

HALAWA-LULUKU DEVELOPMENT FEASIBILITY REPORT

North Halawa Valley

Honolulu
Oahu, Hawaii
November 2019

Prepared for:
Halawa-Luluku Interpretive Development Project
Office of Hawaiian Affairs
560 North Nimitz Highway, Suite 200
Honolulu, HI 96817



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Disclaimer: This report is only for conceptual purposes for the Halawa-Luluku Interpretive Development project. The content presented in this report will not determine actual designs or use of the project sites. This report is only meant to provide insight for the stakeholders in consideration of future growth.

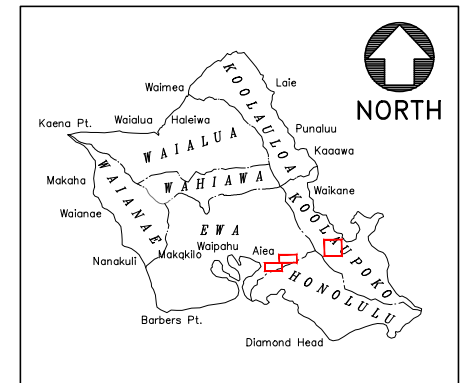
Section 1 Introduction

The Halawa-Luluku Development Feasibility Report (North Halawa Valley) is based on the Interpretive Development Plan (IDP) set forth by the Halawa-Luluku Interpretive Development (HLID) team, acting on behalf of the Office of Hawaiian Affairs (OHA). The IDP was created by the HLID team to initiate the mitigation process of the impacts to cultural and archaeological resources caused by the construction of Interstate H-3. There are two project areas within the HLID project, Luluku and North Halawa Valley. For the purposes of the feasibility report, a report will be done for each project area. Reference can be made to the “PROJECT DESCRIPTIONS: North Halawa Valley and Luluku Project Areas,” dated October 24, 2014; for the background and development of the HLID project and the IDP.

The purpose of the Halawa-Luluku Development Feasibility Report (North Halawa Valley) is to investigate the feasibility of incorporating various elements within the North Halawa Valley project area to assist the selected Stewards (Stewards) with their respective visions. The objective of this report is to provide site layout alternatives based on discussions with the Stewards and coordination with representatives from the Federal Highway Administration (FHWA) / State of Hawaii Department of Transportation (HDOT) and OHA. The project elements presented in this report are based off the IDP for the project area, with input from FHWA/HDOT and the Stewards. Each project element will be explored and options for implementing the element within the project site will be discussed. These various project elements are incorporated into different feasible site layouts, put together through consultations with the stakeholders on what elements are most desirable, the feasibility of implementing the project element, and the budgetary expenses for installation, operation, and maintenance of each element. The cost estimates presented in this report are based on rough budgetary estimates and are subject to change.

As part of the HLID project, the Stewards will develop a work plan to sustain the North Halawa Valley project area. To assist the community group, this feasibility report is intended to provide a basis to move forward towards goals and visions for the project area. At this time, the feasible project alternatives presented in this report will be based on the current capacity of the Stewards. Looking towards future growth projections, provisions to support expansion of the North Halawa Valley project area will also be discussed in this report. Site layouts presented in the feasibility report are conceptual and subject to alterations moving forward.

Refer to Figure 1 for overall HLID project location map.



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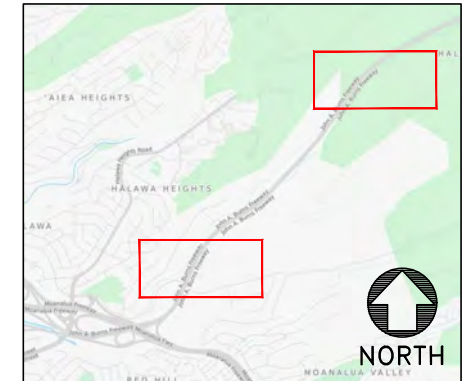
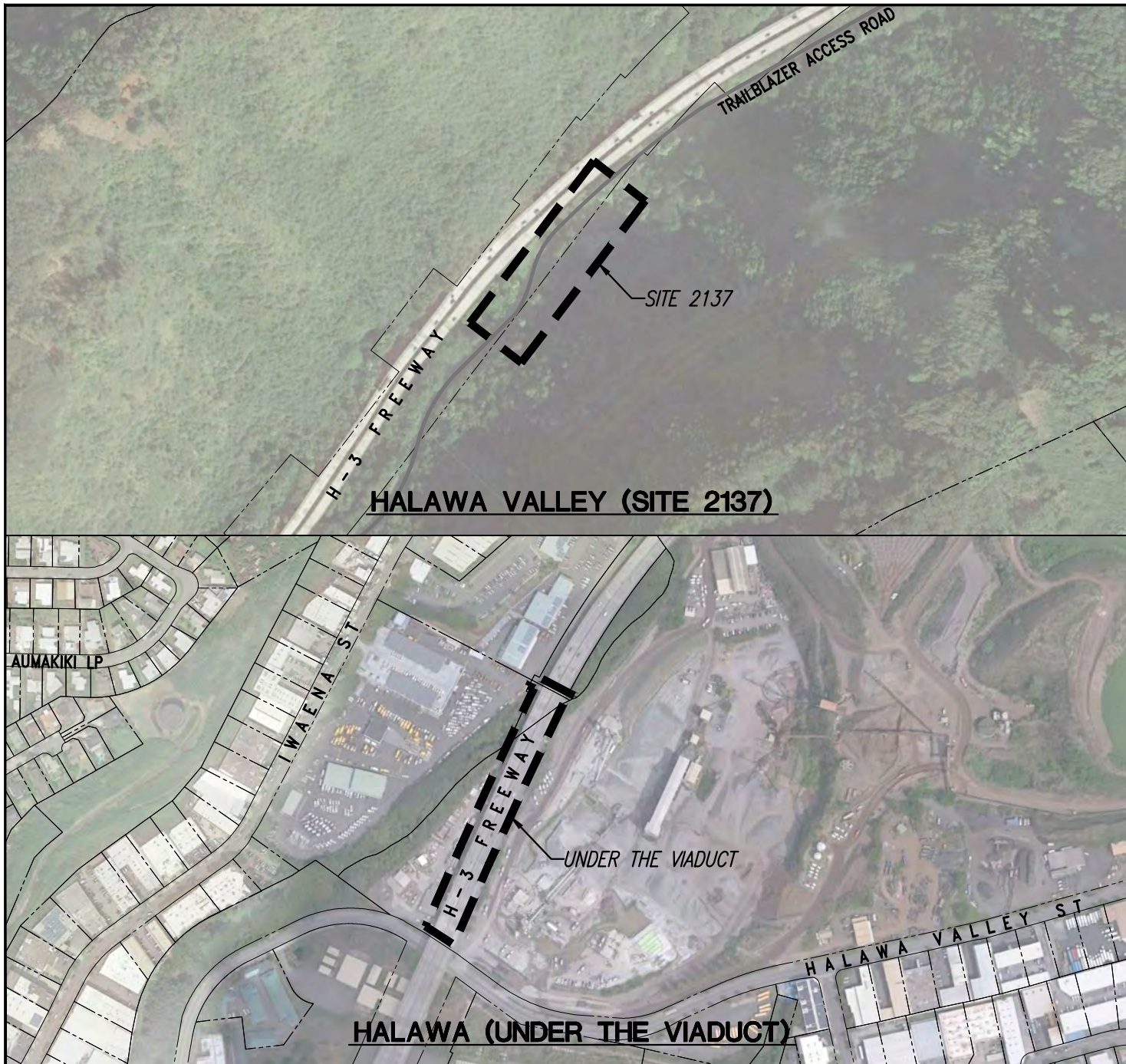
FIGURE 1
OVERALL PROJECT LOCATION MAP

Section 2 Existing Site Conditions

The North Halawa Valley project area is inclusive of two separate project sites. The first project site, referred to as “Under the Viaduct,” is located just off Halawa Valley Street near the entrance to Hawaiian Cement. This site is part of Tax Map Key (TMK): (1)9-9-010: 010 and (1)9-9-073: 028. The limits of the project include the eight (8) bays underneath the Interstate H-3 separated by the viaduct support pillars and within the freeway right-of-way. The project site has been previously disturbed, with a majority of the surface area being impervious with asphalt pavement. The current zoning designation of TMK (1)9-9-010:010 is general agriculture district (AG-2) and TMK (1)9-9-073: 028 is intensive industrial district (I-2). Currently this area is rented out by various tenants and used as commercial office space, materials storage and baseyards.

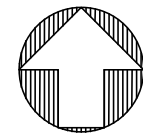
The second project site, referred to as Site 2137, is located mauka of the first project site along the Trailblazer Access Road. This site is part of TMK: (1)9-9-011: 002 and is confined to the boundaries of archaeological Site 2137, known as Hale O Papa. The current zoning designation of TMK (1)9-9-011: 002 is restricted preservation district (P-1). According to the State of Hawaii Department of Land and Natural Resources (DLNR), the project site is within the resource subzone of the conservation district. Currently this area is cared for by Na Kupuna a me Na Kakoo o Halawa Inc. (NKNKHI). This group is recognized as the Stewards for the North Halawa Valley project area and occasionally has work days and provides cultural/educational sessions and tours for various community groups. Consultation was done with the Stewards to advise which project elements were conceptually incorporated for the feasible site layouts.

Refer to Figure 2 for location and vicinity map for the North Halawa Valley project area.

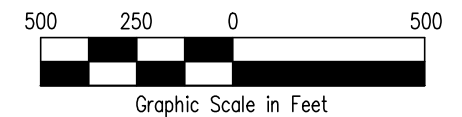


LEGEND

- PROPERTY LINE
- [Dashed Line]** PROJECT AREA



NORTH
Scale : 1"=500'



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FIGURE 2
LOCATION AND VICINITY MAP
FOR NORTH HALAWA VALLEY

Section 3 Project Elements

Project elements were defined based on scope items and discussion with the stakeholders. In the following sections, there will be a description of each project element that explains the intended use for the project site. The options explored to meet the criteria of the project element will also be presented, along with a cost estimate and the permitting needed to construct the project element on-site.

3.1 Administrative Center

The administrative center would provide office space for the Stewards, as well as a possible meeting space or educational space for visitors. For the purposes of this report, the administrative center was considered to be located in the Under the Viaduct area. However, the actual location of the administrative center can be adaptive to be located either Under the Viaduct or at Site 2137. Placing the administrative center Under the Viaduct, would provide connection and access to utilities such as electricity, water and sewer. The administrative center has the versatility to be located under any of the eight (8) bays underneath the viaduct and each bay has sufficient space to provide the structure along with parking spaces. For the administrative center, the option would be to provide a modular building. The modular building would be easy to transport and situate on-site, which would make it a suitable and cost-effective option.

3.1.1 Option 1 – Base

The base option for the proposed administrative center would consist of an administrative office, a minimal gathering area, and a restroom facility. This module (trailer) would be 12-feet by 44-feet (528 square feet) and provide a gathering space approximately 264 square feet to serve about 17 people, one administrative office with 2-3 occupants, and one unisex restroom. Refer to Figure 3 for a concept drawing of this base option for the administrative center.

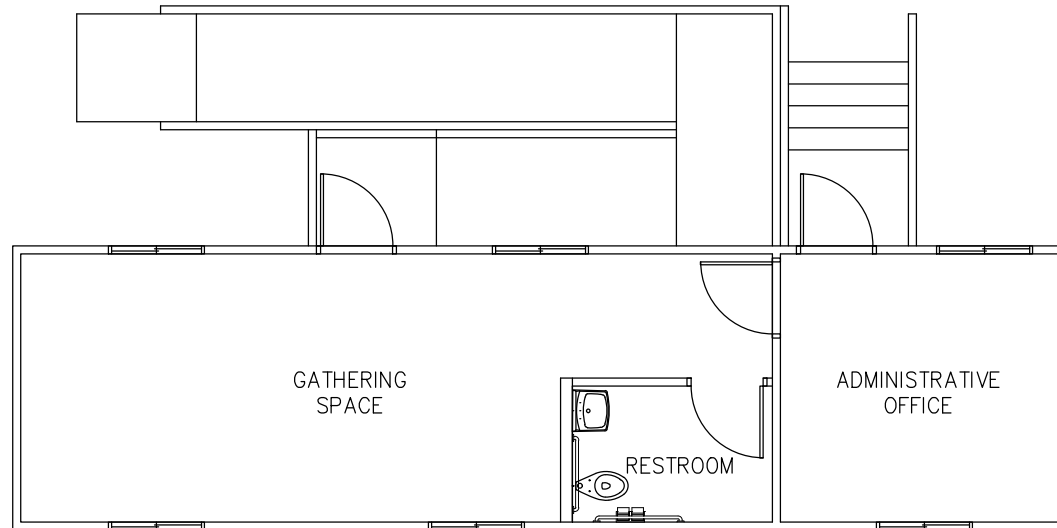
3.1.2 Option 1 – Expanded

Expansion of the base option would be possible by adding additional modules and providing larger spaces. By including additional modules, the Stewards and visitors will be provided with more features such as educational classrooms, larger office spaces, and a restroom facility with a shower. Expansion of the administrative center would provide more options for utilizing the modules for multi-purpose uses. With this modular building set-up, future expansion of the working area would be simple in terms of adding additional modules in accordance with growth and needs of the working group. Refer to Figure 4 for a concept drawing of an expanded option for the administrative center, which provides a structure sized 48-feet by 64-feet (3,072 square feet).

3.1.3 Cost Estimate

Below is a rough magnitude cost estimate for the administrative center options mentioned above. The cost presented below is for material cost and installation cost, any other additional costs will be taken into consideration when developing a feasible site layout for the project area. The cost is subject to change at the time of construction.

Site Location	Option	Cost Estimate
Under the Viaduct	Base Option	\$460,000
Under the Viaduct	Expanded Option	\$1,200,000



FLOOR PLAN
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HALAWA, OAHU, HAWAII

OWNER: STATE OF HAWAII, DEPARTMENT OF TRANSPORTATION

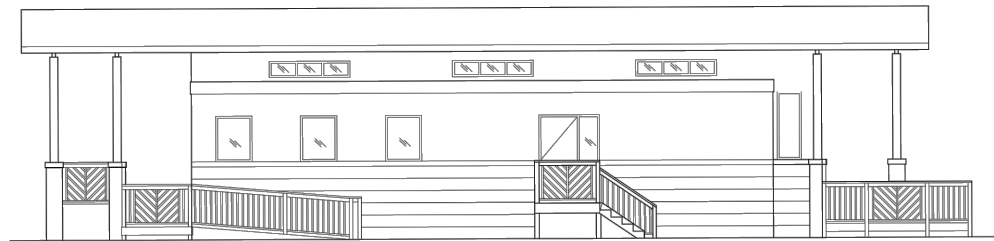
DEVELOPER: OFFICE OF HAWAIIAN AFFAIRS

TAX MAP KEY: 9-9-010:010

FIGURE 3
HALAWA - UNDER THE VIADUCT
ADMINISTRATIVE CENTER - BASE OPTION



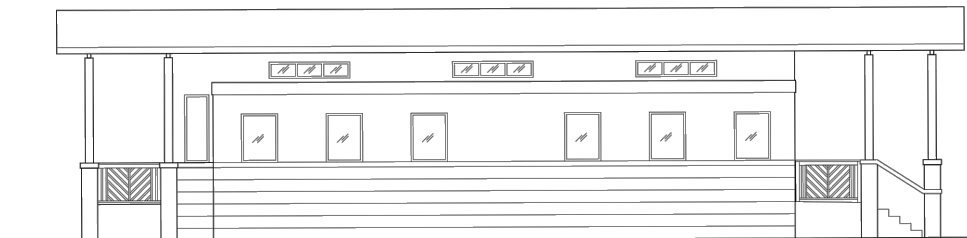
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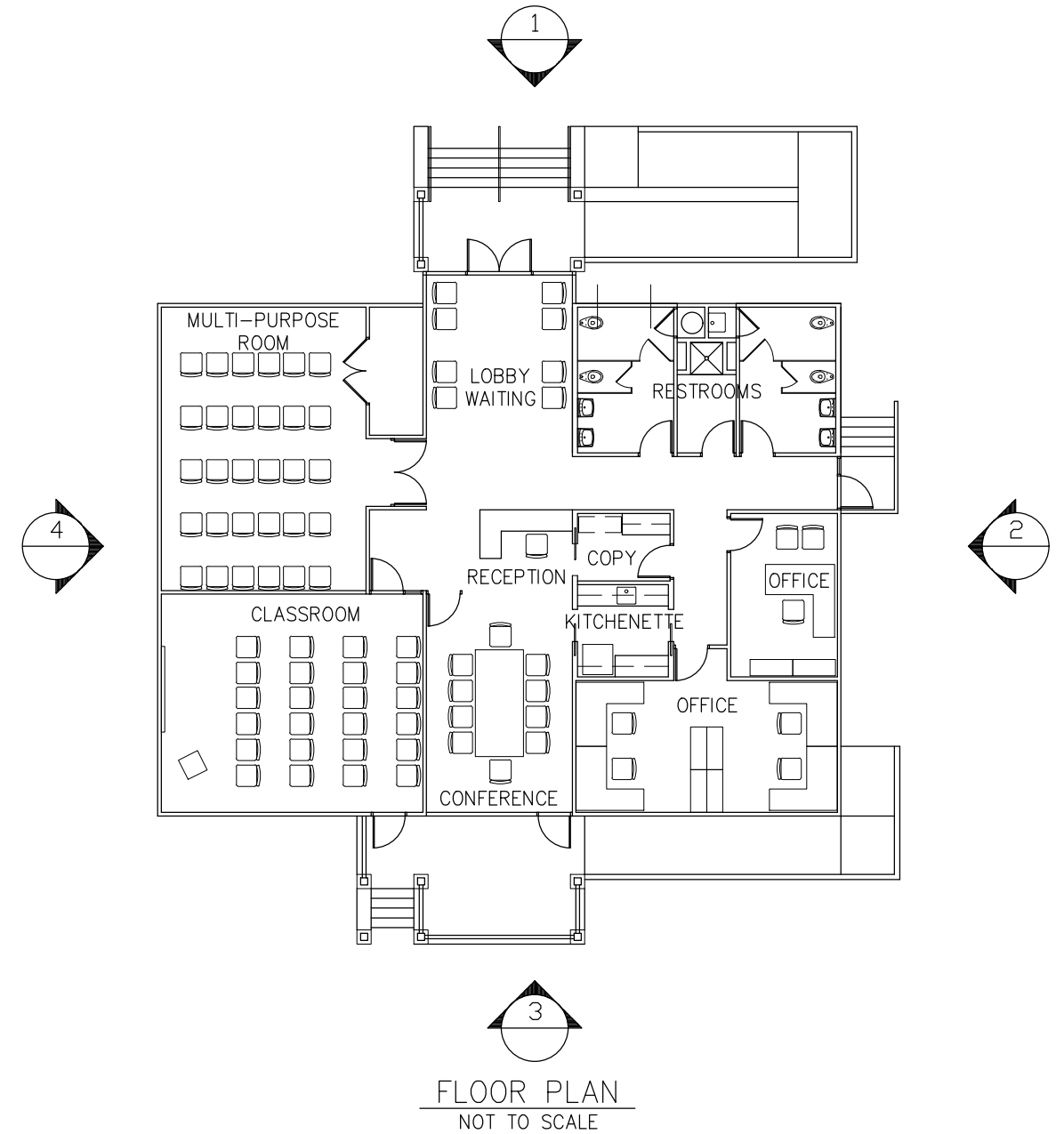
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3 ELEVATION
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4 ELEVATION
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**HALAWA-LULUKU INTERPRETIVE
DEVELOPMENT PROJECT**

HALAWA, OAHU, HAWAII

OWNER: STATE OF HAWAII, DEPARTMENT OF TRANSPORTATION
DEVELOPER: OFFICE OF HAWAIIAN AFFAIRS
TAX MAP KEY: 9-9-010:010

**FIGURE 4
HALAWA - UNDER THE VIADUCT
ADMINISTRATIVE CENTER - EXPANDED OPTION**

3.2 Halau

The halau would provide a gathering and learning space for the Stewards and visitors. This structure would provide shelter for people from the elements, such as rain and sun, while engaging in cultural practices. It would be sited at Site 2137 and positioned off the access roadway area. Construction of the halau would be subject to building code regulations and will require a building permit. Also depending on the site work that will be needed for the structure, a grading permit may be required. In addition, the structure would need to be designed to address the flood zone risk of Site 2137 and assure there is “no rise” within the floodplain. One option to address the flood zone risk is to elevate the finish floor and structural supports above the flood zone to allow flood water to flow underneath the structure, while also providing a strong enough support to withstand the forces of storm runoff and erosion. Alternatively, the halau provided would be an open pavilion-like structure and would be sited at grade with the anticipation of allowing flood water to flow freely over and through the structure.

Although the upper Halawa Valley area has a restricted entry and is in a secluded area, trespassers and hunters have found their way into the remote areas of the valley and have left behind graffiti and have vandalized man-made structures. Ideally, any new structures should be secured.

3.2.1 Option 1

An option that would be explored for the halau would be a structure that is open on all sides with a roof covering. The pavilion-like structure would provide a more permanent and larger meeting space compared to the current tent structure on the existing site. This structure would be approximately 20-feet by 40-feet to accommodate a group up to fifty people. The roof of the halau could also be used to collect rain water in a water catchment system, for non-potable water use on-site. Being that this type of halau would be open on all sides, there would be no provisions to secure or lock the structure when not in-use. Refer to Figure 5 for a concept drawing of the open halau structure.

