, Hawaii 96707
Attn: Ms. Wendy Tolleson

Dear Ms. McMahon:

Subject: Draft Environmental Impact Statement DOC. NO. 0812WT35
Honolulu Seawater Air Conditioning

Thank you for your letter dated December 15, 2008. We understand that as long as activities and protocols are adhered to as stipulated in the Archaeological Monitoring Plan, there will be no effects to historic properties. We will proceed on this basis.

Sincerely,

Frederic Berg
Project Director
Honolulu Seawater Air Conditioning, LLC

LINDA LINGLE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

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

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

RUSSELL Y. TSUJI
FIRST DEPUTY

KEN C. KAWAHARA
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

December 15, 2008

Mr. Shichao Li
Office of Planning, Coastal Zone Management Program
P. O. Box 2359
Honolulu, Hawai'i 96804

LOG NO: 2008.5141
DOC NNO: 0812WT35
Archaeology

Dear Mr. Li:

SUBJECT: Chapter 6E-42 Historic Preservation Review – Draft Environmental Impact Statement, Honolulu Seawater Air Conditioning Project, Honolulu Ahupua'a, District of Kaka'ako, Island of O'ahu, Hawai'i TMK: (1) 211:02, 10-14, 16-18, 24-27, 29, 30, 32, 33, 35-37, 40, 42, 46, 47, 54, 55, 59 & 60: various parcels (por.).

Thank you for the opportunity to review this Draft Environmental Impact Statement (DEIS), which we received on November 13 2008.

This project will entail trenching from an offshore location through several streets in the Chinatown Historic District and parts of Downtown Honolulu for the placement of infrastructure required to support the Seawater Air Conditioning project. Review of the "*Draft Report Archaeological and Cultural Impact Assessment Study to Support the Honolulu Seawater Air Conditioning Project in Portions of Kaka'ako and Downtown Honolulu, Pauoa Ahupua'a, Honolulu (Kona) District, Island of O'ahu, State of Hawai'i, TMK: various*" in the back of this DEIS, and the review of the "*Draft Archaeological Monitoring Plan in Support of the Honolulu Seawater Air Conditioning Project in Portions of Kaka'ako and Downtown Honolulu,. Pauoa Ahupua'a, Honolulu (Kona) District, Island of O'ahu, State of Hawai'i, TMK: various*" was also accepted by this office (Log No. 2008.4720/Doc No. 0811WT21).

As long as the monitoring activities and protocols are adhered to as stipulated in the Archaeological Monitoring Plan, we find that there is **no effect to historic properties.**

Please call Wendy Tolleson at (808) 692-8024 if you have any questions or concerns regarding this letter.

Aloha,

Nancy A. McMahon

Nancy McMahon, Deputy SHPO/State Archaeologist
and Historic Preservation Manager

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August 28, 2009

State of Hawaii, Department of Land and Natural Resources
State Historic Preservation Division
ATTN: Nancy A. McMahon
Deputy State Historic Preservation Officer
601 Kamokila Boulevard, Room 555
Kapolei, Hawaii 96707

Dear Ms. McMahon:

Subject: Draft Environmental Impact Statement DOC NO: 0812AL26
Honolulu Seawater Air Conditioning

Thank you for your letter dated December 10, 2008. In an effort to clearly state and respond to your comments, we have individually listed them, with individual responses. Please note that your comments may have been paraphrased here for brevity.

a. Include potential applicability of Section 106 of the National Historic Preservation Act and Chapter 6E-42 HRS.

Response: A Department of the Army permit would be required and Section 106 of the National Historic Preservation Act and Chapter 6E-42 HRS would apply. The Corps expects applicants for their permits to complete Chapter 6E requirements prior to including the historic preservation information in a permit application. Consequently, an archaeological monitoring plan must be completed and accepted by SHPD beforehand, and included as part of the permit application. The monitoring plan has been completed and accepted. Once the permit application is deemed complete and acceptable, the Army Corps will handle Section 106 consultation, including any meetings and correspondence.

b. Has a reconnaissance level survey been prepared?

Response: A comprehensive survey of all buildings and structures in the APE has not been done. A comprehensive review of all available archaeological studies in the area of potential effect has been completed, reviewed, and approved by SHPD. An architectural survey was not recommended or requested by SHPD because no buildings would require any new additions or attached structures or other appurtenances in order to be connected to the HSWAC system. The only required work would be temporary in nature and would primarily involve trenching between the main HSWAC pipelines and the existing cooling system at each participating building. The HSWAC Project would not have any permanent physical or visual effects to historic properties.

c. Clarify apparent conflict regarding quantity of historical buildings to be connected, and those near which the pipeline will pass.

Response: This inconsistency arose as a result of changes in the preferred distribution route that occurred between the completion of the archaeological study and preparation of the DEIS. The conflict will be eliminated in the FEIS.

d. Connections to eligible and listed properties would be subsurface, or would meet the Secretary of Interior Standards of Renovation (no material or visual impact). Verify that no additional appurtenances would be required and there would be no interior upgrades required in historical buildings.

Response: All connections to historic buildings would be subsurface, or without material or visual impact. No appurtenances would be required; no interior upgrades would be required.

e. Verify that the new pump (cooling) station is not located in a registered or eligible historic district.

Response: The proposed cooling station is not located in a registered or eligible historic district.

f. Clarify that consultation with SHPD may be applicable under Chapters 6E-8 and 6E-42, and potentially Section 106.

Response: Consultation requirements will be clarified in the FEIS.

Sincerely,

Frederic Berg
Project Director
Honolulu Seawater Air Conditioning, LLC

DEPARTMENT OF PLANNING AND PERMITTING
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 7TH FLOOR • HONOLULU, HAWAII 96813
TELEPHONE: (808) 768-8000 • FAX: (808) 527-6743
INTERNET: www.honolulu.gov • DEPT. WEB SITE: www.honoluludpp.org

MUFI HANNEMANN
MAYOR

HENRY ENG, FAICP
DIRECTOR

DAVID K. TANOUE
DEPUTY DIRECTOR

2008/ELOG-2761 (TH)

December 17, 2008

Mr. Frederic Berg
Honolulu Seawater Air Conditioning, LLC
7 Waterfront Plaza, Suite 407
500 Ala Moana Boulevard
Honolulu, Hawaii 96813

Dear Mr. Berg:

Subject: Honolulu Seawater Air Conditioning Project
Draft Environmental Impact Statement (DEIS), Tax Map Keys:
2-1-1, 2, 10, 2-14, 16-18, 24-27, 29, 30, 32, 33, 35-37, 40, 42,
46, 47, 54, 55, 59, & 60: Various Parcels (Por.)

We have reviewed the subject DEIS and offer the following comments.

1. According to our records, only Site 3 of the four (4) sites being considered for the project's cooling station shown in Figure 2-36 is within the City's Kakaako Special District. The other three (3) sites are situated on land under the jurisdiction of the State's Hawaii Community Development Authority (HCDA).

2. Page 3-86, Section 3.9.5.1 of the DEIS should be revised to include a discussion of how the proposed project is consistent with Objective B, Policy 3 of the Energy section of the City's General Plan.

3. Page 3-86, Section 3.9.5.2 of the DEIS should include a discussion about how the proposed project supports the vision, policies, principles and guidelines of the Primary Urban Center Development Plan.

4. Figure 3-34 omits the City's Kakaako Special District which is located south of Ala Moana Boulevard and west of Forrest Avenue. The Kakaako Special District is under the jurisdiction of the City and County of Honolulu and governed by the regulations in Appendix F of the Land Use Ordinance, Chapter 21, Revised Ordinances of Honolulu.

5. The proposed project will need the following permits or approvals from the City and County of Honolulu:

    a. Easements must be obtained from the Department of Planning and Permitting (DPP) for the private pipelines within the City's rights-of-way.

    b. Should the preferred location for the cooling station site be selected, then an application must be submitted to the DPP to subdivide cooling station site (TMK: 2-1-059:012).

    c. The applicant must apply for a drain connection license from DPP.

    d. The on-land pipe storage area will need a Special Management Area (SMA) permit. A minor Shoreline Structure Permit will be required if any portion of the on-land pipe storage area is located in the shoreline area. The on-land pipe storage area on Sand Island is currently zoned P-2 General Preservation District, therefore, a Temporary Use Approval will be required from DPP.

    e The applicant must apply for an effluent discharge permit from the Department of Environmental Services.

6. Table 5 of the DEIS should be revised to add the City and County of Honolulu as the lead agency for the SMA since Sand Island is within the City jurisdiction.

7. Based on our records, there are existing wastewater lines within the planned distribution routes from the preferred site for the cooling station at 210 Coral Street (TMK: 2-1-059:012). Therefore, the applicant is required to submit design plans to the DPP for review and approval. Additionally, when the developer applies for a building permit to develop the cooling station, the developer may be required to make frontage improvements in accordance with Ordinance 2412.

Thank you for the opportunity to comment on this matter. Should you have any questions, please contact Tim Hata of our staff at 768-8043. Should you have any questions regarding the Kakaako Special District, SMA, Shoreline Structure Permits, and Temporary Use Approvals required by DPP, please call our Land Use Permits Division at 768-8013.

Very truly yours,

fr Henry Eng, FAICP, Director
Department of Planning and Permitting

HE:js

p:DivFunction/EA-EIS/2008/2008elog2761.doc

Honolulu Seawater Air Conditioning, LLC
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August 28, 2009

City and County of Honolulu
Department of Planning and Permitting
ATTN: David K. Tanoue, Director
650 South King Street, 7th Floor
Honolulu, Hawaii 96813

Dear Mr. Tanoue:

Subject: Draft Environmental Impact Statement
Honolulu Seawater Air Conditioning

This letter is in response to Mr. Eng's letter dated December 17, 2008 comment on the Honolulu Seawater Air Conditioning project draft EIS. Responses to your comments are below. Please note that your comments may have been paraphrased here for brevity.

1. Only Site 3 of the four options for the cooling station is located in the Kakaako Special District.

Response: Information noted.

2. Revise Page 3-86 Section 3.9.5.1 of the DEIS to discuss how the project is consistent with Objective B, Policy 3 of the Energy section of the City's General Plan.

Response: The following sentences will be added to the FEIS. Objective B, Policy 3 of the Energy section of the City's General Plan reads: "Carry out public, and promote private, programs to more efficiently use energy in existing buildings and outdoor facilities." The HSWAC Project would be consistent with this policy because it would implement energy savings in numerous existing downtown buildings, including a number of public buildings. In addition, it would provide the City an opportunity to promote energy efficiency by connecting its buildings, as appropriate and possible, to the HSWAC system.

3. Revise Page 3-86 Section 3.9.5.2 to show how the project supports the vision, policies, principles and guidelines of the Primary Urban Center Development Plan.

Response: We note the absence of specific "principles" in the Primary Urban Center Development Plan, but respond in terms of the vision, policies and guidelines presented there. The following sentences will be added to the FEIS. The City's vision for the Primary Urban Center (PUC) includes five key elements. Of relevance to the HSWAC Project is that: "Honolulu's natural, cultural and scenic resources are protected and enhanced." The HSWAC project would support this element of the City's vision in several ways. The HSWAC Project would protect and enhance natural resources by reducing the environmental impacts associated with burning fossil fuels and operating conventional air conditioning systems. It would reduce the use of fresh water resources, decrease the volumes of wastewater effluents disposed of into coastal waters, reduce emissions of air pollutants and greenhouse gases, reduce thermal pollution of air and water, reduce transportation, storage and use of hazardous materials, and reduce urban noise. The HSWAC Project also would protect and enhance cultural resources in several ways. Archaeological and cultural studies were completed in preparation of this EIS. The distribution system route was adjusted to

avoid areas most likely to contain high concentrations of cultural deposits. An archaeological monitoring plan for the Project has been prepared and approved by the State Historic Preservation Division. That plan requires monitoring of trenching activities and provides procedures that will be implemented should significant cultural resources, such as burials, be uncovered. The HSWAC Project also would protect and enhance the City's scenic resources. Scenic resources refer to views makai to the sea or mauka to the mountains. The only visible part of the HSWAC System would be the cooling station. The location of the station is immediately makai of a much taller and more massive structure. Views from mauka or makai would not be affected by the presence of the cooling station because those views are already blocked by the existing building. Urban views would be improved to the extent that cooling towers rendered unnecessary by a building's connection to the HSWAC System are removed from downtown buildings.

The City's policies and guidelines for the PUC come under two general areas: land use and transportation; and infrastructure and public facilities. Relevant policies under the former mirror the above vision, i.e., protecting and enhancing natural, cultural and scenic resources, and the HSWAC Project would support these policies as it would the City's vision for the PUC. Guidelines for protecting and enhancing natural, cultural and scenic resources in land use and transportation would be supported by the HSWAC System as follows. The architectural character, landscape setting and visual context of historic landmarks would be preserved by burying all system components except the cooling station and by using subterranean connections to any historic structure that might be connected to the System. The HSWAC System would not degrade specific panoramic views the City desires to protect, most specifically, the view corridor up Cooke Street from Kakaako Waterfront Park toward Punchbowl and the Koolau Range. Significant East-West panoramic views are not identified for the cooling station area, and there are existing buildings taller than the proposed HSWAC cooling station that block views of Honolulu Harbor and Ala Moana from the project site.

The HSWAC Project also would support a number of City policies and guidelines for infrastructure and public facilities. Under policies for water allocation and system development, the HSWAC Project would support the policy to "adapt and implement water conservation practices in the design of new developments and modification of existing uses, including landscaped areas," by modifying air conditioning systems within existing buildings to save 292 million gallons of water annually. The HSWAC Project would also support the general guideline to conserve the use of potable water. Within the City's electrical power policies, the HSWAC Project would support the policy to "promote and implement energy conservation measures" by saving more than 77 million kWh/year on Oahu. The HSWAC Project also would generally support the intention of the electrical power guideline to avoid or mitigate adverse impacts on scenic and natural resources, as described above.

4. Figure 3-34 omits the City's Kakaako Special District south of Ala Moana and west of Forrest Avenue.

Response: This figure will be revised to include the Kakaako Special District.

5.a. Obtain easements from DPP for privately owned pipelines within City rights-of-way.

Response: This requirement will be complied with prior to commencement of construction.

5.b. If the preferred site is selected, the site must be subdivided (TMK 2-1-059:012).

Response: We understand the requirement and are working with the landowner to comply.

5.c. The applicant must apply for a drain connection license from DPP.

Response: HSWAC, LLC will do so.

5.d. On-land pipe storage requires an SMA permit. A minor Shoreline Structure permit is required if any part of storage is located in the shoreline area. A Temporary Use Approval is required for the Sand Island on-land storage area (zoned P-2 General Preservation District).

Response: Thank you for this information. HSWAC, LLC will submit applications for these permits and approvals, and included them in the list of required permits and approvals in the FEIS.

5.e. The applicant must apply for an effluent discharge permit from Department of Environmental Services.

Response: HSWAC, LLC will do so.

