

**STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
OFFICE OF CONSERVATION AND COASTAL LANDS
HONOLULU, HAWAII**

February 28, 2014

**BOARD OF LAND AND
NATURAL RESOURCES
STATE OF HAWAII
HONOLULU, HAWAII**

REGARDING: Conservation District Use Application (CDUA) OA-3670

APPLICANT: City and County of Honolulu – Department of Design and Construction

AGENT: Wilson Okamoto Corporation; Earl Matsukawa

LOCATION: Ko'olaupoko District, Island of Oahu

TMKs: (1) 4-2-015:009; (1) 4-2-017:001, 016, 018 & 021; (1) 4-4-011:013; (1) 4-5-101:037; (1) 4-4-012:001, 064 & 065; (1) 4-5-031:076; (1) 4-5-032:001

AREA OF USE: *Underground* 15,000' long by 14' diameter tunnel

SUBZONE: General

DESCRIPTION OF AREA AND CURRENT USE:

The subject parcels and proposed project site (**Exhibit 1**) are situated along the western portion of the Oneawa Hills which comprise the eastern edge of the remnant Ko'olau volcano caldera (*a cauldron-like volcanic feature usually formed by the collapse of land following a volcanic eruption*) that formed from the deposition of flowing lava. The caldera of the volcano is estimated to extend from Waimanalo to Kaneohe and from the base of the Ko'olau Pali to the area between Lanikai and the Mokulua Islands. The Oneawa Hills are capped with a coarse breccia that consists of fragmented basalt rocks, most likely formed from eroded rocks of the Ko'olau caldera.

Currently, two (2) wastewater treatment facilities are designed to receive and treat the storm and wastewater that collects throughout the southern Kaneohe Bay region (**Exhibit 1**). At this time wastewater and storm water is managed through a 42-inch diameter concrete force main that conveys pre-treated wastewater from the Kaneohe Wastewater Pre-Treatment Facility (WWPTF) to the Kailua Regional Wastewater Treatment Plant (WWTP); the existing force main is aligned primarily along the coast beneath Kaneohe Drive (**Exhibit 2**) and includes numerous Wastewater Pump Stations (WWPS) that service the system (**Exhibit 3**). The Kaneohe WWPTF was previously designed as a secondary treatment facility, which was then converted to a preliminary treatment facility in 1994 as part of the Kailua Regional WWTP Plan. This facility provides screening, grit removal and some flow equalization processes. Grit and accumulated solids

collected from screening are deposited in the Waimanalo Gulch Landfill. The Kailua Regional WWTP is a secondary treatment facility that utilizes the biotower/solids contact process for secondary treatment. This facility was designed to treat an average daily flow of approximately 15.25 million gallons per day (*mgd*).

Surface Water:

The high quantity of rainfall on the Windward side of the Ko'olau Range supports numerous perennial streams; including, but not limited to the Kaneohe Stream, Kāwā Stream and Kea'alu Stream. There are no designated wild or scenic rivers in the project area. Kea'alu Stream is the only stream that may be impacted by the proposed project in that the stream runs from Kailua, beneath the Oneawa Hills and resurfaces south of Pu'u Pāpa'a which empties into Kaneohe Bay. Kaneohe Bay is the most prominent near shore marine feature on the windward side of Oahu, and is the largest sheltered embayment within the Hawaiian Islands. The bay receives drainage input from a number of watersheds and streams that flow from the steep areas that surround the bay, including the Oneawa Hills.

Ground Water:

The project area, within the Conservation District (**Exhibit 4**), lies across the Ko'olaupoko and Waimanalo Aquifer Systems (**Exhibit 5**) which are within the larger Windward Aquifer Sector; these aquifers were previously delineated by the Commission on Water Resource Management (CWRM). Groundwater in these systems occurs in basal aquifers (*water-bearing sands, gravel or fractured rock that is found at the bottom of a geological formation*), high-level dike aquifers (*aquifer in dike formations*) and dike basal aquifers which are a combination of the two. In the upper elevations of both the Waimanalo and Ko'olaupoko Aquifer systems, CWRM has concluded that a direct relationship exists between the surface water and groundwater conditions. At mid-elevations surface water may be hydrologically separated from the basal and dike aquifers by a layer of thick sediments.

Floral and Faunal Resources

The vegetation in all areas surveyed (*AECOS, 2006, 2008*) for the proposed project were identified as typical of disturbed or landscaped environments; with the exception of a mangrove forest located at along the shores of Kaneohe Bay and up into the lower reaches of the Kāwā Stream. Inland from the mangrove forest consists of sparse to moderate growth of Milo trees, and any area not recently disturbed is dominated by non-native grasses and shrubs. There are no plant species listed as endangered, threatened, or currently proposed for listing under either federal or State statutes, nor are any expected given the highly disturbed nature of the project area. All work proposed under this application, besides that of the access shaft being constructed on the existing Board of Water Supply (BWS) property, will be conducted underground with no surficial impacts in the Conservation District.

An avifaunal and listed species survey (*AECOS, 2010*) was completed to assess these resources within the project site. While the focus of the survey included areas outside the Conservation District, the findings of the avian survey are consistent with the habitat present at the project site and would be expected at general locations of coastal windward Oahu. Typically avian occurrence was higher at the Kaneohe end of the project site; although of the avian species observed approximately ~70% are considered introduced or non-native species (i.e., Common myna, Doves). Native species (i.e., Golden Plover, Hawaiian Stilt) were observed primarily within the

terminus of the Kāwā and Kaneohe Streams which empties into Kaneohe Bay and the Waikalua Loko Fishpond. The proposed tunnel route will not pass directly beneath any wetland or special aquatic resource areas.

Architecture and Archeology

An Archeological Assessment Report (AAR) was completed for the proposed gravity tunnel project and included both literature reviews and surface testing to assess potential archeological and historical resources of the area. The archeological literature review conducted for this project included archival sources, historic maps, Land Commission Awards and previous archeological reports to determine if any record of historic or archeological resources could be found. Based on this investigation it was determined that there are no known historic or archeological sites situated along the proposed gravity tunnel route. The location of the proposed access shaft, on BWS property, is heavily developed with water tanks, piping, construction material and facility buildings. Geotechnical testing of the subsurface layer at the proposed access shaft site revealed that the surficial soil layer extends to only 61cm (~2') below the ground to the upper boundary of the basalt bedrock which was excavated to 98m (~320'). The AAR states that there are no known historic or archeological sites along the proposed gravity tunnel route.

PROPOSED USE:

The City and County of Honolulu – Department of Environmental Services and the Department of Design and Construction is proposing to construct a three (3) mile long tunnel, approximately 14-feet in diameter from the Kaneohe WWPTF to the Kailua WWTP to convey wastewater by gravity flow. While the proposed project includes work at the existing Kaneohe WWPTF and Kailua WWTP, only a portion of the gravity flow tunnel (i.e., beneath Oneawa Hills) will be located within the Conservation District General Subzone (**Exhibit 6**). The only surficial land uses proposed include the construction of an emergency access shaft from the surface to the main gravity flow tunnel. While the gravity tunnel is not expected to require any maintenance, the construction of a vertical access shaft is necessary as a precautionary measure. A “T” connection (**Exhibit 7**) will be constructed in the tunnel; along with the placement of prefabricated manhole sections at the top of the excavated shaft, which will then be sealed with a permanent manhole cover.

Tunnel boring will be staged primarily from the Kailua Regional WWTP, using a specialized Tunnel Boring Machine (TBM) (**Exhibit 8**). Initially a vertical access shaft will be excavated in this area and be approximately 80-feet in diameter which is sized appropriately to construct the Tunnel Influent Pump Station (TIPS) that is designed to pump wastewater that is received through the tunnel to the surface for treatment at the Kailua Regional WWTP. The construction of the vertical shaft will occur outside the conservation district, but is the entry point for the TBM. After the shaft is excavated using equipment to lift out the loose material, a horizontal starter tunnel will be constructed, extending approximately 200-feet from the bottom of the vertical shaft into the proposed tunnel alignment. The starter tunnel will be used to as a staging area for assembling and launching the TBM. The TBM will be utilized to bore an approximately 14-foot diameter tunnel through approximately 15,000 linear feet of basalt bedrock (**Exhibit 9**). The TBM is designed to “grip” the sides of the tunnel and push forward with the force necessary to fracture the bedrock to create the tunnel. From the center of TBM “cutter head”, conveyors will transport the rock fragments (i.e., “muck”) to the rear of the TBM which will then be collected and transported via rail car to the surface for disposal. The gravity flow tunnel is aligned to travel mostly beneath

Oneawa Hills to take advantage of what is anticipated to be relatively homogenous basalt bedrock. Due to the strength of the basalt bedrock, as confirmed by numerous test borings and geologic studies, tunnel support mechanisms are anticipated to be minimal. If the TBM encounters fractured rock it can install devices (i.e., rock-bolts) that will provide structural support of the rock mass. If additional support is necessary, welded wire mesh pinned by rock bolts will be installed or a more robust solution that consists of the placement of circular metal rib supports that can hold loose rock in place (**Exhibit 10**).

Following complete excavation of the tunnel, a 10-foot diameter fiberglass tunnel liner will be installed along the excavated tunnel with the spaces between the excavated tunnel and the liner to be grouted for added stability and to provide the necessary grade for gravity flow (**Exhibit 11**). After the insertion of the liner the primary work at the Kailua Regional WWTP will convert from TBM staging and muck removal to construction of the Influent Pump Station.

The purpose of the proposed project was initially to provide a backup system to the existing force main wastewater conveyance system that is currently in operation. As the design and planning phase of the proposed project progressed, it was determined that a gravity flow tunnel would be more conducive to obtaining the objectives of the regional wastewater management plan. Since the most reliable and cost-effective way to collect and convey wastewater is by gravity flow, the Gravity Tunnel system raises the possibility of simultaneously addressing another service need; to reduce wastewater spillage that occur as a result of excessive storm water/groundwater influence. The gravity flow tunnel has been designed to store sudden, unexpected high flows of wastewater, similar in character to a reservoir. Force mains, as are currently in place, do not have the capacity to accommodate such flows; when peaks in wastewater flows coincide with high rainfall events, storm water can enter the system which must then be treated as if it were wastewater before proper disposal. During these "flow peaks" wastewater spillages may occur causing localized flooding in the area. Construction of the gravity flow tunnel would allow the existing force main to be abandoned and the Kaneohe WWPTF to be decommissioned as pre-treatment and pumping into the force main would no longer be necessary.

SUMMARY OF COMMENTS:

The Office of Conservation and Coastal Lands (OCCL) referred the application to the following agencies and offices for review and comment: DLNR - Division of Forestry and Wildlife (DOFAW), Historic Preservation Division (SHPD), Division of Aquatic Resources (DAR), Land Division, Oahu Branch (ODLO), Engineering Division, the Commission on Water Resources Management (CWRM), the Hawaii State Department of Health, the Office of Hawaiian Affairs (OHA), and the City and County of Honolulu - Department of Planning and Permitting and Department of Public Works. The application was also provided to US Army Corps of Engineers (USACOE) and the US Environmental Protection Agency (EPA) along with the Kaneohe and Kailua State Libraries and to the Kaneohe Neighborhood Board (#30) and the Kailua Neighborhood Board (#31).

Comments received from the following entities have been summarized by staff as follows:

DLNR – Engineering

We confirm that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Zones D and X. The National Flood Insurance Program does not have any regulations for developments within Zones D and X.

Applicant Response: We concur that the project is located in the aforementioned FIRM Zones D & X and that the NFIP has no regulations for work in these areas.

DLNR – Division of Forestry and Wildlife (DOFAW)

No comments were received.

DLNR – Land Division (Oahu)

No comments on the proposed project.

DLNR – Division of Aquatic Resources (DAR)

No comments on the proposed project.

DLNR – State Historic Preservation Division (SHPD)

No comments were received.

DLNR – Commission of Water Resource Management (CWRM)

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 the use of alternative water sources, wherever practicable;
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.

Applicant Response:

1. *The City and County of Honolulu (CCH) – Department of Design and Construction (DDC) will coordinate with the CCH – Department of Planning and Permitting and/or the Board of Water Supply (BWS) to incorporate this project into the County's Water Use and Development Plan:*
2. *Alternative water sources will be used whenever practicable;*
3. *As the route of the tunnel will traverse beneath Oneawa Hills, basal groundwater encountered during tunnel boring activities is likely to be brackish or even fresh, despite its location below sea level. Contact with groundwater will occur when the basalt rock is fractured. Water pressure would force water into the tunnel as opposed to flowing out of the tunnel into the groundwater system; therefore the potential for groundwater contamination is minimal. Since the tunnel boring activities will start from the Influent Pump Station at the Kailua Regional WWTP and then proceed uphill any water leaking*

into the tunnel will flow towards the WWTP where it will be collected and pumped out of the tunnel.