3.2.2 Option 2 – Base

A second option for a halau structure would be an enclosed structure. The base option for this halau would be a simple modular building that would include a meeting area, storage, small water catchment system, and restroom. This enclosed structure would allow the option to secure and lock the building when not in-use. Refer to Figure 6 for a concept drawing of this base option for the enclosed halau structure.

3.2.3 Option 2 – Expanded

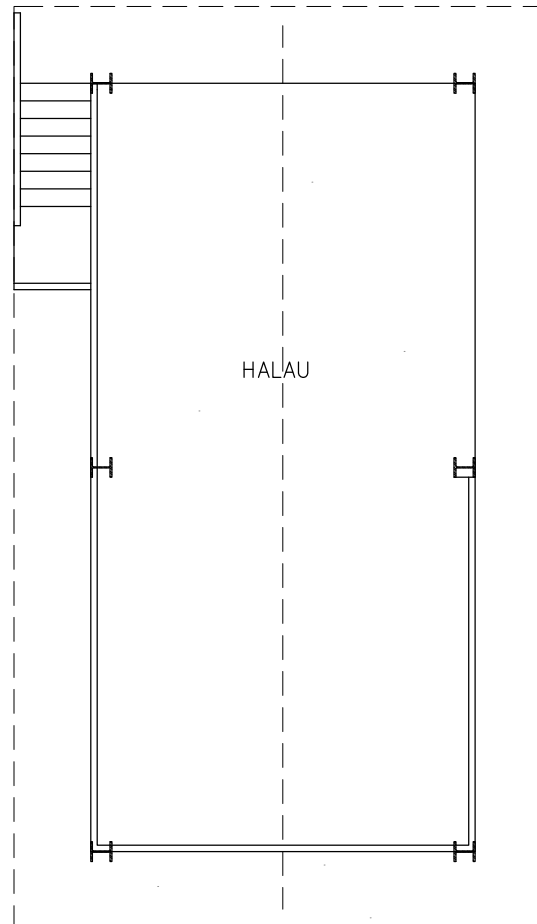
Expansion of this base option would be possible by adding additional modules to provide more space and features for the Stewards and visitors. A more complex enclosed halau structure may include additional features such as a small office, small kitchen area, storage room and a restroom with a shower/changing room. Also expansion of the halau structure could provide use of utilities via an off-grid system; for off-grid sewer, water, and electricity services. Refer to Figure 7 for a concept drawing

of the expanded option for the enclosed halau structure; a more complex halau with more features.


3.2.4 Cost Estimate

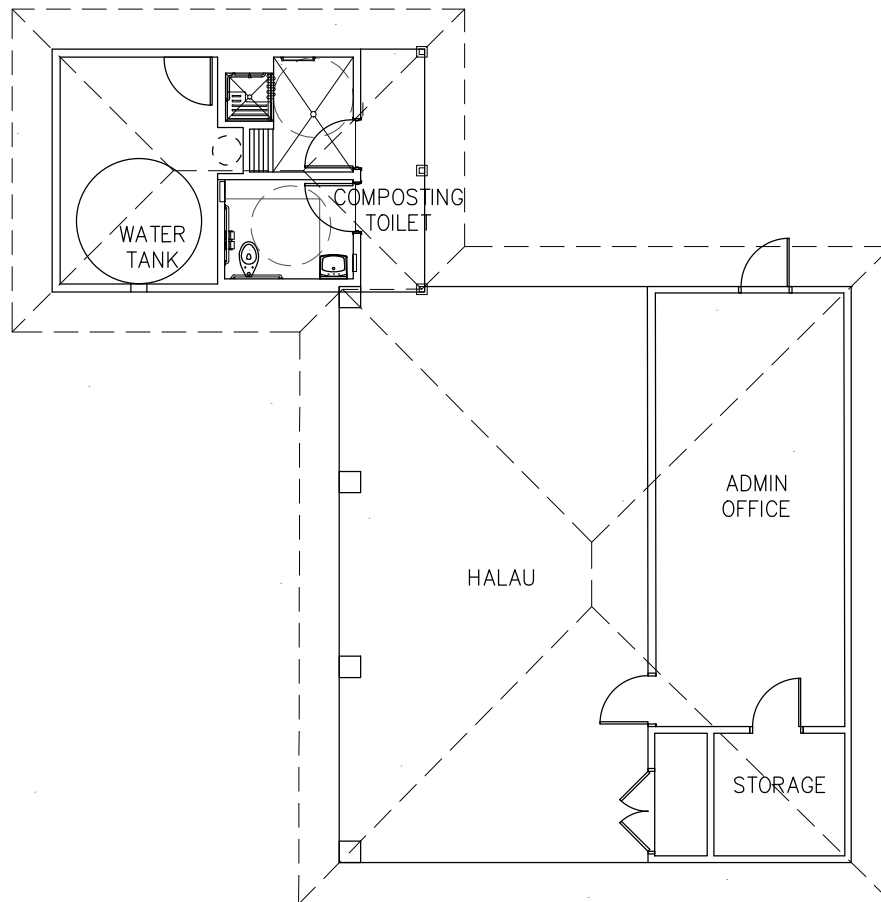
Below is a rough magnitude cost estimate for the halau options mentioned above. The cost presented below is for material cost and installation cost, any other additional costs will be taken into consideration when developing a feasible site layout for the project area. The cost is subject to change at the time of construction.

Site Location	Option	Cost Estimate
Halawa Valley (Site 2137)	Open Structure Halau	\$360,000
Halawa Valley (Site 2137)	Enclosed Structure Halau – Base Option	\$625,000
Halawa Valley (Site 2137)	Enclosed Structure Halau – Expanded Option	\$1,700,000



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FIGURE 5 HALAWA - SITE 2137 OPEN STRUCTURE HALAU		



FLOOR PLAN
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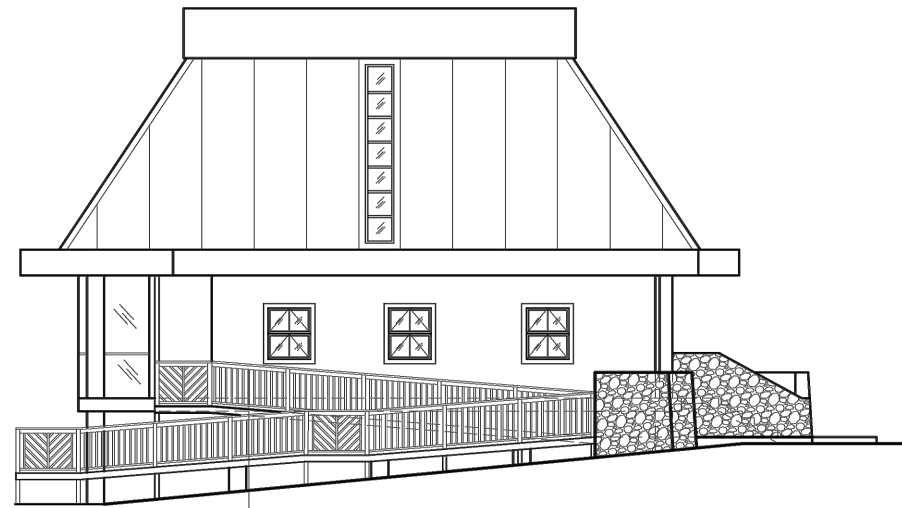
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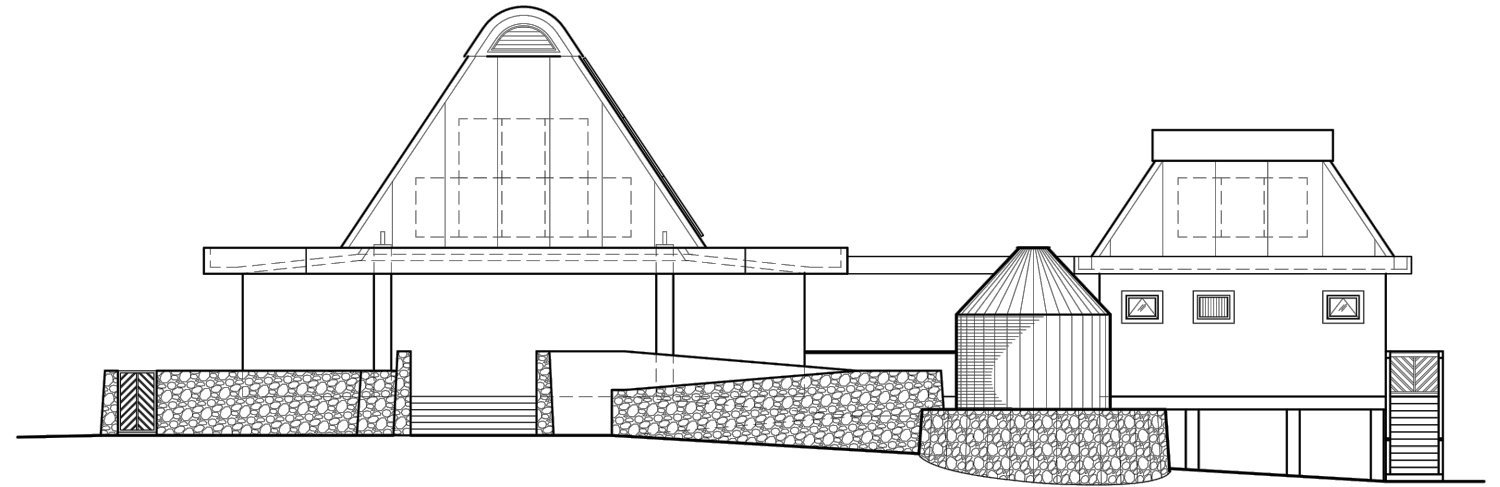
HALAWA, OAHU, HAWAII

OWNER: STATE OF HAWAII, DEPARTMENT OF TRANSPORTATION
DEVELOPER: OFFICE OF HAWAIIAN AFFAIRS
TAX MAP KEY: 9-9-010:010

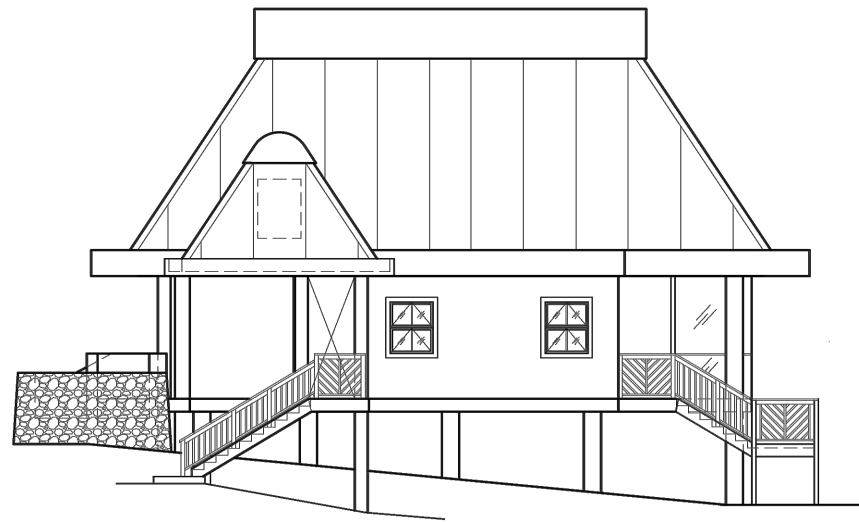
FIGURE 6
HALAWA - SITE 2137
ENCLOSED STRUCTURE HALAU - BASE OPTION



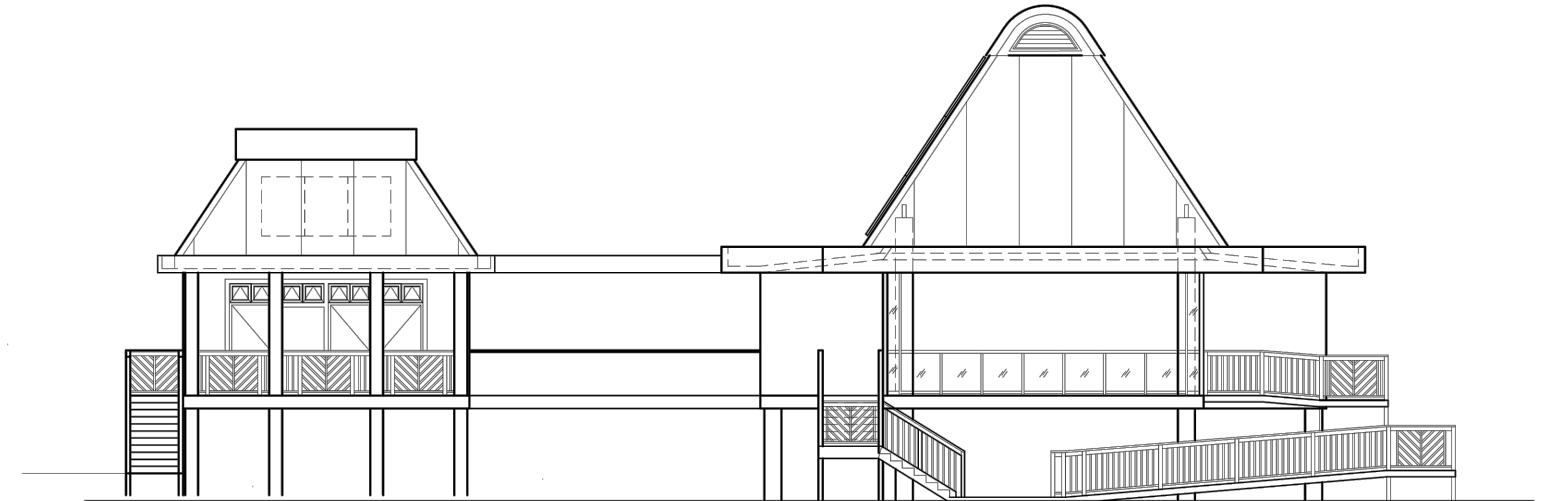
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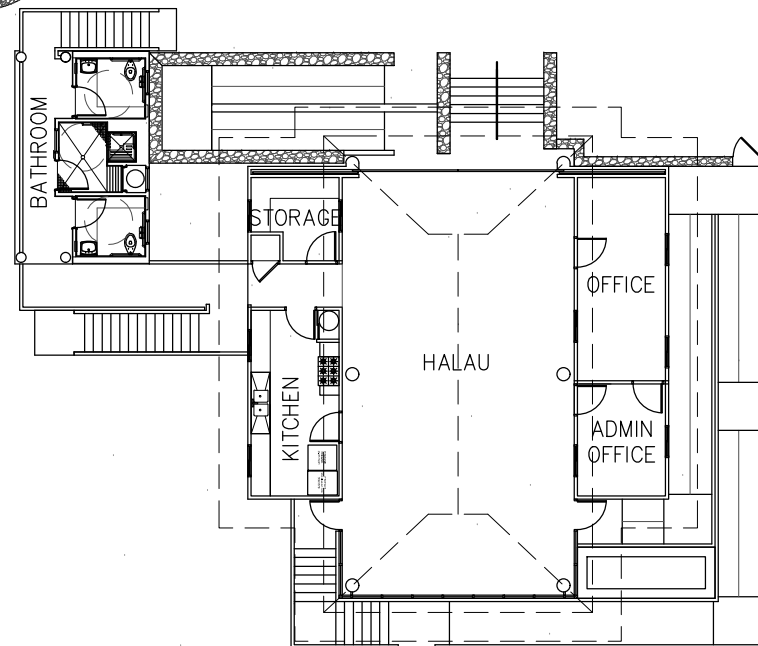
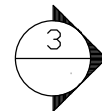
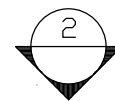
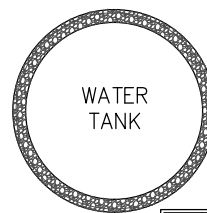
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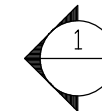
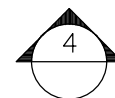
3 ELEVATION
NOT TO SCALE



4 ELEVATION
NOT TO SCALE



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NOT TO SCALE



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FIGURE 7 HALAWA - SITE 2137 ENCLOSED STRUCTURE HALAU - EXPANDED OPTION	

3.3 Storage

On-site storage at Site 2137 can be provided for the Stewarts to store garden supplies, equipment, and tools necessary to upkeep the site. Currently, storage needs are met with a steel shipping container.

3.3.1 Option 1

Retaining the existing steel shipping storage container will be considered as an “no action” option. The container does not show any signs of deterioration and does provide ample storage space for the Stewards at this time. Utilizing the existing storage space is a no cost alternative.

3.3.2 Option 2

Depending on what will be included in the halau structure, there is an option to incorporate a room or closet for storage space within the halau structure. This would be part of the expanded option for the halau and would permit security features to be provided for the storage area.

3.3.3 Option 3

Installation of a new storage facility was also considered as an option for Site 2137. This option would entail removal of the existing shipping storage container and replacing the old container with a permanent storage facility. The facility would include features such as ventilation and lighting with provisions for security features.

3.3.4 Cost Estimate

Below is a rough magnitude cost estimate for the storage options mentioned above. The cost presented below is for material cost and installation cost, any other additional costs will be taken into consideration when developing a feasible site layout for the project area. The cost is subject to change at the time of construction.

Site Location	Option	Cost Estimate
Halawa Valley (Site 2137)	Utilize Existing Storage Container on-site (No Action)	\$0
Halawa Valley (Site 2137)	Include Storage Space within Halau	\$150,000
Halawa Valley (Site 2137)	Permanent Secure Storage Facility with Lighting	\$500,000

3.4 Parking

Parking can be provided at both project sites, Under the Viaduct area and at Site 2137. There will be ample room to provide parking stalls for the minimum number of stalls required by the Honolulu’s Land Use Ordinance. For parking facilities that provide 1 to 25 parking spaces, the Americans with Disabilities Act (ADA) requires one assessable parking space.

3.4.1 Under the Viaduct Area

The area Under the Viaduct is currently paved with an existing driveway access from Halawa Valley Street. Parking in this area can be easily provided by striping the existing pavement. Depending on the size and usage of other project elements that may also be located Under the Viaduct, a minimum of ten parking spaces with one assessible parking space shall be provided for the proposed administrative center.

3.4.2 Site 2137

Parking can also be provided at Site 2137. Level areas off the access road can be paved over to allow parking for vehicles. Increasing the impervious area within the project site will be subject to drainage improvements and storm water quality compliance measures. Alternatively, gravel parking could be provided in those open areas. A gravel parking area will be cost-efficient and contribute less impervious area compared to a paved parking area. A minimum of ten parking stalls including one handicap stall and one loading stall will be provided for Site 2137.

3.4.3 Cost Estimate

Below is a rough magnitude cost estimate for the parking area options mentioned above. The cost presented below is for material cost and implementation of the parking area, any other additional costs will be taken into consideration when developing a feasible site layout for the project area. The cost is subject to change at the time of construction.

Site Location	Option	Cost Estimate
Under the Viaduct	Add Striping to Existing Pavement	\$2,000
Halawa Valley (Site 2137)	Paved Parking Area	\$20,000
Halawa Valley (Site 2137)	Gravel Parking Area	\$10,000

3.5 Trash Receptacles

Trash receptacles can be provided for both project areas Under the Viaduct and in Halawa Valley. At Site 2137, there will be a smaller size trash bin to collect the waste in the valley. On a weekly basis or depending on the usage of the area, the trash will need to be transported from Halawa Valley to the Under the Viaduct area, where a larger trash receptacle will be located. The City and County's Refuse Division only collects trash for households, so the refuse will have to be disposed of by other means.

3.5.1 Option 1

A trash receptacle can be provided at the Under the Viaduct area, near the administrative center. Depending on the needs and estimated trash accumulation of the Stewards, the front-end load trash receptacle can range in sizes from 2 to 8 cubic yards. If more trash volume is projected, then a roll-off container with a capacity of 10 to 40 cubic yards could alternatively be provided. If the Stewards decide to utilize a trash receptable, they

would need to coordinate with a private trash disposal company to pick-up their trash weekly or monthly for a fee.

3.5.2 Cost Estimate

Below is a rough magnitude cost estimate for the range in costs for a trash receptacle of varying capacities. The cost presented below is for the structure only; maintenance fees for coordination for trash pick-up will be the responsibility of the Stewards, if they choose to utilize a trash receptacle on their project site. The cost is subject to change at the time of construction.

Site Location	Option	Cost Estimate
Under the Viaduct	Trash Receptacle (2 to 8 cubic yards)	\$200 to \$600
	Trash Receptacle (10 to 40 cubic yards)	\$500 to \$1,000

3.6 Sewer Service Connection

For restroom and other wastewater operations, alternatives for wastewater services were investigated. Wastewater services will be explored for Under the Viaduct area, as well as in Halawa Valley at Site 2137. Alternate site layouts will include structures at both locations. The wastewater and greywater can both be treated using the same system, if desired.

3.6.1 Under the Viaduct Area

Connection to the existing sewer system will be the most desirable option for buildings that will be located underneath the H-3 viaduct area. As-builts show that there is an existing 6-inch VCP sewer lateral that runs along the fence line from an existing 8-inch VCP sewer main within Halawa Valley Street. A sewer connection permit will be required to connect to the City's sewer system. Depending on where the new sewer connection will be located, construction of a new lateral or extension of the existing sewer lateral will also require a trenching permit, for any trenching work done in the City's right-of-way, from City and County Department of Planning and Permitting (DPP).

Refer to Figure 8 for the proposed sewerline connection Under the Viaduct.