6. Revise DEIS Table 5 to add the City as the lead agency for the Sand Island SMA permit.

Response: The FEIS will clarify the need for two SMA permits and that the City will be the lead agency for the Sand Island SMA.

7. There are wastewater lines within the planned distribution route. Submit design plans to DPP for review and approval.

Response: HSWAC, LLC will do so.

7. Frontage improvements may be required at the cooling station site in accordance with Ordinance 2412.

Response: Thank you for this information. HSWAC, LLC is coordinating with both the City and HCDA to comply with all required design standards and guidelines.

We thank you for your comments and look forward to our continuing dialogue on the project.

Sincerely,

Frederic Berg
Project Director
Honolulu Seawater Air Conditioning, LLC

LINDA LINGLE
GOVERNOR OF HAWAII

CHIYOME L. FUKINO, M.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O. Box 3378
HONOLULU, HAWAII 96801-3378

In reply, please refer to:
EPO-08-157

December 18, 2008

Mr. George Krasnick
TEC, Inc.
1001 Bishop Street, ASB #1400
Honolulu, Hawaii 96813

Dear Mr. Krasnick:

SUBJECT: Draft Environmental Impact Statement (DEIS) for Honolulu Seawater Air Conditioning Project, Honolulu, Oahu, Hawaii
TMK: (1) 2-1-001: various parcels

Thank you for allowing us to review and comment on the subject application. The document was routed to the various branches of the Department of Health (DOH) Environmental Health Administration. We have the following Clean Water Branch and General comments.

Clean Water Branch

Please note that our review is based solely on the information provided in the subject document and its compliance with Hawaii Administrative Rules (HAR), Chapters 11-54 and 11-55. You may be responsible for fulfilling additional requirements related to our program. We recommend that you also read our standard comments on our website at http://www.hawaii.gov/health/environmental/env-planning/landuse/CWB-standardcomment.pdf.

1. Chapter 4. Environmental Consequences of the subject DEIS should include analysis on the probable thermal effects associated with the operation of the cooling water return discharge to the coral communities (Section 4.7.3), protected species and habitats (Section 4.7.5), and essential fish habitat (Section 4.7.6).

2. Any project and its potential impacts to State waters must meet the following criteria:

   a. Antidegradation policy (HAR, Section 11-54-1.1), which requires that the existing uses and the level of water quality necessary to protect the existing uses of the receiving State water be maintained and protected.

   b. Designated uses (HAR, Section 11-54-3), as determined by the classification of the receiving State waters.

c. Water quality criteria (HAR, Sections 11-54-4 through 11-54-8).

3. The Pacific Ocean offshore of the Honolulu Harbor and shore areas are identified as a Priority Category 5 waters in the Section 303(d) of the Clean Water Act list of impaired water bodies. Priority 5 waters are described as surface waters where available data and/or information indicate that at least one (1) designated use is not being supported or is threatened, and a Total Maximum Daily Loads (TMDL) is needed. Accordingly, the subject DEIS should also include considerations toward ensuring the protection and improvement of this water body, not only in regards to the intake and return water pipe construction (See Section 4.7.2., p. 4-21), but also for the operation of the cooling water return discharge.

4. You are required to obtain a National Pollutant Discharge Elimination System (NPDES) permit for discharges of wastewater, including storm water runoff, into State surface waters (HAR, Chapter 11-55). For the following types of discharges into Class A or Class 2 State waters, you may apply for NPDES general permit coverage by submitting a Notice of Intent (NOI) form:

   a. Storm water associated with construction activities, including clearing, grading, and excavation, that result in the disturbance of equal to or greater than one (1) acre of total land area. The total land area includes a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under a larger common plan of development or sale. In particular, the disturbed land area associated with the construction activities at the cooling station, freshwater distribution pipes, and shoreline staging and pipeline assembly site shall be included in the calculation of the total land area for the subject project. An NPDES permit is required before the start of the construction activities.

   b. Hydrotesting water. This permit may be required for the disposal of water used to test the integrity of the cooling water piping system.

   c. Construction dewatering effluent. Besides for the cooling station, a construction dewatering permit may be required for the freshwater distribution pipes installation.

   You must submit a separate NOI form for each type of discharge at least 30 calendar days prior to the start of the discharge activity, except when applying for coverage for discharges of storm water associated with construction activity. For this type of discharge, the NOI must be submitted 30 calendar days before to the start of construction activities. The NOI forms may be picked up at our office or downloaded from our website at http://www.hawaii.gov/health/environmental/water/cleanwater/forms/genl-index.html.

5. For types of wastewater not listed in Item No. 4 above or wastewater discharging into Class 1 or Class AA waters, you may need an NPDES individual permit. An application for an NPDES individual permit must be submitted at least 180 calendar days before the commencement of the discharge. The NPDES application forms may be picked up at our office or downloaded from our website at http://www.hawaii.gov/health/environmental/water/cleanwater/forms/indiv-index.html.

6. You must also submit a copy of the NOI or NPDES permit application to the State Department of Land and Natural Resources, State Historic Preservation Division (SHPD), or demonstrate to the satisfaction of the CWB that SHPD has or is in the process of evaluating your project. Please submit a copy of your request for review by SHPD or SHPD's determination letter for the project along with your NOI or NPDES permit application, as applicable.

7. Please note that all discharges related to the project construction or operation activities, whether or not NPDES permit coverage is required, must comply with the State's Water Quality Standards. Noncompliance with water quality requirements contained in HAR, Chapter 11-54, and/or permitting requirements, specified in HAR, Chapter 11-55, may be subject to penalties of $25,000 per day per violation.

If you have any questions, please visit our website at http://www.hawaii.gov/health/environmental/water/cleanwater/index.html, or contact the Engineering Section, CWB, at 586-4309.

General

We strongly recommend that you review all of the Standard Comments on our website: www.hawaii.gov/health/environmental/env-planning/landuse/landuse.html. Any comments specifically applicable to this project should be adhered to.

If there are any questions about these comments please contact Jiacai Liu with the Environmental Planning Office at 586-4346.

Sincerely,

KELVIN H. SUNADA, MANAGER
Environmental Planning Office

c: EPO
CWB

Honolulu Seawater Air Conditioning, LLC
Managed by Renewable Energy Innovations, LLC, the COOL GREEN & CLEAN™ Company
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August 28, 2009

State of Hawaii
Department of Health
Mr. Kelvin H. Sunada, Manager
Environmental Planning Office
P.O. Box 3378
Honolulu, Hawaii 96801-3378

Dear Mr. Sunada:

Subject: Draft Environmental Impact Statement
Honolulu Seawater Air Conditioning

Thank you for your letter dated December 18, 2008. Our responses to your comments are below. Please note that your comments may have been paraphrased here for brevity.

1. Include in Chapter 4 an analysis of probable thermal effects on coral communities (Section 4.7.3), protected species and habitats (Section 4.7.5), and essential fish habitat (Section 4.7.6).

Response: These issues are being addressed in consultation with the NOAA National Marine Fisheries Service and Hawaii Division of Aquatic Resources. The results will be included in the FEIS.

2.a. Project and potential impacts must meet the antidegradation policy (HAR, Section 11541,1).

Response: Existing uses and the water quality necessary to protect those uses would be maintained.

2.b. Project and potential impacts must meet the designated uses (HAR, Section 11-54-3).

Response: The project meets the requirements for Class A waters, as described in DEIS Section 3.7.2.8 and subsequent sections.

2.c. Project and potential impacts must meet the water quality criteria (Sections 11-54-4 through 11-54-8).

Response: The requirements of these sections have been reviewed, and the applicable requirements indentified. The design of the system is based on adequately addressing the applicable requirements of these sections. The proponent foresees that the requirements of HAR Sections 11-54-1, and 3-8 will be fully addressed and satisfied during the evaluation and processing of the NPDES discharge permit, the 401 Water Quality Certification and the Zone of Mixing application.

3. There are Priority Category 5 impaired waters offshore. Include considerations toward ensuring the protection and improvement of this water body during intake and return pipe construction, and the operation of cooling water return (Section 4.7.2).

Response: The impaired area is within 30 feet of the shoreline. The microtunnel break out point would be outside of the impaired area. Some transient turbidity could occur during construction operations, but BMPs would be put into place to limit this in space and time. It should be noted that this area receives seasonal high surf events that resuspend bottom sediments and greatly increase turbidity. The marine biological community is kept in an early stage of succession by these events. The return seawater discharge would be well outside the impaired area and the negatively buoyant plume would tend to sink and move away from shore and the impaired area.

4.a. Submit NOI for NPDES permit for storm water runoff from construction areas, before start of construction.

Response: The NPDES permit for storm water runoff would be obtained by the contractor. The requirement for this would be included in the construction contract specifications.

4.b. Submit NOI for NPDES permit for discharge of hydrotesting water [if required].

Response: At this point, it is not known if hydrotesting would be done, but we understand the necessity for a general permit should it be necessary.

4.c. Submit NOI for NPDES permit for construction dewatering effluent.

Response: The NPDES permit for construction dewatering effluent would be obtained by the contractor. The requirement for this would be included in the construction contract specifications.

5. An NPDES permit is required for other wastewater discharging into Class 1 or Class AA waters.

Response: We understand the requirement for an NPDES individual permit and have been working with the Clean Water Branch staff to prepare an application.

6. Demonstrate that SHPD has or is evaluating the project (include SHPD letter with NOI or NPDES permit application).

Response: Our archaeological consultants have been consulting with SHPD. SHPD has reviewed and approved an archaeological monitoring plan which would be implemented during construction. A copy of the letter will be included with the NPDES submittals.

7. All discharges must comply with the State's Water Quality Standards.

Response: We are working with the staff of the Clean Water Branch to ensure that all proposed construction Best Management Practices would be acceptable. They would then be included in the construction contract specifications. A Zone of Mixing application will be submitted for the return seawater flow. Modeling of the discharge plume indicates that a relatively small Zone of Mixing would be required before ambient water quality criteria are met.

General - Review Standard Comments on website www.hawaii.gov/health/environmental/env-planning/landuse/landuse.html. Adhere to any applicable comments. [The following specific links were identified as having applicable comments. Each is addressed individually].

1. Environmental Planning Office (surface water quality management programs) The requirements listed on this URL have been addressed, are included in the DEIS, and / or will be addressed as part of the NPDES discharge permit.
2. Hazard Evaluation and Emergency Response Office (Phase I Environmental Site Assessment) – Acknowledged.
3. Clean Air Branch (dust during construction). This is addressed in DEIS Section 4.8.2.2.
4. Clean Water Branch (applicable items were included in CWB DEIS comment letter)
5. Noise, Radiation, and Indoor Air Quality Branch Chapter 11-46 Community Noise Control (construction noise). This is addressed in DEIS Section 4.3.8.

Sincerely,

Frederic Berg
Project Director
Honolulu Seawater Air Conditioning, LLC

LINDA LINGLE
GOVERNOR

MAJOR GENERAL ROBERT G. F. LEE
DIRECTOR OF CIVIL DEFENSE

EDWARD T. TEIXEIRA
VICE DIRECTOR OF CIVIL DEFENSE

10859

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JAN 14 2009
OFFICE OF PLANNING

PHONE (808) 733-4300
FAX (808) 733-4287

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE DIRECTOR OF CIVIL DEFENSE
3949 DIAMOND HEAD ROAD
HONOLULU, HAWAII 96816-4495

January 13, 2009

Mr. Abbey Seth Mayer, Director
Office of Planning
Department of Business, Economic
Development and Tourism
235 South Beretania Street, 6th Floor
Honolulu, Hawaii 96813

Dear Mr. Mayer:

Draft Environmental Impact Statement
Honolulu Seawater Air Conditioning Project, Kakaako, Oahu, Hawaii

Thank you for the opportunity to comment on this development. After careful review of the documents provided for this project, we feel that potential natural hazards have been acknowledged and that appropriate mitigation measures have been considered in preparing for any future incident.

We look forward to reviewing the final Environmental Impact Statement. If you have any questions, please call Mr. Richard Stercho, Hazard Mitigation Planner, at (808) 733-4300, extension 583.

Sincerely,

EDWARD T. TEIXEIRA
Vice Director of Civil Defense

c: Office of Planning, Coastal Zone Management Program
Office of Environmental Quality Control

Honolulu Seawater Air Conditioning, LLC
Managed by Renewable Energy Innovations, LLC, the COOL GREEN & CLEAN™ Company
7 Waterfront Plaza, Suite 407, Box 124, 500 Ala Moana Boulevard, Honolulu HI 96813
Tel 808.531.SWAC (7922) Fax 808.531.7923 www.honoluluswac.com

August 28, 2009

State of Hawaii
Department of Defense
Office of the Director of Civil Defense
ATTN: Edward T. Teixeira, Vice Director
3949 Diamond Head Road
Honolulu, Hawaii 96816-4495

Dear Mr. Teixeira:

Subject: Draft Environmental Impact Statement
Honolulu Seawater Air Conditioning

Thank you for your letter dated January 13, 2009. We appreciate your acknowledgement that we have addressed mitigation of potential natural hazards.

Sincerely,

Frederic Berg
Project Director
Honolulu Seawater Air Conditioning, LLC

FAX TRANSMITTAL SHEET

ENVIRONMENTAL CENTER
University of Hawaii
2500 Dole Street, Krauss Annex 19, Honolulu, HI 96822
Telephone: (808) 956-7361 Fax: (808) 956-3980

DATE: 12/23/2008

FROM: Peter Rappa
Environmental Review Coordinator

TO: Frederic Berg, HSWAC (531-7923)

Shichao Li, Office of Planning (587-2824)

George Krasnick, TEC, Inc. (382-4613)

Katherine Puana Kealoha, OEQC (586-4186)

SUBJECT: **DRAFT ENVIRONMENTAL IMPACT STATEMENT HONOLULU SEAWATER AIR CONDITIONING**

No. of Pages: including cover sheet: 9

Water Resources Research Center
Environmental Center

UNIVERSITY of HAWAI'I
MĀNOA

December 23, 2008
RE: 784

Frederic Berg
Honolulu Seawater Air Conditioning, LLC
7 Waterfront Plaza, Suite 407
500 Ala Moana Boulevard
Honolulu, HI 96813

Dear Mr. Berg:

Draft Environmental Impact Statement
Honolulu Seawater Air Conditioning
Honolulu, Oahu

The applicant, Honolulu Seawater Air Conditioning, LLC, proposes to construct a seawater air conditioning system to service downtown Honolulu. The system would be comprised of a 63-inch seawater intake pipe extending four miles offshore to 1,770 feet below sea level; a 55-inch seawater return pipe extending 2,000 feet offshore to a depth of 150 feet below sea level; a pump station in the Makai district of Kaka`ako; and a system of distribution pipes linking the pump station to customer buildings in downtown Honolulu. The project will also necessitate a staging ground for the assembly of the pipes. This is proposed for a channel in Keehi Lagoon and an adjacent area on the western side of Sand Island. The seawater air conditioning system has the potential to diminish Oahu's dependence on imported oil, reduce potable water use, and reduce environmental impacts associated with traditional air conditioning systems. Environmental resources potentially affected by the project include marine biota, water quality, archaeological and historic sites, traffic, air quality, and noise. Mitigation measures are included to address these potential adverse effects.