4. *The CCH-DDC has, and will continue to work with the State of Hawaii Department of Health to address any concerns that may arise regarding water quality.*

City and County of Honolulu – Department of Planning and Permitting

We note that the portion of the gravity tunnel which is within the Special Management Area (SMA), but not within the Conservation District (i.e., north of Kaneohe Bay Drive on the Kaneohe end), was granted a SMA Use Permit by the Honolulu City Council on July 10, 2013 (*Resolution No. 13-136, CDI*); and

We also note that construction and grading plans for some of the project components at the Kailua WWTP, which are not within the SMA or Conservation District, have been issued.

Applicant Response:

We appreciate your confirmation that a portion of the gravity tunnel is within the Special Management Area (SMA), but not in the Conservation District and that portion of the project was granted an SMA Use Permit by the Honolulu City Council on July 10, 2013; and

We also appreciate your confirmation that construction and grading plans for some of the project components at the Kailua WWTP, which is neither in the SMA or Conservation District, has been issued.

State of Hawaii – Department of Health

No comments on the proposed project.

ANALYSIS:

Following review and acceptance for processing, the Applicant's Agent was notified, by letter dated *September 30, 2013* that:

1. The construction of a new wastewater gravity flow tunnel and emergency access shaft are identified land uses in the Conservation District General Subzone pursuant to Hawaii Administrative Rules (HAR) §13-5-22, P-6, **PUBLIC PURPOSE USES, (D-1)** *Not for profit land uses undertaken in support of a public service by an agency of the county, state, or federal government, or by an independent non-governmental entity, except that an independent non-governmental regulated public utility may be considered to be engaged in a public purpose use. Examples of public purpose uses may include but are not limited to public roads, marinas, harbors, airports, trails, water systems and other utilities, energy generation from renewable resources, communication systems, flood or erosion control projects, recreational facilities, community centers, and other public purpose uses, intended to benefit the public in accordance with public policy and the purpose of the conservation district. As always, the final decision to approve, modify, or deny the CDUA lies with the Board of Land and Natural Resources;*
2. Pursuant to HAR §13-5-40, **HEARINGS**, a public hearing will not be required;

3. In conformance with Chapter 343, Hawaii Revised Statutes (HRS), as amended, and Chapter 11-200, HAR, an Environmental Impact Statement (EIS) has been completed for the proposed project. A Final EIS (FEIS) was submitted to this office with the City and County of Honolulu, Department of Environmental Services as the accepting authority. Notification of the FEIS - FONSI was published in the Office of Environmental Quality Control (OEQC) publication the *Environmental Notice* on May 23, 1011; and
4. The portion of the gravity flow tunnel which lies within the Conservation District is not located in the Special Management Area (SMA) although an SMA Use Permit was issued to the applicant by the Honolulu City Council on July 10, 2013 for the portions of the proposed project that lie within the SMA.

Notice of this Conservation District Use Application (CDUA) was published in the *November 8, 2013* issue of Office of Environmental Quality Control (OEQC) document the Environmental Notice; no comments were received from the public.

ADDITIONAL PERMITTING AND REGULATORY ANALYSIS:

Pursuant to a May, 2007 Stipulated Order issued by the Environmental protection Agency (EPA), the City and County of Honolulu (CCH) began pursuing construction of a new force main (FM2) (**Exhibit 12**) to supplement the existing force main (FM1) which is currently conveying pre-treated wastewater from the Kaneohe WWPTF to the Kailua Region WWTP. This stipulated order has since been incorporated into an overarching 2010 judicial consent decree (2010 Decree). The decree requires that FM2 be completed and operational by December 2014, or the CCH could be subject to daily monetary fines. Over the past 3 years the CCH has been diligently pursuing planning and design of FM2 to replace the existing FM1 to meet the deadlines for compliance. In 2010 a new solution involving the construction of a gravity-flow sewer tunnel was purposed as an alternative to the construction of the FM2 wastewater conveyance method.

The Gravity Tunnel alternative was not considered previously as it was determined to not be cost-effective; however, after considering new technology and constant maintenance costs associated with FM1 and FM2 it was determined that the Gravity Tunnel would be the preferred method for the new wastewater conveyance system.

A pre-assessment consultation process included efforts to inform the community and solicit input in scoping of the draft EIS. The process included formal written consultation (pursuant to HRS §343 and HAR §11-200); meetings with elected officials, agencies (i.e., federal, State and local), and stakeholders; public information/scoping meetings in the community and a core working group to incorporate all concerns, comments and variable into the final proposal. A public information meeting was held on September 28, 2010 to determine what would be included in the EIS. From the FEIS document it appears that the majority of public comments aimed to address the alternatives proposed and the work being conducted outside of the Conservation District (i.e., at the WWTP and WWPTF). The main concern regarding the work being proposed within the Conservation District related to noise and vibration, and the potential effects on nearby homeowners. The contactor and CCH has determined that noise and vibration monitoring will be conducted to alleviate any concerns from the neighboring properties; initially a pre-assessment of

structures will be completed which will allow for a determination of any impacts related to the drilling activities.

§13-5-30 CRITERIA:

The following discussion evaluates the merits of the proposed land use by applying the criteria established in HAR §13-5-30.

- 1) *The proposed use is consistent with the purpose of the Conservation District.*
The objective 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.

The project is consistent with the purpose of the Conservation District General Subzone as the Gravity Tunnel will replace the existing, outdated, force main, therefore reducing the potential for wastewater spills that might otherwise occur should the existing wastewater force main system fail. The proposed Gravity Tunnel also has the capacity to receive and store wastewater flows, especially during peak flow conditions as a result of excessive storm water and ground water entering the wastewater collection system. This proposed work will also reduce the potential for spills during wet weather conditions.

The only surface feature within the Conservation District is the vertical access shaft being constructed on the existing BWS reservoir parcel, which is development with structures, landscaping and access roads. The proposed access shaft will be in-line with the character of the site as the only new structure visible would be a low-profile manhole cover.

The Gravity Tunnel will have little impact on the long-term stability of the land and is designed to improve public health, safety and welfare by replacing the failing force main system.

- 2) *The proposed land use is consistent with the objectives of the Subzone of the land on which the use will occur.*

The objective of the General Subzone is to *designate open space where specific conservation uses may not be defined, but where urban use would be premature.* The proposed use is an identified land use in the General Subzone of the Conservation District pursuant to HAR §13-5-22, P-6 **PUBLIC PURPOSE USES (D-1) Not for profit land uses undertaken in support of a public service by an agency of the county, state, or federal government, or by an independent non-governmental entity, except that an independent non-governmental regulated public utility may be considered to be engaged in a public purpose use.**

Since the portion of the proposed project that occurs within the Conservation District is situated well below ground, no impacts to open space resources are anticipated as a result of constructing or operating the new wastewater/storm water system. As the only surface land uses proposed within the conservation district is the access tunnel, which is sited at the existing BWS reservoir site that is already heavily developed, impacts to open space

resources will be non-existent. Therefore staff believes the surrounding conservation district will not be affected and that this project will not alter the existing character of the Oneawa Hills.

- 3) *The proposed land use complies with the provisions and guidelines contained in Chapter 205A, HRS entitled "Coastal Zone Management" (CZM), where applicable.*

The CZM program is intended to promote the protection and maintenance of fragile coastal resources through the state of Hawaii. While portions of the proposed project site are located within the CCH Special management Area (SMA) and the Coastal Zone, no work being proposed in the conservation district lies within the SMA. The applicable objectives of the CZM that relate to the proposed project within the Conservation District are listed below:

Recreational Resources:

The nearest recreational resource to the gravity tunnel within the conservation District is an established trail that is often used for hiking the area known as Oneawa Hills, Kokokahi Ridge, or Kawaewae; the trail follows along the ridge of the Oneawa Hills from Friendship Gardens to the end of Lipalu Street. Since the portion of the proposed tunnel within the Conservation District would be will below ground, no impacts to recreational resources (i.e., Oneawa Hills Trail) are anticipated from either construction or operation of the gravity tunnel.

The proposed vertical access shaft, the only proposed work on the surface within the Conservation District, is located 0.7 miles from the existing trail and will be constructed entirely on the existing fenced in BWS reservoir site which is not accessible by the public. Based on the subsurface location of the majority of the proposed project and the location of the surface work within an area with no current public access, staff believes there will be no impacts to the recreational resources of the area.

Archeological Resources:

An Archeological Assessment Report (AAR) was conducted for the proposed project in November 2012 which determined that there are no known historic or archeological sites on the ground surface along the portion of the proposed tunnel alignment that is located within the Conservation District. The BWS parcel that will house the access shaft has already been heavily developed and/or impacted and is not accessible to the public; previous work has shown the BWS site contains no archeological and /or cultural resources. Should any significant historic or archeological resources be found during construction activities, all work shall cease within the immediate area and the State Historic Preservation Division (SHPD) shall be notified immediately.

Scenic and Open Space Resources:

Since the portion of the proposed tunnel situated within the Conservation District will be located deep underground, no impacts to scenic and/or open space resources are anticipated as a result of constructing and operating the proposed gravity tunnel. All surface work being proposed, both in and outside the Conservation District, will occur at previously established or disturbed sites (i.e., Kailua Regional WWTP, BWS Reservoir

Site) which will be in character with the existing structures, conveyances and facilities already present.

Coastal Resources/ Coastal Hazards:

The nearest coastal water body to the portion of the proposed gravity tunnel within the Conservation District is Kaneohe Bay, located 0.4miles at its closest point. Since the portion of the proposed tunnel within the Conservation District is situated below ground, no impacts to coastal ecosystems are anticipated as a result of the construction or operation of the tunnel. Additionally, the proposed tunnel will have a net positive impact by reducing and/or eliminating runoff from entering Kaneohe Bay during storm or high rainfall events as it does now with the current force main system.

Managing Development and Public Participation:

Two public informational meetings were held in conjunction with the EIS process for the proposed project and the alternatives discussed early in the planning phases. The first meeting was a scoping meeting for the EIS held in September, 2010 and the second, held in February, 2011, was held to present to project studied in the Draft EIS; present key findings of the Draft EIS, and solicit verbal and written comments from the public. In addition to these two (2) meetings, individual meetings were conducted with various agencies, organizations, elected officials and stakeholders.

A Core Working Group (CWG) was created to establish and maintain dialogue with a diverse group of people from various parts of the community during the planning and design phases of the proposed project. The CWG comprised of three types of community groups; individual stakeholders with unique interests (i.e., homeowners); organizations and agencies (i.e., state and federal); and the general public (i.e., Kaneohe and Kailua region residents); 23 people participated in the CWG process.

The public, community organizations, landowners, and other potential stakeholders' entities have been provided multiple opportunities to comment on the proposed project. Government agencies, community organizations, and other interested parties have been consulted through various meetings and the EA/EIS Preparation Notice (EISPN) comment process. The Special management Area (SMA) permit process, as well as the Conservation District Use Application (CDUA) process, has provided additional opportunities for the public to provide comments or input on the proposed project.

- 4) *The proposed land use will not cause substantial adverse impact to existing natural resources within the surrounding area, community or region.*

Since the portion of the proposed tunnel within the Conservation District would be well below the ground surface, no impacts on natural resources associated with the surface are anticipated. Basalt rock (i.e., bedrock) is a natural resource used primarily for construction here in Hawaii, although it is unlikely that the bedrock, at this depth, would be needed (i.e., mined) in the future.

In the short term, there will be soil disturbance impacts related to construction activities at the vertical access shaft site. Construction in this area will entail the disturbance of soils at

the surface and may include excavation, movement of construction equipment, stockpiling of construction material and excavated material as well as material from the shaft excavation. While the vertical access shaft site will require less than one (1) acre of soil disturbance, the project is subject to *Section 402* of the *Clean Water Act*, which requires an Individual National Pollutant Discharge Elimination System (NPDES) Permit for Construction Storm water due to the combined area of soil disturbance for the overall project (i.e., both inside and outside the Conservation District). Best management Practices (BMPs) with regards to soil loss, soil erosion and runoff will be incorporated during all phases of construction (**Exhibit 13**).

During construction the Gravity Tunnel may encounter groundwater where the basalt bedrock is fractured. If significant amounts of groundwater are encountered in fractured basalt, holes can be drilled ahead of the TBM and grout injected under pressure to locally seal off groundwater infiltration into the tunnel. By boring uphill from the Kailua Regional WWTP, groundwater that is encountered will flow out of the tunnel via gravity flow and drain into the shaft at the Kailua Regional WWTP for removal. Hence, any contaminant that may occur will not flow into the groundwater system; instead it will be collected and transported for disposal and/or treatment. Once completed, the tunnel will be completely sealed from the groundwater system through the installation of the tunnel lining and the placement annular grouting in the spaces between the lining and bore hole.

- 5) *The proposed land use, including buildings, structures and facilities, shall be compatible with the locality and surrounding areas, appropriate to the physical conditions and capabilities of the specific parcel or parcels.*

Since the portion of the proposed project that lies within the Conservation District is primarily underground, no impacts to surrounding areas associated with the surface are anticipated as a result of construction or operation of the tunnel.

The BWS Reservoir site, where the vertical access shaft will be located, currently contains an access road, perimeter fencing, and a water tank. The proposed vertical access shaft will be a covered manhole which will be visually consistent with the existing character of the BWS Reservoir site (**Exhibit 14**).