3.6.2 Site 2137

As for Site 2137, running a new sewer line along the Trailblazer Access Road to connect to the City's existing sewer system would require approximately 9,800 linear feet of new sewer piping. Cost and construction of a sewer line of this magnitude would outweigh the feasibility of this option.

An option for wastewater services at Site 2137 would be to provide a septic tank system. Per Hawaii Administrative Rules (HAR) §11-62, for an Individual Wastewater System (IWS), a septic tank and the effluent from the septic tank needs to be discharged into a

soil absorption system, sand filter, irrigation system, or another treatment unit approved by the Director of Department of Health (DOH). IWS's are allowed in flood zones, but the specific design requirements would require additional field tests and further discussions with DOH.

A septic tank is an underground, water-tight container usually made of concrete, fiberglass, or plastic. The tank allows the solids in the wastewater to settle to the bottom of the tank forming sludge, while the oil and grease float to the top forming scum. The remaining liquid effluent flows out the tank and into another treatment method. It is uncertain what DOH will dictate as acceptable because the soil is relatively impermeable, and the site is in the vicinity of Halawa Stream, but the most likely economical option for the second treatment will be a seepage pit. A seepage pit is a tank with perforated sides, or bricks stacked on top of each other, forming a cylinder. The wastewater would then percolate out of the sides and into the soil, similar to a cesspool.

The septic tank would need to be periodically pumped to clean out the sludge and scum by a licensed septic pumper. It is generally recommended the tanks be cleaned once a year.

To obtain approval for an IWS, a permit application is required to be sent to DOH Wastewater Branch. Further field investigations and discussions with DOH would be required to determine appropriate treatment methods. The IWS permit is discussed in more detail in Appendix A of this report.

3.6.3 *Cost Estimate*

Below is a rough magnitude cost estimate for the sewer service connection options mentioned above. The cost presented below is for the material cost and installation cost of the infrastructure only, any other additional costs will be taken into consideration when developing a feasible site layout for the project area. The cost is subject to change at the time of construction.

Site Location	Option	Cost Estimate
Under the Viaduct	Connection to Exist. Sewer	\$50,000
Site 2137	Connection to Exist. Sewer	\$9,000,000
	Septic Tank System	\$20,000 to \$60,000 \$200 to \$700 per septic pumping

3.7 *Off-Grid Toilets*

Because the cost of a septic system and sewer connection may not be feasible, off-grid toilet options were investigated. A site constraint to consider is the project site is located within the floodplain. Because of this, the bottom of the toilets/composting units should be elevated and/or flood-proofed.

Off-grid toilets would be subject to the same permitting requirements as a septic system, described in Section 3.6.2 of this report.

3.7.1 Option 1

A composting toilet is a type of toilet that treats human waste by using a natural biological process to convert human waste into a reusable end-product. This type of toilet does not require connections to septic tanks or sewer systems and is therefore ideal for off-grid areas such as national parks, camp grounds, and rural areas.

Waterless composting toilets are the most widely-used type of composting toilets since they do not require a water source. Waste is collected in a container beneath the toilet. The container contains a bulking material which mixes with the waste and oxygen, allowing bacteria to convert the material into a safe and usable liquid fertilizer. Solar panels and ventilation fans can be installed to control the odors of the compost toilets.

Manufacturers provide large capacity units with compost bins of 80 cubic feet, capable of handling 60 visits a day or 22,000 visits a year. One or two toilet units are available with prefabricated structures, which would save on construction costs. The composting bin would require approximately four feet of vertical space below the toilet.

Regular maintenance would include adding bulking material to the compost chamber and raking the compost pile. Periodic maintenance would include the cleaning of the fan and cleaning of the compost chamber approximately once a year.

3.7.2 Option 2

Portable toilets (Porta Potties) can be brought on-site and used as a short-term solution to accommodate larger groups and events. Portable toilets typically use a chemical to minimize odors and need to be pumped frequently. However, the cost for renting the portable toilets would likely outweigh the compost toilet options in the long run.

3.7.3 Cost Estimate

Below is a rough magnitude cost estimate for the off-grid toilet options mentioned above. The cost presented below is for material cost and installation cost, any other additional costs will be taken into consideration when developing a feasible site layout for the project area. The cost is subject to change at the time of construction.

Site Location	Option	Cost Estimate
Halawa Valley (Site 2137)	Waterless Composting Toilet (Large Capacity)	\$200,000 (Prefabricated two toilet unit including the structure) \$100,000 (Prefabricated single toilet unit including the structure)
Under the Viaduct and Halawa Valley (Site 2137)	Portable Toilets (Porta Potties)	\$200 to \$500 per day

3.8 Water Service Connection

For operations requiring water, alternatives for water services were investigated and explored for Under the Viaduct area, as well as in Halawa Valley at Site 2137.

3.8.1 Under the Viaduct Area

Connection to the existing water system will be an alternative for buildings that will be located underneath the H-3 viaduct area. As-builts show that there is an existing 1-inch water lateral from the existing 8-inch ductile iron water main within Halawa Valley Street. The water meter is located within the sidewalk area fronting the project area parcel. A request to connect to the existing water meter will need to be sent to the Honolulu Board of Water Supply. Depending on where the new water connection will be located, construction of a new lateral or extension of the existing water lateral will require a trenching permit, for any trenching work done within the City's right-of-way, from City and County Department of Planning and Permitting (DPP).

Refer to Figure 8 for the proposed waterline connection Under the Viaduct.

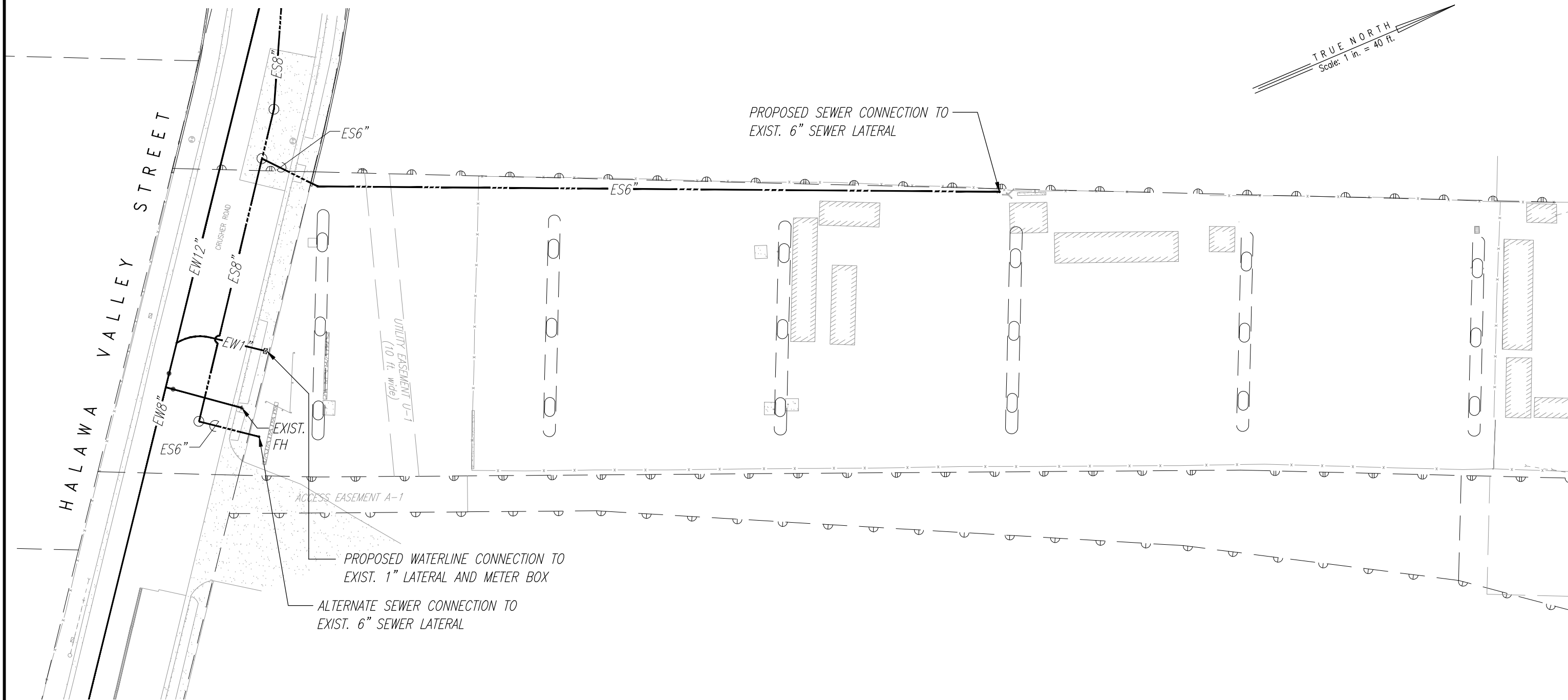
3.8.2 Site 2137

As for Site 2137, running a new water line along the Trailblazer Access Road to connect to the City's existing water system would require approximately 9,800 linear feet of new water piping. Cost and construction of this waterline along with the required appurtenances would outweigh the feasibility of this option. Therefore, connection to the existing water system for this project area will not be a viable option and remote alternatives for water accommodations will be explored.

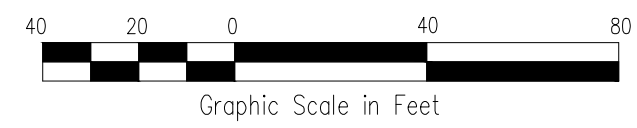
3.8.3 Cost Estimate


Below is a rough magnitude cost estimate for the water service connection options mentioned above. The cost presented below is for the material cost and installation cost of the infrastructure only; mobilization costs, and other additional costs will be taken into consideration when developing a feasible site layout for the project area. The cost is subject to change at the time of construction.

Site Location	Option	Cost Estimate
Under the Viaduct	Connection to Exist. Water	\$50,000
Halawa Valley (Site 2137)	Connection to Exist. Water	\$8,000,000



**HALAWA - UNDER THE VIADUCT
UTILITY CONNECTION**
SCALE: 1"=40'





Community Planning and Engineering, Inc.
Engineering Design | Construction Management | Infrastructure Planning
1286 Queen Emma Street Honolulu, Hawaii

**HALAWA-LULUKU INTERPRETIVE
DEVELOPMENT PROJECT**

HALAWA, OAHU, HAWAII

OWNER: STATE OF HAWAII, DEPARTMENT OF TRANSPORTATION
DEVELOPER: OFFICE OF HAWAIIAN AFFAIRS
TAX MAP KEY: 9-9-011:002

**FIGURE 8
HALAWA - UNDER THE VIADUCT UTILITY
CONNECTION**

3.9 *Rain Catchment*

Site 2137 in Halawa Valley will have an option to utilize rain catchment from the buildings that will be located on the site. The rain water collected will be for non-potable usages such as irrigation.

Rain water collected from the structures' roofs, can be drained and collected into a water tank. The most economical type of roofing material used for water catchment is non-toxic painted or enameled galvanized steel. Elastomeric coatings can also be used over other materials, but this type of coating will need to be repainted every seven years. The gutter would be made of aluminum, PVC, or plastic. Screens would be used to keep large debris out of the catchment system. A simple first flush system, consisting of a downspout chamber collecting sediment before reaching the tanks, would be installed to reduce contamination. The tanks will be placed on concrete pads or compacted gravel.

3.9.1 *Option 1*

One option for the rain catchment tank material is polyethylene. The maximum size of a polyethylene tank is 4,000 to 5,000 gallons. If more storage is needed, additional tanks can be brought to the site and the tanks can be connected with piping. Polyethylene tanks are more expensive than corrugated steel tanks, but the polyethylene tanks are likely more durable and offer more mobility and flexibility.

3.9.2 *Option 2*

An alternative tank material is corrugated steel. Tank sizes ranging from 1,000 gallons to 10,000 gallons would be reasonable for this project. In terms of initial cost, a corrugated steel tank would be more economical than a polyethylene tank. However, over time, the corrugated steel tank may require more maintenance since it is more likely to corrode and leak, which would also affect the quality of the water.

3.9.3 *Cost Estimate*

Below is a rough magnitude cost estimate for the rain catchment storage tank options mentioned above. The cost presented below is for material cost and installation cost of a 5,000-gallon tank, any other additional costs will be taken into consideration when developing a feasible site layout for the project area. The cost is subject to change at the time of construction.

Site Location	Option	Cost Estimate (for a 5,000 gallon tank)
Halawa Valley (Site 2137)	Polyethylene Water Storage Tank	\$30,000
	Corrugated Steel Water Storage Tank	\$20,000

3.10 Water Storage Tank

There will be no access to a nearby waterline at Site 2137 in Halawa Valley, therefore alternatives for an on-site water storage tank were investigated. The water tank will store potable water for usages such as washing hands, shower needs, kitchen needs, and drinking water. It should be noted that wastewater treatment will have to be provided if fixtures are installed that produce wastewater.

It is recommended that green or black polyethylene tanks be used to reduce the exposure of sunlight and algae growth. Locally, polyethylene tanks have capacities of up to 5,000 gallons, however a tank that size likely wouldn't be able to be moved once installed, so potable water would have to be delivered to the site. Logistically, portable smaller capacity tanks would be simpler. Multiple tanks could be connected together if more capacity is required.

Corrugated steel tanks are also an option, but leaks and corrosion may become an issue, which would lead to the water becoming non-potable.

3.10.1 Option 1

It is assumed that pressurized water lines would be desired on-site. This can be achieved by installing a booster pump. The pump could be powered by batteries and solar panels or the pump can be tied into the electrical system. The inlet end of the pump would connect to the water tank and the outlet would connect to the structures. The pump would detect the pressure in the water line and turn on/off to keep the specified pressure in the system. However, if large groups are anticipated, the pump would have to turn and off more often, which may cause excessive wear and tear over time. Also, the water pressure will be lower if multiple water fixtures are in use at the same time.

If desired by the Stewards, a pressurized well tank in addition to the booster pump can be installed for the water storage tank. Well tanks have capacities ranging from 20 gallons to over 100 gallons. The well tanks contain a diaphragm which expands and compresses, which helps keep pressure in the system. This allows the pump to cycle less frequently, extending the life of the pump, as well as providing a more stabilized pressure when multiple fixtures are in use at the same time.

3.10.2 Option 2

If having a pressurized water system is not a priority, a gravity fed water storage tank can service the Halawa Valley area. Due to the topography of the site, a water tank could be elevated ten feet above the ground and the water could be accessed by a valve on the tank or installing piping. However, the piping would produce a water pressure of approximately 4 psi which would not be sufficient for most uses. By comparison, the Board of Water Supply requires a minimum pressure of 40 psi in pipelines.

3.10.3 Cost Estimate

Below is a rough magnitude cost estimate for the water storage tank options mentioned above. The cost presented below is for material cost and installation cost of a 1,000-gallon tank structure and appurtenances, any other additional costs will be taken into consideration when developing a feasible site layout for the project area. The cost is subject to change at the time of construction.

Site Location	Option	Cost Estimate (for a 1,000 gallon tank)
Halawa Valley (Site 2137)	Water Storage Tank w/ Booster Pump	\$22,000
	Water Storage Tank w/ Booster Pump and Well Tank	\$25,000
	Gravity Fed Water Storage Tank	\$16,000

3.11 Electrical Service through Grid Power

Both project areas are planning to have a structure on-site and will mostly likely require electrical power for operations. With the proposed layout of the Under the Viaduct area, electrical demands are estimated to require a total connected load of approximately 60 amps, or 130 amps if structure will accommodate air conditioning. At Site 2137, the estimated electrical demands will require a total connected load of approximately 40 amps. For these estimated electrical demand services, alternatives for electrical service through grid power were investigated and explored for Under the Viaduct area, as well as in Halawa Valley at Site 2137.

3.11.1 Under the Viaduct Area

An existing HECO power system is available nearby the Under the Viaduct area. The site is adjacent to asphalt and cement facilities that are likely connected to the grid, but the exact point of connection and cost is pending further HECO coordination. Approximate distance for connection is expected to be between 50 and 1000 feet. Exterior pole-mounted lights, for Under the Viaduct area, is recommended to provide a measure of safety and security around the parking lot(s). An estimated number of light poles required for the site is 7 light poles to be installed and spaced evenly throughout the site.

In addition, with grid power connection, an option for security cameras (CCTV) can be installed around the Under the Viaduct site. The cameras will be able to feed video recordings to a TV screen in a security office in the administration building.

3.11.2 Site 2137

An existing HECO power system is not available nearby Site 2137. Therefore, providing electrical service through grid power would require new electrical poles to be installed roughly 7,500 feet to the nearest point of connection, through the mountains. Installing an excess number of electrical poles and wiring will outweigh the feasibility

of this option and this will not be a viable option for this project area and remote alternatives for electrical power accommodations will be explored.

3.11.3 *Cost Estimate*

Below is a rough magnitude cost estimate for providing electrical services through grid power. The cost presented below is for material cost and installation cost to provide connection to the existing HECO power system, any other additional costs will be taken into consideration when developing a feasible site layout for the project area. The cost is subject to change, pending further coordination with HECO at the time of construction.

Site Location	Option	Cost Estimate
Under the Viaduct	Grid Power	\$100,000*
	w/ Site Lighting	\$45,000 (Additional)
	w/ CCTV system	\$25,000 (Additional)
Halawa Valley (Site 2137)	Grid power	Not Feasible

*Subject to change pending HECO coordination.

3.12 *Electrical Service through Renewable Power*

Due to the potential of high costs to provide electricity through grid power, an alternate option of renewable power was explored for both project sites.

3.12.1 *Under the Viaduct*

The area Under the Viaduct is not well situated for renewable power. The H-3 Viaduct above the site blocks sunlight and prevents wind turbines from being mounted high enough to harness the stronger winds. Pursuing renewable energy sources at this site is not recommended.

3.12.2 *Site 2137*

Site 2137 does not have excessive tree cover, allowing for the possibility of utilizing solar or wind power to offset grid power costs or forego connecting to the grid entirely.

Building roofs at the site or an open clearing away from trees or the H-3 viaduct could be used for mounting a solar photovoltaic (PV) system of up to approximately 5kW. Installation costs are approximately \$4 per watt. Installation of a 5kW system would cost roughly \$20,000, providing approximately 6,000 kWh per year. In addition, exterior pole-mounted lights are recommended, for Site 2137, to provide a measure of safety and security along the driveway and parking lot. To reduce site power usage and trenching costs, it is recommended to use solar PV powered light poles. A set of 7 poles would be provided throughout the site, at a cost of \$6,000 per pole.

Wind power is also an option in this area, however it is expected that Halawa Valley has slower wind speeds, which may be suboptimal for wind power generation. If desired, one or more wind turbines could be installed on towers to reach above the tree

line. Additionally, it is unknown at this time if the Department of Transportation would raise concerns with a 30 foot or taller wind turbine being erected next to the H-3 Viaduct. A 2.5 kW wind turbine system would cost roughly \$20,000, and be expected to generate approximately 4,500 kWh per year. These figures are subject to change, pending further coordination with DOT and with a local wind turbine installer.

An alternate for solar and wind power generation at Site 2137 would be utilizing a generator on-site to provide electrical power. A generator could be provided as a back-up for the solar or wind power generation options or be a stand-alone option. Sizing of the generator will vary depending on the estimated use on-site.

Due to the high cost of connecting this remote site to the power grid, it is recommended to add a battery storage system in addition to all the options mentioned above. Cost for a 27 kWh battery system, including installation, is approximately \$20,000.

3.12.3 Cost Estimate

Below is a rough magnitude cost estimate for providing electrical services through renewable power generation. The cost presented below is for material cost and installation cost of the renewable power system, any other additional costs will be taken into consideration when developing a feasible site layout for the project area. The cost is subject to change, at the time of construction.

Site Location	Option	Cost Estimate
Under the Viaduct	Renewable Power	Not Recommended
Site 2137*	Solar PV System	\$20,000
	w/ Site Lighting	\$42,00 (Additional)
	Wind Power	\$20,000
	Generator	\$50,000

*Battery storage is recommended in addition to the options (\$20,000)

3.13 Telephone, Internet and Cable Television Service

Options for telephone, internet, and cable television services were also looked in to for usage at both site locations, Under the Viaduct and Site 2137.

3.13.1 Option 1

Spectrum (formerly Oceanic Time Warner Cable, providing telephone, internet, and cable TV) service is available for both sites, although it will require installing additional utility poles.

For Under the Viaduct area, Spectrum service is available from approximately 1,000 feet mauka, along the H-3. Rough cost for Spectrum service is \$35,000; rough cost to install supporting utility poles is \$6,000 per pole, or \$30,000 for 5 that would be anticipated.

For Site 2137, Spectrum service would be available via connection from Under the Viaduct area. For the service to reach the site, it will require overhead pole lines to be installed, approximately 7,500 feet in length. Rough cost for Spectrum service is \$135,000, which would run on the same poles installed by HECO.

3.13.2 Option 2

Hawaiian Telcom (providing telephone and internet) service is also available for both sites, although the nearest point of connection is pending further Hawaiian Telcom coordination and consultation.

For Under the Viaduct area, depending on the connection point for Hawaiian Telcom service, a rough cost for the service is \$15,000 and a rough cost to install supporting utility poles is \$6,000 per pole, or \$30,000 for 5 that would be anticipated in worst case.

For Site 2137, Hawaiian Telcom service would be available via connection from Under the Viaduct area and will require overhead infrastructure to be installed. Rough cost for Hawaiian Telcom service is \$75,000, which would run on the same poles installed by HECO.

3.13.3 Option 3

Viasat (providing internet) service via satellite signal is not recommended for Under the Viaduct, as the H-3 Viaduct will block satellite signals and since cable utility service is available within 1000 feet.