This review was conducted with the assistance of Hans Krock, Ocean and Resources Engineering; Geno Pawlak, Ocean and Resources Engineering; Jacquelin Miller, Environmental Center; Brian Glazer, Oceanography; Margaret McManus, Oceanography; Mark Merrifield Oceanography; Frank Sansone, Oceanography, Eric De Carlo, Oceanography; Alexander Shor, Associate Dean for Research; Roy Wilkens, Hawaii Institute of Geophysics and Planetology; and Ryan Riddle, Environmental Center.

General Comments

This is a large scale project that will have implications on the use of energy in Hawaii for years to come. The total cost of this project is estimated to be $152.5 million dollars and the amount of construction in both the ocean and on land will be extensive. Trenching through some of the busiest parts of the city of Honolulu will also be disruptive as the draft environmental impact statement adequately discloses. We would find it informative if there was some information on the number of users of this system, the breakeven level of use, and whether the Honolulu Seawater Air Conditioning, LLC has agreement with potential users for its product. We also note that with the economic down turn that funding may not be so easy to obtain and that potential customers may not be able to find adequate financing to pay for retrofitting. Is there a possibility that this project will not be implemented if permitted? We were not able to find this type of economic information in the DEIS.

2500 Dole Street, Krauss Annex 19 Honolulu, Hawai'i 96822
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In addition to our general comments, we also have one major comment and several specific comments.

Major Comment – Preferred Alternative for the Offshore Intake and Outlet Pipeline

The proposed Honolulu seawater air conditioning project includes deployment of intake and outlet pipes (63" and 55", respectively) offshore of Kakaako Waterfront Park, as described in the DEIS on pages 2-7 to 2-19. The DEIS considers various routes for the pipes (see attached Figure 1 at the end of this review), with the preferred route angling southward cross the reef in the direction of the Kewalo Basin entrance. The pipes will follow a micro-tunneled shaft that will extend below the sea-bed from shore to a breakout point at a depth of about 35 feet.

As outlined in the DEIS, the preferred route for the pipes traverses the University of Hawaii's Kilo Nalu Observatory (http://www.soest.hawaii.edu/OE/KiloNalu/ see also Figure 2 at the end of this review) research corridor, with the planned breakout point located approximately 100 yards from the main observatory node. This route poses a number of problems for operations at the Observatory which are outlined below.

The Kilo Nalu Observatory is managed and maintained by the University of Hawaii at Manoa, Department of Ocean and Resources Engineering (ORE), School of Ocean and Earth Science and Technology (SOEST). The Observatory has been in operation since August 2005, delivering cabled power and communications to instrumentation that provide measurements of physical and chemical ocean conditions. These real-time observations form a critical part of the Hawaii Ocean Observing System (HIOOS; www.hioos.org). The Observatory also hosts federally funded research projects sponsored by the National Science Foundation, the Office of Naval Research, the Department of Homeland Security, the National Oceanic and Atmospheric Administration Coastal Services Center and the Sea Grant College Program, totaling over $4 million. In addition, Kilo Nalu also receives funding from the City and County of Honolulu in support of a monitoring program for the Sand Island Wastewater Treatment ocean outfall.

A primary research focus for the Observatory is to obtain an accurate characterization of sand and reef beds in response to changes in the physical conditions. These environments are important habitats for bottom fish, invertebrates, and other commercially important species. The Kilo Nalu observations provide knowledge that can be used to support the management of these habitats to ensure a healthy ecological state. Kilo Nalu research also provides insight into biogeochemical fluxes (e.g. carbon dioxide) into and out of the sediments – potentially important factors in climate change research. Kilo Nalu is among only a handful of cabled observatories across the country and the only one in a tropical reef environment. The Kilo Nalu location is unique in that it enables access to both sand and reef environments at a range of depths from 30-120 feet, in close proximity to shore.

Kilo Nalu is permitted by the State of Hawaii Department of Land and Natural Resources (DLNR) under Conservation District Use Permit (CDUP) OA-1941. The area was initially permitted in 1987 to establish an offshore Ocean Test Range for the University's J.L.L. Look Laboratory. The test range included a corridor 200 feet wide, extending seaward 1500 feet from 300 yards offshore. The area was expanded in 2006 under DLNR site plan approval OA 06-40 to include additional instruments to be deployed 300 meters east, west and offshore of the seaward end of the test range.

While we support the general development of the seawater cooling system, we have some concerns with the current proposal. The proposed seawater air conditioning project has the potential to (1) significantly disrupt

Kilo Nalu operations, (2) to affect ongoing research at the Observatory and (3) to affect the nearshore environment. Specific concerns include:

- Deployment operations of the intake and outlet pipes will occur very near to Kilo Nalu's primary cables node, presenting the risk of damage to the Observatory infrastructure and disruption of ongoing sensitive ocean research experiments.
- The intake and outlet pipes, which will be elevated approximately one meter above the seabed, will introduce a significant disturbance to the natural environment that is the focus of Kilo Nalu research. Specifically, the hydrodynamic wake associated with current flow past the two pipes can be expected to modify the flow over a large distance to either side of the pipes, contaminating hydrodynamic observations which are meant to represent natural conditions. In addition, these flow disturbances can be expected to locally modify sediment transport, another key research focus at Kilo Nalu.
- The outflow of cold, nutrient and CO_2 rich, low oxygen water into the coastal ocean from the outlet pipe just offshore of Kilo Nalu may have significant effects on local plankton dynamics and sediment-water interface biogeochemistry. Plankton population dynamics in Malama Bay are being closely studies by researchers at UH. In particular, recent and ongoing research at the Kilo Nalu Ocean Observatory is focused on the tendency of some species of phytoplankton and zooplankton to temporarily converge in vertically thin layers in the water column. These biotic layers are only centimeters thick but can extend horizontally for kilometers and persist for several hours. Because the plankton densities within these layers can be orders of magnitude higher than just above or below the layer, they influence many aspects of marine ecology, such as feeding, larval survival, behavior and predation by higher trophic levels. Plankton dynamics such as the formation, maintenance and dissipation of these thick plankton layers could be significantly affected by the introduction of unnaturally cold, nutrient rich water at the seawater air conditioning discharge location.
- The present route for the two pipes crosses a band of dense coral that spans a region between 50 feet and 65 feet depth between the Kilo Nalu 10- and 20-meter nodes, an important ecological habitat. In addition, the hydrodynamics and biogeochemistry of the reef system are principal foci for Kilo Nalu research. This area is also a popular recreational dive site frequented by numerous commercial dive tours.

To alleviate these issues, we suggest the following modifications for the planned system:

- A route to the west of the proposed preferred route would avoid the Kilo Nalu research corridor. Moving the breakout point 200 meters to the west and slightly further offshore would avoid any direct impact to operations at the Kilo Nalu 10-meter node. The offshore extension would avoid impact to reef coverage that extends to a depth of approximately 40 feet. The offshore extension of the pipe should maintain a minimum distance of 150 meters from the Kilo Nalu 20-meter node to minimize hydrodynamic effects. This route would also minimize impact to the dense offshore coral band since coral coverage becomes sparse to the west.
- Effects of nutrient input would be diminished with increase distance from the Kilo Nalu research corridor and/or with increase injection depth. A western route would improve nutrients effects although the ideal solution would include a deeper location for the return flow (below the surface mixed layer). Minimizing dilution of the outflow would also maximize the injection depth by maximizing the density of the outflow plume.

- Selection of the offshore path and subsequent deployment of the pipes should be coordinated with UH Kilo Nalu personnel to ensure that impact to Observatory infrastructure and operations is minimized.

Given appropriate consideration for potential impacts discussed above, there is significant potential for synergies between the seawater air conditioning project and the Kilo Nalu Ocean Observatory, including ocean state observations and long term environmental monitoring efforts

Brief Action Description (p. g)

On page g of the Executive Summary, the DEIS states, "Below the rubble slope is the biotope of sand where the substratum flattens and is comprised of sand and coral rubble. The diversity of marine life on the sand/rubble plain seaward of the 100 foot isobath is not well developed." Our video observations of deep water dredged material disposal areas offshore of Honolulu and Pearl Harbors suggest that these rubble areas are frequently more productive of macrofauna than the more uniform sand or silt environments. The basis for this statement should be provided.

Reduced Use of Harmful Chemicals (p. 1-7)

In section 1.2.1.4 the DEIS states that seawater air conditioning systems greatly reduce the use of harmful chemicals used in traditional cooling systems. We would like to know the types of harmful chemicals that the seawater air conditioning systems reduces and the percentage of this reduction?

Increased Use of Renewable Energy (p. 1-9)

The reference to the total volume of the oceans in evaluating the impacts of this project seems unnecessary.

Simple Operating System (p. 1-14)

What would be the costs for individual customers to link up with the system?

Secondary Use of Return Seawater and Return Chilled Water (p. 1-15)

It seems unfortunate that some better use cannot be set aside for the return water other than treating it as a waste. For example, could it be warmed sufficiently through heat pumps or otherwise so that it could be discharged into the upper end of the Ala Wai Canal and thus greatly improve the circulation of the canal? Could some of it be mixed with the Sand Island sewage discharge to increase the density of that plume and thus encourage it to remain well below the surface?

Microtunneling (pp. 2-12 – 2-17)

If dewatering is required during the installation of the microtunnel shaft or jacking pits, it is important to note the potential for subsidence in adjacent structures as took place in Waikiki several years ago.

Breakout Point to Diffuser (pp. 2-19 – 2-21)

In the first paragraph on page 2-20, there is mention of the deployment of a silt screen. What are the conditions that will lead to a decision to deploy a silt screen? Are there experts familiar with the currents and waves at the site who are available in Hawaii and can design the silt screen?

Figure 2-20 (p. 2-27)

The picture in Figure 2-20 depicts a floating pipeline. Are there plans to deploy a floating pipeline for this proposed project?

Operation (p. 2-40)

In Section 2.5.3.8 the DEIS states, "The temperature of the return seawater would be approximately 58°F at peak demand, but this may vary with system demand, customer installations, and distribution pipe insulation." How greatly would this temperature vary under different scenarios?

Repair (pp. 2-40 – 2-41)

How much damage could the pipeline receive and still function? Under what scenarios and in what capacities would the system cease to function at any capacity?

Auxillary Chillers (p. 2-47)

How greatly would the temperature of the intake water vary on a seasonal basis? How much is projected to be spent on auxillary cooling in the winter vs. the summer?

Historic Buildings & Structures within the APE That Have Been Deemed Eligible for Listing on the National Register of Historic Places (pp. 3-8 – 3-9)

On pages 3-8 – 3-9 the DEIS states "Discussion with staff at SHPD and a review of their files did not yield information on the specific locations of the Hotel Street properties deemed eligible or on all types of features considered to be contributing." What is the reason for this confusion?

AM/PM Peak Hour Traffic at Selected Downtown and Kaka`ako Intersections (p. 3-19)

In table 3-6, Level-of-Service (LOS) designations would be helpful for evaluating the extent of existing traffic.

Hurricanes and Other Severe Weather Events (p. 3-26)

Given the movement experienced by a pipeline off Barber's Point following Hurricane Iwa, what conditions is this pipeline built to withstand?

December 23, 2008
Page 6

Ambient Noise and Vibration (p. 4-15 – 4-16)

It seems that noise pollution during construction would be a bigger issue than has been portrayed in the DEIS, especially if evening or extended work hours are initiated.

Social and Economic Resources (pp. 4-16 – 4-17)

While the HSWAC project may not have a significant social impact on Honolulu overall it may have a significant economic impact to small business in the area during the construction of the terrestrial distribution network. Open trenching often prevents or discourages people from patronizing retail establishments because these businesses may be difficult to access and leave or there may be no nearby parking. Will anything be done to mitigate this potential impact?

Marine Water Quality (pp. 4-18 – 4-25)

The main environmental impact of the proposed project is the trade-off between the positive environmental effects of reduced greenhouse gas emissions and reduced potable water consumption with the potentially negative effects of discharging seawater from below the thermocline to a depth above the thermocline. While we agree that the proposed discharge will have no significant detrimental impact, this is not adequately supported by the data presented in the DEIS. These impacts can be clearly evaluated using readily available site-specific data and established mathematical techniques. Specifically the DEIS does not include the largest relevant water quality database for the area - that from the City and County of Honolulu monitoring program.

The DEIS does not adequately take into account the main factor in the vertical and horizontal mixing and transport processes of the discharge area - the very dynamic internal wave climate. There also appears to be misunderstandings concerning the State Water Quality Standards with respect to areas of applicability and proper statistical form. Additionally, calculations of plume dynamics and phytoplankton net growth kinetics are not covered in the DEIS. Again, while we agree that the proposed discharge will have no significant detrimental effect, these areas should still be addressed and included in the DEIS.

Thank you for the opportunity to review this Draft EIS.

Sincerely,

Peter Rappa
Environmental Review Coordinator

cc: OEQC
Shichao Li, Office of Planning
George Krasnick, TEC, Inc.
James Moncur, WRRC
Jacquelin Miller
Hans Krock
Geno Pawlak
Ryan Riddle

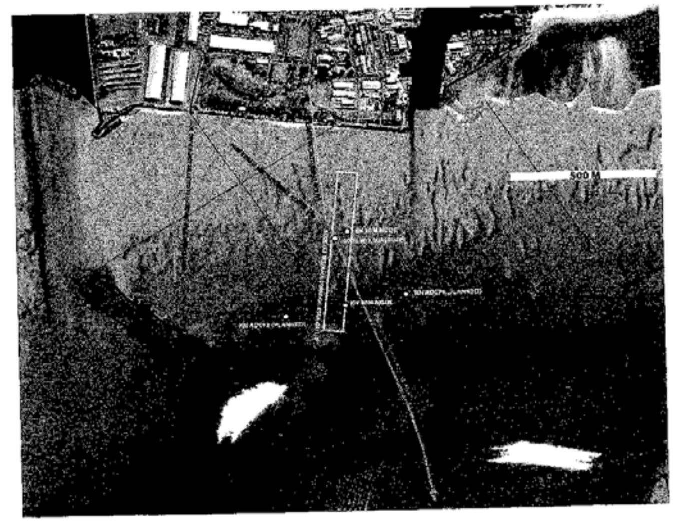

Figure 1 – Layout of proposed seawater air conditioning inlet/outlet pipes offshore of Kakaako. The Kilo Nalu research corridor is indicated by the white outline. Depth contours are at 20 meter intervals

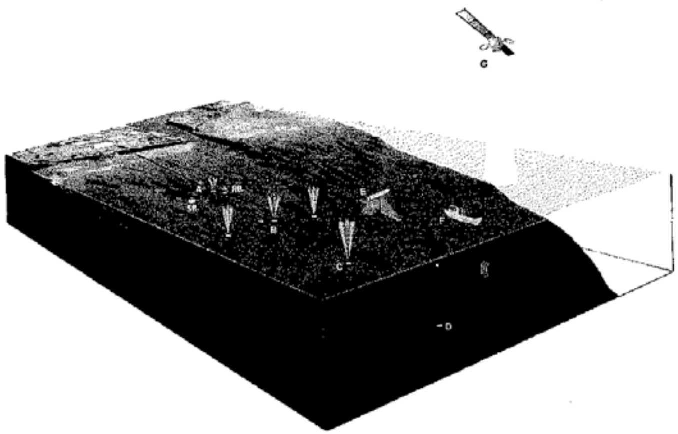

Figure 2 - Overview of the Kilo Nalu Nearshore Reef Observatory; 10 m node (A) with sandy bed (SB) and reef bed sites (RB); 20 m node (B) with lateral subnodes; 30 m (C) and 40 m subnodes (planned) (D); AUV spatial sampling (E); ship-based sampling (F); and satellite-based remote sensing (G).