- 6) *The existing physical and environmental aspects of the land, such as natural beauty and open space characteristics, will be preserved or improved upon, whichever is applicable.*

As no new surface impacts are being proposed within the conservation district, besides the work within the existing BWS Reservoir site, staff anticipates that there will be no impacts on the natural beauty and open space character of the area.

- 7) *Subdivision of land will not be utilized to increase the intensity of land uses in the Conservation District.*

The proposed project does not involve subdivision of Conservation District land.

- 8) *The proposed land use will not be materially detrimental to the public health, safety and welfare.*

The purpose of the Gravity Tunnel is to replace the existing force main currently in operation. The proposed tunnel has been designed to reduce the potential for wastewater spills that might otherwise occur should the existing wastewater force main system fail. The proposed tunnel also has been designed to receive and store wastewater flows, especially during peak flow or storm flow conditions as a result of excessive storm water and groundwater entering the wastewater collection system; this will reduce the potential for spills during wet weather conditions. In addition to the NPDES and SMA permit requirements the project is subject to §11-54, HAR regarding compliance with the State of Hawaii – Department of Health (DOH) water quality standards. A site specific BMP Plan has been submitted to the DOH for review and approval in conjunction with the Federal NPDES permit application.

Primary Public Concern – Ground Vibrations

Ground vibrations, from the construction of the tunnel within the Conservation District, would be limited to the use of the TBM during excavation of the Gravity Tunnel. In general, the greater the separation distance between the TBM and “receptor” (i.e., structure or monitoring location), the lower the ground vibration will be. Ground vibration levels for the proposed project are anticipated to be approximately 0.01 inches per second at a separation distance of 150-feet. This level (0.01 in/sec) is much lower than the 0.15 in/sec which is the most conservative vibration level for “potential damage to structures” (**Exhibit 15**); this level occurs when separation is less than 25-feet. At its closest point the TBM will be approximately 150 feet from the nearest structures, located beneath Moakaka Place while at the other end the TBM will be approximately 200-feet below the Yacht Club Terrace subdivision residences.

Subsequent to the publication of the Final EIS for the project, a number of residents in the general vicinity of the tunnel alignment expressed concerns about ground vibrations causing property damage, exacerbating the slope instability and the potential of rock falls. Towards addressing their concerns, and to establish a database for determining if tunneling operations could have resulted in property damage, the CCH established a monitoring program for concerned property owners. The program includes procedures for inventorying existing damage, tracking subsidence and slope stability prior to and during construction, and vibration monitoring during construction. In addition the CCH is requiring the construction contractor to provide a process for reporting, assessing and pursuing ground vibration damage claims.

DISCUSSION:

The purpose of the proposed Gravity Tunnel is based on the requirement to reduce the potential for wastewater spillage that occurs from the existing force main conveyance system. The Gravity Tunnel raises the possibility of simultaneously addressing the need to reduce wastewater spillage due to excessive storm water and to minimize groundwater from entering the wastewater collection system. While an alternative alignment for a wastewater conveyance system, known as Force Main 2, was explored, it was determined that the proposed Gravity Tunnel alignment posed

the least hazard, and potential for environmental impacts. The alternative (Force Main 2) location sited the conveyance system entirely below the substrate of Kaneohe Bay and included potential impacts not associated with tunneling through bedrock (i.e., FRAC-outs).

The proposed improvements will have beneficial long-term water quality impacts on coastal waters by reducing the risk and associated wastewater spills that could potential enter coastal waters and Kaneohe Bay. The purpose of the Gravity Tunnel is to eliminate reliance on the existing force main to convey wastewater from the Kaneohe WWPTF to the Kailua Regional WWTP. This will prevent potential wastewater spills by removing the need for pumping in addition to providing for the storage of peak wet-weather inflow and infiltration in the collection system.

The impacts to the Conservation District are limited to the surface work located at the existing BWS Reservoir site for the vertical access shaft and the underground tunneling by the TBM. As these surface impacts are minor, staff believes that the proposed project, as a public purpose use, is necessary and is in character with the surrounding uses. Additionally this project has been specifically designed to minimize or eliminate impacts associated with wastewater and storm water runoff and spoils and as such will provide a more reliable wastewater/storm water conveyance system for the Kaneohe and Kailua Region.

The applicant will be required to implement standard construction BMPs to reduce potential impacts during the construction and development phases of the Gravity Tunnel; more specifically the vertical access shaft which includes surface impacts. Construction activities will comply with applicable federal, State and County regulations and standards, and noise and air quality potential impacts will be mitigated through compliance with the Department of Health regulations.

Cultural Impact Analysis:

A Cultural Impact Assessment (CIA) report was completed for the proposed Kaneohe-Kailua Wastewater Conveyance project in support of the proposed project's environmental review process. The CIA examined cultural and historical resources; reviewed previous archeological and cultural work at or near the project site; consulted with knowledgeable parties regarding cultural practices in the area and prepared a report that summarized the findings. The agent contacted all relevant agencies in preparation of the CIA report which included the State Historic Preservation Division (SHPD), the Office of Hawaiian Affairs (OHA), and the Oahu Island Burial Council (OIBC), along with various community and cultural organizations within Kaneohe. To assist in the determination of current and previous gathering practices regarding the areas natural and cultural resources the agent initiated interviews with local *Kapuna* (elder) and *Kama'aina* (Native born) in which questions were asked that focused on gathering practices, *mauka* and *makai* resources, burials, trails, historic properties and *wahi pana* (celebrated places).

Archeological and historical investigations suggest that many of the ahupua'a within the moku of Ko'olaupoko contained well developed fishpond systems and stream-fed upland terraces. The estuary system of Kaneohe Bay contained lagoons and productive fisheries where native Hawaiians harvested fish such as the *'ama'ama* and the *awa*; there may have been as many as 30 loko i'a (fish ponds) on Kaneohe Bay during pre-Māhele times. Major development of the area was influenced by the change to pineapple and rice farming which then led to the eventual

construction of the necessary infrastructure for a growing community. Kāwā Stream, which formerly flowed into Waikalua Loko fishpond, was channelized in the 1960's and 1970's to flow into Kaneohe Bay. Kaneohe Stream, which had provided water for *lo'i* and rice farming, was also channelized and dammed in the 1970's.

A number of interviews were conducted to assess the potential impacts the proposed project may have on cultural and native practices in the area. A review of the interview transcripts reveal that the majority of the interviewees determined that fishing, gathering at the shoreline, and fishponds were the most important cultural and native practices in this area, and that increased development over the years has influenced, and even eliminated, access and the resource. There were some concerns regarding the potential for inadvertent discoveries of burial sites not previously located, although the concern focused on the areas immediately surrounding the Kailua WWTP and the Kaneohe WWPTF, not in the conservation district portion of the project (i.e., Oneawa Hills).

Many of the interviewees stated that they are not aware of any historical, cultural or archeological sites at or near the project area within the conservation district and as such none provided any concerns or recommendations regarding the proposed tunnel. Therefore to the extent to which traditional and customary native Hawaiian rights are exercised, staff believes that the proposed action will have minimal to no effect on traditional Hawaiian rights in this region.

Since the majority of the proposed project activities within the Conservation District will occur at depths below 35-40 feet (~11m), surface impacts will be minimal to non-existent. The only location of surface work is within the established BWS reservoir site that has been previously developed with grading, construction of buildings, etc., and general landscaping. The BWS reservoir site is not accessible to the public. In the unlikely event subsurface prehistoric deposits or human burials are inadvertently discovered during construction or land uses activities, such activities would be immediately suspended in the vicinity of the discovery and SHPD would be notified. OCCL has concluded that the application meets the Conservation Criteria outlined in Hawai'i Administrative Rules (HAR) §13-5 and after careful review of the application, OCCL recommends that the Chair approve this proposal.

RECOMMENDATION:

Based on the preceding analysis, Staff recommends that the Board of Land and Natural Resources **APPROVE** this application for a Gravity Flow tunnel for wastewater/storm water conveyance located beneath the Oneawa Hills, in the Ko'olaupoko District, Island of O'ahu, on Tax Map Keys: (1) 4-2-015:009; (1) 4-2-017:001, 016, 018 & 021; (1) 4-4-011:013; (1) 4-5-101:037; (1) 4-4-012:001, 064 & 065; (1) 4-5-031:076; (1) 4-5-032:001, subject to the following conditions:

1. The permittee shall comply with all applicable statutes, ordinances, rules, and regulations of the federal, state, and county governments, and applicable parts of this chapter;
2. The permittee, its successors and assigns, shall indemnify and hold the State of Hawaii harmless from and against any loss, liability, claim, or demand for property damage, personal injury, and death arising out of any act or omission of the applicant, its successors, assigns, officers, employees, contractors, and agents under this permit or relating to or connected with the granting of this permit;

3. The permittee shall obtain appropriate authorization from the department for the occupancy of state lands, if applicable;
4. The permittee shall comply with all applicable department of health administrative rules, and the applicable parts of HAR §13-5-42;
5. Before proceeding with any work authorized by the department or the board, the permittee shall submit four copies of the construction plans and specifications for the various farm facility buildings to the chairperson or an authorized representative for approval for consistency with the conditions of the permit and the declarations set forth in the permit application. Three of the copies will be returned to the permittee. Plan approval by the chairperson does not constitute approval required from other agencies;
6. Unless otherwise authorized, any work or construction to be done on the land shall be initiated within one (1) year of the approval of such use, in accordance with construction plans that have been signed by the chairperson, and shall be completed within three (3) years of the approval of such use. The permittee shall notify the department in writing when construction activity is initiated and when it is completed;
7. All representations relative to mitigation set forth in the accepted Environmental Impact Statement (EIS) for the proposed use are incorporated as conditions of the permit;
8. The permittee understands and agrees that the permit does not convey any vested right(s) or exclusive privilege;
9. In issuing the permit, the department and board have relied on the information and data that the permittee has provided in connection with the permit application. If, subsequent to the issuance of the permit such information and data prove to be false, incomplete, or inaccurate, this permit may be modified, suspended, or revoked, in whole or in part, and the department may, in addition, institute appropriate legal proceedings;
10. When provided or required, potable water supply and sanitation facilities shall have the approval of the department of health and the county department of water supply;
11. Provisions for access, parking, drainage, fire protection, safety, signs, lighting, and changes on the landscape shall be provided;
12. Where any interference, nuisance, or harm may be caused, or hazard established by the use, the permittee shall be required to take measures to minimize or eliminate the interference, nuisance, harm, or hazard;
13. Obstruction of public roads, trails, lateral shoreline access, and pathways shall be avoided or minimized. If obstruction is unavoidable, the permittee shall provide alternative roads, trails, lateral beach access, or pathways acceptable to the department;
14. Except in case of public highways, access roads shall be limited to a maximum of two lanes;

15. During construction, appropriate mitigation measures shall be implemented to minimize impacts to off-site roadways, utilities, and public facilities;
16. Cleared areas shall be re-vegetated, in accordance with landscaping guidelines provided in this chapter, within thirty days unless otherwise provided for in a plan on file with and approved by the department;
17. Use of the area shall conform to the program of an appropriate soil and water conservation district or plan approved by and on file with the department, where applicable;
18. Specific Best Management Practices (BMP) outlined in the accepted Management Plan and throughout this staff report shall be utilized during all phases of the proposed project;
19. The permittee shall obtain a county building or grading permit or both for the use prior to final construction plan approval by the department;
20. For all landscaped areas, landscaping and irrigation shall be contained and maintained within the property, and shall under no circumstances extend seaward of the shoreline as defined in section 205A-1, HRS;
21. Artificial light from exterior lighting fixtures, including but not limited to floodlights, uplights, or spotlights used for decorative or aesthetic purposes, shall be prohibited if the light directly illuminates or is directed to project across property boundaries toward the shoreline and ocean waters, except as may be permitted pursuant to section 205A-71, HRS . All exterior lighting shall be shielded to protect the night sky;
22. The permittee acknowledges that the approved work shall not hamper, impede, or otherwise limit the exercise of traditional, customary, or religious practices of native Hawaiians in the immediate area, to the extent the practices are provided for by the Constitution of the State of Hawaii, and by Hawaii statutory and case law; and
23. Other terms and conditions as prescribed by the chairperson.

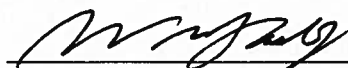
Failure to comply with any of these conditions shall render a permit void under the chapter, as determined by the chairperson or board.