Although, Viasat is an available option for Site 2137 for satellite internet service, with an installation cost of \$100, and \$175 per month for service. Business service package includes unlimited data (though it slows after 75GB in a month), 35MB/second download speed, and 4MB/second upload speed. Satellite TV from Viasat is also an available option if desired, with an install cost of \$100 to \$300, and service cost of roughly \$80/month.

Based on installation costs, Viasat is the recommended alternative for providing satellite internet service for Site 2137. Internet speeds are slower than a cable connection, but still acceptably fast for video streaming.

3.13.4 Cost Estimate

The table on the following page, shows a rough magnitude cost estimate for providing telephone, internet, and cable television services. The cost presented on the following page is for the installation of the respective service, any other additional costs will be taken into consideration when developing a feasible site layout for the project area. The cost is subject to change, pending further coordination with the service companies at the time of construction.

Site Location	Option	Cost Estimate
Under the Viaduct	Spectrum	\$65,000
	Hawaiian Telcom	\$45,000
	Viasat	Not Recommended
Halawa Valley (Site 2137)	Spectrum	\$135,000
	Hawaiian Telcom	\$75,000
	Viasat	\$300 + \$80 per month (TV) \$100 + \$175 per month (Internet)

3.14 Gas Service

For operations requiring gas, alternatives for gas services were investigated.

Based on preliminary site investigations, there are no known gas lines in the area near the viaduct area and Site 2137. Therefore, to provide gas services for the Stewards, a gas tank would need to be present on-site. The gas tank would need to be refilled and maintained when required.

A gas tank can be installed Under the Viaduct and in Halawa Valley. However, because Halawa Valley is in a flood zone, if a tank were to be installed at Site 2137, the tank will need to be flood-proofed. Generally, flood-proofing involves strapping and anchoring the tank to a concrete base to ensure the tank doesn't float away.

3.14.1 Option 1

A permanent large capacity gas tank can be installed at either or both locations. Because of its size and potential danger, more restrictions and requirements are needed for large capacity tanks than the smaller tanks. A separate entity, such as Hawaii Gas, would also have to refill the tanks on-site since the tanks would not be portable. This option would likely cost more but would be the easiest for user maintenance. The cost for refilling a tank at Site 2137 may also be higher than refilling a tank Under the Viaduct.

A Honolulu Fire Department (HFD) Permit for Tank Installation would have to be obtained for tanks with capacities of more than 60 gallons.

3.14.2 Option 2

If the demand of the gas tank usage is low, an alternate option would be portable propane gas tanks. These portable tanks could also be used to provide gas to the site. The maximum portable size would be a 100-pound (23.6 gallon) tank, which is approximately 4-feet tall and 1.5-feet in diameter, however multiple tanks can be placed on-site if more capacity is needed. The placement and regulations of the portable tanks are much less restrictive than the large gas tanks. The portability of the tanks would allow the Stewards to refill the tanks at local hardware stores.

3.14.3 Cost Estimate

Below is a rough magnitude cost estimate for providing gas services via propane gas tank options. The cost presented below is for material cost and installation cost to provide a propane gas tank on-site, any other additional costs will be taken into consideration when developing a feasible site layout for the project area. The cost is subject to change, at the time of construction.

Site Location	Option	Cost Estimate
Under the Viaduct and Halawa Valley (Site 2137)	Large Capacity Permanent Propane Gas Tank	\$7,000
	Small Capacity Portable Propane Gas Tank	\$4,000

3.15 Nursery

A nursery would consist of a propagation area to grow Native Hawaiian plants, which could be used for landscaping, food, medicine, utilitarian objects, education, and other uses.

3.15.1 Under the Viaduct

A plant nursery requires a good amount of direct sunlight, room to grow and an abundant source of water. A water source Under the Viaduct can likely be provided but the site would lack direct sunlight. Artificial lighting is very costly to purchase, operate and maintain and may not be a viable option. Observations of existing plantings Under the Viaduct shows that plants do not perform well. Placing a nursery in this area would not be an economically viable ideal and therefore not recommended.

3.15.2 Site 2137

A nursery is also not recommended for Site 2137. In addition to the need for sunlight, a nursery would require a flat area, which would likely be located adjacent to the freeway. Unfortunately, the freeway would block direct sunlight to the nursery for a portion of the day. It is also expected that water will be limited in its availability at Site 2137. The existing landscaped areas could be expanded to accommodate a limited quantity of plant material however, given the amount of available water, manpower, and space, a nursery would not be economically viable for this area as well.

3.16 Landscaping

Landscaping would provide privacy and improve the aesthetics for the Halawa sites. It could also help with the maintenance by acting as a dust screen or weed barrier.

3.16.1 Under the Viaduct

The landscape scope for the Under the Viaduct area is to plant screening trees on both sides of the freeway bay to block the view of the adjacent properties and filter the dust that blows into the site. Landscape planting directly under the freeway should be minimized because plantings directly under a freeway typically will not grow well due

to existing site conditions. The constant shade and dust will subject the plant material to stress, which is ideal for infestation of aphids, etc.

The plants considered for this dust screen planting along the existing chain link fence will be palm trees since they do grow naturally in the understory of large shade trees and can tolerate some shade. Assuming water and electricity is provided to the site, irrigation can be provided with an automatic conventional irrigation system with a 120-volt automatic irrigation controller.

3.16.2 Site 2137

The proposed landscape design for Site 2137 would develop a sustainable gathering space(s) that is usable, mud free and relatively weed free. Gathering spaces on the site can be identified and cleared of weeds. Then, a layer of gravel over a weed barrier could be placed to raise the ground above the mud and keep the weeds to a manageable level. The gravel/weed barrier will let air and water pass through and protect any archaeological items beneath. The landscape scope for this project area is to plant a hedge along the front of the site along the access road. A native tree will be planted at the entry point to identify the entry.

3.16.3 Cost Estimate

Below is a rough magnitude cost estimate for landscaping for both project areas. The cost presented below is for the material and planting of the vegetation, any other additional costs will be taken into consideration when developing a feasible site layout for the project area. The cost is subject to change at the time of construction.

Site Location	Option	Cost Estimate
Under the Viaduct	Landscaping	\$50,000
Halawa Valley (Site 2137)	Landscaping	\$15,000

Section 4 Feasible Project Alternatives

Feasible project alternatives for both Under the Viaduct area and Site 2137 were developed, to include select project elements based on input from the stakeholders. The feasibility of each alternative presented below is based off of budgetary constraints, construction/mobility factors, and the capacity of management for the Stewards. The alternative site layouts are suggestive and can be altered to include or not include certain project elements.

4.1 Under the Viaduct Area

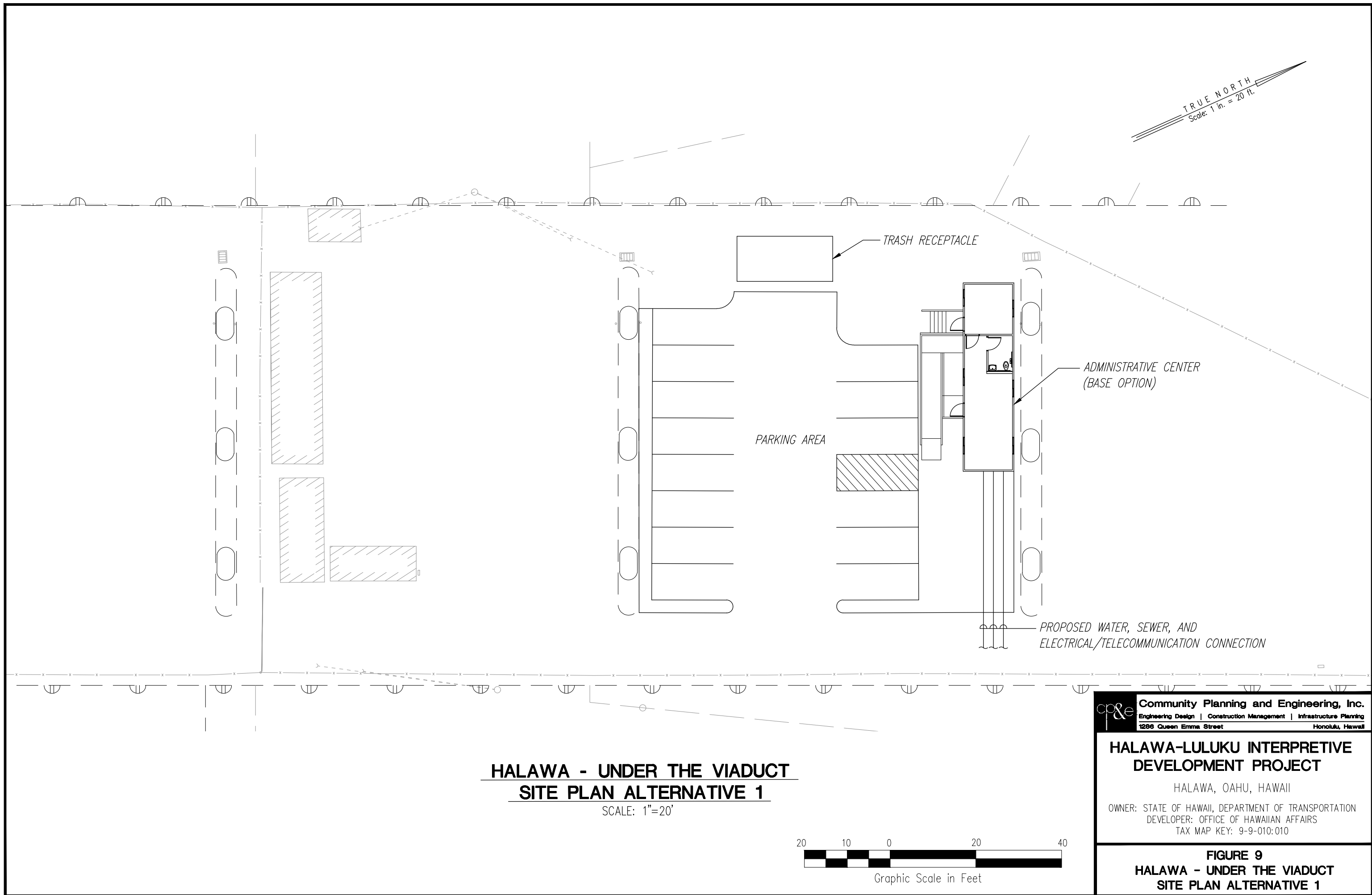
The Under the Viaduct area compasses the eight (8) bays underneath the Interstate H-3, located off of Halawa Valley Street near the entrance of Hawaiian Cement. This area has been previously disturbed, with a majority of the surface area being impervious with asphalt pavement. Utilizing this area will provide the Stewards access to utilities such as electricity, sewer, and water services.

4.1.1 Alternative 1

This site layout is aimed to provide the bare essential needs of the Stewards Under the Viaduct area. The layout will include the following project elements: a modular building (inclusive of administrative office, a meeting space, and restroom facility), trash receptacles, and parking. In addition, the modular building set-up would require connection to existing utilities for electrical, telecommunication, sewer, and water services. Being that the option for utility services would require off-grid alternatives for Site 2137, this alternative will allow the Stewards to utilize and easily access these services Under the Viaduct. This site layout will also provide the Stewards and visitors a common area to meet before heading up valley to Site 2137. This area would provide parking for visitors and the option to carpool to minimize the traffic flow heading into Halawa Valley. See the table below for a breakdown of the estimated cost. Incidental construction cost will include factors, such as, but not limited to, construction management, archaeological monitoring, geotechnical monitoring, construction surveying, and mobilization.

Project Element	Cost
Modular Building	\$460,000
Parking (Striping)	\$2,000
Trash Receptacles (8 cubic yard Dumpster Only)	\$600
Sewer Service Connection	\$50,000
Water Service Connection	\$50,000
Electricity Service Connection	\$100,000
Telecommunication Service Connection	\$65,000
Incidental Construction Cost	\$315,000
Estimated Total Cost	\$1,042,600

Refer to Figure 9 for site plan Alternative 1 for Under the Viaduct area.



4.2 *Halawa Valley (Site 2137)*

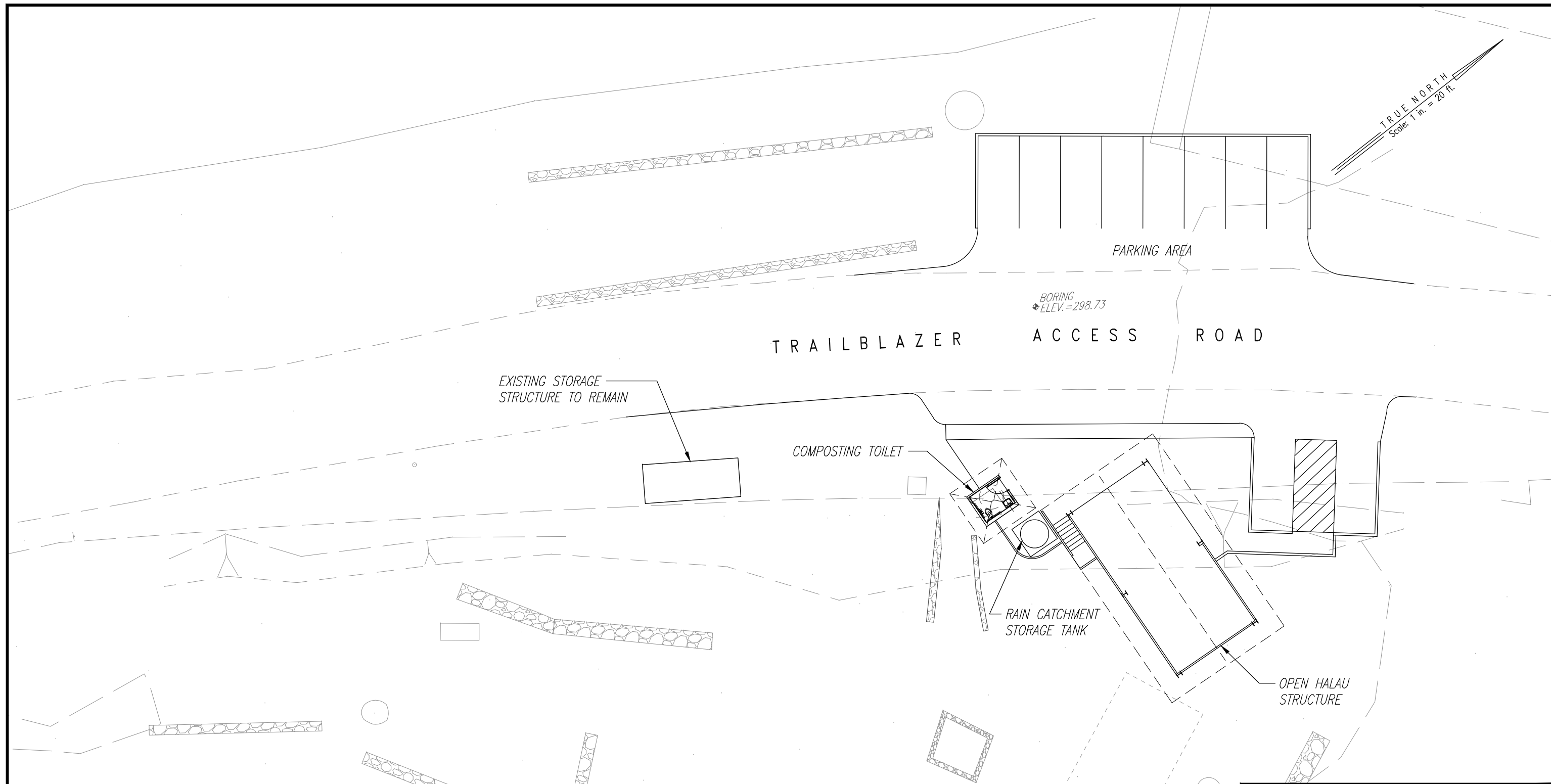
Halawa Valley, referred to as “Site 2137,” is located mauka of the Under the Viaduct project area along the Trailblazer Access Road. This area has been minimally disturbed and is covered with natural vegetation. The project site is in a remote area, where access to existing utilities would be infeasible, leaving the only consideration being off-grid measures. All structures for Site 2137 will be positioned closely to the roadway to preserve the existing site as much as possible.

4.2.1 *Alternative 1*

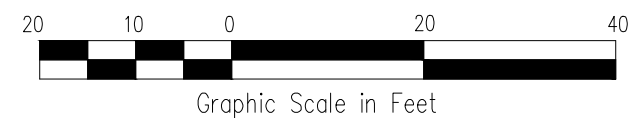
This alternative site layout is aimed to provide the bare essential needs of the Stewards up in the valley at Site 2137. Alternative 1 will include the following project elements: an open structure halau, rain catchment, composting toilet, and parking. This alternative will provide an open structure halau, which would be a more permanent structure than the current set-up of the ez-corner tents. Although this structure would not have provisions to be secured, it would provide a covered and stable area to meet under. A rain catch storage tank would be provided near the halau to collect rain water from the roof area and store the water for non-potable uses. Also, a single composting toilet will be provided for the Stewards and visitor use while up at the site. In addition, a designated parking area would be provided off the access road. This alternative will provide the Stewards with more permanent structures than what is currently on-site while also managing a budget to implement such elements. Refer to the table below for a breakdown of the estimate cost for Alternative 1. Incidental construction cost will include factors, such as, but not limited to, construction management, archaeological monitoring, geotechnical monitoring, construction surveying, and mobilization.


Project Element	Cost
Open Structure Halau	\$360,000
Rain Catchment Storage Tank (5,000 gallon)	\$30,000
Composting Toilet (Single)	\$100,000
Parking (Gravel)	\$10,000
Incidental Construction Cost	\$220,000
Estimated Total Cost	\$720,000

Refer to Figure 10 for site plan Alternative 1 for Site 2137.



HALAWA - SITE 2137
SITE PLAN ALTERNATIVE 1
 SCALE: 1"=20'



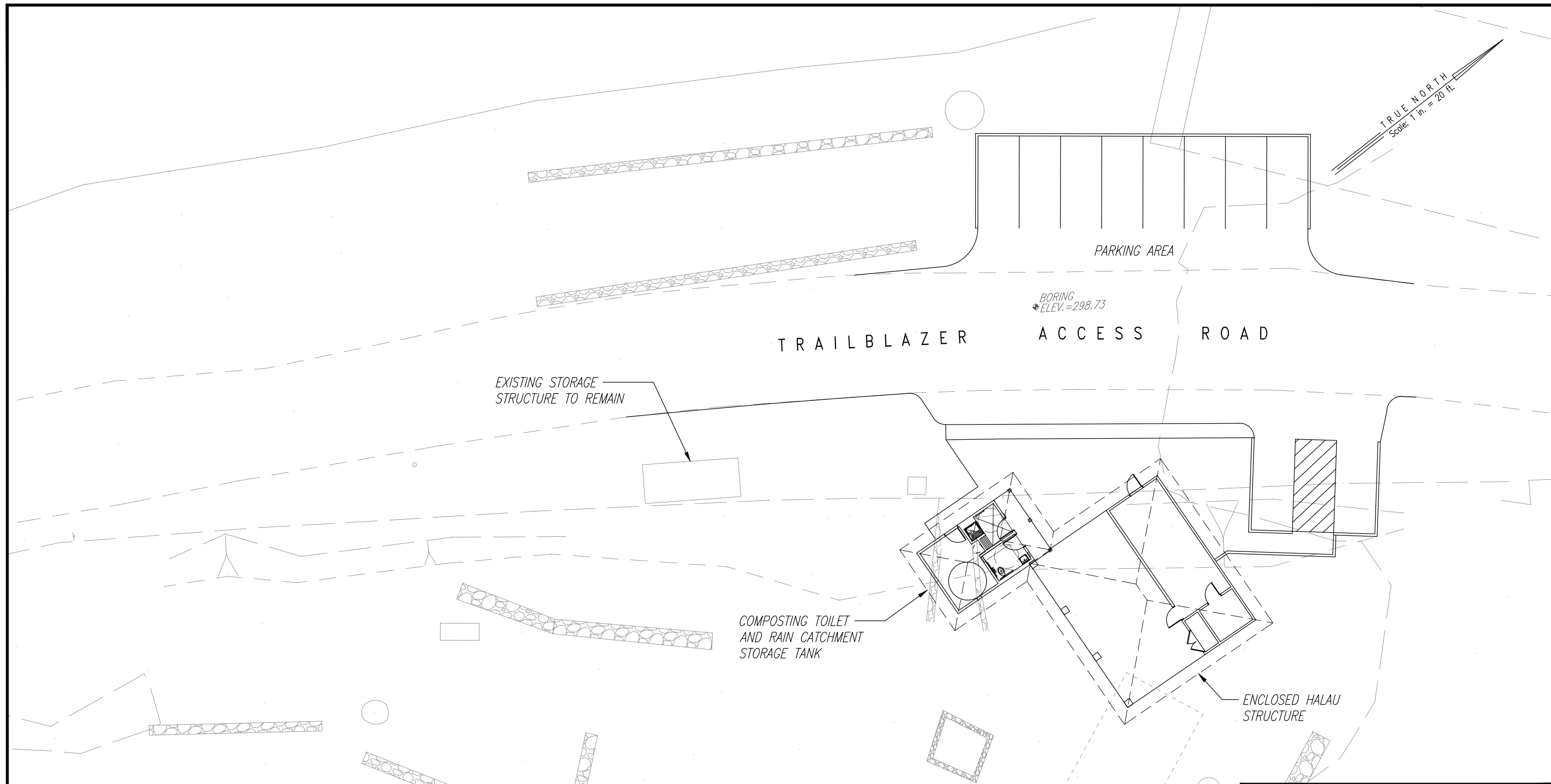
	Community Planning and Engineering, Inc. Engineering Design Construction Management Infrastructure Planning 1286 Queen Emma Street Honolulu, Hawaii
	HALAWA-LULUKU INTERPRETIVE DEVELOPMENT PROJECT HALAWA, OAHU, HAWAII OWNER: STATE OF HAWAII, DEPARTMENT OF TRANSPORTATION DEVELOPER: OFFICE OF HAWAIIAN AFFAIRS TAX MAP KEY: 9-9-011:002
FIGURE 10 HALAWA - SITE 2137 SITE PLAN ALTERNATIVE 1	

4.2.2 *Alternative 2*

This alternative site layout will provide something more complex than the previous alternative, but still restraining from a few project elements. Alternative 2 will include the following project elements: an enclosed halau structure, composting toilet, rain catchment storage tank, and parking. The enclosed halau structure would provide a meeting area, as well as provisions for the structure to store items overnight and be secured. As part of the halau structure, double composting toilets would be provided. Also, this alternative will provide a rain catchment storage tank to collect rain water from the roof and store the water for non-potable uses. Alternative 2 is looking to provide the Stewards with project elements that would provide more functionality than Alternative 1, while keeping the budgetary cost in mind. Refer to the table below for a breakdown of the estimate cost for Alternative 2. Incidental construction cost will include factors, such as, but not limited to, construction management, archaeological monitoring, geotechnical monitoring, construction surveying, and mobilization.