Honolulu Seawater Air Conditioning, LLC

Managed by Renewable Energy Innovations, LLC, the **COOL GREEN & CLEAN™** Company

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August 28, 2009

Mr. Peter Rappa
Environmental Review Coordinator
University of Hawaii
Environmental Center
2500 Dole Street, Krause Annex 19
Honolulu, Hawaii 96822

Dear Mr. Rappa:

Subject: Draft Environmental Impact Statement
Honolulu Seawater Air Conditioning

Thank you for your letter dated December 23, 2008. Our responses to your comments are below. Please note that your comments may have been paraphrased here for brevity.

General Comments:

Please provide information on the number of system users, breakeven point for the system and agreements with users.

Response: HSWAC anticipates approximately 35 to 45 users of the system. Although a breakeven point is not calculated for financial purposes, it would be reasonable to expect that perhaps 80% of the system would need to be committed to fund the project. At present we have 80% of the system committed to users that have signed a letter of interest. These potential users are in the lengthy process of evaluating the HSWAC system internally requiring input from ownership, management, staff and consultants. It is HSWAC policy not to disclose agreements with users, however we may disclose First Hawaiian Tower has reached an agreement to use the HSWAC system.

Major Comments

1. Preferred Alternative for the Offshore Intake and Outlet Pipeline: As described in the Draft EIS, the offshore pipeline is routed through the University of Hawaii Kilo Nalu Observatory posing a number of problems for the observatory.

Response: We recognize the routing will pose significant problems for the observatory and have worked with University of Hawaii research leaders on a route further to the west as suggested by the researchers.

2. Minimizing outflow dilution (removing diffusers) would maximize injection depth by maximizing outflow plume density.

Response: We are open to the possibility of directing the outflow plume down slope to achieve these objectives, however we believe current State and Federal water quality regulations may not allow this approach.

Specific Comments.

1. Page g of the Executive Summary states that marine life in the biotope of sand and coral rubble plain seaward of 100 foot isobath is not well developed. Please provide evidence of this.

Response: Please refer to page 6 (pages unnumbered) paragraph titled, "The Biotope of Sand" of Appendix B – Preliminary Marine Biological Observations Offshore of the Kakaako Landfill for a description of observations of this area.

2. What are the chemicals referred to in Section 1.2.1.4 and what percentage reduction in use of these chemicals are experienced with a seawater air conditioning system?

Response: In the last paragraph of Section 1.2.1.4 water treatment chemicals referred to are bleach (sodium hypochlorite), non-oxidizing biocide (Nalco 7330), bromine-based oxidizing biocide (Nalco CB-40), and corrosion inhibitor (Nalco 3DT-289).These chemicals are 100% eliminated with the use of the seawater air conditioning system.

3. Reference to the total volume of the oceans in evaluating the impacts of this project seems unnecessary (page 1-9).

Response: The reference was meant to provide support to the claim that HSWAC uses a 100% renewable energy source, for those wondering what the facts are behind the claim.

4. What are the costs for customers to connect on the system?

Response: Costs vary significantly among customers depending on the building A/C configuration. Generally, connection costs are offset by the HECO rebate of $300 per displaced ton of electrically operated air conditioning.

5. Could the return water be used for improving circulation in the Ala Wai or increasing sewage discharge density so that sewage discharge is encouraged to settle rather than rise?

Response: As stated in Section 1.2.4.5 use of return water is limited at the anticipated location of the Cooling Station in Kakaako. The cost of distributing return water to the Ala Wai or Sand Island WWTP at this time would be prohibitive. We agree using the return water effectively would be a great benefit.

6. Note the potential for ground subsidence in adjacent properties during dewatering operations.

Response: So noted. Our engineers are considering all effects of dewatering, including adjacent property subsidence.

7. What is needed to decide on the deployment of silt screen and are experts in Hawaii to design the system, if needed?

Response: HSWAC, LLC is consulting with several major marine construction firms with extensive experience working in Hawaii's coastal waters. Best Management Practices will be employed to minimize turbidity around the construction areas. These contractors' experience and advice will provide the practical guidance necessary to understand what turbidity mitigation measures will be possible and effective.

8. Is a floating pipeline expected to be deployed for this project?

Response: The pipeline is floated into position during deployment. Once properly located, water is introduced into the pipeline to sink it into position.

9. How much variation is there in return water temperature?

Response: The temperature of the return seawater will vary between 53°F and 58°F depending on system demand.

10. How much damage can the pipeline sustain before it can no longer serve?

Response: The pipeline is no longer useful when it can no longer supply seawater at the design volume and temperature of 44,000 gpm and 45 degrees F. As indicated in Section 2.5.3.9, it is unlikely the pipe will be damaged in operational mode if it survives the stress experienced during deployment.

11. How much seasonal variation in auxiliary cooling is anticipated and how much of this is due to the variability in the intake water temperature?

Response: The variability in auxiliary cooling supplied to the chilled water distribution loop will be almost entirely dependent on the demand for cooling and insignificantly dependant on the variation on deep seawater intake temperature.

12. What caused the confusion referred to on page 3-8 and 3-9 at the State Historic Preservation Division regarding lack of information on the location of eligible properties and contributing features for Hotel street historic properties?

Response: SHPD did not have the information in their files. There was no confusion.

13. In table 3-6, Level of Service (LOS) designations would be helpful for evaluating the extent of existing traffic.

Response: We agree, but this information is not available from city or state offices. With the exception of construction lane closures while the freshwater pipes are installed, the HSWAC Project will have no impact on traffic.

14. What weather conditions is the offshore pipeline designed to withstand?

Response: The modeling for the offshore pipeline includes waves produced by hurricanes such as those that have made landfall in Hawaii.

15. Noise pollution may be greater than indicated in the DEIS.

Response: Noise levels referred to in the DEIS are allowable noise limits. These limits must be respected throughout construction.

16. Will anything be done to mitigate the impact of access to small businesses during construction?

Response: Appropriate notices will be given to small businesses affected by lane closures. Mitigation measures required as part of the street usage permit will require minimization of restrictions of driveway access, maintenance of pedestrian, bicycle and handicapped access, and restrictions on lane closures during rush hours.

17. Please provide an evaluation of the effects of discharging water above the thermocline taken from below the thermocline using readily available water quality database from the City and County of Honolulu.

Response: Although the City and County of Honolulu does have an extensive water quality database, it has no data on the effects of discharging water above the thermocline taken from below the thermocline.

18. Please elaborate on the description of the plume in the following areas:

a. Dynamic internal wave climate

b. Applicability of State Water Quality Standards and proper statistical form

c. Plume dynamics

d. Phytoplankton net growth kinetics

Response: Mamala Bay is noted for its internal waves which are related to tidal oscillations. These internal waves drive the temperature variations seen at the intake depth. The return seawater plume will be denser than the receiving waters and will tend to sink regardless of the internal wave climate. The State Water Quality Standards are applicable. Sufficient data will be collected to establish a statistically valid baseline prior to construction and operation. A Zone of Mixing application will be submitted to establish an area that will allow adequate dilution of the return flow. The return seawater will have greater concentrations of phytoplankton macronutrients than the receiving water. However, the dilution afforded by the diffuser will bring nutrient concentrations to within state standards at the ZOM boundary. In addition, advection and mixing in this open coastal area will rapidly disperse and dilute the nutrients. Phytoplankton which receive a nutrient subsidy from the return waters will likewise be dispersed and diluted by prevailing ocean dynamics.

Sincerely,

Frederic Berg, Project Director
Honolulu Seawater Air Conditioning, LLC

LINDA LINGLE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

70812

BRENNON T. MORIOKA
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RECEIVED
DEC 24 2008
OFFICE OF PLANNING

IN REPLY REFER TO:
DIR 1677
STP 8.3077

December 23, 2008

Mr. Abbey Seth Mayer
Director
State of Hawaii
Department of Business, Economic Development & Tourism
Office of Planning
235 South Beretania Street, 6th Floor
Honolulu, Hawaii 96813

Dear Mr. Mayer:

Subject: Honolulu Seawater Air Conditioning Project
Draft Environmental Impact Statement

Thank you for providing the subject document for review and comments.

The State Department of Transportation (DOT) understands that the subject project proposed by Honolulu Seawater Air Conditioning, LLC (HSWAC LLC) entails constructing a seawater air conditioning system in downtown Honolulu. The system would consist of piping in cold seawater from about four miles offshore between Honolulu Harbor and Kewalo Basin to a cooling station in Kakaako, where it would be distributed to various buildings located in downtown Honolulu.

The subject project will impact DOT airports, harbors and highways systems in the project area, especially during construction and installation. The DEIS indicates the proposed on-land pipe storage and assembly area is on the southwest corner of Sand Island and the offshore staging location is one portion of the Keehi Lagoon seaplane runway channels (Channel D). Once assembled, the pipeline segments would be deployed seaward and ultimately connected to the cooling station and other system facilities in the Kakaako area. DOT submits the following comments.

Given the proposed location for staging, construction and transportation of the pipelines, there are potential impacts to the airport system. DOT requests that HSWAC LLC contact the Airports Division, Planning Section at (808) 838-8817 and address the following:

1. Under separate cover, the Airports Division previously indicated to the Department of Land and Natural Resources (DLNR) Land Division on 10/31/08, that they had no objections to a Request for Revocable Permit for Staging Area (TMK: (1) 1-5-041:006 & 022 and seaward, based upon the temporary nature of the operation.

2. However, after further evaluation, because the proposed staging area is in the approach and departure path of Runway 8R-26L at Honolulu International Airport, the Airports Division has indicated that the use of crane barges (as depicted on Figure 2-33) may be an obstruction or hazard to air navigation. Therefore, Airports Division recommends that the applicant submit a Federal Aviation Administration (FAA) Form 7460-1, Notice of Proposed Construction or Alteration to the FAA for a determination. Information and forms are available at the following website: https://www.oeaaa.faa.gov/oeaaa/external/portal.jsp

The staging, construction and deployment of the pipelines also impacts harbor facilities. DOT requests that HSWAC LLC address the following issues and contact the Harbors Division, Engineering Planning Section at (808) 587-1888.

1. Page 2-30. The DEIS describes the detailed staging and construction operations of the pipelines on the makai (ocean side) side of Sand Island and adjacent waters, the seaward deployment and the connectivity to the system facilities through the makai side of Kakaako Park. This activity will impact shipping lanes into and out from Honolulu Harbor, therefore, the applicant must coordinate the transport of floating pipelines with Harbors Division.

2. Page 2-29. While Channel D appears to be the preferred location, the EIS should fully address the use of Channel C as it may impact our maritime users at Pier 60.

As the land side of the system is dispersed throughout the downtown area, various highways facilities will be impacted. DOT requests that HSWAC LLC address the following issues and contact the Highways Division, Planning Branch at (808) 587-1830.

1. A traffic management plan, including a traffic control plan, must be submitted to the Highways Division for review and approval prior to construction.

2. A permit for oversize and overweight vehicles may be required to transport the large pipe, materials and equipment on the State highways, including H-1, Nimitz Highway, Sand Island Access Road and Ala Moana Boulevard.

3. A permit to work in the State highway right of way is required for the microtunneling under State Route 92 (Ala Moana Boulevard) at Keawe Street.

4. The above noted permits and approvals should be added to the Listing of Permits and Approval in the Final EIS.

DOT appreciates the opportunity to provide comments. If there are any questions, please contact Mr. David Shimokawa of the DOT Statewide Transportation Planning Office at (808) 587-2356.

Very truly yours,

Francis Paul Keeno

for BRENNON T. MORIOKA, PH.D., P.E.
Director of Transportation

Honolulu Seawater Air Conditioning, LLC
Managed by Renewable Energy Innovations, LLC, the COOL GREEN & CLEAN™ Company
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Tel 808.531.SWAC (7922) Fax 808.531.7923 www.honoluluswac.com

August 28, 2009

State of Hawaii
Department of Transportation
ATTN: Brennon Morioka, Director
869 Punchbowl Street
Honolulu, Hawaii 96813-5097

Dear Dr. Morioka:

Subject: Draft Environmental Impact Statement
Honolulu Seawater Air Conditioning

Thank you for your letter dated December 23, 2008. Below please find our responses to your numbered comments. Your comments have been paraphrased for brevity.

<u>Airports</u>

1. The Airports Division previously had no objection to a Request for Revocable Permit for Staging Area.
   Response: We will coordinate construction activities with the Airports Division, Planning Section, as requested.
2. After further evaluation, crane barges may be an obstruction to air navigation in the approach and departure path of runway 8R-26L at Honolulu International Airport. Therefore, Airports Division recommends submittal of FAA Form 7460-1, Notice of Proposed Construction or Alteration to the FAA for a determination.
   Response: HSWAC will submit the FAA form and add the requirement to the list of permits and approvals in the Final EIS.

<u>Harbors</u>

1. Staging and construction operations in Keehi Lagoon and off Kakaako Park will impact shipping lanes into and out of Honolulu Harbor; therefore, the applicant must coordinate the transport of floating pipelines with Harbors Division, Engineering Planning Section.
   Response: During staging, the floating pipelines would be stored in a dead-end section of Keehi Lagoon, outside of any active shipping lane. During deployment, which would require about 24 hours, the assembled pipeline would be towed out of Keehi Lagoon and across the entrance to Honolulu Harbor. Coordination with Harbors Division and the Coast Guard will be done, and the appropriate Notice to Mariners published in advance. In addition, users of Keehi Lagoon will be notified in advance and provisions made for passage into and out the Lagoon during deployment. These arrangements will be specified in the Final EIS.
2. While Channel D appears to be the preferred location, the EIS should fully address the use of Channel C as it may impact our maritime users at Pier 60.
   Response: There would be no use of Channel C in HSWAC staging or deployment operations. The pipeline would be assembled in sections in Channel D and as completed towed out Kalihi Channel. The deployment operation, including time on-site east of the Honolulu Harbor entrance channel would be approximately 24 hours, with the actual deployment occurring during the night to avoid daytime heating of the pipe, which would affect the properties of the plastic. During the portion of the 24-hour deployment operation when the pipe is being pulled through the Kalihi Channel, a passage on the western side of the channel will be maintained open to allow the passage of vessels from to and from Pier 60 and the small boat marina.