Respectfully submitted,

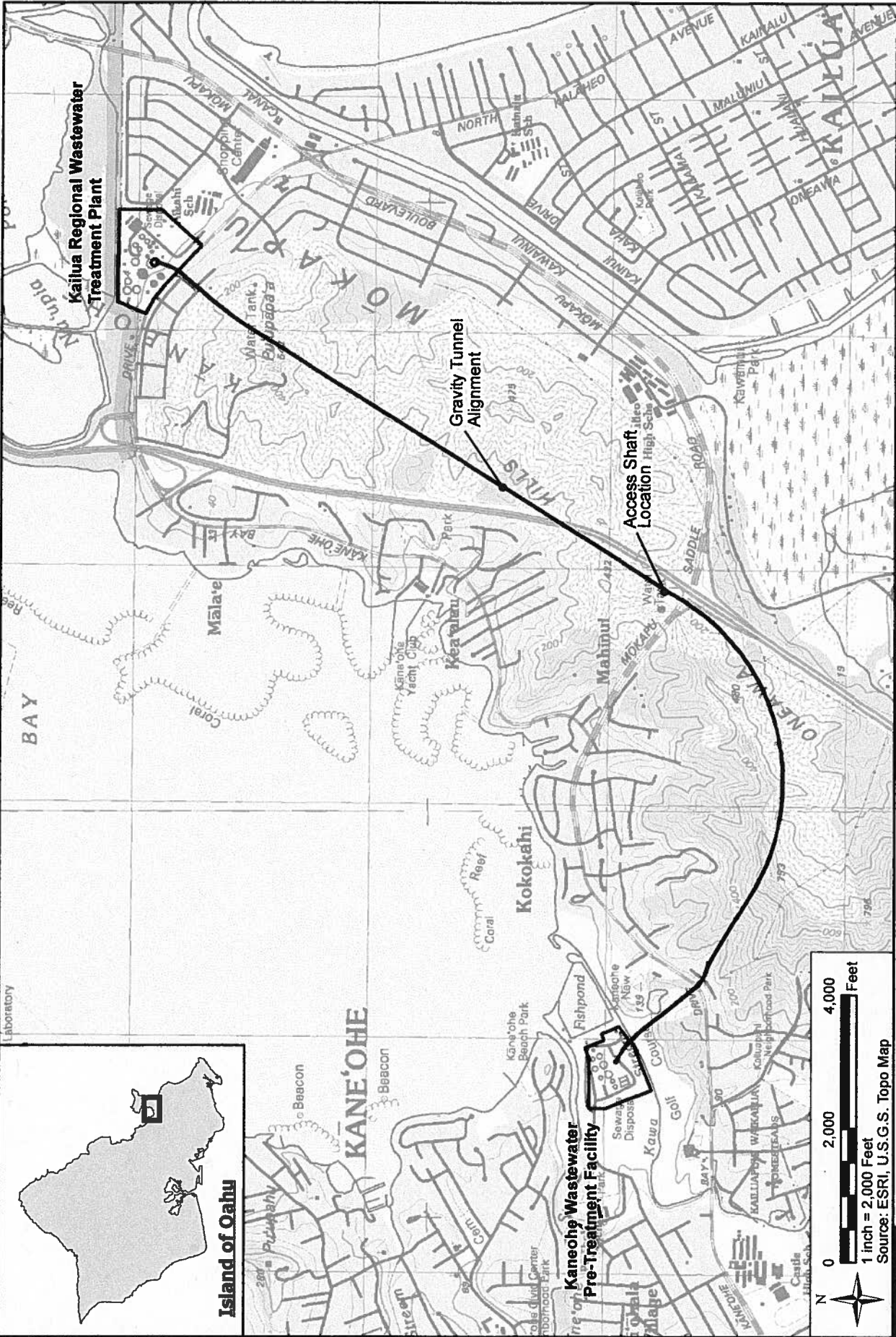


Alex J. Roy, M.Sc., Staff Planner
Office of Conservation and Coastal Lands

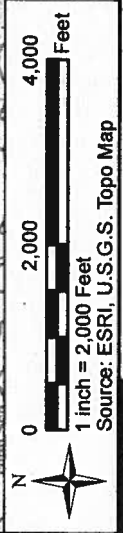
Approved for submittal:



William J. Aila, Jr., Chairperson
Board of Land and Natural Resources



Island of Oahu

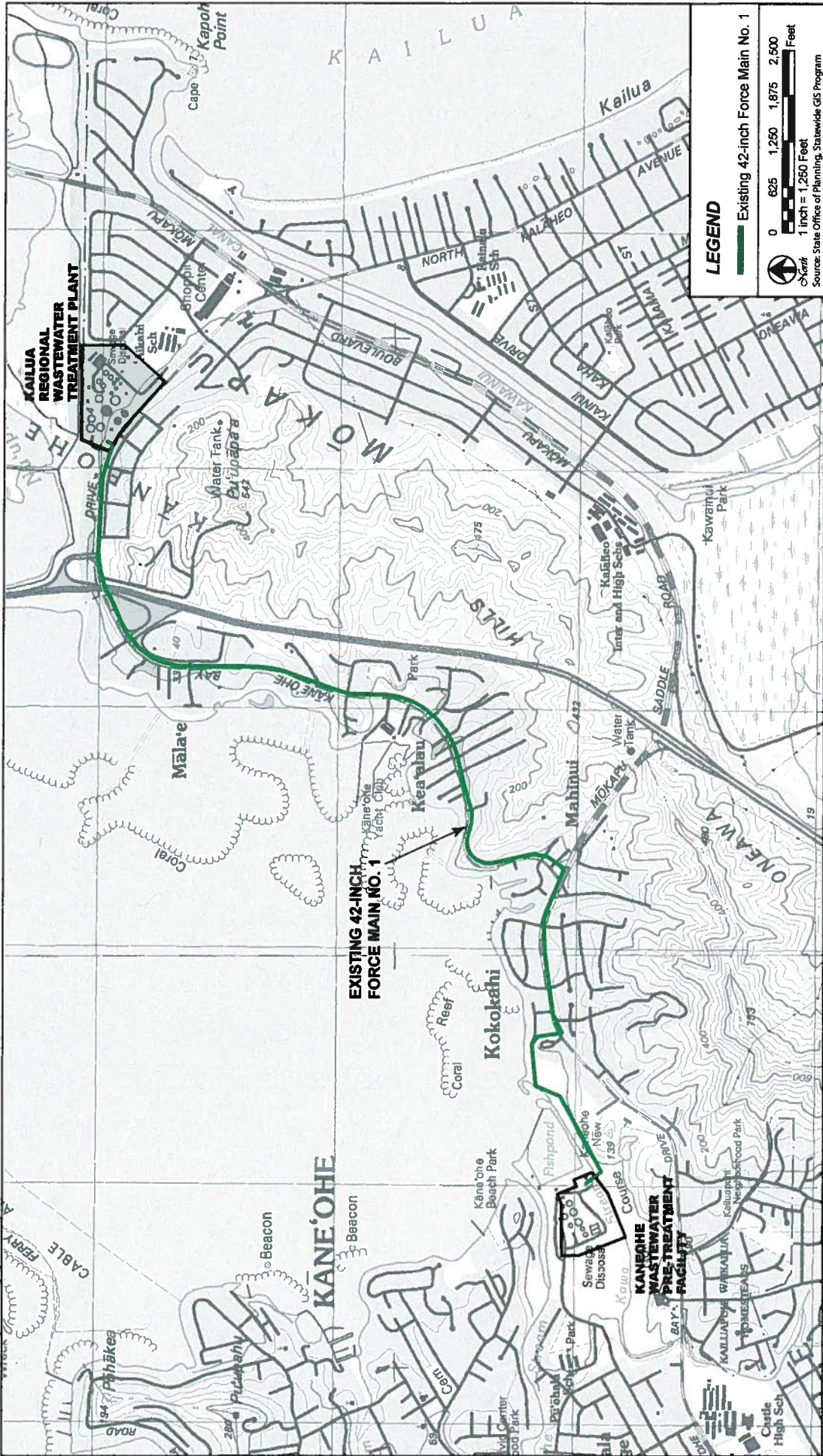


KANEOHE - KAILUA WASTEWATER CONVEYANCE AND TREATMENT FACILITIES - CONSERVATION DISTRICT USE APPLICATION



EXHIBIT 1 0A-3070

W-7801-01 Kaneohe Kohala Facility Plant Manning Agreement Final Map Draft ES



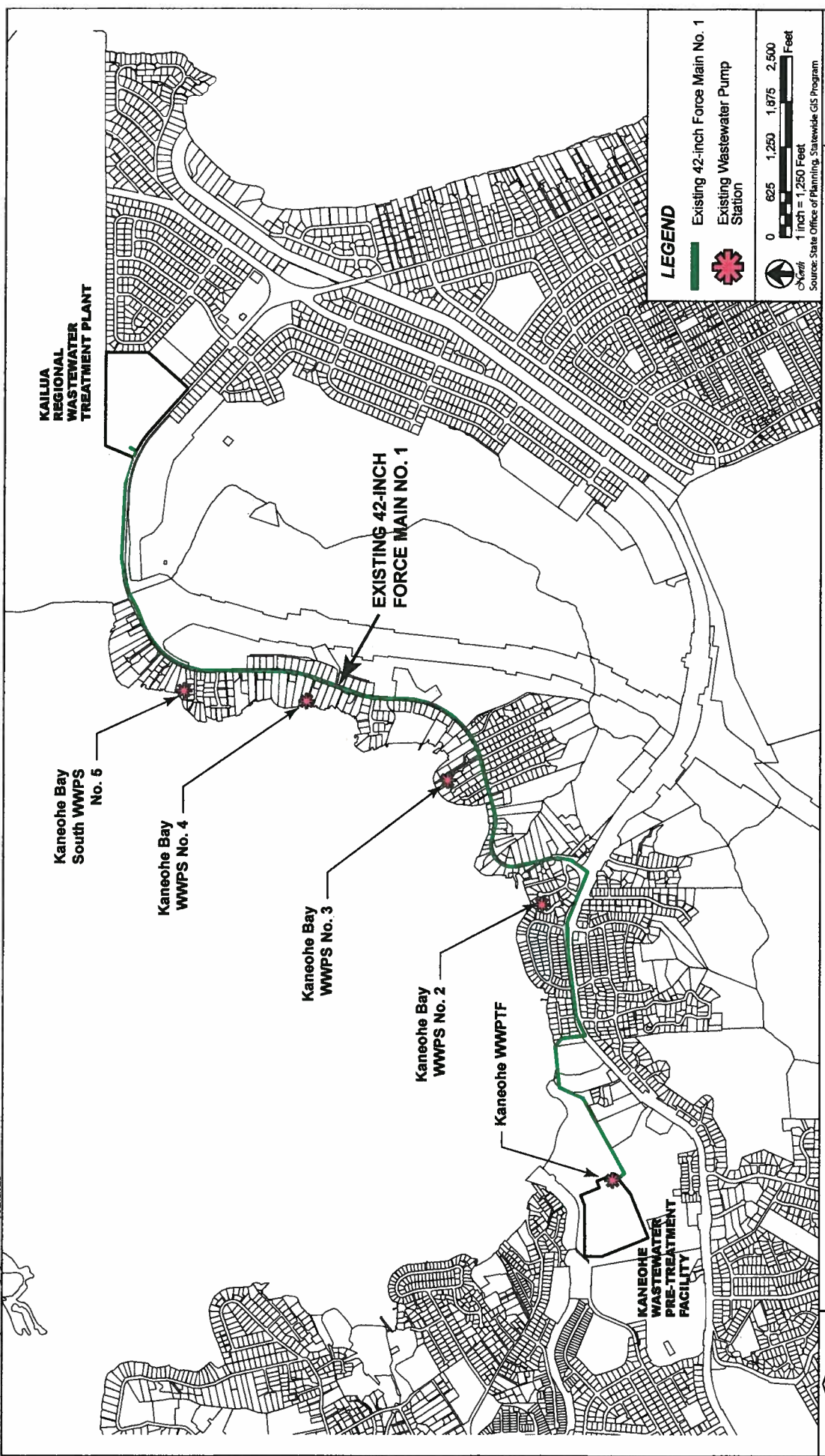
KANEOHE / KAILUA WASTEWATER CONVEYANCE AND TREATMENT FACILITIES

EXISTING 42-INCH FORCE MAIN NO. 1

WILSON OKAMOTO CORPORATION ENGINEERS • PLANNERS

EXHIBIT 2 OA-3670

W:\2011-01 Kaneohe Cellular Facility Plant Planning\Figure\Final Map\CDraft_EPS

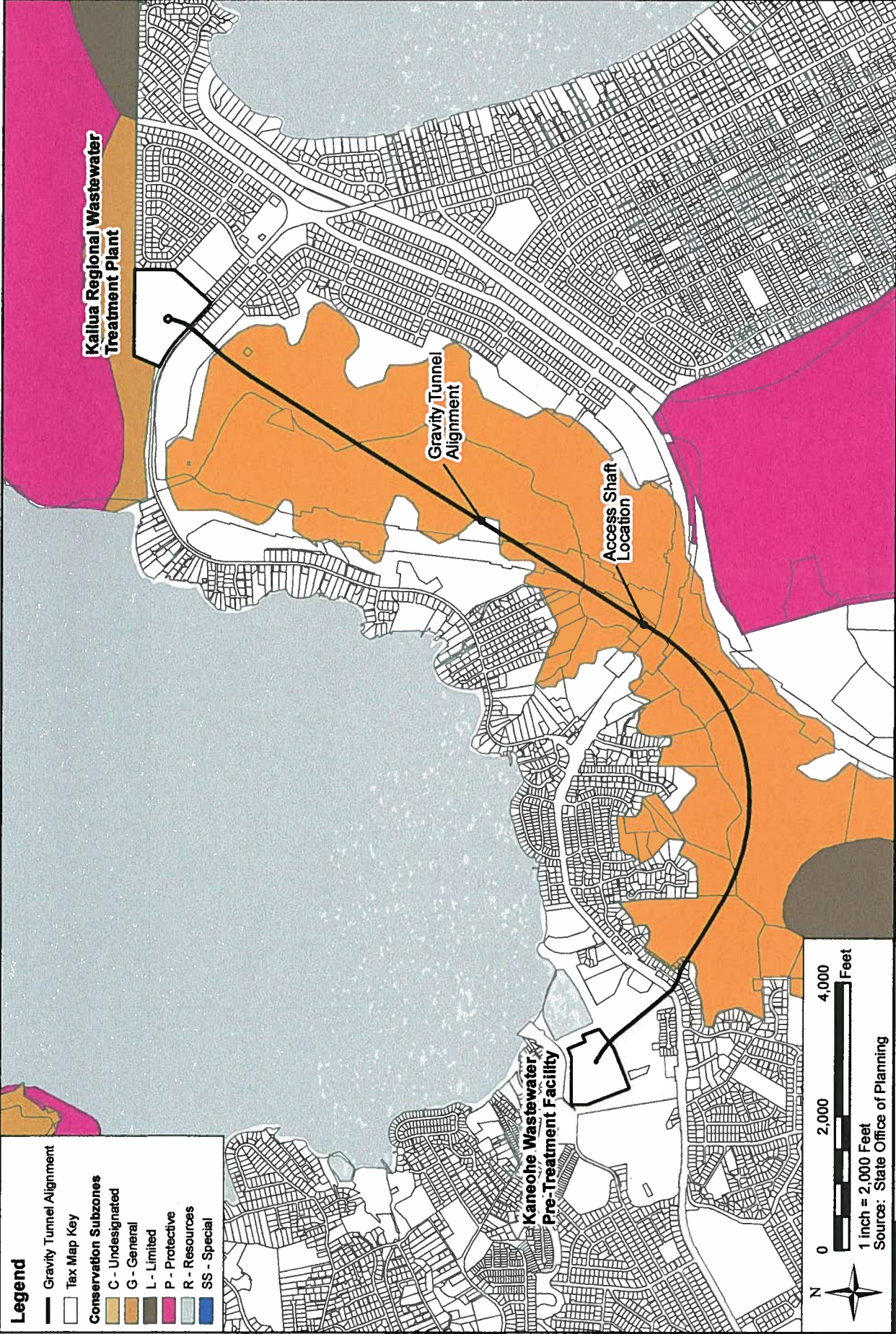


WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

KANEOHE / KAILUA WASTEWATER CONVEYANCE AND TREATMENT FACILITIES

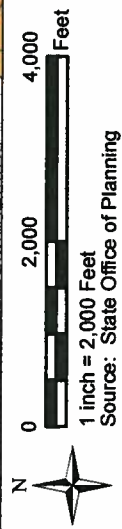
LOCATION OF PUMP STATIONS

EXHIBIT 3 *OA-3670*



Legend

- Gravity Tunnel Alignment
- Tax Map Key
- Conservation Subzones**
- C - Undesignated
- G - General
- L - Limited
- P - Protective
- R - Resources
- SS - Special



KANEOHE - KAILUA WASTEWATER CONVEYANCE AND TREATMENT FACILITIES - CONSERVATION DISTRICT USE APPLICATION

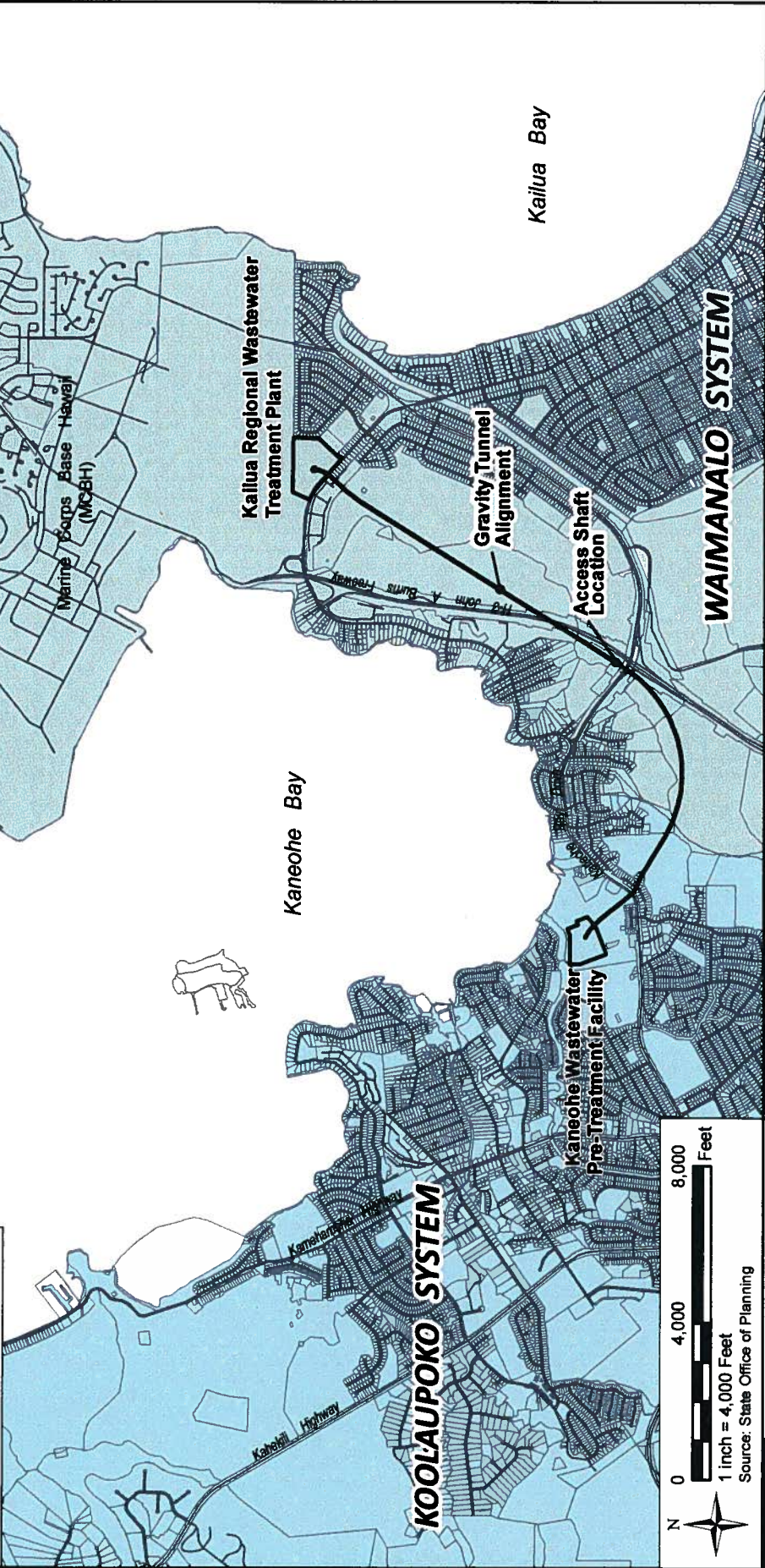
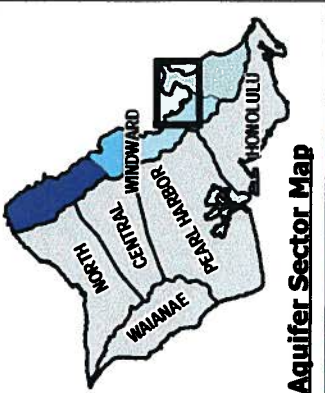
CONSERVATION SUBZONE MAP

EXHIBIT 4 OA-3670



EXHIBIT 5

OA-3670



KANEHOE - KAILUA WASTEWATER CONVEYANCE AND TREATMENT FACILITIES - CONSERVATION DISTRICT USE APPLICATION

AQUIFERS MAP

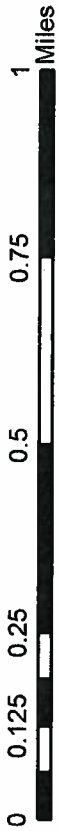
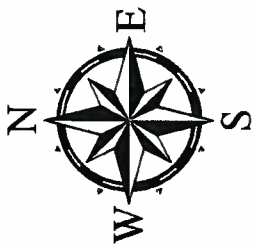


EXHIBIT 6

OA-3670

Approx. area covered under CDUA OA-3670

Approx. Tunnel location

approx. location of Access Shaft

KWWPTF

KRRWTP

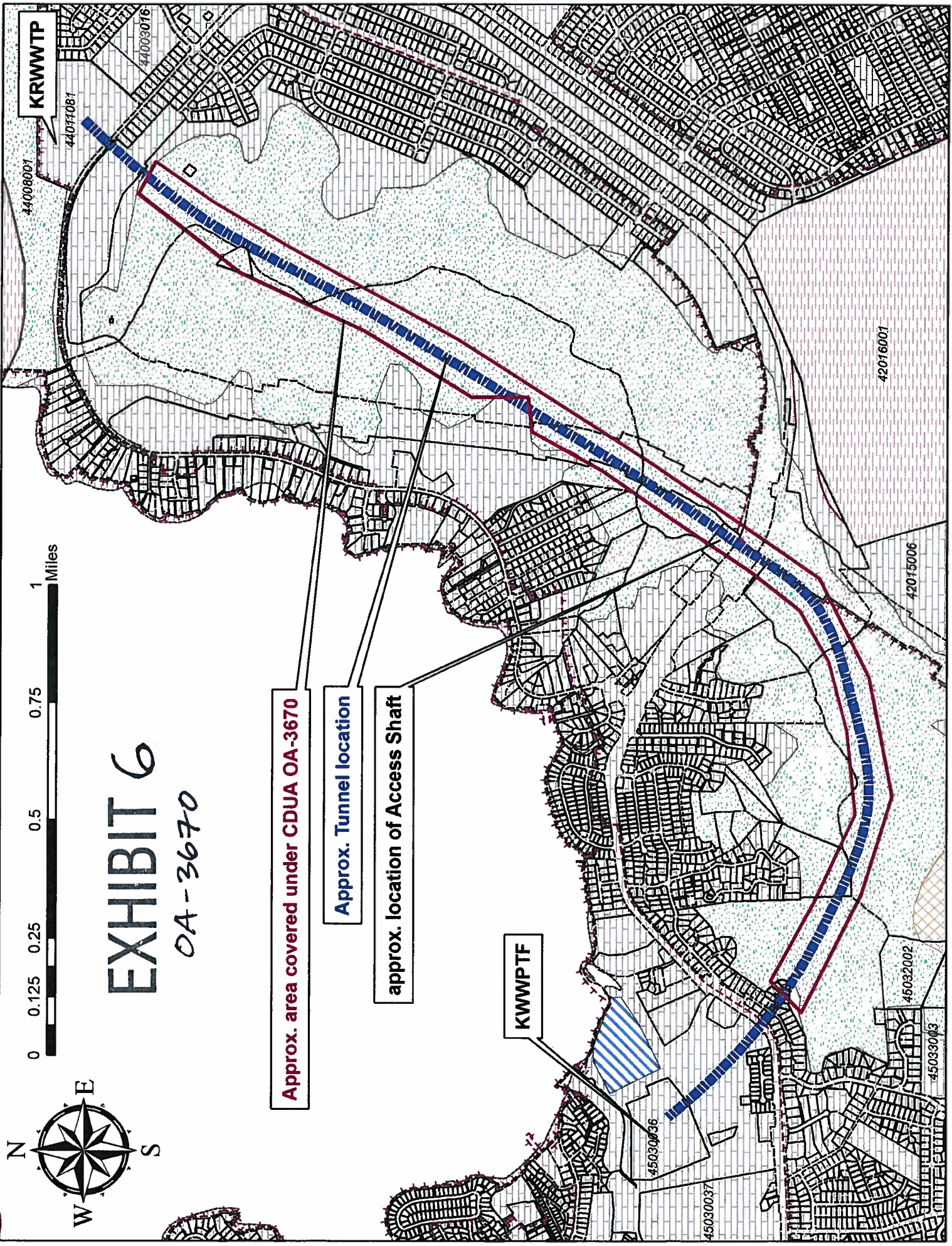
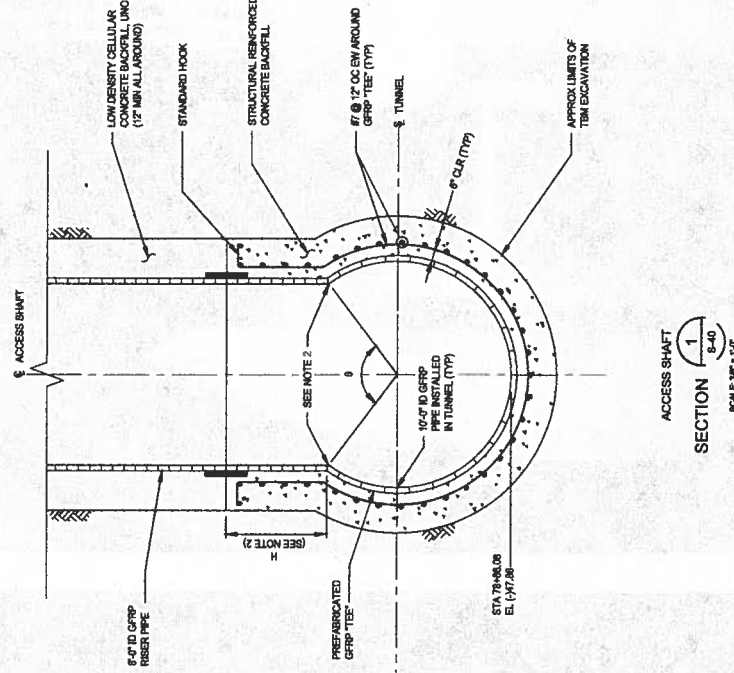
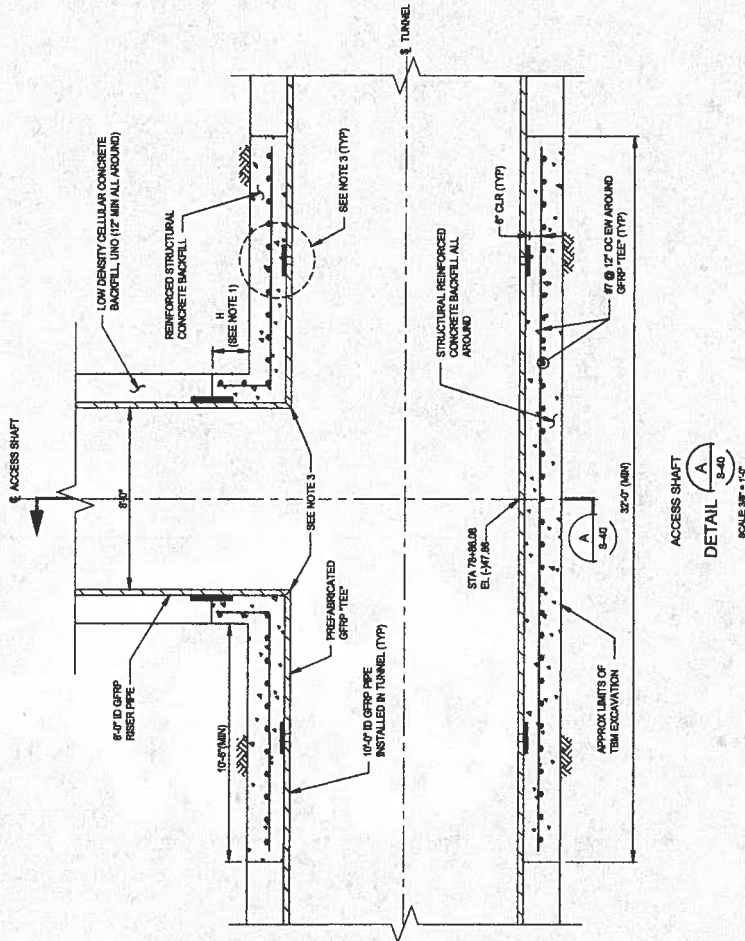