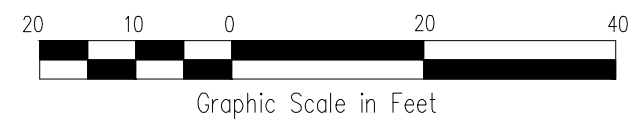
Project Element	Cost
Enclosed Halau Structure	\$625,000
Composting Toilet (Double)	\$200,000
Rain Catchment Storage Tank (5,000 gallon)	\$30,000
Parking (Gravel)	\$10,000
Incidental Construction Cost	\$372,000
Estimated Total Cost	\$1,237,000

Refer to Figure 11 for site plan Alternative 2 for Site 2137.



**HALAWA - SITE 2137
SITE PLAN ALTERNATIVE 2**

SCALE: 1"=20'



Community Planning and Engineering, Inc.
Engineering Design | Construction Management | Infrastructure Planning
1286 Queen Emma Street Honolulu, Hawaii

**HALAWA-LULUKU INTERPRETIVE
DEVELOPMENT PROJECT**

HALAWA, OAHU, HAWAII

OWNER: STATE OF HAWAII, DEPARTMENT OF TRANSPORTATION
DEVELOPER: OFFICE OF HAWAIIAN AFFAIRS
TAX MAP KEY: 9-9-011:002

**FIGURE 11
HALAWA - SITE 2137
SITE PLAN ALTERNATIVE 2**

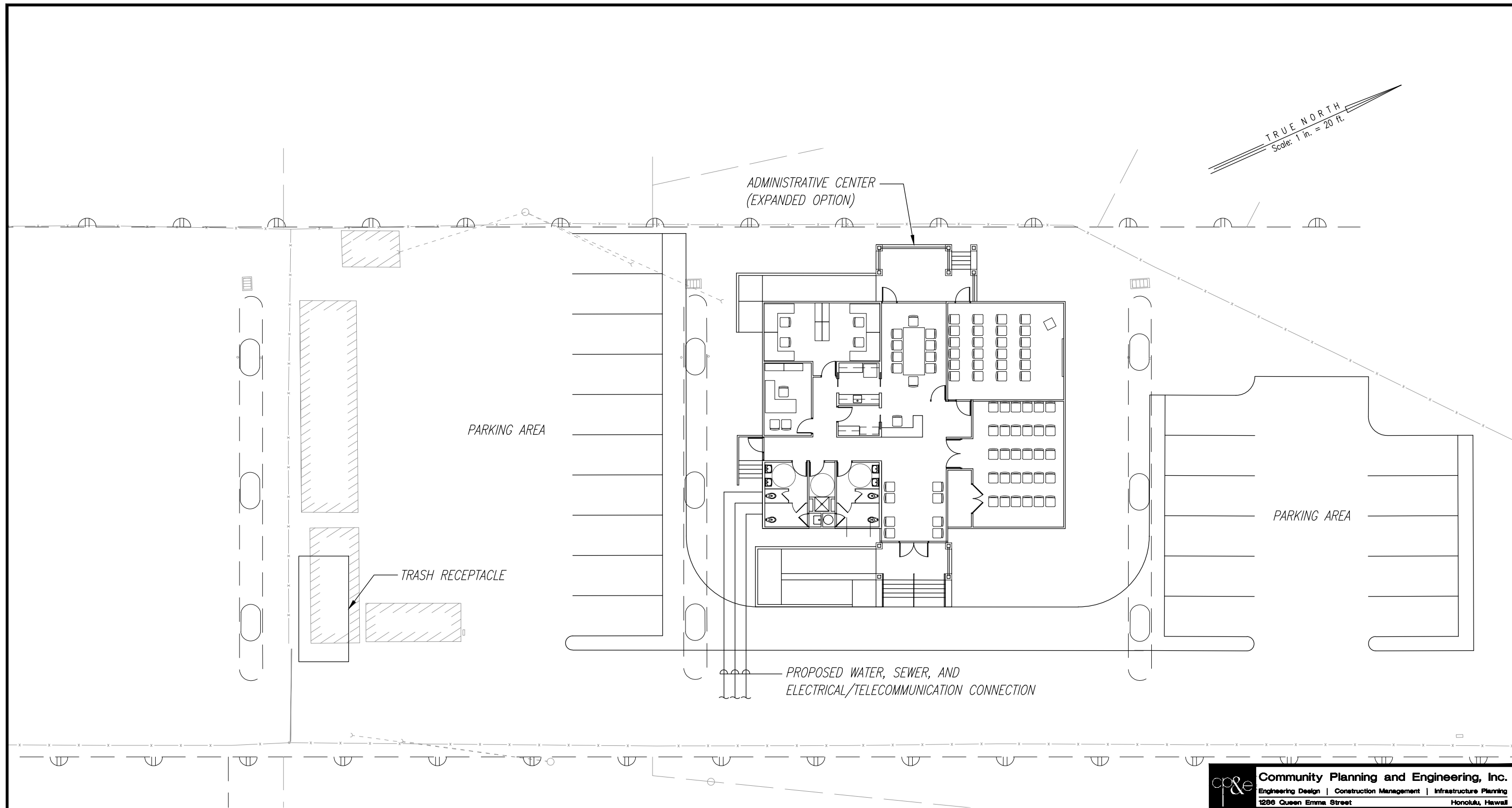
Section 5 Future Growth Projections

As the Stewards works towards their goals and visions for the North Halawa Valley area, they will concurrently need to look at future expansion of their working area. Looking towards the future growth projections of the working group, an overall site layout was developed for Under the Viaduct area, as well as Site 2137. These site layouts would be inclusive of all the project elements discussed in the previous section. The site layouts presented are only conceptual and will be subject to further coordination and consultation.

For Under the Viaduct area, the overall site layout would include the following project elements: a modular building (inclusive of a large administrative office working space, educational classrooms, a lobby area, and a restroom facility with showers), trash receptacles, and parking. In addition, this modular building on-site would have connections to existing utilities for electrical, sewer, and water services. The overall site layout would provide a large enclosed area and sufficient space to have multi-purpose uses for educational classes, meeting areas, and office spaces. The modular building would also provide sufficient space for a restroom and shower facility for the Stewards and visitors to use and wash off after spending time up valley. Refer to the table below for a breakdown of the estimate cost for the overall site layout for the Under the Viaduct area. Incidental construction cost will include factors, such as, but not limited to, construction management, archaeological monitoring, geotechnical monitoring, construction surveying, and mobilization.

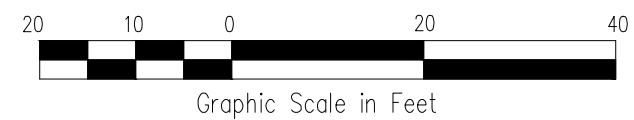
Project Element	Cost
Modular Building	\$1,200,000
Parking (Striping)	\$2,000
Trash Receptacles (8 cubic yard Dumpster Only)	\$600
Sewer Service Connection	\$50,000
Water Service Connection	\$50,000
Electricity Service Connection	\$100,000
Telecommunication Service Connection	\$65,000
Incidental Construction Cost	\$624,000
Estimated Total Cost	\$2,091,600

Refer to Figure 12 for the overall site layout for Under the Viaduct area.



**HALAWA - UNDER THE VIADUCT
ULTIMATE SITE LAYOUT**

SCALE: 1"=20'



Community Planning and Engineering, Inc.
Engineering Design | Construction Management | Infrastructure Planning
1286 Queen Emma Street Honolulu, Hawaii

**HALAWA-LULUKU INTERPRETIVE
DEVELOPMENT PROJECT**

HALAWA, OAHU, HAWAII

OWNER: STATE OF HAWAII, DEPARTMENT OF TRANSPORTATION

DEVELOPER: OFFICE OF HAWAIIAN AFFAIRS

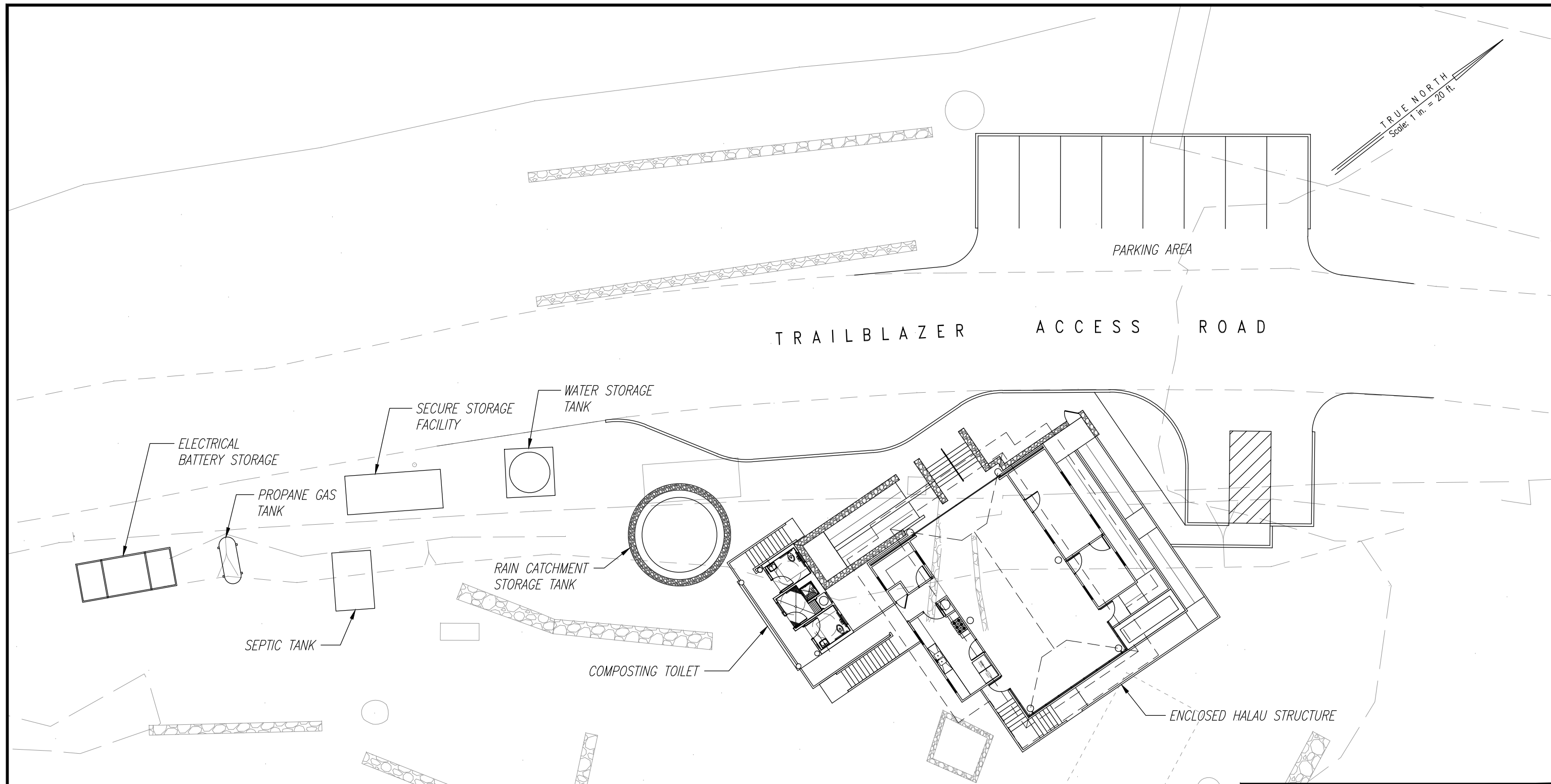
TAX MAP KEY: 9-9-010:010

**FIGURE 12
HALAWA - UNDER THE VIADUCT
ULTIMATE SITE LAYOUT**

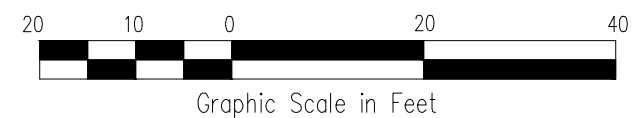
For Site 2137, the overall site layout would include the following project elements: an enclosure halau structure (inclusive of meeting area, office space, kitchen area, and storage), a secured storage facility, composting toilet, rain catchment storage tank, water storage tank, electricity through solar panels, and parking. This overall site layout would encompass a majority of the project elements into one common area with the halau structure. Looking into future projected growth with the Stewards, a site layout of this magnitude may be required to support the needs and functionality of the Stewards. Refer to the table below for a breakdown of the estimate cost for the overall site layout for Site 2137. Incidental construction cost will include factors, such as, but not limited to, construction management, archaeological monitoring, geotechnical monitoring, construction surveying, and mobilization.


Project Element	Cost
Enclosed Halau Structure	\$1,700,000
Secured Storage Facility with Lighting	\$500,000
Composting Toilet (Double)	\$200,000
Rain Catchment Storage Tank	\$30,000
Water Storage Tank (w/booster pump and well tank)	\$25,000
Electricity (Solar PV System with Site Lighting and Battery Storage)	\$82,000
Septic Tank System	\$60,000
Parking (Gravel)	\$10,000
Incidental Construction Cost	\$1,100,000
Estimated Total Cost	\$3,707,000

Refer to Figure 13 for the overall site layout for Site 2137.



HALAWA - SITE 2137
ULTIMATE SITE LAYOUT
 SCALE: 1"=20'



	Community Planning and Engineering, Inc. Engineering Design Construction Management Infrastructure Planning 1286 Queen Emma Street Honolulu, Hawaii
	HALAWA-LULUKU INTERPRETIVE DEVELOPMENT PROJECT HALAWA, OAHU, HAWAII OWNER: STATE OF HAWAII, DEPARTMENT OF TRANSPORTATION DEVELOPER: OFFICE OF HAWAIIAN AFFAIRS TAX MAP KEY: 9-9-011:002
FIGURE 13 HALAWA - SITE 2137 ULTIMATE SITE LAYOUT	

Section 6 Summary

The Halawa-Luluku Interpretive Development Project was set out to initiate the mitigation process of the impacts to cultural and archaeological resources cause by the construction of the Interstate H-3. Through this feasibility report, various project elements were explored to determine the feasibility of incorporating such elements within the North Halawa Valley project area. The project elements and site layout alternatives presented in this report were aimed to assist the working community group (Stewards) with their vision for the North Halawa Valley project area. Through the exploration of the project elements and site layout alternatives for the project area, in addition to consultation with the stakeholders, a recommended site layout alternative was chosen. The recommended alternative was based on budgetary constraints, construction/mobility factors, and the capacity of management for the Stewards.

For the North Halawa Valley project area, the recommended alternative is summarized in the following table along with cost estimates:

North Halawa Valley (Site 2137)	
Project Element	Cost
Open Structure Halau	\$360,000
Rain Catchment Storage Tank (5,000 gallon)	\$30,000
Composting Toilet (Single)	\$100,000
Parking (Gravel)	\$10,000
Incidental Construction Cost	\$220,000
Estimated Total Cost	\$720,000

For the purposes of this planning report, the alternative presented above will be the recommended alternative moving forward into the design phase of this HLID project for the North Halawa Valley project area. The estimated cost for the recommended alternative is a rough budgetary estimate and is subject to change. During the design phase, collaboration and coordination will be required between the design team and Stewards to develop a viable final design. Due to budgetary cost restraints and possible unforeseen conditions during design and construction, certain elements of the recommended site layout may be changed or altered.

Section 7 References

1. Halawa-Luluku Interpretive Development Team, Office of Hawaiian Affairs, 2014. *PROJECT DESCRIPTIONS: North Halawa Valley and Luluku Project Areas.*
2. HAR §11-50. Food Safety Code, Department of Health (2017).
3. HAR §11-62. Wastewater Systems, Department of Health (2016).
4. Hawaii State Department of Health, Wastewater Branch, 2009. *Guidelines for the Resuse of Gray Water.*
5. Keala Pono Archaeological Consulting, LLC, 2015. *FINAL – Archaeological Condition Assessment Plan for Selected Sites along the Interstate H-3 Highway Corridor; Halawa Ahupua`a and Luluku (Kane`ohe Ahupua`a), `Ewa and Ko`olaupoko Districts, Island of O`ahu, Hawai`i.*
6. Maccomber, Patricia S.H., 2010. *Guidelines on Rainwater Catchment Systems of Hawaii.*
7. City and County of Honolulu, Department of Planning and Permitting, 2017. *Storm Water BMP Guide for New and Redevelopment.*
8. Water Resources Research Center and Engineering Solutions, Inc., 2008. *Onsite Wastewater Treatment Survey and Assessment.*

Appendix A – Permitting

There will be several Federal, State, and City and County of Honolulu permits and approvals that will need to be obtained to complete the project. The permits and approvals listed below may be required for the proposed project. Further consultation with the permitting agencies will be done in the design phase to determine if the permit/approval is required based on the chosen site layout and project elements. It is assumed that the nearby streams would not be altered. However, if the streams are altered, additional federal and local permits would be required.

State of Hawaii Permitting

Department of Health, Compliance Branch

The DOH Compliance Assistance Branch does not have permitting requirements but provides guidance to which agency within DOH should be consulted based on the scope of the proposed work.

Department of Health, Clean Water Branch

National Pollutant Discharge Elimination System (NPDES)

The DOH CWB has a responsibility to protect Hawaii's coastal and inland water resources. An NPDES permit from the CWB is required before any discharge of flow is released into State waters. Either a general or individual NPDES permit may be required for the discharge of dewatering effluent, stormwater, or wastewater. A Notice of Intent (NOI) must be submitted to the CWB a response shall be received within thirty days.

Section 401 Water Quality Certification (WQC)

The DOH CWB is authorized under Section 401 of the Federal Clean Water Act to administer the Section 401 WQC program in Hawaii. A WQC is required to apply for a Federal license or permit to conduct any activity including but not limited to the construction or operation of facilities which may result in any discharge into nearshore or inland waters.

Some activities including maintenance, utility line activities, temporary construction, and dewatering may be granted coverage under the Blanket Section 401 WQC developed by the 2012 Department of the Army NWP file number WQC0804.

Department of Health, Wastewater Branch

Plans Approval

DOH Wastewater Branch is responsible for the review and approval of planning/environmental documents, wastewater project plans and specifications, final construction inspections of wastewater projects, and assisting in enforcement activities in the joint Federal-County-State Wastewater Construction Grants

Program, the State Revolving Fund Program, and for regulating wastewater systems in accordance with Administrative Rule, Chapter 11-62, entitled, “Wastewater Systems.”

Individual Wastewater System (IWS) Permit

A State Department of Health Individual Wastewater System permit is required to construct a new individual wastewater system. This permit involves owner, engineer, and contractor certifications/inspections, a site evaluation, percolation tests, approval of construction, site, and floor plans, approval of an operations manual, and approval of a sludge disposal plan.

State Historic Preservation Division (SHPD)

Section 106

Any federally funded projects are subject to Section 106 Protection of Historic Properties of the National Historic Preservation Act (NHPA). The NHPA requires Federal Agencies to take into account the effects of the project on historic properties and to allow the Advisory Council on Historic Preservation (ACHP) an opportunity to comment on the project. The Federal Agency may also seek public comments.

Chapter 6E-8

Under Hawaii Revised Statutes (HRS) Chapter 6E-8 “Review of Effect of Proposed State Projects”, SHPD shall be consulted to determine its potential to effect historic property, aviation artifact, or a burial site. A written concurrence from SHPD is required prior to commencement of construction.

Disability and Communication Access Board (DCAB)

Plan Review

DCAB reviews and provides recommendations on all State and County plans and specifications for buildings, facilities, and sites, as required under Hawaii Law HRS Chapter 103-50, in order to ensure that they are designed and constructed to be accessible to persons with disabilities.

Office of Conservation and Coastal Lands (OCCL)

Conservation District Use Application (CDUA)

A Conservation District Use Permit is required for any work activities within an area designated as the conservation district. The Conservation District is established by the State Land Use Commission and includes large areas of mountain and shoreline lands, virtually all traditional Hawaiian fishponds, and most submerged offshore lands. Maps displaying the boundaries of the Conservation District are available at DLNR.