Highways
1. A traffic management plan, including a traffic control plan, must be submitted to the Highways Division for review and approval prior to construction.
Response: This plan will be prepared and submitted for approval as required.
2. A permit for oversize and overweight vehicles may be required to transport the large pipe, materials and equipment on State Highways.
Response: The application for the oversize/overweight vehicles will be submitted as required.
3. A permit to work in the State highway right of way is required for microtunneling under Ala Moana Boulevard.
The permit application for work in the State highway right of way will be submitted as required.
4. The above noted permits and approvals should be added to the List of Permits and Approvals in the Final EIS.
Response: The above permits and approvals will be added to the List of Required Permits and Approvals in the Final EIS.

Sincerely,

Frederic Berg
Project Director
Honolulu Seawater Air Conditioning, LLC

HAWAII COMMUNITY DEVELOPMENT AUTHORITY

KAKAAKO KALAELOA

Linda Lingle
Governor

Jonathan W. Y. Lai
Chairperson

Anthony J. H. Ching
Executive Director

677 Ala Moana Boulevard
Suite 1001
Honolulu, Hawaii
96813

Telephone
(808) 587-2870

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(808) 587-8150

E-Mail
contact@hcdaweb.org

Web site
www.hcdaweb.org

Ref. No.: PL EIS 6.26

January 5, 2009

Honolulu Seawater Air Conditioning, LLC
7 Waterfront Plaza, Suite 407
500 Ala Moana Boulevard
Honolulu, Hawaii 96813

Attention: Mr. Frederic Berg

Ladies and Gentlemen:

Re: Review of Draft Environment Impact Statement ("DEIS") for the Honolulu Seawater Air Conditioning Project

The Hawaii Community Development Authority ("HCDA") have reviewed the subject DEIS and have the following comments to offer to supplement previous comments made directly to the preparers, TEC, Inc. in our letter of September 21, 2007:

- As a point of clarification, the zoning criteria stated in 2.5.4.4.3 (p. 2-49), apply to the final project on the entire site, of which the Honolulu Seawater ("HSWAC") project is a relatively small part. It is our understanding that the final project will be constructed to completely enclose the HSWAC cooling station. The HCDA also reserves the right to evaluate the final project intended for this site.

- The proposed alignment of the microtunnel route depicted in Figure 2-43, may be affected by HCDA's intent to realign Keawe Street at the Ala Moana Boulevard intersection. HSWAC should coordinate design at this intersection with HCDA to avoid conflict.

- Depending on the timing of the enclosure of the cooling station, design review may require interim measures to mitigate the proposed design of the cooling station as stated in 3.9.3.3 (p. 3-83), which is not intended to be visible. HSWAC should submit their proposed design to HCDA at its earliest convenience to avoid permit delays.

Honolulu Seawater Air Conditioning, LLC
Page Two
January 5, 2009

- Based on information provided in 4.3.6 (p. 4-11), the HCDA understands that the alignment of the intake and exhaust lines have not yet been determined. The "eastern alternative" will be tunneled under the Kakaako Waterfront Park ("Park"). HCDA reserves the right to review construction plans to ensure that there is no risk in releasing contaminants now sealed under the Park. This should most appropriately be done during negotiations with HCDA for any easement rights.

Please direct any questions to Mr. Deepak Neupane, P.E., AIA, Director of Planning and Development, at 587-2870.

Sincerely,

Anthony J. H. Ching
Executive Director

AJHC/TT:ak
c: Office of Environmental Quality Control
(Department of Health)
Shichao Li
(Office of Planning, Coastal Zone Management Program)
Mr. George Krasnick
(TEC, Inc.)

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August 28, 2009

State of Hawaii
Hawaii Community Development Authority
ATTN: Anthony J. H. Ching
677 Ala Moana Blvd Suite 1001
Honolulu, Hawaii 96813

Dear Mr. Ching:

Subject: Draft Environmental Impact Statement
Honolulu Seawater Air Conditioning

Thank you for your letter dated January 5, 2009. Our responses to your comments are below. Please note that your comments may have been paraphrased here for brevity.

a. Clarification on zoning, extent of HSWAC project to overall project on the site, and HCDA reserves the right to evaluate the final project for the site.
Response: We understand that the zoning criteria in section 2.5.4.4.3 apply to the entire site. We further understand that the landowner intends to use portions of the site for other purposes. HSWAC LLC is not directly involved in those other uses. The landowner and/or future developers will coordinate directly with HCDA regarding those uses.
b. HCDA's proposed realignment of Keawe Street may affect the proposed alignment of the microtunnel route in this street. Coordinate design to avoid conflict.
Response: The proposed realignment is noted. Determination of suitable pipeline routes in this area will be coordinated with HCDA.
c. Design review may require interim measures to mitigate the proposed design of the cooling station (section 3.9.3.3), which is intended to be not visible. Submit design as soon as possible to avoid permit delays.
Response: Comment noted and acknowledged. Plans for the cooling station will be submitted for review as soon as they are available.
d. HCDA reserves the right to review plans for the "eastern alternative" sea water pipe, to ensure there is no risk in releasing contaminants form Kaka'ako Waterfront Park. This will be reviewed during negotiations of easement rights.
Response: The eastern alternative microtunnel route has been eliminated due to both the concerns about potential release of contaminants from beneath the park and also the conflict with the University of Hawaii's Kilo Nalu oceanographic instrumentation array which is deployed offshore where the microtunnel would break out of the seabed. The preferred alternative is now a more western route, which would not pass under the park and would not interfere with the University's facilities or operations.

Sincerely,

Frederic Berg
Project Director
Honolulu Seawater Air Conditioning, LLC

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

EIS

January 20, 2009

Mr. Shichao Li
Hawaii State Office of Planning
P.O. Box 2359
Honolulu, HI 96804

Dear Mr. Li:

Re: Honolulu Seawater Air Conditioning
Draft Environmental Impact Statement

Thank you for the opportunity to comment on the above-referenced project. Hawaiian Electric Company, Inc. (HECO) has no objections at this time. The following comments were received from our Engineering, Construction & Maintenance, and Technology Departments:

(1) Engineering/Project Management (Earlynne Oshiro, 543-7825). Care should be taken to avoid impacting our facilities when lateral connections to buildings are made.

(2) Construction & Maintenance (Paul Nakagawa, 543-7062). Depending on the project location and route, HECO may have existing overhead and underground facilities in the area, and will need continued access to our facilities for operation and maintenance purposes, as covered by our existing easement(s). Our Engineering Department should be contacted to coordinate electrical service and any relocation of HECO's existing facilities for the proposed project.

(3) Technology (Art Seki, 543-7987). Following are specific comments on the text of the DEA:

- **Page e, Brief Action Description, Paragraph 3.** Make clear that temperature of the intake of the CWP would be approximately 45°F.
- **Page j, First Full Paragraph.** Will the City's Rapid Transit route impact HSWAC's route?
- **Page 1-4.** Update Figure 1-2.
- **Page 1-5, Oil Price Trends.** Recent downward trends/demand for oil may need to be factored in.
- **Page 1-5, Cost of Electricity.** In the first line, suggest changing "Energy now represents..." to "Fuel oil now represents...."
- **Page 2-47. Backup Electrical Generators.** Are air permits needed for backup generators?
- **Page 4-11, Utilities, First Paragraph.** Spell check "electricity."

We appreciate your efforts to keep us apprised of the planning process. As the project progresses, please continue to keep us informed. We will be better able to evaluate any effects on our system facilities further along in the project's development. We request that development plans show all affected HECO facilities, and address any conflicts between the proposed plans and HECO's existing facilities. Please forward the pre-final development plans to HECO for review.

Should it become necessary to relocate HECO's facilities, please immediately submit a request in writing and we will work with you so that construction of the project may proceed as smoothly as possible. Please note that there may be costs associated with any relocation work, and that such costs may be borne by the requestor. Because any redesign or relocation of HECO's facilities may cause lengthy delays, upon determination that HECO facilities will need to be relocated, HECO should be notified immediately in order to minimize any delays in or impacts on the project schedule.

To coordinate HECO's continuing input in this project, I suggest dealing directly with the points of contact noted above. Thank you again for the opportunity to comment.

Sincerely,

Kirk S. Tomita

Kirk S. Tomita
Senior Environmental Scientist

cc: Ms. Katherine P. Kealoha (OEQC)
TEC Inc.
E. Oshiro
P. Nakagawa
A. Seki

Honolulu Seawater Air Conditioning, LLC
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August 28, 2009

Hawaiian Electric Company, Inc
ATTN: Kirk S. Tomita
P.O. Box 2750
Honolulu, Hawaii 96840-0001

Dear Mr. Tomita:

Subject: Draft Environmental Impact Statement
Honolulu Seawater Air Conditioning

Thank you for your letter dated January 20, 2009. Our responses to your comments are below. Please note that comments may have been paraphrased here for brevity.

1. Avoid affecting HECO facilities when making lateral connections to buildings.

Response: Comment acknowledged. We will consult with HECO in advance of construction to ascertain the locations of HECO facilities. Exercise of due care in excavating for lateral building connections would be included in the project plans and specifications and made a part of construction contracts.

2. HECO will need continued access to overhead and underground facilities for operation and maintenance. Contact the Engineering Department to coordinate electrical service and relocation of HECO exiting facilities.

Response: Comment acknowledged. We will consult with HECO's Engineering Department in advance of construction to ascertain the locations of HECO facilities, access needs, electrical service and any necessity for relocation of facilities.

3 a. Clarify that the intake temperature would be 45°F.

Response: The last sentence of the fifth paragraph states "Temperature of the intake water would be approximately 45°F."

b. Will the City's Rapid Transit affect the HSWAC route?

Response: One of the considerations used in developing the preferred route for the distribution system was avoidance of the route of the City's Rapid Transit system, as noted in paragraph 4 on page 2-57.

c. Update Figure 1-2.

Response: We will consult with HECO to get the necessary data to update this figure.

d. Recent downward trend in oil demand may need to be considered.

Response: Section 1.1.3.1.3 will be reviewed and modified as necessary to reflect recent trends.

e. On page 1-5, Section 1.1.3.2, change "Energy now…" to Fuel oil now…."

Response: The change will be made.

f. Are air permits required for backup generators?

Response: No. Use of emergency generators, including for testing, maintenance and emergencies, is exempt from air permitting requirements.

g. Correct spelling of electricity on page 40-11.

Response: The correction will be made.

4. Project plans should show affected HECO facilities and address conflicts between the proposed system and HECO facilities; submit the pre-final plans for HECO review.

Response: HSWAC, LLC will continue to consult with HECO as plans are finalized.

5. Request in writing if facilities relocations are necessary. There may be associated costs and time delays.

Response: HSWAC, LLC will continue to consult with HECO as plans are finalized.

Sincerely,

Frederic Berg
Project Director
Honolulu Seawater Air Conditioning, LLC

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 11TH FLOOR
HONOLULU, HAWAII 96813
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MUFI HANNEMANN
MAYOR

EUGENE C. LEE, P.E.
DIRECTOR

RUSSELL H. TAKARA, P.E.
DEPUTY DIRECTOR

December 15, 2008

Mr. Frederic Berg
Honolulu Seawater Air Conditioning, LLC
7 Waterfront Plaza, Suite 407
500 Ala Moana Boulevard
Honolulu, Hawaii 96813

Dear Mr. Berg:

Subject: Draft Environmental Impact Statement
Honolulu Seawater Air Conditioning Project

Thank you for giving us the opportunity to review the above Draft Environmental Impact Statement.

The Department of Design and Construction (DDC) has the following comments:

- The City-owned park referred to in the Draft Environmental Impact Statement (DEIS) alternatively as "Mother Waldron Playground" and "Mother Waldron Park and playground" is officially known as Mother Waldron Neighborhood Park. The Honolulu Municipal Building, referenced on page 4-4, has recently been renamed the Frank F. Fasi Municipal Building. We would appreciate your revising the Final Environmental Impact Statement (FEIS) to reflect the officially recognized names.

- The project proponent installing the Honolulu Seawater Air Conditioning (HSWAC) water lines will need to closely coordinate with the City and owners of existing subsurface utility lines within the street rights-of-way to avoid potential spatial conflicts. It is also not clear in the DEIS what plans and procedures are in place to address any potential accidental rupture or disturbance of existing utility lines while digging or drilling to install HSWAC lines. We request that this issue be addressed in the FEIS.

- We also recommend that all illustrative figures in the FEIS be designed for possible independent, stand-alone reproduction and interpretation, with each containing (as appropriate), a title, graphic scale, north arrow, date, citation of source(s) of information, and a legend. Acronyms used in figures (such as "APE," "DC," etc.) should be defined in each figure, or avoided altogether.

- DDC would like to review the construction plans when they become available.

Should you have any questions, please call Clifford Lau, Chief, Facilities Division, at 768-8483.

Very truly yours,

FOR Eugene C. Lee, P.E.
Director

ECL:lt (287229)

c: DDC Facilities Division
DDC Wastewater Division

Honolulu Seawater Air Conditioning, LLC
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August 28, 2009

Mr. Eugene C. Lee, P.E., Director
City and County of Honolulu
Department of Design and Construction
650 South King Street, 11th Floor
Honolulu, Hawaii 96813
Attn: Mr. Clifford Lau, Chief, Facilities Division

Dear Mr. Lee:

Subject: Draft Environmental Impact Statement
Honolulu Seawater Air Conditioning

Thank you for your letter dated December 15, 2008. Your comments are responded to below. Please note that your comments may have been paraphrased here for brevity.

a. Use "Mother Waldron Neighborhood Park" and "Frank F. Fasi Municipal Building" when referring to these two facilities.
Response: We will do so.

b. Coordinate with the City and owners of subsurface utilities to avoid spatial conflicts. Address plans and procedures in case of accidental rupture or disturbance of existing utility lines during construction.
Response: Coordination with the City and owners of utilities will be undertaken in preliminary and final design of the piping system. Emergency and other repair procedures will be included in the project plans and specifications.

c. We recommendation that illustrative figures be "stand alone." Avoid or explain acronyms.
Response: Will do so when possible and appropriate. Some figures are reprinted from other documents. All acronyms will be defined.

d. DDC would like to review construction plans when available.
Response: Plans will be submitted for permits as required. We trust that routing and review will occur in accordance with City and County procedures, including review by your Department. Preliminary plans will be circulated with DDC prior to final submittal package.