EXHIBIT 7

0A-3670

NOTES:

1. BACKFILL GRP "TEE" WITH STRUCTURAL REINFORCED CONCRETE TO THE TOP OF THE TEE AND STRUCTURAL CONCRETE TO THE TOP OF THE TEE. PROVIDE PLACEMENT OF THE RISER PIPE.
2. PROVIDE STRUCTURAL SUPPORT SUCH AS AT LUNG WITHIN THE TUNNEL UNDERNEATH THE "TEE" SECTION PRIOR TO INSTALLING AND BACKFILLING THE REMAINING ACCESS SHAFT RISER PIPE SEGMENTS.
3. JOINT DETAILS ARE SCHEMATICS ONLY. SUBMIT JOINT DETAILS FOR APPROVAL.



Source: S-41 Access Shaft Final Structure Details, Jacobs Associates, January 2013

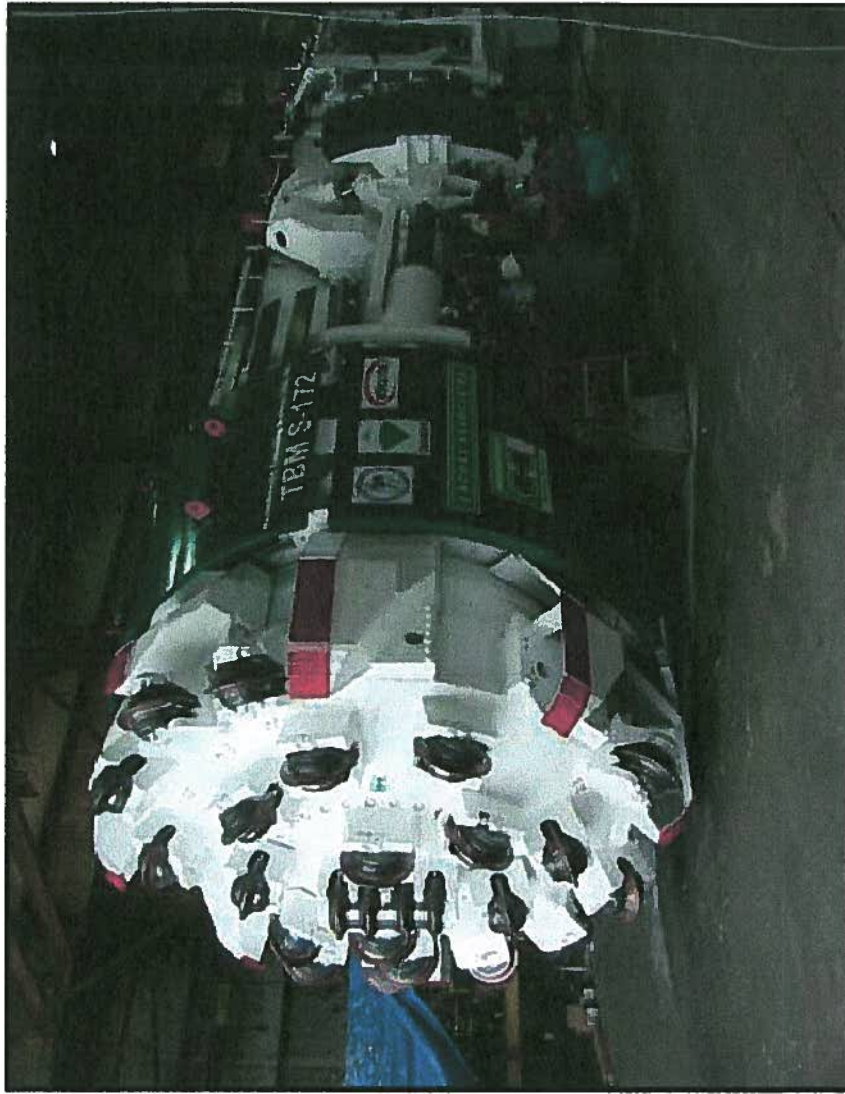
KANEIHE - KAILUA WASTEWATER CONVEYANCE AND TREATMENT FACILITIES - CONSERVATION DISTRICT USE APPLICATION

ACCESS SHAFT STRUCTURE DETAILS



EXHIBIT 8 OA-3670

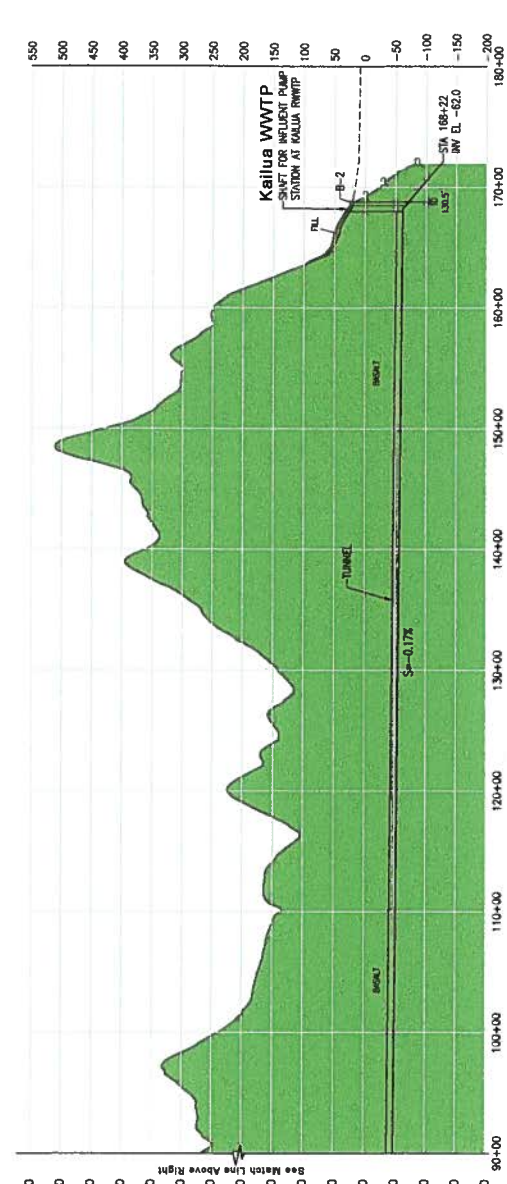
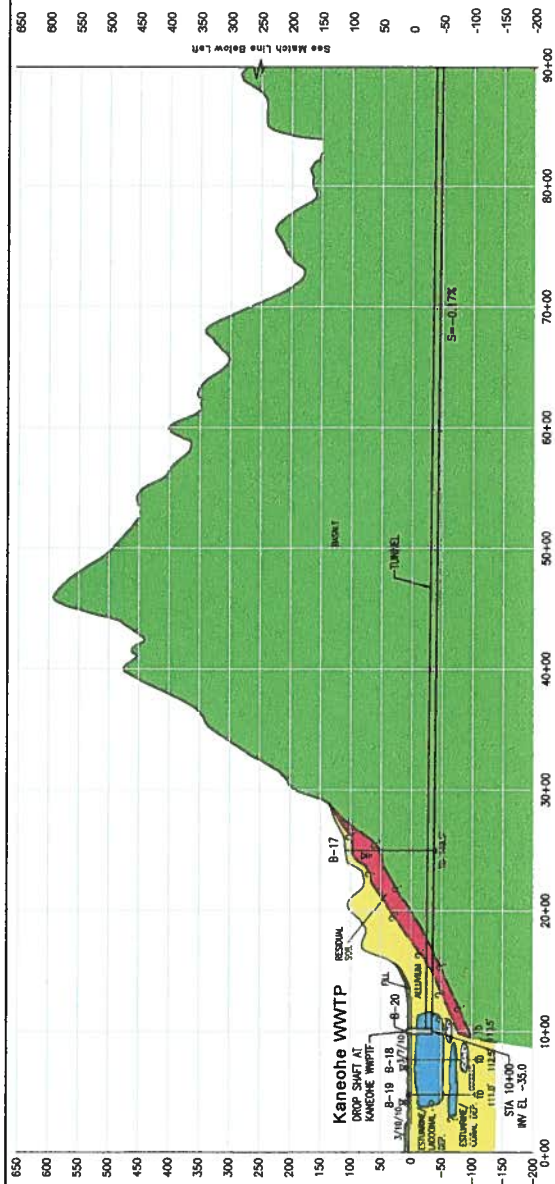
Rock Boring TBM with Rotating Cutter Head



Hydraulic Grippers



Source: Fig 2-21 Photos of Rock Boring TBM, FEIS Kaneohe/Kailua Wastewater Conveyance and Treatment Facilities
Wilson Okamoto Corporation, May 2011



GEOLOGY LEGEND:

| | |
|--------------|---------------------------------------|
| [Brown Box] | FILL |
| [Yellow Box] | ALLUVIUM |
| [Blue Box] | LAGOONAL/ESTUARINE/ CORAL DEPOSITS |
| [Red Box] | RESIDUAL SOIL/ WEATHERED ROCK |
| [Green Box] | BASALT |
| [Dotted Box] | COBBLES, BOULDERS |
| ⊕ | GROUNDWATER LEVEL ON DATE SHOWN |
| 10 141.5' | TOTAL DRILL DEPTH |