Office of Environmental Quality Control (OEQC)

Environmental Assessment (EA) or Environmental Impact Statement (EIS)

Under the State's environmental review law, activities that trigger Chapter 343, HRS are required to prepare an EA or an EIS.

Department of Transportation, Highways

Lane Use / Occupancy Permit

A HDOT Lane Use / Occupancy Permit is required if there is a need to occupy a lane for construction activities adjacent to or within the HDOT Highways right-of-way.

Permit to Construct Within a State Highway

HDOT requires permits for the routine construction projects within the state highway right-of-way. This permit includes utility service connections, minor repairs, or minor adjustment of utilities. Permit applications are reviewed by the O'ahu District Office and require two sets of construction plans (including a traffic control plan), insurance, a minimum permit fee of \$10, minimum bond of \$1,000, and two sets of plans.

City and County of Honolulu Permitting

Department of Planning and Permitting

Building Permit

According to Revised Ordinances of Honolulu (ROH) Chapter 18, Section 18-3.1, a building permit is required for the following:

- (1) Erect, construct, enlarge, alter, repair, move, improve, remove, convert or demolish any building or structure;
- (2) Any electrical work;
- (3) Install, remove, alter, repair or replace any plumbing, fire sprinkler, gas or drainage piping work or any fixture, gas appliance, or water heating or treating equipment; or
- (4) Construct, reconstruct or improve any sidewalk, curb or driveway in any public street right-of-way

Flood Determination in General Floodplain District

Prior to processing any development plans for approval, a request for flood determination within the project area shall be submitted to DPP. This will determine the flood hazard district requirements and may initiate a flood study to be conducted for the project site.

Grading Permit

Projects with grading in excess of 50 cubic yards of cut or fill, or cut or fill of more than 3 feet would require a grading permit. Construction plans would have to be submitted to DPP for review and approval.

Grubbing Permit

Projects requiring clearing and grubbing of the site prior to any grading work being conducted will require a grubbing permit. Construction plans would have to be submitted to DPP for review and approval.

Sewer Connection Permit

A Sewer Connection Application is required for projects that will increase sewage flow to the municipal sewer system. This includes new sewer connections from unsewered lots and new commercial buildings.

DOH also requires a rejected City and County of Honolulu sewer connection application before their review of IWS permits.

Storm Water Quality

DPP requires different levels of storm water quality measures depending on the project's area of disturbance. Prior to starting work, an Erosion and Sediment Control Plan (ESCP) will have to be developed. The ESCP is a plan to prevent and control erosion and sediment discharge from the construction site. The project sites would likely be classified under a category 3 or 4. For project in those categories, construction drawings with a Best Management Practices (BMP) site plan, BMP design details, and other drawings must be included.

The projects sites would also be considered a priority B1 or B2 under the City's Water Quality Rules. Priority B1 projects are any new development that results in 5,000 square feet or more impervious area and/or parking lots with 20 stalls or more. Priority B2 projects are new developments that results in 500 to 5,000 square feet of impervious area. The design requirements for Priority B1 projects are stricter than Priority B2 projects. The runoff for Priority B1 projects must be kept on-site as much as possible and the runoff not retained on-site must be treated. This can be done by installing infiltration basins, permeable pavement, vegetative swales, bioretention, etc. A Storm Water Quality Report (SWQR) must also be prepared by a Certified Water Pollution Plan Preparer (CWPPP) and be approved by the DPP Director. Priority B2 projects, on the other hand, are not required to retain the runoff on-site. Also, the project would only need to a Storm Water Quality Checklist (SWQC) prepared by a CWPPP to be approved by the DPP Director. An Operations Manual (O&M) Plan would have to be prepared detailing how the BMP measures will be maintained.

Trenching Permit

If there is trenching of any public street, sidewalk, or thoroughfare, a trenching permit will be required. Trenching may be required for sewer or water connections. An ESCP would be needed with the trenching permit. Clearances from other City departments and utility companies having underground installations would have to be obtained. Bond and insurance are also required.

Department of Transportation Services

Street Usage Permit

A street usage permit is required for all work performed within the City and County of Honolulu right-of-way, parking on City and County of Honolulu roadways for construction related activities, and roadway closure for construction related activities. Some construction activities may be subject to a required traffic control plan. Permit fees are required only when construction obstructs or uses metered parking spaces including on-street parking and municipal parking lots.

Honolulu Fire Department (HFD)

Permit for Tank Installation

A permit or license shall be obtained from the HFD's Fire Prevention Bureau to install or operate equipment in connection with the storage, handling, use, or sale of flammable or combustible liquids regulated, such as propane, for tanks with capacities of over 60 gallons.

Appendix B – Agency Responses



DEPARTMENT OF PLANNING AND PERMITTING
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET * HONOLULU, HAWAII 96813
Phone: (808) 768-8209 * Fax: (808) 768-4210

SEWER CONNECTION APPLICATION

APPLICATION NO.: **2019/SCA-0109**

STATUS: **Approved**

DATE RECEIVED: **01/16/2019**

IWDP APP. NO.:

PROJECT NAME: **2019/SCA-0109 Hawala-Luluku Interpretive Development Project**

\$15,878.40

Estimated Wastewater
System Facility Charge*

LOCATION:

Zone	Section	Plat	Parcel
4	5	041	009

8,799,120 Sq. Ft.

SPECIFIC LOCATION: **99-1100 Halawa Valley Street**

APPLICANT: **Camacho, Frank**
1286 Queen Emma Street
Honolulu, Hawaii 96813

DEVELOPMENT TYPE: **Schools (other)**

SEWER CONNECTION WORK DESIRED:

OTHER USES: **Administrative Building**
Tours with 100 Students
2 Employees

NON-RESIDENTIAL AREA: s.f.

APPROXIMATE DATE OF CONNECTION: **03/31/2020**

PROPOSED UNITS

No. of New Units: **0**

Studios:

1-Bedroom:

2-Bedroom:

3-Bedroom:

4-Bedroom:

5-Bedroom:

6-Bedroom:

EXISTING UNITS

No. of Existing Units: **0**

Studios:

1-Bedroom:

2-Bedroom:

3-Bedroom:

4-Bedroom:

5-Bedroom:

6-Bedroom:

UNITS TO BE DEMOLISHED

No. of Units to be Demolished: **0**

Studios:

1-Bedroom:

2-Bedroom:

3-Bedroom:

4-Bedroom:

5-Bedroom:

6-Bedroom:

REMARKS

APPROVAL DATE: **01/28/2019**

EXPIRATION DATE: **01/27/2021**

Valid 2-years after approval date. Construction plans shall be completed and approved within this 2-year period. Construction shall commence within 1-year after approval of plans.

** Applicable WSFC shall be collected at the prevailing rate in accordance with ROH 1990, Chapter 14, Sections 14-10.3, 14-10.4, 14-10.5 and Appendix 14-D.*

REVIEWED BY: **Jon Coloma**

Site Development Division, Wastewater Branch

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843
www.boardofwatersupply.com



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JADE T. BUTAY, Ex-Officio

ERNEST Y. W. LAU, P.E.
Manager and Chief Engineer

ELLEN E. KITAMURA, P.E.
Deputy Manager and Chief Engineer

Mr. Laine Okimoto
Community Planning and Engineering, Inc.
1286 Queen Emma Street
Honolulu, Hawaii 96813

Dear Mr. Okimoto:

Subject: Your Email Dated May 21, 2019 Requesting Comments on the Availability of Water for the Proposed Office Buildings at Halawa Under the Viaduct, and at Luluku at Parcel 20 of the H-3 Right of Way, Tax Map Key: 9-9-010: 010; Near 4-5-041: 017

Thank you for your email regarding the proposed office buildings.

The existing water system is adequate to accommodate the proposed office building at the Halawa project site, under the viaduct (Tax Map Key [TMK]: 9-9-010: 010). However, please be advised that this information is based upon current data, and therefore, the Board of Water Supply (BWS) reserves the right to change any position or information stated herein up until the final approval of the building permit application. The final decision on the availability of water will be confirmed when the building permit application is submitted for approval.

The developer will be allowed to connect to the existing 16-inch waterline for the Luluku Site.

The existing water system cannot provide adequate fire protection to accommodate the proposed office/meeting building at the Luluku project site (near TMK 4-5-041: 017). The BWS Water System Standards (WSS) require a fire hydrant to be located fronting the property and provide a fire flow of 2,000 gallons per minute for commercial developments. The nearest fire hydrant, fire hydrant W-01331, is located approximately 2,034 feet from the property. Therefore, the developer will be required to install the necessary water system improvements to provide adequate fire protection in accordance with our WSS. The construction drawings should be submitted to BWS 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 requirements should be coordinated with the Fire Prevention Bureau of the Honolulu Fire Department.

If you have any questions, please contact Robert Chun, Project Review Branch of our Water Resources Division at 748-5443.

Very truly yours,



ERNEST Y. W. LAU, P.E.
Manager and Chief Engineer

Appendix C – Reports

**GEOTECHNICAL EXPLORATION REPORT
FOR HALAWA - LULUKU INTERPRETIVE DEVELOPMENT PROJECT
NORTH HALAWA VALLEY PROJECT AREA
HALAWA, OAHU, HAWAII**

For:

Community Planning & Engineering, Inc.
1286 Queen Emma Street
Honolulu, HI 96813

By:



Geotechnical • Environmental • Construction Management
Testing • Inspection • Drilling & Sampling

CORPORATE HEADQUARTERS
94-547 Ukee Street, Suite No. 210
Waipahu, Hawaii 96797

Tel: (808) 676-6677 - Fax: (808) 676-7733 - Email: Secretary@pscconsultants.com
www.psc-hawaii.com

**GEOTECHNICAL EXPLORATION REPORT
FOR HALAWA - LULUKU INTERPRETIVE DEVELOPMENT PROJECT
NORTH HALAWA VALLEY PROJECT AREA
HALAWA, OAHU, HAWAII**

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**GEOTECHNICAL EXPLORATION REPORT
FOR HALAWA - LULUKU INTERPRETIVE DEVELOPMENT PROJECT
NORTH HALAWA VALLEY PROJECT AREA
HALAWA, OAHU HAWAII**

July 16, 2019

PSC Job No. 216301.10 – Halawa Project Area

INTRODUCTION

This report presents the results of our Geotechnical Study for the North Halawa Valley Project Area portion of the proposed Halawa-Luluku Interpretive Development (HLID) Project at the North Halawa Valley project area in Halawa, Oahu, Hawaii. The project site is shown on the Project Location Map, Plate 1. Our work was performed in accordance with the scope of work outlined in our proposal dated January 25, 2016.

The purpose of the HLID project is to mitigate some of the impacts to cultural and archaeological resources caused by the construction of Interstate H-3 based off the 1987 Memorandum of Agreement (MOA) between the Federal Highways Administration (FHWA), State Historic Preservation Division (SHPD), and Advisory Council on Historic Preservation (ACHP) which mandates prescribed mitigation actions for Interstate H-3 construction.

The scope of the project area has been defined to include certain portions of Luluku and North Halawa Valley. Through years of community outreach and the accumulation of archaeological data, an Interpretive Development was created to clearly identify impacts to cultural and archaeological resources caused by Interstate H-3 and to express the vision of the Working Group for healing the land as well as the community. The project is divided into the two project areas (North Halawa Valley and Luluku). This report reflects the North Halawa Valley Project Area site.

On the basis of the information provided to us, the North Halawa Valley project area will generally include construction of an Education Center, Utilities, Parking, Maintenance Building, Storage, Trash Receptacle/Stall, Nursery, Aquaponics, Meeting House, Composting Toilets, Water Catchments, Water Tank, Trails/Erosion Control, Flood Warning System, Outdoor Nursery/Aquaponic, Dining House, Potable/Non-Potable Water Source, Grid Power, Stewardship Residence, Grey Water Treatment and Hale Pana Pono.

This report summarizes the findings from our field exploration and laboratory testing and presents our geotechnical engineering recommendations for feasibility planning derived from our analysis for the proposed North Halawa Valley Project Area. These recommendations are intended for planning and design input only.

Community Planning and Engineering, Inc. is the planner for this project and the clients include the Federal Highway Administration (FHWA), Historic Preservations Division (SHOPO) and the Advisory Council of Historic Preservation (ACHP).

PURPOSE AND SCOPE

Our Geotechnical Report for the proposed project provides a general overview of the subsurface conditions at the North Halawa Valley Project Area site. The subsurface information obtained will be used for the development of geoenvironmental recommendations for the site improvements including building foundations, and road and parking areas.

Our work was done in general accordance with our proposal dated January 25, 2016. The scope of work included the following:

1. Coordinate and schedule the soil investigation;
2. Secure clearances from various agencies and companies to obtain drilling access permits;
3. Drill two borings to depths up to 16 feet below the existing ground surface;
4. Provide a field engineer to monitor the drilling operation, obtain soil samples at selected depth intervals, and maintain a log of the soils encountered within each boring;
5. Perform laboratory tests on selected samples to determine the relevant engineering properties of the near surface soils;
6. Analyze the field and laboratory data; and
7. Provide a written report summarizing our findings and recommendations.

FIELD EXPLORATION

Our field exploration program consisted of drilling and sampling two borings at the proposed North Halawa Valley project area. Borings 1 and 2 were drilled to approximately 10 feet and 16 feet below the existing ground surface. The locations of the borings drilled are shown on Plate 2. Boring locations considered vehicular traffic, overhead obstructions, existing parking and roadways, existing walkways, buried lines, and accessibility of drilling rigs and trucks.

The borings were advanced using a truck-mounted drill rig equipped with 4-inch solid-stem augers. Samples of the surface soils were obtained at selected levels using a 3.0-inch O.D. by 2.4-inch I.D. split barrel Modified California (MC) sampler. The samplers were driven 18 inches using 140-lb hammer falling 30 inches. The number of blows required to drive the sampler for the last 12 inches are presented on the Log of Borings on Plates 4 and 5.

Our field engineer classified the soils in the field by visual/manual methods. Soils are classified in accordance with the Unified Soil Classifications System shown on Plate 3. Graphic presentations of the materials encountered are presented on the Log of Borings.

SITE DESCRIPTION

The project site for the proposed Education Center, Utilities, Parking, Maintenance Building, Storage, Trash Receptacle/Stall, Nursery, Aquaponics, Meeting House, Composing Toilets, Water Catchments, Water Tank, Trails/Erosion Control, Flood Warning System, Outdoor Nursery/Aquaponic, Dining House, Potable/Non-Potable Water Source, Grid Power, Stewardship Residence, Grey Water Treatment and Hale Pana Pono are generally located along the Halawa Valley area in Oahu Hawaii. The project site consisted generally of construction roads and fenced in areas that run along H-3.

A topographic survey plan was not provided at the time this report was prepared; however, based on our field observations the general topography of the project site was flat paved road way adjacent to the viaduct. At the time of our field exploration, the project site was generally covered by construction roads, paved and fenced in areas.

SUBSURFACE CONDITIONS

Our borings at the North Halawa Valley Project Area generally encountered alluvial soils consisting of very stiff to hard clayey sands and gravel sand mixtures extending down to the maximum depth explored of about 16 feet below the existing ground surface. Boring No. 1 was drilled in a pavement area and encountered a pavement structure overlying the alluvial soils consisting of about 16 inches of asphalt and about 5 inches of medium dense sandy gravel fill material.

We did not encounter groundwater in the borings at the time of our field exploration. However, it should be noted that groundwater levels are subject to change due to rainfall, time of year, seasonal precipitation, surface water runoff, and other factors.

LABORATORY TESTING

Moisture Content

Moisture Content (ASTM D2216) determinations were performed on selected samples as an aid in the classification and evaluation of soil properties. The test results are presented on the Logs of Borings at the appropriate sample depths.

Gradation Test

Two sieve analyses tests (ASTM C136) were performed on selected soil samples to evaluate the gradation of the material. The results are used to classify the soil. The test results are summarized on the Logs of Borings at the appropriate sample depth. Graphic presentation of the Gradation test results is provided on Plate 6.

Atterberg Limits

Two Atterberg Limits tests (ASTM D4318) were performed on selected soil samples to evaluate the liquid and plastic limits. The results are used to help classify the soil and to obtain an indication of the expansion and shrinkage potential of the spoil with changes in moisture content. The test results are summarized on the Logs of Borings at the appropriate sample depth. Graphic presentation of the Atterberg Limits test result is provided on Plate 6.

DISCUSSION AND RECOMMENDATIONS

Site Preparation

At the onset of earthwork, the area within the contract grading limits should be cleared of trees, vegetation, debris, rubbish, boulders and other deleterious materials. These materials should be removed and properly disposed of offsite.

Areas to receive fill should be scarified to a depth of about 8 inches, moisture-conditioned to at least 2 percent above the optimum moisture content and compacted to a minimum of 90 percent relative compaction. Relative compaction refers to the in-place, dry density of soil expressed as percentage of the maximum dry density of the same soil established in accordance with ASTM Test designation D 1557. The optimum moisture content is the moisture content corresponding to the maximum compacted dry density.

Soft or yielding areas encountered during site preparation should be over-excavated to expose firm soil surface and stabilized by backfilling with select material placed in 8-inch thick, loose lifts and compacted to a minimum of 90 percent relative compaction. It is important that the scarification and recompaction operations be performed in the presence of a representative of PSC Consultants, LLC (PSC).

Fills and Backfills

In general, the excavated on-site soils should be suitable for use as general fill materials, provided that they are free of vegetation, deleterious materials, and rock fragments greater than 3 inches in largest dimension. It should be noted that the project site is located in a high rainfall environment throughout the year; therefore, the in-situ soils will constantly be in a very moist to wet condition and drying or aerating the excavated materials may be necessary prior to their use as general fill.

Imported fill materials should consist of select granular fill material, such as crushed basalt or coral. The select granular fill should be well-graded from coarse to fine with particles no larger than 3 inches in largest dimension and should contain between 10 and 30 percent particles passing the No. 200 sieve. The material should have a laboratory CBR value of 20 or more and should have a maximum swell of less than 1 percent when tested in accordance with ASTM D1883.

Aggregate base materials should consist of crushed basaltic aggregates and should conform to Section 31 of the City and County of Honolulu, Department of Public Works, “Standard Specifications for Public Works Construction,” dated September 1986. Imported fill materials should be tested for conformance with these recommendations prior to delivery to the project site for the intended use.

Fill Placement and Compaction Requirements

As mentioned above, the project site is located in a high rainfall environment throughout the year; therefore, the in-situ soils will constantly be in a very moist to wet condition and drying or aerating the excavated materials may be necessary prior to their use as general fill.

General fill materials should be placed in level lifts not exceeding 8 inches in loose thickness, moisture-conditioned to at least 2 percent above the optimum moisture content and compacted to at least 90 percent relative compaction. Select granular fill materials should be placed in level lifts of about 8 inches in loose thickness, moisture-conditioned to above the optimum moisture, and compacted to at least 90 percent relative compaction.

Aggregate base and subbase course materials should be moisture conditioned to above the optimum moisture content, placed in level lifts not exceeding 8 inches in loose thickness, and compacted to a

minimum of 95 percent relative compaction.

Relative compaction refers to the in-place, dry density of soil expressed as percentage of the maximum dry density of the same soil established in accordance with ASTM Test designation D 1557. The optimum moisture content is the moisture content corresponding to the maximum compacted dry density.

Compaction should be accomplished by sheepfoot rollers, vibratory rollers, or other types of acceptable compaction equipment. Water tamping, jetting, or ponding should not be allowed to compact the fills. Where compaction is less than required, additional compactive effort should be applied with adjustment of moisture content as necessary, to obtain the specified compaction. It should be noted that excessive vibrations from compaction equipment may soften the on-site soils with high in-situ moisture contents; therefore, vibrations should be carefully controlled during compaction efforts.

Excavations

Based on the anticipated grading and our field exploration, excavation for this project will generally consist of excavations for pavement structure, foundations, and infrastructure installation. Some of the excavations may encounter boulders and clusters of cobbles within the alluvial soils. It is anticipated that most of the materials may be excavated with normal heavy excavation equipment. However, deep excavations and boulder excavations may require the use of hoerams.

The above discussions regarding the rippability of the subsurface materials are based on field data from the borings drilled at the site. Contractors should be encouraged to examine the site conditions and the subsurface data to make their own reasonable and prudent interpretation.

Building Foundations

Based on the information provided and the subsurface conditions encountered at the project site, a shallow foundation system consisting of spread and/or continuous footings may be used to support the proposed building structure. Due to the varying consistency and high in-situ moisture contents of the on-site soils, we recommend placing a minimum 18-inch thick layer of select granular fill material below the foundations to provide a firm and unyielding bearing layer. The select granular fill should also extend a minimum of 18 inches beyond the perimeter of the foundations.

An allowable bearing pressure of up to 2,500 pounds per square foot (psf) may be utilized for the design of building foundations bearing on the 18-inch thick layer of select granular fill material. This bearing value is for supporting dead-plus-live loads and may be increased by one-third (1/3) for transient loads, such as those caused by wind or seismic forces.

Footings subgrades should be recompacted to a firm surface prior to the placement of the geotextile fabric and select granular fill material. Soft and/or loose materials encountered at the bottom of footing excavations should be over-excavated to expose the underlying firm materials. The over-excavation should be backfilled with select granular fill material compacted to a minimum of 90 percent relative compaction. It should be noted that excessive vibrations from compaction equipment may soften the on-site soils with high in-situ moisture contents; therefore, vibrations should be carefully controlled during compaction efforts.