Sincerely,

Frederic Berg
Project Director
Honolulu Seawater Air Conditioning, LLC

DEPARTMENT OF FACILITY MAINTENANCE
CITY AND COUNTY OF HONOLULU
1000 Uluohia Street, Suite 215, Kapolei, Hawaii 96707
Phone: (808) 768-3343 • Fax: (808) 768-3381
Website: www.honolulu.gov

MUFI HANNEMANN
MAYOR

CRAIG I. NISHIMURA, P.E.
DIRECTOR AND CHIEF ENGINEER

GEORGE "KEOKI" MIYAMOTO
DEPUTY DIRECTOR

IN REPLY REFER TO:
DRM 08-1146

December 9, 2008

Mr. Frederic Berg
Honolulu Seawater Air Conditioning, LLC
7 Waterfronf Plaza, Suite 407
500 Ala Moana Boulevard
Honolulu, Hawaii 96813

Dear Mr. Berg:

Subject: Honolulu Seawater Air Conditioning Project
Draft Environmental Impact Statement (DEIS)

Thank you for the opportunity to review and provide comments to the DEIS dated October 2008 for the subject project.

There are numerous underground utilities within the roadways identified for installation of the proposed air conditioning water lines, including storm water drain pipes and culverts of various sizes. Although not mentioned in the DEIS, it is our understanding that the proposed water lines will not adversely affect our storm water drainage systems in the Downtown and Kakaako areas and that there shall be a minimum three feet cover between the top of the installed water lines and the roadway surface.

We support the use of micro tunneling and directional drilling methods for the installation of the air conditioning water pipes within a short portion of the project. However, to lessen the impact on the project roadways and existing underground utilities, we request that open trench construction be kept to a minimum and additional less destructive trenchless methods be considered for roadways where trenching is being proposed.

Should you have any questions, please call Charles Pignataro of the Division of Road Maintenance, at 768-3697.

Sincerely,

Craig I. Nishimura, P.E.
Director and Chief Engineer

c: Office of Planning, Costal Zone Management Program
TEC, Inc.

Honolulu Seawater Air Conditioning, LLC
Managed by Renewable Energy Innovations, LLC, the COOL GREEN & CLEAN™ Company
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August 28, 2009

Mr. Craig I. Nishimura, Director and Chief Engineer
City and County of Honolulu
Department of Facility Maintenance
1000 Uluohia Street, Suite 215
Kapolei, Hawaii 96707
Attn: Mr. Charles Pignataro

Dear Mr. Nishimura:

Subject: Draft Environmental Impact Statement
Honolulu Seawater Air Conditioning

Thank you for your letter dated December 9, 2008. Our responses to your comments are provided below. Please note that your comments may have been paraphrased here for brevity.

a. It was noted that the proposed water lines will not affect storm drains. The requirement was stated that there shall be a minimum three feet cover from the top of roads to the top of the water lines

Response: Acknowledge. In conditions where the three feet clear requirement cannot be met, other appropriate separation details will be proposed for consideration.

b. Minimize open trench work and consider trenchless methods in roads.

Response: Cut and cover trenching and trenchless construction methods to install the distribution pipes will be considered on a location-by-location basis. The construction method selected will depend on cost, constructability, traffic impacts, existence of underground obstructions, and access for maintenance of the pipes. To minimize the traffic impact on the roads affected by the project, construction will be performed during evenings and weekends when and where appropriate. Coordination with the City departments and owners of underground utilities will be undertaken in the design of the distribution piping network and utility relocations.

Sincerely,

Frederic Berg
Project Director
Honolulu Seawater Air Conditioning, LLC

DEPARTMENT OF PARKS AND RECREATION
CITY AND COUNTY OF HONOLULU
KAPOLEI HALE • 1000 ULUOHIA STREET, SUITE 309 • KAPOLEI, HAWAII 96707
TELEPHONE: (808) 768-3003 • FAX: (808) 768-7053 • INTERNET: www.honolulu.gov

MUFI HANNEMANN
MAYOR

LESTER K.C. CHANG
DIRECTOR

GAIL Y. HARAGUCHI
DEPUTY DIRECTOR

November 21, 2008

Mr. Frederic Berg
Honolulu Seawater Air Conditioning, LLC
7 Waterfront Plaza, Suite 407
500 Ala Moana Boulevard
Honolulu, Hawaii 96813

Dear Mr. Berg:

Subject: Draft Environmental Impact Statement
Honolulu Seawater Air Conditioning

Thank you for the opportunity to review and comment on the Draft Environmental Impact Statement for Honolulu Seawater Air Conditioning.

The Department of Parks and Recreation has no comment and as the proposed project will not impact any program or facility of the department you are invited to remove us as a consulted party to the balance of the EIS process.

Should you have any questions, please contact Mr. John Reid, Planner, at 768-3017.

LESTER K. C. CHANG
Director

LKCC:jr
(287239)

cc: Office of Environmental Quality Control
Office of Planning, Coastal Zone Management Program

Honolulu Seawater Air Conditioning, LLC
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August 28, 2009

Mr. Lester K.C. Chang, Director
City and County of Honolulu
Department of Parks and Recreation
Kapolei Hale
1000 Uluohia Street, Suite 309
Kapolei, Hawaii 96707
Attn: Mr. John Reid

Dear Mr. Chang:

Subject: Draft Environmental Impact Statement
Honolulu Seawater Air Conditioning

Thank you for your letter dated November 21, 2008; as requested we will remove the Parks and Recreation from our parties to be consulted for this EIS.

Sincerely,

Frederic Berg
Project Director
Honolulu Seawater Air Conditioning, LLC

DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 3RD FLOOR
HONOLULU, HAWAII 96813
Phone: (808) 768-8305 • Fax: (808) 523-4730 • Internet: www.honolulu.gov

MUFI HANNEMANN
MAYOR

WAYNE Y. YOSHIOKA
DIRECTOR

RICHARD F. TORRES
DEPUTY DIRECTOR

TP11/08-287256R

December 22, 2008

Received
12/23/08

Mr. Frederic Berg
Honolulu Seawater Air Conditioning, LLC
7 Waterfront Plaza, Suite 407
500 Ala Moana Boulevard
Honolulu, Hawaii 96813

Dear Mr. Berg:

Subject: Honolulu Seawater Air Conditioning, LLC Draft Environmental Impact Statement

This is in response to your letter of October 27, 2008, requesting our review of the Draft Environmental Impact Statement (DEIS) for the Honolulu Seawater Air Conditioning Project. We offer the following comments:

1. Our Traffic Engineering Division (TED) notes that nighttime traffic control devices should conform to the Manual for Uniform Traffic Control Devices (MUTCD) standards. Bicycles should also be considered in the traffic plans.

2. This project will affect bus routes, bus stops, and para-transit operations. Therefore, at least two weeks prior to the finalizing of construction plans, the Contractor shall notify our Public Transit Division (PTD) at 768-8396 and Oahu Transit Services, Inc. (bus operations: 848-4578 or 848-6016 and para-transit operations: 454-5041 or 454-5020) of the scope of work, duration of project, location, and proposed closure of any street, traffic lane, sidewalk, or bus stop.

3. We also request that the PTD be involved in the development of the traffic management plan to mitigate the impacts to bus operations.

4. The Honolulu Seawater Air Conditioning, LLC shall repair any traffic signal infrastructure that would be impacted by the construction and maintenance of their project, which would include the Department of Transportation Services sensor loops and underground electrical lines.

Mr. Frederic Berg
Page 2
December 22, 2008

Should you have any questions on the matter, please contact Mr. Brian Suzuki at 768-8349.

Very truly yours,

WAYNE Y. YOSHIOKA
Director

cc: Office of Environmental Quality Control
Office of Planning, Coastal Zone Management Program
TEC, Inc.

Honolulu Seawater Air Conditioning, LLC
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August 28, 2009

Mr. Wayne Y. Yoshioka, Director
City and County of Honolulu
Department of Transportation Services
650 South King Street, 3rd Floor
Honolulu, Hawaii 96813
Attn.: Mr. Brian Suzuki

Dear Mr. Yoshioka:

Subject: Draft Environmental Impact Statement
Honolulu Seawater Air Conditioning

Thank you for your letter dated December 22, 2008. Responses to your comments are below. Please note that your comments may have been paraphrased here for brevity.

1. Nighttime traffic control devices should conform to the Manual for Uniform Traffic Control Devices (MUTCD). Bicycles should be considered in the traffic plans.

   Response: All traffic control devices will be in conformance with the MUTCD, and bicycles will be considered in traffic plans.

2. Two weeks prior to finalization of construction plans, notify the Public Transit Division (PTD), Oahu Transit Services, Inc. and para-transit operation of the scope of work, duration, and proposed closure of any street, traffic lane, sidewalk or bus stop.

   Response: These notifications will be completed at least two weeks prior to finalization of construction plans.

3. Involve PTD in development of the traffic management plan to mitigate impacts on bus operations.

   Response: We will consult with PTD in development of the traffic management plan.

4. HSWAC, LLC shall repair any traffic signal infrastructure, including sensor loops and underground electrical lines, impacted during construction and maintenance.

   Response: This requirement will be included in the project plans and specifications. Construction contractors and HSWAC, LLC personnel will be required to comply.

Sincerely,

Frederic Berg
Project Director
Honolulu Seawater Air Conditioning, LLC

To: **Honolulu Seawater Air Conditioning, LLC**
7 Waterfront Plaza, Suite 407
500 Ala Moana Boulevard
Honolulu, Hawaii 96814

Cc: **TEC Inc. 1001**
Bishop Street
American Savings Bank Tower, Suite 1400
Honolulu, Hawaii 96813

Shichao Li
Office of Planning
PO Box 2359
Honolulu, HI 96804

Subject: Comments on Honolulu Seawater Air Conditioning Draft Environmental Impact Statement

From: **Geno Pawlak**, Associate Professor, Department of Ocean and Resources Engineering
Eric De Carlo, Assistant Professor, Department of Oceanography
Brian Glazer, Assistant Professor, Department of Oceanography
Margaret McManus, Associate Professor, Department of Oceanography
Mark Merrifield, Professor, Department of Oceanography
Frank Sansone, Professor, Department of Oceanography
Alexander Shor, Associate Dean for Research
Roy Wilkens, Researcher, Hawaii Institute of Geophysics and Planetology

School of Ocean and Earth Science and Technology
University of Hawaii at Manoa

The proposed Honolulu seawater air conditioning project includes deployment of intake and outlet pipes (64" and 55", respectively) offshore of Kakaako Waterfront Park, as described by the October 2008 draft Environmental Impact Statement (EIS). The draft EIS considers various routes for the pipes (Figure 1), with the preferred route angling southward across the reef in the direction of the Kewalo Basin entrance. The pipes will follow a micro-tunneled shaft that will extend below the sea-bed from shore to a breakout point at a depth of about 35 feet.

As outlined in the draft EIS, the preferred route for the pipes traverses the University of Hawaii's Kilo Nalu Observatory (http://www.soest.hawaii.edu/OE/KiloNalu/; Figure 2) research corridor, with the planned breakout point located approximately 100 yards from the main observatory node. This route poses a number of problems for operations at the Observatory which are outlined below.

The Kilo Nalu Observatory is managed and maintained by the University of Hawaii at Manoa Department of Ocean and Resources Engineering (ORE), School of Ocean and Earth Science and Technology (SOEST). The Observatory has been in operation since August 2005, delivering cabled power and communications to instrumentation that provide measurements of physical and chemical ocean conditions. These real-time observations form a critical part of the Hawaii Ocean Observing System (HIOOS; www.hioos.org).

The Observatory also hosts federally funded research projects sponsored by the National Science Foundation, the Office of Naval Research, the Department of Homeland Security, the National Oceanic and Atmospheric Administration Coastal Services Center and the Sea Grant College Program, totaling over $4 million. In addition, Kilo Nalu also receives funding from the City and County of Honolulu in support of a monitoring program for the Sand Island Wastewater Treatment ocean outfall.

A primary research focus for the Observatory is to obtain an accurate characterization of sand and reef beds in response to changes in the physical conditions. These environments are important habitats for bottom fish, invertebrates, and other commercially important species. The Kilo Nalu observations provide knowledge that can be used to support the management of these habitats to ensure a healthy ecological state. Kilo Nalu research also provides insight into biogeochemical fluxes (e.g. carbon dioxide) into and out of the sediments – potentially important factors in climate change research. Kilo Nalu is among only a handful of cabled observatories across the country and the only one in a tropical reef environment. The Kilo Nalu location is unique in that it enables access to both sand and reef environments at a range of depths from 30-120 feet, in close proximity to shore.

Kilo Nalu is permitted by the State of Hawaii Department of Land and Natural Resources (DLNR) under Conservation District Use Permit (CDUP) OA-1941. The area was initially permitted in 1987, to establish an offshore Ocean Test Range for the University's J.L.L Look Laboratory. The test range included a corridor 200 feet wide, extending seaward 1500 feet from 300 yards offshore. The area was expanded in 2006 under DLNR site plan approval OA 06-40 to include additional instruments to be deployed 300 meters east, west and offshore of the seaward end of the test range.

While we **strongly support** the general development of the seawater cooling system, we have some concerns with the current proposal. The proposed seawater air conditioning project has the potential (1) to significantly disrupt Kilo Nalu operations, (2) to affect ongoing research at the Observatory, (3) to affect the nearshore environment. Specific concerns include:

- Deployment operations of the intake and outlet pipes will occur very near to Kilo Nalu's primary cabled node, presenting the risk of damage to the Observatory infrastructure and disruption of ongoing sensitive ocean research experiments.
- The intake and outlet pipes, which will be elevated approximately one meter above the seabed, will introduce a significant disturbance to the natural environment that is the focus of Kilo Nalu research. Specifically, the hydrodynamic wake associated with current flow past the two pipes can be expected to modify the flow over a large distance to either side of the pipes, contaminating hydrodynamic observations which are meant to represent natural conditions. In addition, these flow disturbances can be expected to locally modify sediment transport, another key research focus at Kilo Nalu.
- The outflow of cold, nutrient and CO_2 rich, low oxygen water into the coastal ocean from the outlet pipe just offshore of Kilo Nalu may have significant effects on local plankton dynamics and sediment-water interface biogeochemistry. Plankton population dynamics in Mamala Bay are being closely studied by researchers at UH. In particular, recent and ongoing research at the Kilo Nalu Ocean Observatory is focused on the tendency of some species of phytoplankton and zooplankton to temporarily converge into vertically thin layers in the water column. These biotic layers are only centimeters thick, but can extend horizontally for kilometers, and persist for several hours. Because plankton densities within these layers can be orders of magnitude higher than just above or below the layer, they influence many aspects of marine ecology, such as feeding, larval survival, behavior, and predation by higher trophic levels. Plankton dynamics, such as the formation, maintenance, and dissipation of these thin plankton layers could be significantly affected by the introduction of unnaturally cold, nutrient rich water at the seawater air conditioning discharge location.

- The present route for the two pipes crosses a band of dense coral that spans a region between 50 feet and 65 feet depth between the Kilo Nalu 10- and 20-meter nodes, an important ecological habitat. In addition, the hydrodynamics and biochemistry of the reef system are principal foci for Kilo Nalu research. This area is also a popular recreational dive site frequented by numerous commercial dive tours.