Prepared by:
Jacobs Associates Engineering/Consultants
May 18, 2010



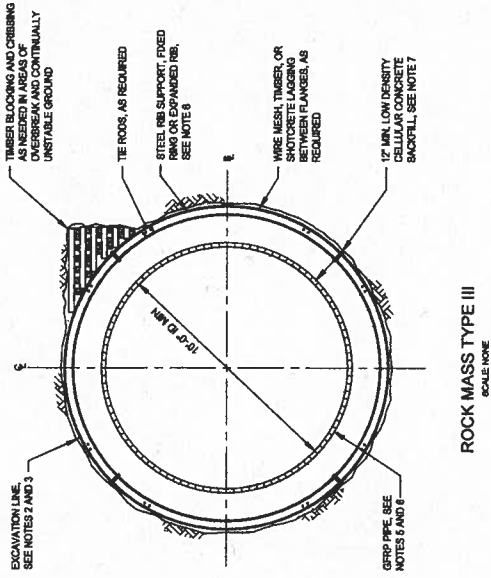
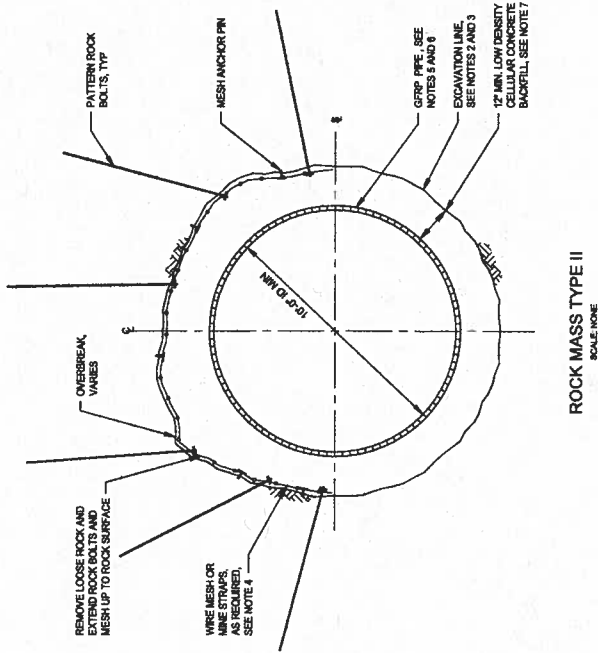
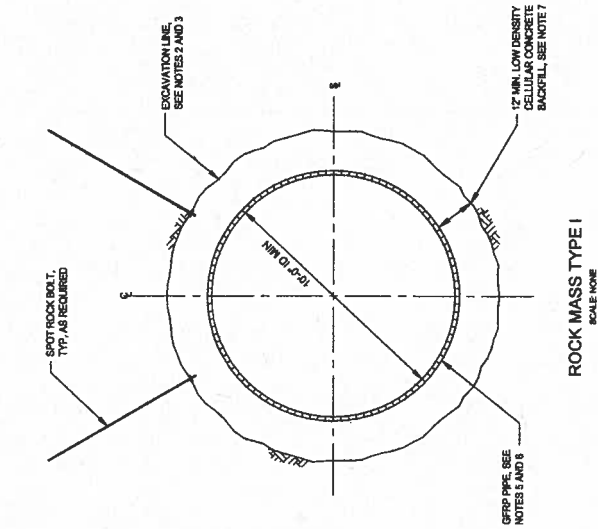
KANEOHE / KAILUA WASTEWATER CONVEYANCE AND TREATMENT FACILITIES
ALTERNATIVE 2: GRAVITY TUNNEL PROFILE

EXHIBIT 9 *OA-3670*

50' 100' 200'
HORIZONTAL SCALE: 1"=500'
10' 20' 40'
VERTICAL SCALE: 1"=100'

NOTES:

1. SELECT DESIGN, INSTALL AND MAINTAIN THE INITIAL SUPPORT REQUIRED FOR TUNNEL EXCAVATIONS. TYPICAL TUNNEL SECTIONS SHOWN ILLUSTRATE THE TYPE OF INITIAL SUPPORT THAT MAY BE CONSIDERED. ANTICIPATED GROUND CONDITIONS AND ROCK MASS TYPES ARE DESCRIBED IN THE GCR INITIAL AND ROCK MASS TYPES ARE SUBJECT TO REVIEW AND ACCEPTANCE BY THE OFFICER-IN-CHARGE.
2. EXCAVATION LIMITS ARE APPROXIMATE AND WILL DEPEND ON THE SELECTED PIPE DIMENSIONS AND CONTRACTORS' MEANS AND METHODS OF EXCAVATING AND SUPPORTING THE TUNNEL.
3. EXCAVATION LINES SHOWN ARE SCHEMATIC ONLY AND NOT INTENDED TO REPRESENT GROUND CONDITIONS OR AMOUNT OF OVERBREAK THAT MAY OCCUR DURING TUNNEL EXCAVATION.
4. WIRE MESH AND WIRE STRAPS TO BE ATTACHED TO ROCK FACE WITH MESH ANCHOR PINS AND ROCK BOLTS TIGHTENED TO BEARING PLATES AS REQUIRED.
5. PIPE INSTALLED IN TUNNEL SHALL BE GLASS FIBER-REINFORCED THERMOSETTING RESIN PIPE (GFRP).
6. SECURE GFRP LINGS TO PREVENT MOVEMENT OR FLUTATION DURING BACKFILLING.
7. MINIMUM CLEARANCE SHALL BE MEASURED FROM OUTSIDE OF GFRP PIPE TO THE INSIDE FACE OF THE INITIAL GROUND SUPPORT, AS APPLICABLE.
8. ALTERNATE INITIAL SUPPORT TYPES COMPATIBLE WITH A SHELDED TBM ARE NOT SHOWN FOR CLARITY.



Source: T-30 TBM Tunnel Typical Sections, Jacobs Associates, January 2013

KAMEOHE - KAILUA WASTEWATER CONVEYANCE AND TREATMENT FACILITIES - CONSERVATION DISTRICT USE APPLICATION

TYPICAL TUNNEL SECTIONS

EXHIBIT 10 OA-3670



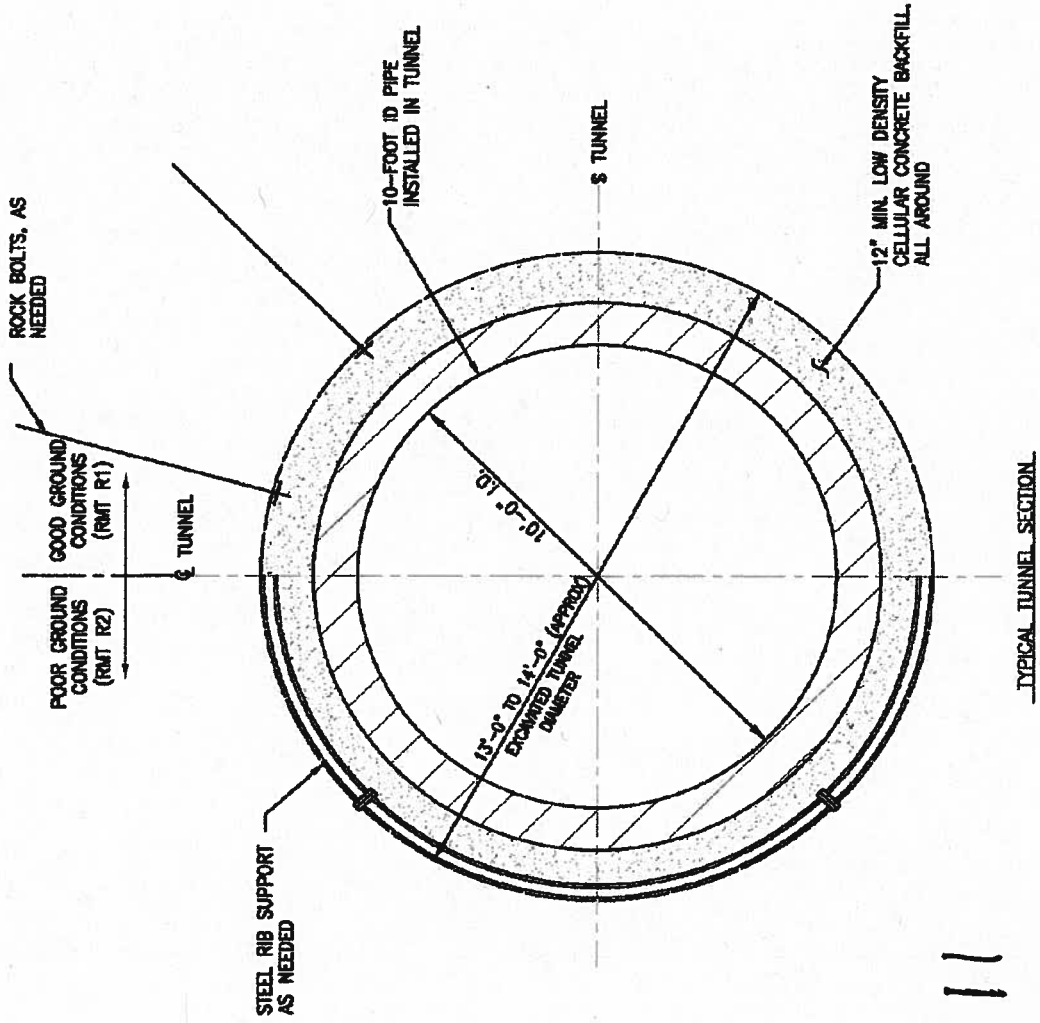


EXHIBIT 11

OA-3670

NOT TO SCALE

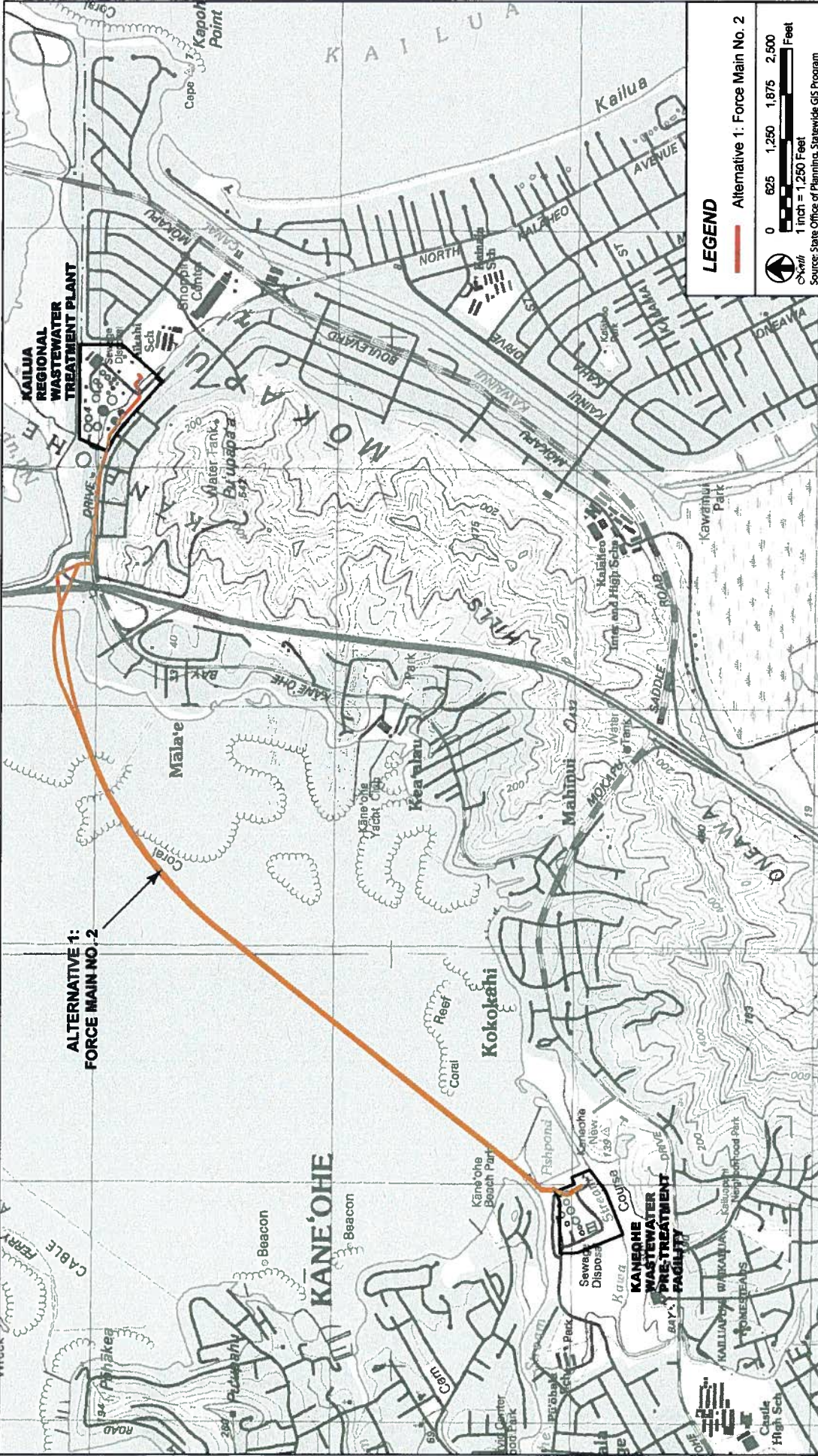


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ENGINEERS & PLANNERS

KANEHOE / KAILUA WASTEWATER CONVEYANCE AND TREATMENT FACILITIES

GRAVITY TUNNEL SECTION WITH STRUCTURAL SUPPORT ALTERNATIVES

W12801-01 Kaneohe Kailua Facility Plan Planning Engineers' Final Maps Draft E.S.