In general, the bottom of footings should be embedded a minimum of 24 inches below the lowest adjacent finished grades. Footings located adjacent to planned (or existing) retaining walls should be embedded deep enough to avoid surcharging the retaining wall foundations. Foundations next to utility trenches should be embedded below a one horizontal to one vertical (1H:1V) imaginary plane extending upward from the bottom edge of the utility trench, or the foundation should be extended to a depth as deep as the inverts of the utility lines. This requirement is necessary to avoid surcharging adjacent below-grade structures with additional structural loads and to reduce the potential for appreciable foundation settlement.

If foundations are designed and constructed in strict accordance with our recommendations, we estimate total settlements of the foundations to be less than 1 inch. Differential settlements between adjacent footings supported on similar materials may be on the order of 0.5 inches or less.

Lateral loads acting on the structures may be resisted by friction between the base of the foundation and the bearing materials and by passive earth pressure developed against the near-vertical faces of the embedded portion of foundations. A coefficient of friction of 0.4 may be used for footings bearing directly on the 18-inch thick layer of select granular fill material. Resistance due to passive earth pressure may be estimated using an equivalent fluid pressure of 300 pounds per square foot per foot of depth (pcf) assuming the soils around the footings are well compacted. Unless covered by pavements or slabs, the passive pressure resistance in the upper 12 inches below the finished grade should be neglected.

Concrete Slabs-On-Grade

Based on the results of our field exploration, the near-surface soils exhibit a moderate expansion potential when subjected to moisture fluctuations. Therefore, we recommend placing a minimum 12-inch thick layer of non-expansive select granular fill material below the slab to reduce moisture changes in the slab subgrade soils. Placement of the non-expansive select granular fill layer would reduce the potential for future distress to the lightly loaded slabs-on-grade resulting from shrinking and swelling of the on-site soils due to changes in the moisture content. The layer of select granular fill would also serve as a protective layer or working platform since the site is located in a high

rainfall environment. The non-expansive select granular fill should be compacted to a minimum of 90 percent relative compaction.

Prior to placing the non-expansive select granular fill, we recommend scarifying the subgrade soils to a depth of about 8 inches, moisture-conditioning the soils to at least 2 percent above the optimum moisture content and compacting to a minimum of 90 percent relative compaction. The underlying subgrade soils and select granular fill should be wetted and kept moist until the final placement of slab concrete. Where shrinkage cracks are observed after compaction of the subgrade, we recommend preparing the soils again as recommended. Saturation and subsequent yielding of the exposed subgrade due to inclement weather and poor drainage may require over-excavation of the soft areas and replacement with engineered fill.

For interior building slabs (not subjected to vehicular traffic or machinery vibration), we recommend placing a minimum 4-inch thick layer of cushion fill consisting of open-graded gravel (ASTM C33, No. 67 gradation) below the slabs and above the non-expansive select granular fill layer. The open-graded gravel cushion fill would provide uniform support of the slabs and would serve as a capillary moisture break. To reduce the potential for future moisture infiltration through the slab and subsequent damage to floor coverings, an impervious moisture barrier is recommended on top of the gravel cushion fill layer. Flexible floor coverings, such as carpet or sheet vinyl, should be considered because they can better mask minor slab cracking.

Where the slabs will be subjected to equipment vibration and/or vehicular traffic, we recommend placing the floor slab over 6 inches of aggregate subbase in lieu of the 4-inch thick layer of cushion fill mentioned above. The aggregate subbase should consist of crushed basaltic aggregates compacted to a minimum of 95 percent relative compaction. Where slabs are intended to function as rigid pavements, a minimum slab thickness of 6 inches may be used for preliminary design purposes. Provisions should be made for proper load transfer across the slab joints that will be subject to vehicular traffic.

We anticipate exterior concrete walkways may be required for the proposed project. We recommend supporting concrete walkways on a minimum 12-inch thick layer of non-expansive select granular fill. The select granular fill should be compacted to at least 90 percent relative compaction. Control joints should be provided at intervals equal to the width of the walkways with expansion joints at right-angle intersections. The thickened edges of slabs adjacent to unpaved areas should be embedded at least 12 inches below the lowest adjacent grade.

It should be emphasized that the areas adjacent to the slab edges should be backfilled tightly against the edges of the slabs with relatively impervious soils. These areas should also be graded to divert water away from the slabs and to reduce the potential for water ponding around the slabs.

Pavements

We anticipate that asphaltic concrete (flexible) pavements are planned for the access roadway and parking areas. While traffic loading has not been specified, we anticipate that the vehicle loading for the access road and parking areas will consist primarily of passenger vehicles with some light trucks.

We have assumed that the pavement subgrade will consist of the on-site granular material, medium dense to dense. As discussed above, the project site is located in a high rainfall environment throughout the year and the in-situ soils will constantly be in a very moist to wet condition. Aggregate base course with nominal maximum size of 1.5 inches should be used.

Based on the site conditions encountered and the above assumptions, we recommend using the following pavement sections for preliminary design purposes:

Flexible Pavement Section

2.0-Inch	Asphaltic Concrete
<u>10.0-Inch</u>	<u>Aggregate Base Course</u>
12.0-Inch	Total Pavement Thickness

The above pavement section is based on the assumption that the actual pavement subgrade soils will be similar to the soils generally encountered during our field exploration and that adequate drainage will be provided for the paved areas. The pavement subgrade soils should be scarified to a minimum depth of about 8 inches, moisture-conditioned to about 2 percent above the optimum moisture content and compacted to no less than 90 percent relative compaction.

Prior to placing the aggregate base course materials, the triaxial geogrid should be placed over the finished subgrade soils and rolled out flat and tight with no folds in accordance to the manufacturer's recommendations. Adjacent rolls of triaxial geogrid should be overlapped a minimum of 12 inches. Aggregate base course materials should consist crushed basaltic aggregates with a 1.5-inch maximum nominal size and should conform to Section 31 of the City and County of Honolulu, Department of Public Works, "Standard Specifications for Public Works Construction," dated September 1986.

CBR and density tests and/or field observations should be performed on the actual subgrade used for the road construction to confirm the adequacy of the above pavement section.

Road and Walkway Drainage

Subdrains should be provided where there is a possibility that runoff from rainfall or irrigation could saturate the subsurface soils. Exposed surface soils should be protected from erosive runoff by providing surface drains, diversion berms, sloping surface, concrete curbs, dry wells and other flood control devices.

Utility Trenches

Granular bedding consisting of 6 inches of No. 3B Fine gravel is recommended under the pipes. Free draining granular materials, such as No. 3B fine gravel (ASTM C 33, No. 67 gradation) should also be used for the trench backfill above and at sides of the pipes to provide support around the pipes and to reducing the potential for damaging the pipes.

CONCLUSIONS

Clayey sands with relatively high in-situ moisture contents will be a likely soil profile for this portion of the North Halawa Valley Project Area and the HLID project. Conventional earthwork and construction methods may be used for the proposed project grading.

In general, the excavated on-site soils should be suitable for use as general fill materials, provided that they are free of vegetation, deleterious materials, and rock fragments greater than 3 inches in largest dimension. It should be noted that the project site is located in a high rainfall environment throughout the year; therefore, the in-situ soils will constantly be in a very moist to wet condition and drying or aerating the excavated materials may be necessary prior to their use as general fill.

The information and recommendations presented in this report have been based upon the existing materials encountered at the site, and during construction PSC Consultants, LLC (PSC) should be notified in the event that soil conditions change so we can modify or amend our recommendations as necessary.

LIMITATIONS

The analysis and recommendations submitted in this report are based, in part, upon information obtained from two test borings and laboratory tests. Variations of subsoil conditions may occur, and the nature and extent of these variations may not become evident until construction is underway. If variations then appear evident, it will be necessary to reevaluate the recommendation provided in this report.

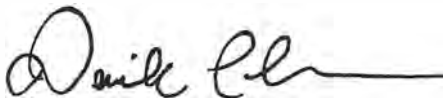
PSC Consultants LLC selected the boring locations in this report. The boring locations were located by taping from existing features and structures shown on the plans. The physical locations and elevations of the test boring should be considered accurate only to the degree implied by the methods used.

This report has been prepared for the exclusive use of Community Planning and Engineering, Inc., and their consultants for specific application to this project in accordance with generally accepted geotechnical engineering principles and practices. It may not contain sufficient data or proper information to serve the structural/civil engineer for their design work or a contractor wishing to bid on this project. No warranty is expressed or implied.

The owner/client should be aware that unanticipated soil/rock and cavity/soft spot conditions are commonly encountered. Unforeseen soil/rock conditions, hard layers, soft deposits, and cavities may occur in localized areas and may require probing or corrections in the field (which may result in construction delays) to attain a properly constructed project.

The findings in this report are valid as of the present date. However, changes in the soil conditions, either natural or manmade, can occur with the passage of time. In addition, changes in applicable or appropriate standards occur, whether they result from legislation or from the broadening of knowledge. Accordingly, the findings in this report might be invalidated, wholly or partially, by changes outside of our control. Therefore, this report is subject to review by the controlling agencies and is valid for a period of two years.

Respectfully submitted:
PSC CONSULTANTS, LLC



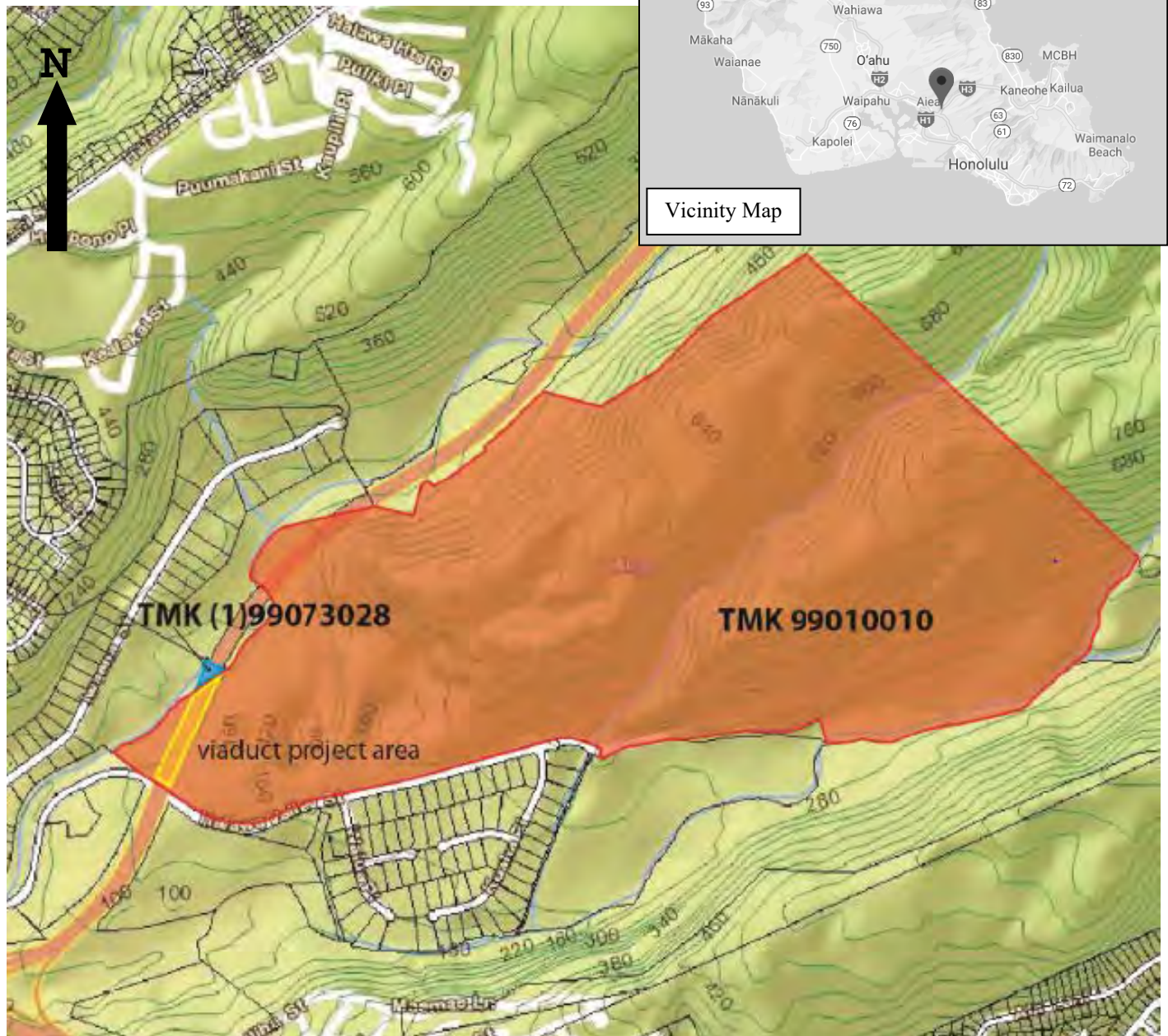
Derrick S. Chan, P.E.
President



This work was prepared by
me or under my supervision
(License Expires April 30, 2020)

Community Planning & Engineering, Inc.
PSC Job No. 216301.10 – Halawa Project
Area July 16, 2019
Page 12 of 12

Encl.: Plate 1	Project Location and Vicinity Map
Plate 2	Boring Location Map
Plate 3	Unified Soil Classification System
Plate 4	Log of Boring B-1
Plate 5	Log of Boring B-2
Plate 6	Grain Size Distribution
Plate 7	Atterberg Limits Data



Reference: Halawa Valley and Luluku Project Plans
NOT TO SCALE

Project Location and Vicinity Map



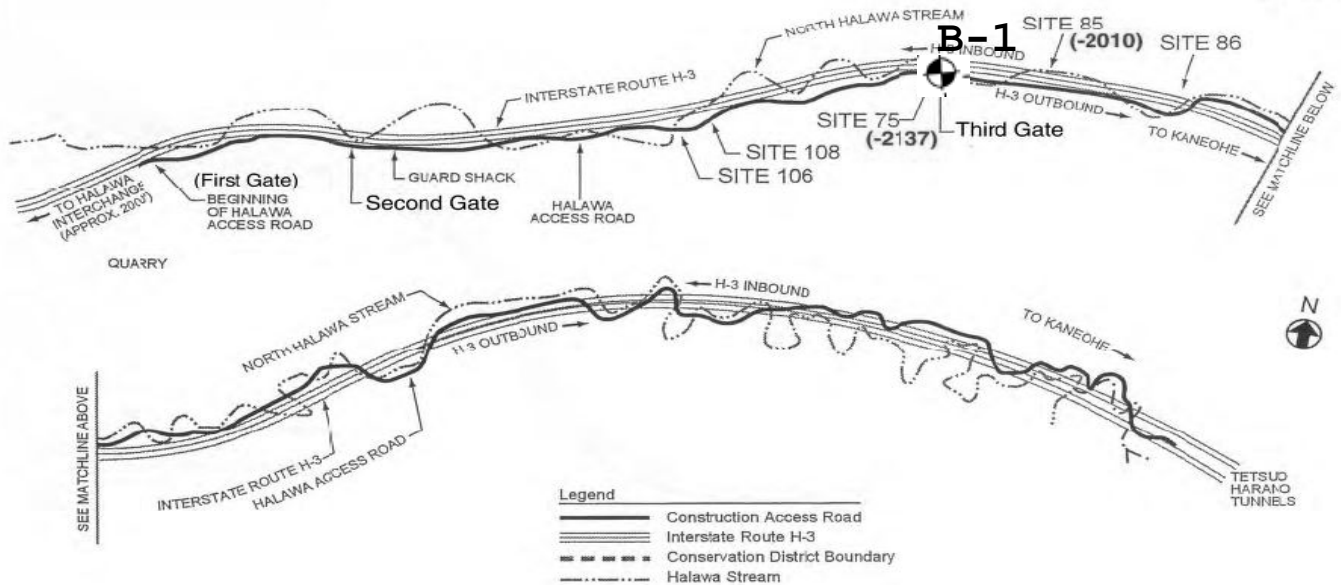
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SOILS, FOUNDATION, AND GEOLOGICAL ENGINEERS

North Halawa Valley Project Area
Community Planning & Engineering, Inc.
Halawa - Luluku Interpretive Development Project
Halawa, Oahu, Hawaii

DATE: July 16, 2019

PROJECT NO. 216301.10

(Not to scale)



LEGEND

● Boring Location

Reference: Halawa Valley and Luluku Project Plans
NOT TO SCALE

Boring Location Map



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Community Planning & Engineering, Inc.
Halawa - Luluku Interpretive Development Project
Halawa, Oahu, Hawaii

DATE: July 16, 2019

PROJECT NO. 216301.10

PLATE NO. 2

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS 50% OR MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS 50 % OR MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50			ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN OR EQUAL TO 50			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS	

Unified Soil Classification System





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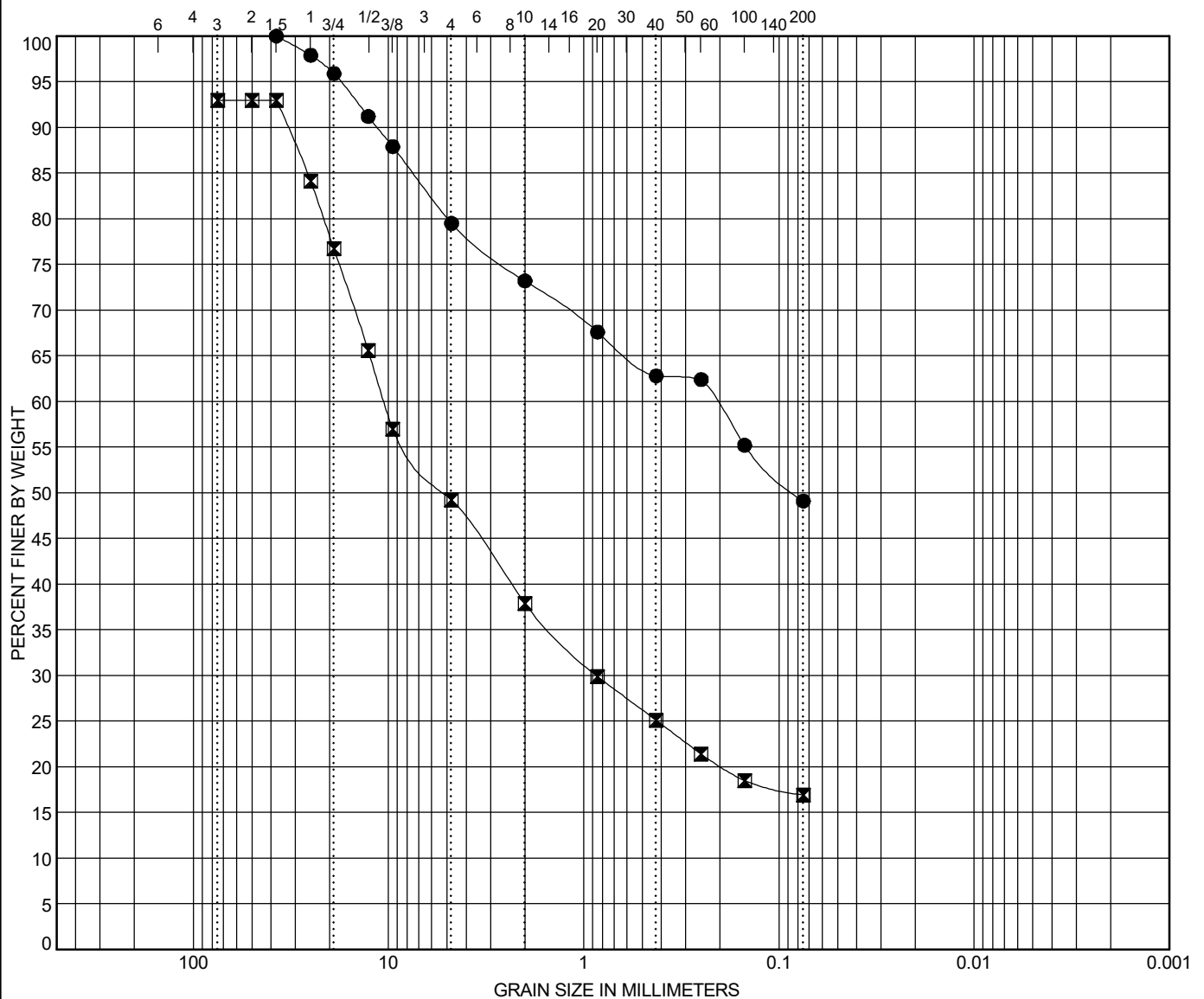
North Halawa Valley Project Area
Community Planning & Engineering, Inc.
Halawa - Luluku Interpretive Development Project
Halawa, Oahu, Hawaii