To alleviate these issues, we suggest the following modifications of the planned system:

- A route to the west of the existing route would avoid the Kilo Nalu research corridor. Moving the breakout point 200 meters to the west and slightly further offshore would avoid any direct impact to operations at the Kilo Nalu 10 meter node. The offshore extension would avoid impact reef coverage that extends to a depth of approximately 40 feet. The offshore extension of the pipe should maintain a minimum distance of 150 meters from the Kilo Nalu 20 meter node to minimize hydrodynamic effects. This route would also minimize impact to the dense offshore coral band since coral coverage becomes sparse to the west.
- Effects of nutrient input would be diminished with increased distance from the Kilo Nalu research corridor and/or with increased injection depth. A western route would improve nutrient effects, although the ideal solution would include a deeper location for the return flow (below the surface mixed layer). Minimizing dilution of the outflow would also maximize the injection depth by maximizing the density of the outflow plume.
- Selection of the offshore path and subsequent deployment of the pipes should be coordinated with UH Kilo Nalu personnel to ensure that impact to Observatory infrastructure and operations is minimized.

Finally, we reiterate that we **strongly support** the overall efforts to develop a seawater air conditioning system for Honolulu, given appropriate consideration for potential impacts discussed above. There is also significant potential for synergies between the seawater air conditioning project and the Kilo Nalu Observatory, including ocean state observations and long term environmental monitoring efforts.

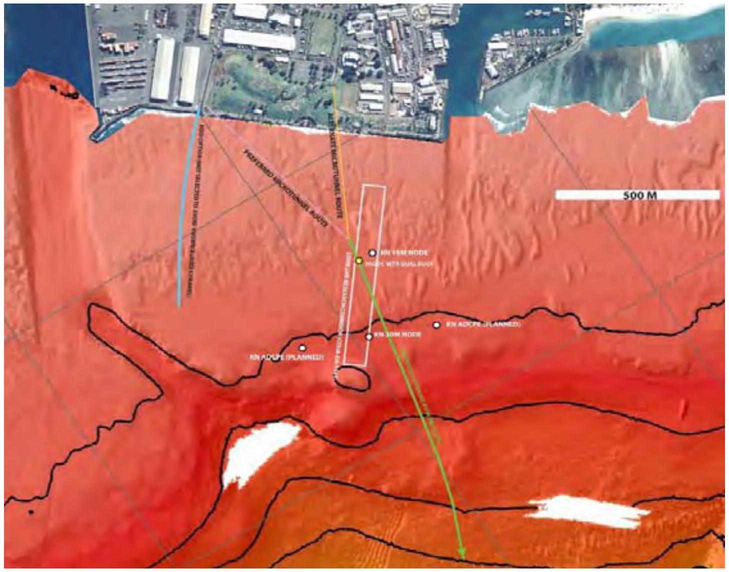

Figure 1 – Layout of proposed seawater air conditioning inlet/outlet pipes offshore of Kakaako. The Kilo Nalu research corridor is indicated by the white outline. Depth contours are at 20 meter intervals

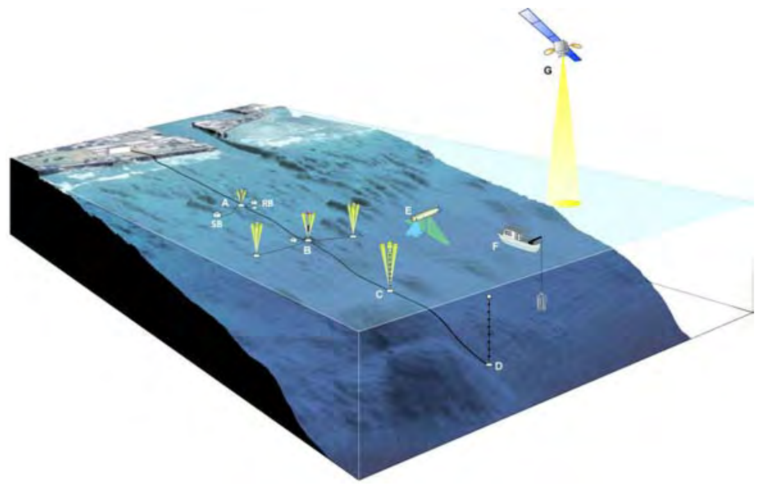

Figure 2 - Overview of the Kilo Nalu Nearshore Reef Observatory; 10 m node (A) with sandy bed (SB) and reef bed sites (RB); 20 m node (B) with lateral subnodes; 30 m (C) and 40 m subnodes (planned) (D); AUV spatial sampling (E); ship-based sampling (F); and satellite-based remote sensing (G).

Honolulu Seawater Air Conditioning, LLC
Managed by Renewable Energy Innovations, LLC, the **COOL GREEN & CLEAN™** Company
7 Waterfront Plaza, Suite 407, Box 124, 500 Ala Moana Boulevard, Honolulu HI 96813
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August 28, 2009

University of Hawaii at Manoa
Department of Ocean and Resources Engineering
ATTN: Geno Pawlak, Associate Professor
2540 Dole Street
Holmes Hall 402
Honolulu, Hawaii 96822

Dear Dr. Pawlak:

Subject: Draft Environmental Impact Statement
Honolulu Seawater Air Conditioning

Thank you for your undated memo regarding the Honolulu Seawater Air Conditioning (HSWAC) Draft Environmental Impact Statement (DEIS). We appreciate your support for the HSWAC Project and understand how the offshore pipe route proposed in the DEIS would affect the Kilo Nalu Observatory and your ongoing research. In an effort to better understand your concerns and devise a suitable solution that would avoid potential impacts to the Observatory, we have had several meetings with you and a number of other potentially affected and knowledgeable ocean researchers from the University of Hawaii. We appreciate your assistance in further describing your system and operations and helping us identify a potentially suitable alternative route.

The below paragraphs restate and respond to your specific suggestions.

a. *A route to the west of the existing route would avoid the Kilo Nalu research corridor. Moving the breakout point 200 meters to the west and slightly further offshore would avoid any direct impact to operations at the Kilo Nalu 10 meter node. The offshore extension would avoid impact reef coverage that extends to a depth of approximately 40 feet. The offshore extension of the pipe should maintain a minimum distance of 150 meters from the Kilo Nalu 20 meter node to minimize hydrodynamic effects. This route would also minimize impact to the dense offshore coral band since coral coverage becomes sparse to the west.*

Response: HSWAC LLC desires to avoid any impact on the physical condition and operation of the Kilo Nalu Observatory. In our meetings with you several other alternative routes were suggested that would eliminate impacts to the Observatory and also reduce potential impacts to corals. We are in the process of completing surveys of the bathymetry, biota and geotechnical characteristics of the most promising of these routes. We expect these investigations to be completed soon, permitting us to propose in the Final EIS a preferred offshore route that would eliminate impacts to the Observatory.

b. *Effects of nutrient input would be diminished with increased distance from the Kilo Nalu research corridor and/or with increased injection depth. A western route would improve nutrient effects, although the ideal solution would include a deeper location for the return flow (below the surface mixed layer). Minimizing dilution of the outflow would also maximize the injection depth by maximizing the density of the outflow plume.*

Response: The regulatory regime for ocean discharges has been developed in consideration of the characteristics of wastewater and power plant thermal discharges, both of which are positively buoyant, can rise to the surface, and be driven onshore by prevailing winds. The HSWAC return seawater would be negatively buoyant due to its temperature relative to the receiving water and would sink. To comply with State and Federal water quality regulations and requirements, the return seawater pipe has been designed with a terminal diffuser that would allow compliance with water quality standards at the boundary of a Zone of Mixing surrounding the diffuser. This comment and the elaboration given when we met introduce a very interesting concept. Basically, what the University is recommending is that we forgo the diffuser in favor of directing the return seawater offshore and downslope as quickly as possible to minimize effects above the thermocline. We agree this would avoid any potential effects to more nearshore areas, but we are not sure if this concept is feasible from a regulatory standpoint. We acknowledge and appreciate your willingness to participate in discussions about this concept with regulators at the Hawaii Department of Health and the U.S. Environmental Protection Agency and will coordinate with you when this is possible.

c. *Selection of the offshore path and subsequent deployment of the pipes should be coordinated with UH Kilo Nalu personnel to ensure that impact to Observatory infrastructure and operations is minimized.*

Response: HSWAC LLC agrees. This coordination has started with the discussions described above.

Your remaining concern related to the character of the return seawater and effects on plankton dynamics and sediment-water interface biogeochemistry. In our subsequent discussions, it was made clear that any such effects are currently unpredictable, but are being actively researched by scientists at UH. For this reason, we propose that HSWAC, LLC and the University collaboratively monitor the seawater return flows to better understand the effects of the system. We look forward to your thoughts on how we might structure a monitoring program to meet our regulatory requirements and your research interests.

Sincerely,

Frederic Berg
Project Director
Honolulu Seawater Air Conditioning, LLC

Received 12/23/08

Frederic Berg
Honolulu Seawater Air Conditioning, LLC
7 Waterfront Plaza, Suite 407
500 Ala Moana Blvd
Honolulu, HI 96813

December 19, 2008

Dear Mr Berg:

The National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) has reviewed the draft Environmental Impact Statement (EIS) for the Honolulu Seawater Air Condition Project.

NMFS Habitat Conservation Division comments/concerns are as follows:

- Can you provide a map of described biotopes which indicate exactly where drilling routes and break out point for pipes will be?
- What is the size distribution of corals in the potentially impacted near shore area?
- What does the benthos look like along the entire pipe and at the intake point?
- Will organisms be entrained at the intake point, and if so which organisms?
- Will fish and coral larvae be impacted by the return water?

Sincerely,

D. Jayewardene

Danielle Jayewardene
Coral Reef Ecologist
NOAA, Pacific Islands Regional Office
1601 Kapiolani Blvd, Suite 1110
Honolulu, HI 96814
Phone # (808) 944 2162
Fax # (808) 973 2941

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August 28, 2009

National Oceanic and Atmospheric Administration
Pacific Islands Regional Office
ATTN: Danielle Jayewardene, Coral Reef Ecologist
1601 Kapiolani Blvd, Suite 1110
Honolulu, HI 96814

Dear Ms. Jayewardene:

Subject: Draft Environmental Impact Statement
Honolulu Seawater Air Conditioning

Thank you for your letter dated December 19, 2008. To better understand your concerns and how HSWAC, LLC might respond to them, we met with you on January 15, 2009. Our responses below reflect our understanding of that discussion. Please note that your comments may have been paraphrased here for brevity.

a. Provide a map of described biotopes indicating exactly where drilling routes and breakout point will be.

Response: We will identify in the FEIS exactly where the drilling routes and breakout point would be and characterize the potentially affected biotope. We understand you are interested in the cumulative footprint of the breakout point and concrete collars at depths where corals may be affected (to depths of 150 meters), and these areas will be provided in the FEIS.

b. What is the size distribution of corals in the potentially impacted near shore area?

Response: We understand your concern is whether potentially affected coral colonies are large or small. As part of the route survey process, HSWAC, LLC will use a remotely operated vehicle or submersible to photograph the proposed route. The colonies seen in previous surveys are all small because the seasonally high surf keeps the community in an early stage of succession.

c. What does the benthos look like along the entire pipe length and at the intake point?

Response: We understand your concerns are for specific types of productive habitats. The photographs of the route were evaluated for the presence of other valuable habitat. Seagrass beds and potential bottomfish habitat were not observed.

d. Will organisms be entrained at the intake point, and if so, which organisms?

Response: Faunal density and diversity at the intake point are low. Common organisms in the water column include fishes and crustaceans. An excerpt from Chave and Malahoff (1998)[1] summarizes the trends with

[1] Chave, E.H. and A. Malahoff. *In Deeper Waters: Photographic Studies of Hawaiian Deep-sea Habitats and Life-forms.* University of Hawai'i Press, Honolulu. 125pp.

depth: "Chave and Mundy (1994)[2] report that the number of Hawaiian benthic fish species decreases logarithmically with depth. The greatest number of species inhabit depths between 15 and 200 meters, the fewest 2,000 meters. Crustaceans seem to follow the same distribution pattern as fishes." The most relevant baseline for entrainment in intakes at comparable depths in Hawaii is the intakes at the Natural Energy Laboratory of Hawaii at Keahole Point on the Big Island. Their experience is that intake screens need to be cleaned at a frequency of about twice a year. Considering the volume of water being pumped, the quantity of entrained biomass is negligible.

e. Will fish and coral larvae be impacted by the return water?

Response: Assuming the diffuser would be installed as proposed, the temperature of the return seawater plume, under worst case current conditions, would meet state water quality standards within about 27 feet of the centerline of the diffuser. In the near-field portion of the plume, the flow of water would preclude entry of fish and coral larvae. In the far field portion of the plume, the return seawater would be significantly diluted and the temperature would be closer to ambient. That, coupled with the typical currents in the area, make it unlikely that the residence time for larvae in the plume would be great enough to cause any lasting effect.

Other concerns expressed in our meeting that were not included in your letter were:

1. Deployment operations should avoid collisions with sea turtles.

Response: All vessels involved in the deployment operation would move at very slow speeds, such that turtles can easily avoid collisions. We understand that you have BMPs for vessel speeds and will obtain copies for use in the deployment operations.

2. Ensure that impulsive noises remain below 160 dB re 1 μPa to protect marine mammals. Source frequency or separation distance was not discussed, but it was stated that a safety range should be established for marine mammals during any pile driving operations.

Response: Offshore marine mammals are unconstrained in movement and it is very likely that if a noise became annoying or frightening they would move away from it. Nevertheless, a marine mammal watch would be manned and if marine mammals are sighted, operations would cease until the mammals left the area.

Sincerely,

Frederic Berg
Project Director
Honolulu Seawater Air Conditioning, LLC

[2] Chave, E.H. and B.C. Mundy. 1994. Deep-sea benthic fishes of the Hawaiian Archipelago, Cross Seamount and Johnston Atoll. *Pacific Science 48*:367-409.

OCEES
Ocean Engineering
& Energy Systems

December 11, 2008

Honolulu Seawater Air Conditioning, LLC
Attn: Frederic Berg
7 Waterfront Plaza, Suite 407
500 Ala Moana Boulevard
Honolulu, HI 96813

Subject: *Original comments of HSWAC Draft Environmental Impact Statement (DEIS)*

Mr. Berg:

Accompanying this letter please find a copy of OCEES International's original comments in review of the Honolulu Seawater Air Conditioning Project - Draft Environmental Impact Statement.

We have reviewed the document as requested and find it an excellent DEIS. We suggest approval of the EIS and fully support the project accordingly. Should you have any further questions or follow-up pertaining to this document or our attached comments, please do not hesitate to contact me at (808) 954-6020 or at my e-mail address soney@ocees.com.

OCEES appreciates the opportunity to review this report and participate in the process for such a positive and necessary renewable energy project for the City & County of Honolulu as well as the State of Hawaii.