ALTERNATIVE 1:
FORCE MAIN NO. 2

LEGEND

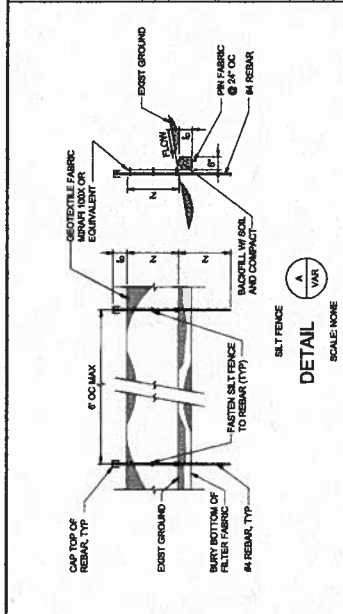
- Alternative 1: Force Main No. 2
- 0 625 1,250 1,875 2,500 Feet
- 1 inch = 1,250 Feet
- Source: State Office of Planning, Statewide GIS Program

KANEOHE / KAILUA WASTEWATER CONVEYANCE AND TREATMENT FACILITIES

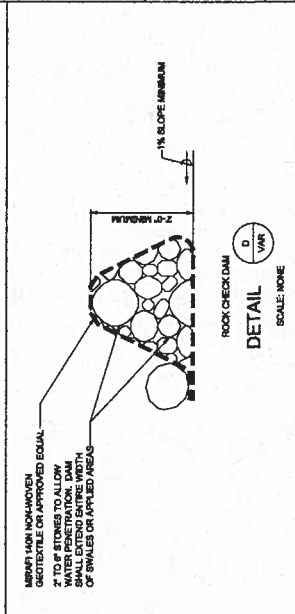
FORCE MAIN NO. 2

WILSON OKAMOTO CORPORATION
ENGINEERS-PLANNERS

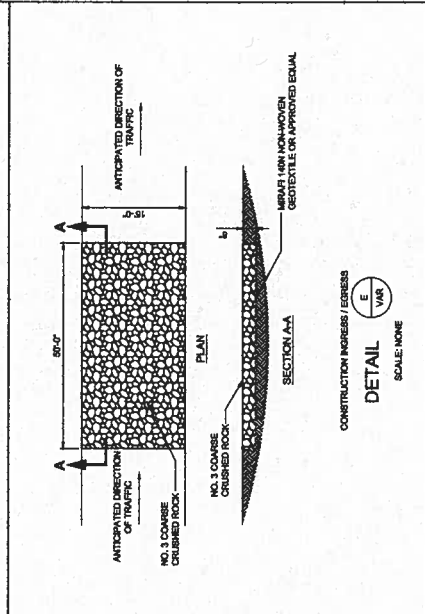
EXHIBIT 12 *OA-3670*



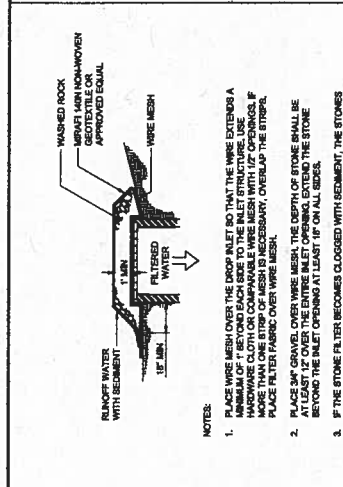
DETAIL A
SCALE: NONE



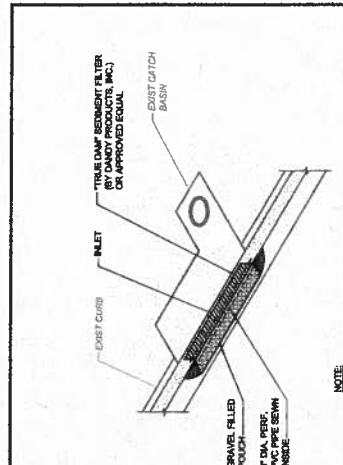
DETAIL B
SCALE: NONE



DETAIL E
SCALE: NONE



DETAIL B
SCALE: NONE



DETAIL C
SCALE: NONE

- NOTES:**
1. CONTRACTOR SHALL PROVIDE AND INSTALL THE SEDIMENT CONTROL FILTER.
 2. THE CONTRACTOR SHALL INSTALL THE SEDIMENT CONTROL FILTERS ONE DAY PRIOR TO EXCAVATION WORK NEAR THE CATCH BASIN. THE CONTRACTOR SHALL MAINTAIN THE FILTERS THROUGHOUT THE EXCAVATION WORK. UPON COMPLETION OF THE EXCAVATION WORK, IF ADDITIONAL EXCAVATION WORK IS REQUIRED IN THE AREA, THE SAME INSTALLATION AND REMOVAL PROCEDURE DESCRIBED IN THIS AREA, THE SAME INSTALLATION AND REMOVAL PROCEDURE SHALL BE USED. THE CONTRACTOR SHALL REMOVE AND REINSTALL THE SEDIMENT CONTROL FILTERS AT THE DESIGNATED CATCH BASIN. THE CONTRACTOR SHALL MAINTAIN THE FILTERS THROUGHOUT THE WORKING DAY.
 3. THE CONTRACTOR SHALL REMOVE THE FILTERS AT THE START AND THE END OF EACH WORKING DAY.
 4. THE CONTRACTOR SHALL REMOVE THE FILTERS AT TIMES OF ABOVE NORMAL RAINFALL EVENTS AND REPLACE THEM WHEN EVENT HAS PASSED.

NOTE:
CONTRACTOR SHALL REMOVE SEDIMENT FILTERS DURING AN EVENT OF ABOVE NORMAL RAINFALL AND REPLACE AFTER EVENT HAS PASSED.

| | |
|-------------------------------------------------------------------------------------------|------------------|
| | |
| WASTEWATER DIVISION DEPARTMENT OF DESIGN & CONSTRUCTION CITY AND COUNTY OF HONOLULU | |
| KANEHOE / KAILUA SEWER TUNNEL | |
| TEMPORARY EROSION AND SEDIMENTATION CONTROL DETAILS | |
| PROJECT NO. 11185-KAILUA TUNNEL TFS-HEADWORK DETAIL | SHEET NO. 7 OF 7 |
| JOB NO. W11-12 | DATE: 01/20/13 |

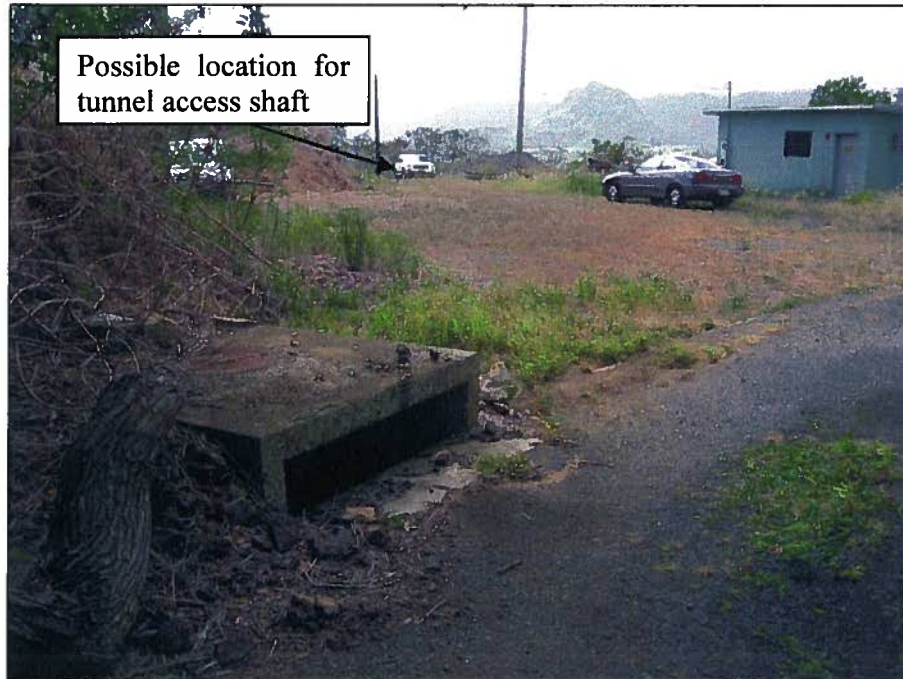
Source: G-20 Temporary Erosion and Sedimentation Control Details, Jacobs Associates, January 2013

DRAWING: G-20 TEMPORARY EROSION AND SEDIMENTATION CONTROL DETAILS - CONSERVATION DISTRICT USE APPLICATION

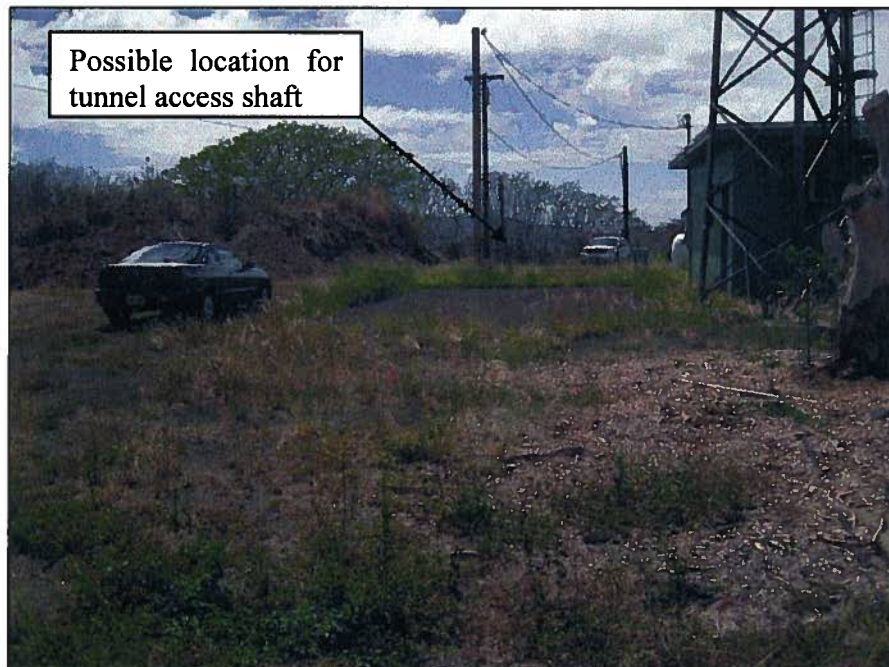
KANEHOE - KAILUA WASTEWATER CONVEYANCE AND TREATMENT FACILITIES - CONSERVATION DISTRICT USE APPLICATION

TEMPORARY EROSION AND SEDIMENTATION CONTROL DETAILS

EXHIBIT 13 OA-3670



Flat, undeveloped area just east of water tank, BWS property at Mōkapu Saddle Road, view to southeast



. Area east of water tank, BWS property at Mōkapu Saddle Road, and possible location for tunnel access shaft

EXHIBIT 14
OA-3670

| PEAK GROUND VELOCITY (mm/sec) | PEAK GROUND VELOCITY (In/sec) | COMMENT |
|-------------------------------|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 193.04 | 7.6 | Major damage to buildings (mean of data). |
| 137.72 | 5.4 | Minor damage to buildings (mean of data). |
| 101.16 | 4.0 | 'Engineer structures' safe from damage. |
| 50.8 | 2.0 | Safe from damage limit (probability of damage <5%). No structural damage. |
| 33.02 | 1.3 | Threshold of risk of 'architectural' damage for houses. |
| 25.4 | 1.0 | No data showing damage to structures for vibration <1 in./sec. |
| 15.24 | 0.6 | No risk of 'architectural' damage to normal buildings. |
| 10.16 | 0.4 | Threshold of damage in older homes. |
| 5.08 | 0.2 | Statistically significant percentage of structures may experience minor damage (including earthquake, nuclear event, and blast data for old and new structures). No 'architectural' damage. |
| 3.81 | 0.5 to 0.15 | Upper limits for ruins and ancient monuments. |
| 1.0 | 0.04 | Vertical vibration clearly perceptible to humans. |
| 0.32 | 0.01 | Vertical vibration just perceptible to humans. |

Source: 'State-of-the-Art Review: Prediction and Control of Groundborne Noise and Vibration from Rail Transit Trains'; U.S. Department of Transportation; December 1983.

Source: Y. EBISU & ASSOCIATES
Acoustic Study for the Gravity Tunnel Between Kaneohe WWPS and Kailua WWTF, December 2010



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CORPORATION
ENGINEERS • PLANNERS

KANEOHE / KAILUA WASTEWATER CONVEYANCE AND TREATMENT FACILITIES

SUMMARY OF BUILDING DAMAGE CRITERIA

EXHIBIT 15 OA-3670