Sincerely,

Stephen K. Oney, PhD
Executive Vice President/
Chief Technical Officer

Cc: George Krasnick, TEC, Inc.
Shichao Li, Office of Planning, Coastal Zone Management Program

OCEES
Ocean Engineering
& Energy Systems

OCEES International Original Comments

Honolulu Seawater Air Conditioning Project Draft Environmental Impact Statement (DEIS)

Submitted 12/11/08

1) Page e, paragraph 2, sentence 2 – Is Freon still commonly used?
2) Page e, paragraph 2, last sentence – I would write "seawater supply and return system" as the seawater return is of interest in the EIS.
3) Page g, last paragraph, sentence 3 – The return ***mass*** would be equal to the intake ***mass***. The ***volume*** would vary slightly due to changes in density with change in temperature, salinity and pressure
4) Page h, second paragraph, sentence 2 – "sunk" is misspelled as "ssunk"
5) Page j, paragraph 5, sentence 3 – I think hydrochlorofluorocarbons (HCFCs) are more common now. They are still ozone-depleting, but not as bad as CFCs and are being replaced by hydrofluorocarbons (HFCs) which basically do not deplete the ozone layer, but are a greenhouse gas.
6) Page m, last paragraph – One sentence states"…the more easterly route would require a shorter microtunnel drive." Two sentences later, it is stated that "… The more westerly alternative would reduce distance and cost of microtunneling." This seems contradictory. The second to last sentence has a typo where "also" is spelled as "alos"
7) Page 1-3, section 1.1.2.2 – additional advantage to reducing NOx is that NO is a carcinogen.
8) Page 2-2, sec.2.2.1.3, 2nd to last sentence – I believe this was meant to be written as "As ***with*** central chiller-based…"
9) Page 2-16, last sentence – "…***construction***…" should be "…***constructed***…"
10) Page 2-16, 2nd Paragraph, 1st Sentence, "-60 ft ***or*** deeper" not ***of***
11) Page 2-21, third paragraph, last few sentences – If there are 51 weights with two piles each, how are there only 61 piles? It seems there should be 112 total if there are 51 doubles and 10 singles.
12) Page 2-37, Item 12, 3rd sentence, "… and would ***involve*** …" not ***involving***
13) Page 2-40, paragraph 1 – The return ***mass*** would be equal to the intake ***mass***. The ***volume*** would vary slightly due to changes in density with change in temperature, salinity and pressure
14) Page 2-41, Item 6, 1st sentence, "… allow parts to be ***flown*** in…" not ***flow***
15) Page 2-43, Disadvantages – A wet sump would allow a free surface whereby noncondensible gases would come out of solution (i.e., CO_2) due to pressure changes from deep water to atmospheric. This

previously sequestered CO_2 would reduce the positive carbon footprint attributed to the SWAC system.

16) Page 2-48, 1st sentence, "... occupying an unused portion..." not "unused ***a*** portion"
17) Page 3-3, Section 3.2.2, CIA is referred to prior to explanation of acronym which occurs later in Section 3.2.3. Should move full acronym reference up to Section 3.2.2
18) Page 3-5, Section 3.2.2.3, 1st paragraph, "... and they are ***shown*** in Figure 3-3." Not ***show***
19) Page 3-48 and 3-49 – Tables 3-17 and 3-18 have no units
20) Page 3-73, fifth paragraph, 2nd sentence – "...transported the ***ask***..." Should be "***ash***" instead of "ask"
21) Page 3-73, last paragraph, 2nd sentence – "...up to 45 thick..." no units given for the "45?"
22) Page 3-74, Section 3.8.2.1, 3rd sentence, "...average at the airport is 18.3 inches to 152.1 inches..." not "...average at the airport is 18.3 inches ***at the airport*** to 152.1 inches..."
23) Page 3-74, 5th paragraph, "... from the lagoon dredging of the seaplane runways." Not "... from the lagoon ***is*** dredging..."
24) Page 4-11, Section 4.3.6, 1st sentence, "...demands for ***electricity***, potable..." not ***electrity***
25) Page 4-16, Section 4.4, paragraph 4, sentence 4, "During ***the2007***..." should read "During ***the 2007***..."
26) Page 4-17, 3rd paragraph, 2nd sentence, "...$294 million more ***than***..." instead of "...$294 million more ***that***..."
27) Page 4-29, Section 4.9.1, paragraph 3, "...conformance with the ***Hawai'iState***..." should read "...conformance with the ***Hawai'I State***..."
28) Page 5-4, 1st sentence, makes no sense – should be restructured to clarify meaning.

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August 28, 2009

Ocean Engineering and Energy Systems
ATTN: Stephen K. Oney, Ph.D.
Executive Vice President, Chief Technical Officer
6600 Kalanianaole Hwy., Suite 224
Honolulu, HI 96825

Dear Dr. Oney:

Subject: Draft Environmental Impact Statement
Honolulu Seawater Air Conditioning

Thank you for your letter dated December 11, 2008. We appreciate your support for the project and your thorough review of the text. Your suggested editorial comments will be made. Below are our responses to your specific questions. Please note that your comments may have been paraphrased here for brevity.

1. Page e, para 2 - Is Freon still commonly used?

Response: Yes, although being phased-out, Freon and similar compounds are still in use.

11. Page 2-21, para 3 – last few sentences – discrepancy in calculation of number of weights.

Response: The final tally of weights and piles will be revised in the FEIS to reflect a change in the preferred route of the seawater pipes.

Sincerely,

Frederic Berg
Project Director
Honolulu Seawater Air Conditioning, LLC

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

HRD08/3186C

December 4, 2008

Fredric Berg
Honolulu Seawater Air Conditioning, LLC
7 Waterfront Plaza, Suite 407
500 Ala Moana Boulevard
Honolulu, Hawai'i 96813

RE: Request for comments on the draft environmental impact statement (DEIS), Honolulu Seawater Air Conditioning, LLC, Honolulu, Hawai'i.

Aloha e Fredric Berg,

The Office of Hawaiian Affairs (OHA) is in receipt of the above-mentioned letter dated October 27, 2008. OHA has reviewed the project and offers the following comments.

OHA offers our general support for this proposed project. We see it as a timely and necessary step towards independence for Hawai'i in this new century. We also note that the applicant has well prepared the way for this project by the numerous invitations to review, thorough presentation of issues and via personal meetings.

We appreciate that the applicant has been proactive regarding the potential to uncover iwi kūpuna and cultural artifacts. We agree that areas of moderate to high probability of finding such deposits should undergo on-site archeological and cultural monitoring during trenching. (DEIS, pages 4-6, and 4-8)

We also see that the applicant has tried to avoid impacting areas of high coral coverage. OHA does have some concerns regarding impacts to the coral bottom due to the numerous piles, anchors, moorings and possible temporary wharf to be used. We appreciate the restoration for the landward portions of this proposal and seek the same approach towards the makai portions as well. We suggest habitat restoration in nearby areas to mitigate for the loss of the coral colonies that cannot be avoided.

We do have additional concerns and suggestions to improve the project. Water quality standards within the zone of mixing (especially for nitrate) should be compatible with state and federal standards. Additionally, we understand that the pipes to be used have a lifetime of approximately 75 years. Therefore, we ask about maintenance schedules and repair/removal plans for this project. We stress that at no time in the future should this project be abandoned in place and left to deteriorate on the sea floor.

Submerged lands OHA are ceded lands. As such, we request that they be treated with the respect due to them as they are part of the 1.8 million acres of land that belongs to the Hawaiian monarchy that were transferred to the state when Hawai'i became a U.S. state. OHA also is supposed to receive a portion of the revenue generated from the use of these and other ceded lands.

OHA also notes that there will be prolonged impacts to our beneficiaries practicing their constitutionally protected rights such as fishing and paddling particularly in the proposed staging area. We suggest that the applicant at least contact Na 'Ohana O Na Hui Wa'a and the Oahu Canoe Racing Association. We are also weary of access issues for the residents of Mokauea during this proposal. Additionally we note that any widening of the dunes has the potential to uncover iwi kūpuna.

OHA would also like to suggest that when possible the project area be landscaped with drought tolerant native or indigenous species that are common to the area. Any invasive species should also be removed. Doing so would serve to further the traditional Hawaiian concept of mālama 'āina and create a more Hawaiian sense of place. This would also help to reduce the amount of impervious surfaces in the project area, thereby reducing runoff as well. Tree and landscape planting to shade paved parking areas and provide shade and cooling to building elements and outdoor use areas should also be considered.

Because much of this project is so close to the coast, all outdoor lights should be fully shaded or full cut-off styles. Uplighting should be avoided. Every effort should be made to avoid lighting situations where light glare projects upwards or laterally. Lighting that directly illuminates the shoreline and ocean waters or directed toward the shoreline is prohibited under Hawaii Revised Statutes §205A-30.5. Large, high-intensity floodlights located on building tops or poles should also be avoided. Use of amber colored or other color (such as blue or green) filters or bulbs should be used to assist in decreasing risk of seabird attraction and the potential confusion of honu. For the same reasons, OHA also recommends the use of motion detection-activated lights to prevent lights from being on for extended periods of time. Also, the painting of buildings and other facilities should be in earth tones; white or reflecting colors are to be avoided.

Thank you for the opportunity to comment. If you have further questions, please contact Grant Arnold by phone at (808) 594-0263 or e-mail him at granta@oha.org.

'O wau iho no me ka 'oia'i'o,

Clyde W. Nāmu'o
Administrator

Honolulu Seawater Air Conditioning, LLC
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August 28, 2009

Mr. Clyde W. Namu'o, Administrator
State of Hawaii
Office of Hawaiian Affairs
711 Kapiolani Boulevard, Suite 500
Honolulu, Hawaii 96813
Attn: Mr. Grant Arnold

Dear Mr. Namu'o:

Subject: Draft Environmental Impact Statement
Honolulu Seawater Air Conditioning

Thank you for your letter dated December 4, 2008 and your support of the HSWAC Project. Responses to your comments are below. Please note that your comments may have been paraphrased here for brevity.

a. We suggest habitat restoration to mitigate loss of coral colonies.

Response: Three aspects of the HSWAC Project that would minimize or mitigate impacts to corals include: 1) The HDPE pipes would be placed below the sea floor in areas of high coral coverage. 2) Where exposed, the pipes would be located approximately one meter above the sea floor. 3) Where the pipes are above the seabed, the attached concrete collars resting on the sea floor would provide significant new substrata for coral settlement and growth. The DEIS quantifies this beneficial impact. The net effect is comparable to establishment of an artificial reef. Such structures have proven highly effective in enhancing biomass and productivity of marine communities.

b. Water quality standards in the zone of mixing should be compatible with State and Federal Standards.

Response: The purpose of a zone of mixing is to allow a discharge that would not initially meet water quality standards to be diluted such that it complies with appropriate standards within a reasonable distance. Without zones of mixing no wastewater outfalls or discharges of generating station cooling waters would be permitted. Modeling done using the EPA-approved CORMIX model shows that the HSWAC seawater return would meet applicable water quality standards within a very short distance of the release point. In the case of nitrate the discharge plume under worst-case conditions would be expected to meet water quality standards within 150 feet of the diffuser.

c. Maintenance, repair and removal of the pipes are concerns. Pipes should not be abandoned in place.

Response: Maintenance: The system is designed to operate maintenance free over its operational life. The seawater pipe system at the Natural Energy Laboratory of Hawaii provides experience for these types of seawater pipe systems. That system is operated maintenance free. The HSWAC seawater pipes would be inspected after any major disruptions such as a hurricane or tidal wave as well as periodically. Repair: The HSWAC pipes would be repaired when required as described in DEIS Section 2.5.3.9. Long term

Operation: Although the anticipated pipeline life is 75 years, it is also expected that the system would remain in place and operational beyond 75 years. Work done on the system in future decades would be based on current practices at that time and knowledge gained from long-term operation and evaluation of such systems. It should be noted that removal of submerged structures after such a long time in the water may cause significant damage to the associated marine communities that have developed to exploit the habitat provided by the structures. It is likely that future regulators would require segment-specific surveys to assess the relative benefits of removing or abandoning in place of the pipes.

d. Request that submerged ceded lands be given the respect due to them.

Response: Due respect would be accorded the submerged lands. All applicable regulations and requirements relating to project elements within ceded lands would be addressed.

e. Fishing and paddling rights in staging area would be impacted. Contact Na ʻOhana O Na Hui Waʻa and Oahu Racing Association.

Response: Fishing and paddling would be restricted in the immediate vicinity of the in-water pipe storage area for safety reasons. HSWAC is working with the Division of Boating and Ocean Recreation to address this and related issues.

f. Access to Mokauea [Island] would be restricted.

Response: Access to Mokauea Island would not be obstructed or restricted in any way as a result of the staging work.

g. "Widening of dunes" could uncover iwi kūpuna.

Response: The existing piles of sand and broken coral are not proposed to be widened; however, there are two existing unpaved curved roads through the piles, which currently provide access from the park to the shoreline, which are proposed to be widened to accommodate transport of pipes from the on-shore area to the water. The sand and coral piles would be returned to existing conditions after completion of the work in the staging area.

The long piles of sand and broken coral located parallel to the shoreline in the proposed staging area are dredge spoils removed from the lagoon to create the sea plane 'runway' in the 1940s. This would not have been a dune available for burial during the period when dune interment of iwi kūpuna was practiced. The Draft EIS inaccurately referred to these dredge piles as dunes; this will be corrected in the Final EIS. Should any iwi kūpuna be unexpectedly discovered during widening of the existing road, due respect would exercised, and laws addressing such discoveries would be followed.

h. Landscape with drought tolerant native or indigenous species. Remove invasive species. Consider tree and landscape planting to cool parking and buildings.

Response: Thank you for your suggestions. The cooling station site would have only a small area available for landscaping and consideration would be given to using native or indigenous species.

i. Outdoor lighting should be designed to avoid uplighting and glare and be protective of seabirds and sea turtles.

Response: All exterior lighting would be designed according to applicable regulations which are protective of seabirds and sea turtles.

j. Paint buildings non-reflective, non-white "earth tones."

Response: HSWAC, LLC would comply with all appropriate HCDA design guidelines for building exteriors. The intention is for the cooling station building to be as inconspicuous as possible.

Sincerely,

Frederic Berg
Project Director
Honolulu Seawater Air Conditioning, LLC

APPENDIX G
COOLING STATION SITE PHOTOGRAPHS

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PHOTO 1:
Preferred cooling station site looking Diamond Head.

PHOTO 2:
Preferred cooling station site looking ‘Ewa.

PHOTO 3:
Preferred cooling station site looking Makai.

PHOTO 4:
View from Kaka'ako Waterfront Park towards preferred cooling station site.

PHOTO 5:
Alternative 2 cooling station site looking toward Honolulu Harbor from Kaka‘ako Waterfront Park.

PHOTO 6:
Alternative 2 cooling station site looking ‘Ewa from Kaka‘ako Waterfront Park.