DATE: July 16, 2019

PROJECT NO. 216301.10

BORING LOCATION:								DRILLER: Valley Well		BORING NO. B-1																																												
BORING ELEVATION (ft): N/A								LOGGED BY: DSC																																														
DATE (S) DRILLED: 9/12/2017								TYPE RIG: Mobile B-59																																														
OTHER LAB TESTS	DRY UNIT WEIGHT (pcf)	MOISTURE CONTENT (%)	CORE RECOVERY (%)	R.Q.D. (%)	NUMBER OF BLOWS/12"	SAMPLER TYPE & NUMBER	DEPTH IN FEET	GRAPHIC SYMBOL	U.S.C.S.	GEOTECHNICAL DESCRIPTION																																												
										Asphalt																																												
									GM	Gray SILTY GRAVEL with some sand, moist, medium dense (fill)																																												
N/A					40	MC			SC	Brownish gray CLAYEY SAND with some gravel, wet, medium dense																																												
							5		SC	Brownish gray CLAYEY SAND with some gravel, wet, medium dense																																												
SA, PI		11.1			26	MC			SC	Brownish gray CLAYEY SAND with some gravel, wet, medium dense																																												
N/A					Refusal	NR	10			Refusal. Boring Terminated at 10'. No Ground Water Encountered.																																												
							15																																															
							20																																															
<table border="0"> <tr> <td colspan="6">SAMPLE TYPE</td> <td colspan="5">OTHER LABORATORY TESTS</td> </tr> <tr> <td colspan="2">D&M - Dames & Moore</td> <td colspan="2">SPT - Standard Penetration</td> <td colspan="2">MD - Moisture/Density</td> <td colspan="5">UC - Unconfined Compression</td> </tr> <tr> <td colspan="2">CB - Core Barrel</td> <td colspan="2">SH - Shelby Tube</td> <td colspan="2">CON - Consolidation Test</td> <td colspan="5">SG - Specific Gravity</td> </tr> <tr> <td colspan="2">AUG - Auger Cuttings</td> <td colspan="2">NR - No Recovery</td> <td colspan="2">PI - Atterberg Limits</td> <td colspan="5">SA - Sieve Analysis</td> </tr> </table>											SAMPLE TYPE						OTHER LABORATORY TESTS					D&M - Dames & Moore		SPT - Standard Penetration		MD - Moisture/Density		UC - Unconfined Compression					CB - Core Barrel		SH - Shelby Tube		CON - Consolidation Test		SG - Specific Gravity					AUG - Auger Cuttings		NR - No Recovery		PI - Atterberg Limits		SA - Sieve Analysis				
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								North Halawa Valley Project Area Community Planning & Engineering, Inc. Halawa - Luluku Interpretive Development Project																																														
								DATE: July 16, 2019		PROJECT NO.: 216301.10																																												

BORING LOCATION:				DRILLER: Valley Well				BORING NO. B-2		
BORING ELEVATION (ft): N/A				LOGGED BY: DSC						
DATE (S) DRILLED: 9/12/2017				TYPE RIG: Mobile B-59						
OTHER LAB TESTS	DRY UNIT WEIGHT (pcf)	MOISTURE CONTENT (%)	CORE RECOVERY (%)	R.Q.D. (%)	NUMBER OF BLOWS/12"	SAMPLER TYPE & NUMBER	DEPTH IN FEET	GRAPHIC SYMBOL	U.S.C.S.	GEOTECHNICAL DESCRIPTION
										Asphalt 5"
N/A					65	MC			SP	Reddish brown SAND with some silt and basaltic gravel, medium dense to dense, dry
SA, PI		10.8			50	MC	5		GM	Brown SILTY GRAVEL with some clay and basaltic gravel, medium dense, moist
N/A					60+	NR	10			
N/A					23	MC	15		GM	Brown SILTY GRAVEL with some clay and basaltic gravel, medium dense, moist
										Boring Terminated at 16'. No Ground Water Encountered.
20										
SAMPLE TYPE						OTHER LABORATORY TESTS				
D&M - Dames & Moore		SPT - Standard Penetration		MD - Moisture/Density		UC - Unconfined Compression				
CB - Core Barrel		SH - Shelby Tube		CON - Consolidation Test		SG - Specific Gravity				
AUG - Auger Cuttings		NR - No Recovery		PI - Atterberg Limits		SA - Sieve Analysis				
LOG OF BORING										
 CONSULTANTS, LLC SOILS, FOUNDATION, AND GEOLOGICAL ENGINEERS						North Halawa Valley Project Area Community Planning & Engineering, Inc. Halawa - Luluku Interpretive Development Project				
						DATE: July 16, 2019			PROJECT NO.: 216301.10	



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	LL	PL	PI	Cc	Cu
● B-1 @ DEPTH 5ft.	CLAYEY SAND with GRAVEL SC	41	24	17		
☒ B-2 @ DEPTH 5ft.	SILTY GRAVEL with SAND GM	42	26	16		

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-1 @ DEPTH 5ft.	37.5	0.211			20.5	30.4	49.1	
☒ B-2 @ DEPTH 5ft.	75	10.512	0.859		43.8	32.3	16.9	

GRAIN SIZE DISTRIBUTION



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SOILS, FOUNDATION, AND GEOLOGICAL ENGINEERS

North Halawa Valley Project Area
Community Planning & Engineering, Inc.
Halawa - Luluku Interpretive Development Project
Halawa, Oahu, Hawaii

Date: July 16, 2019

Project No.: 216301.10

Appendix D – Data Cut Sheets

West Oahu Aggregate Co., Inc.

Prices Effective 7/1/18

855 Umi Street

Honolulu, HI 96819

Ph. 808-847-7780/Fax 808-847-7782

www.woahawaii.com

PRICE LIST

YARDS DIMENSIONS	BIN COST	DUMP FEE	SUBTOTAL	TAX	TOTAL
10 (18'L X 8'W X 3'H)	350.95	287.95	638.90	30.10	\$669.00
10 (11'L X 8'W X 5'H)	350.95	287.95	638.90	30.10	\$669.00
15 (13'L X 8'W X 5.5'H)	360.50	287.95	648.45	30.55	\$679.00
20 (16'L X 8'W X 5'H)	376.73	287.95	664.68	31.32	\$696.00
30 (22'L X 8'W X 6'H)	401.56	287.95	689.51	32.49	\$722.00
40 (24'L X 8'W X 6'H)	436.90	287.95	724.85	34.15	\$759.00

The above pricing includes up to:

- 5 tons of construction debris & \$57.59 per ton thereafter
- 4 tons of green waste & \$48.17 per ton thereafter
- 2 tons of household debris & \$95.36 per ton thereafter

A second invoice will be generated if a bin exceeds the 5-ton weight limit.

Additional charges for the following:

- \$150.00 relocation fee
- \$32.25 standby fee, per 15 minutes (after the first 15 min.)
- \$55.00 per each mattress
- \$98.00 per ton, for loads containing carpets (2-ton minimum charge).
- \$125.00 fee to reload unacceptable materials
- \$75.00 per car tire
- \$125.00 per truck tire
- \$100.00 fee for graffiti cleaning/removal.
- **\$20.00 per day, per bin, for bins kept beyond 10 calendar days**

Additional Handling Fees for Unacceptable Materials:

- \$100.00 Minimum cleaning fee for Hazardous Materials, i.e. gas, paint, oxygen, chemicals, etc.
- \$75.00 Auto parts (each item)
- \$100.00 Each appliance, i.e. refrigerators, freezers, AC units, washing machines, dryers, water heaters, etc.
- \$50.00 Each battery
- \$50.00 Each Computer, copy machine, printer or each miscellaneous electronic equipment, etc.

NOTE:

- Please call our office if you need to keep a bin longer than 10 calendar days.
- It is the customer's responsibility to contact our office to schedule a pick-up.
- Do not mix Green Waste with any other debris. Green Waste is defined by West Oahu Aggregate as anything that grows above the ground (trimmings, grass, etc.). All soil must be removed from green waste before placing in bin.
- All tree stumps can be no larger than 2' x 2' in size and should not be mixed with any other waste material.

NO SOIL IS ALLOWED IN BIN – UNLESS TESTED FOR CONTAMINANTS & FALLS BELOW HAWAII EAL LEVELS

By accepting the delivery of the rental bin, you acknowledge and agree to the terms stated above.

We at West Oahu Aggregate thank you and appreciate your business!

Below Ground Septic Tanks - Two Compartment

CAPACITY (GAL)	SIZE (IN.)	FOB POINTS (1)
1000	102 x 60 x 58	CIFF,Tn
1250	116 x 55 x 66	CIFF,Tn
1500	143 x 55 x 66	CIFF,Tn

Below Ground Septic Tanks - Single Compartment

CAPACITY (GAL)	SIZE (IN.)	FOB POINTS (1)
300	54(DIA) x 51H	CIFF,Tn
500	60(DIA) x 64H	CI,Tn
500	101 x 51 x 42	IPF,Tn
750	96 x 52 x 58	PIC
1000	86 x 65 x 68	H
1000	102 x 60 x 58	IPF,Tn
1250	116 x 55 x 66	IPF,Tn
1250	86 x 76 x 68	H
1500	143 x 55 x 66	IPF,Tn

Bruiser Septic Tanks - Single Compartment

CAPACITY (GAL)	SIZE (IN.)	FOB POINTS (1)
1000	60 x 102 x 58	NIPC,Tn
1250	55 x 116 x 66	NIPC
1500	55 x 133 x 66	NIPC,Tn

Bruiser Septic Tanks - Two Compartment

CAPACITY (GAL)	SIZE (IN.)	FOB POINTS (1)
1000	60 x 102 x 58	NIPC,Tn
1250	55 x 116 x 66	NIPC
1500	55 x 133 x 66	NIPC,Tn

Below Ground Water Storage Tanks

CAPACITY (GAL)	SIZE (IN.)	FOB POINTS (1)
325	54 Dia x 51H	CIFF,Tn
550	64 Dia x 64H	CI,Tn
600	101 x 51 x 58	IPF,Tn
1000	86 x 65 x 68	H
1200	102 x 60 x 58	CIFF,Tn
1250	86 x 76 x 68	H
1700	143 x 55 x 66	CIFF,Tn

Septic & Water Tank Accessories

Item	
Manhole Extension	15 H x 20
Manhole Extension	24 H x 20
20" Lid & 12" Riser	
Septic & Water Tank Lid	20
Septic & Water Tank Lid	24

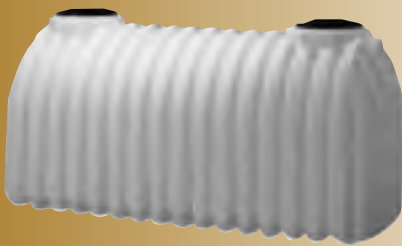
Septic Tank Plumbing Kits

Item	
Service Weight Sanitary	Schedule 40 Sanitary (2 ea)
Service Weight or Schedule 40	Service Weight Tee & Gasket (1 ea)

Septic Tank



Underground Water Tank



IMPORTANT- Review tank handling, installation & use guidelines, pg. 20.

- The degree of translucency varies with wall thickness and tank color.
- Tank sizes are nominal. Capacities indicate approximate volume.
- Calibrations on molded tanks indicate approx. vol.
- Tanks UV stabilized for outdoor use.
- Go to chemtainer.com for updated product information.

Material Selection

A brief description of our materials:

(Always refer to our Chemical Resistance Chart at **chemtainer.com** before selecting tank materials.)

1) Polyethylene

A high quality thermoplastic that has outstanding resistance to both physical and chemical degradation. The overall general toughness and excellent chemical resistance to a wide array of wet and dry industrial chemicals and food products make polyethylene ideally suited for storage tanks and containers. Polyethylene is translucent and its natural color ranges from slightly off white to creamy yellow, depending on wall thickness and type. Ultraviolet light stabilizers are added for use in outdoor applications. Colors are available on request for a nominal up charge.

A) Linear Polyethylene

Linear Polyethylene has superior mechanical properties, high stiffness, excellent low temperature impact strength and excellent environmental stress crack resistance. The linear polyethylene used by Chem-Tainer Industries meets specifications contained in FDA regulation 21CFR177.1520 (c) 3.1 and 3.2 and so may be used as an article or a component of articles intended for use in contact with food, subject to any limitations in the regulations. Maximum operating temperature for linear polyethylene is 140° F. weldable.

B) Crosslinkable Polyethylene

Crosslinkable polyethylene is a high density polyethylene that contains a crosslinking agent which reacts with the polyethylene during molding, forming a crosslinked molecule similar to a thermoset plastic. This reaction improves toughness and environmental stress crack resistance. Crosslinked Polyethylene (XLPE) is not weldable and does not meet FDA requirement 21CFR177.1520. Maximum operating temperature of crosslinked polyethylene is 150° F. Available only in limited sizes and styles. Please contact sales office.

2) Polypropylene

Polypropylene is a rigid plastic that has a higher operating temperature limit than polyethylene: 212° F. It offers good chemical resistance, has a high resistance to stress crack, and is autoclavable. Polypropylene (PP) is not recommended for applications in sub-freezing temperature or where high impact strength is needed. A rough, irregular interior surface is common characteristic of molded polypropylene. Available only in limited sizes and styles. Please contact sales office.



Model M54 Double Specification Sheet

NSF Certification

The Clivus Model M54 is certified by the National Sanitation Foundation under Standard 41 (day-use, park).

Capacity

The M54 Double is comprised of two M54 Composters set side by side.

VOLUME FOR EACH M54:

Solids storage capacity: 81 cubic feet; 604 US gallons

Liquid storage capacity: 40 cubic feet; 300 US gallons

Daily capacity at average temp. >65°F: 60 visits

Annual capacity at average temp. >65°F: 22,000 visits. Total annual capacity for M54 Double: 44,000 visits

Specifications and Materials

DIMENSIONS

Kit Shipping Dimensions: Length: 122"; Width: 85.5"; Height: 114"

Pre-fabricated Shipping Dimensions (2 pcs):

Base: Length: 118"; Width: 65"; Height: 48"

Building: Length: 122"; Width: 85.5"; Height: 114"

Shipping Weight: 4,800 lbs (ships in several pieces; maximum weight of any piece is 2,400 pounds)

Assembled Building Dimensions:

Outside Length: 118"; Width: 132"; Height: 110"

Building Enclosure (inside)

Inside Length: 84"; Inside Width: 61.5"

Composter Base

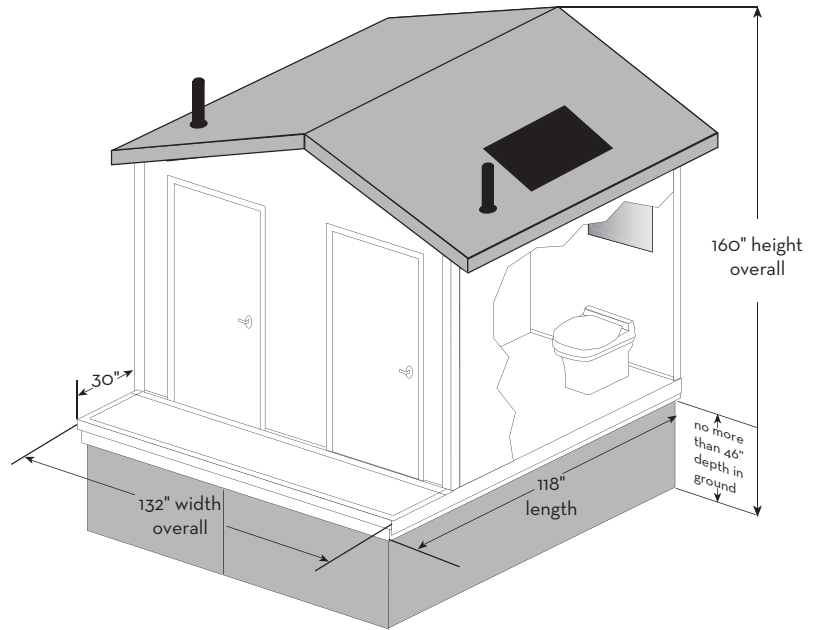
Length: 118"; Width: 65"; Height: 48"

MATERIALS

Composter Base

Composter Base is rotationally molded high-density linear polyethylene resin that conforms with the following specifications:

- Density (ASTM TEST 4883): 0.942 g/cm³
- Tensile Strength at Yield (ASTM D638): 2,950 psi
- Dart Impact (-40°C, 250 mils thickness): 108 ft-lbs
- Env. Stress Crack Resistance, 100% Igepal (D1693): 550 hrs



Building

Building walls are eight structural insulated panels (SIP) with expanded polystyrene core with fiberglass reinforced plastic over OSB interior finish and OSB exterior surface finished with 1" rough-sawn pine board-and-batten (other exterior finishes optional). Doors are 24 gauge cold rolled steel with zinc coating, factory painted medium gloss white, foamed-in-place polyurethane core; steel hinges; adjustable strike; frame milled from 5/4 kiln-dried pine; door opening: 36" x 80". Fixed window is 36" x 24" frosted lexan. Standard exterior is board and batten and custom painted.

Roof is two structural insulated panels (SIP) of 4" virgin expanded polystyrene faced with white fiberglass reinforced panels inside and OSB plywood outside for application of asphalt shingles or other finish.

Floor is expanded polystyrene core with 7/16" plywood underside with painted .016 aluminum skin and 7/16" plywood top surface with .08" non-skid rubber coating surface.

Standard package ships as a kit. Pre-fabrication is an option.

VENTILATION

DC: 12V fan. Maximum free air is 100 cfm. Power input is 5 watts. CSA & UL approved. DC fan is powered by an optional photo-voltaic system customized for location and site requirements. Call for quotation. AC fan also available.

TOILETS

Waterless toilets constructed of impact resistant fiberglass with sanitary white finish. Seat and lid are made of plastic; the liner is rotationally molded polyethylene. Grab bars and toilet paper holder included.

Toilet Height: 18"; Width: 18.5"; Length: 24.25"

ADA COMPLIANT

The M54 Trailhead conforms to the requirements for universal access of the Americans with Disabilities Act .



Provided by:

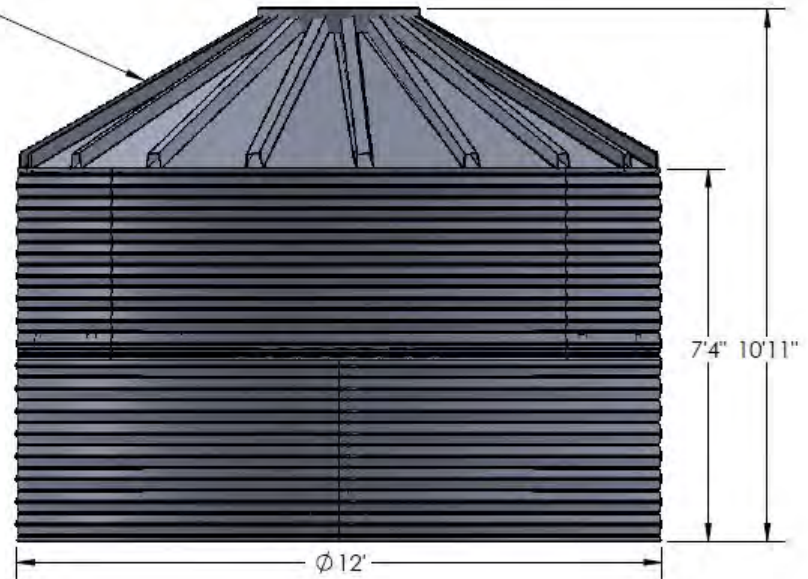
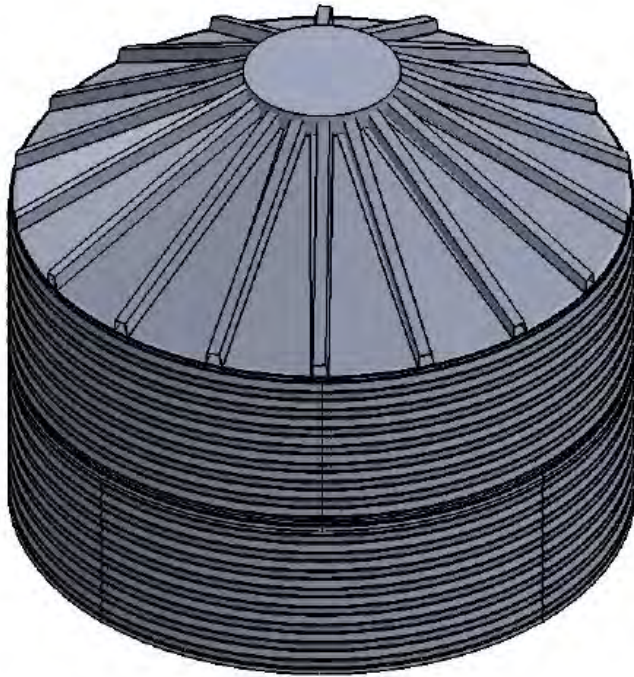
Dan Peters

Tel: 678-771-0098

E-Mail: Dan@RainHarvest.com

RainHarvest Systems
4475 Alicia Lane
Cumming, GA 30028

30° ROOF CONFIGURATION



WATER STORAGE TANK PROJECT DATA SHEET

PART I – GENERAL SUMMARY:

A) Section includes: Requirements, including, but not limited to:

- Contain Water Systems Inc. Water Storage Tank.
- Interior Components.
- Accessories necessary for a complete installation.

B) Related work:

- Refer to water tank manufacturer drawings.
- Refer to civil documents.
- Refer to mechanical documents.

PART II – SUBMITAL DOCUMENTS:

- Accessory Specifications – Tank Manufacturer approved.
- Warranty Documents – Tank warranty must be 20 years minimum.
- Shop Drawings.

- Submittal Drawings.
- Coordination Drawings.
- Operations & Maintenance Data.

PART III – QUALITY ASSURANCE:

- Water Tank specifications & Warranties – To be a manufactured water storage tank meeting the above & below design requirements. Must have a minimum 20 year warranty, must have a minimum 40 mil liner for structural integrity, must have an NSF 61 approved potable liner for potential client application switchover in the future, must have minimal G115 Galvanizing on the tank walls & **tank roofs**, Estimations must be compliant with all AWWA Codes & Standards, OSHA Codes & Standards, Seismic Zones 4 Standards (Highest Seismic). All Tanks must come with a minimum 165 MPH Wind Rating. All other project code requirements must be listed here. Tanks must meet AWWA Standards & 2012 IBC Minimum.

PART IV - DELIVERY, STORAGE & HANDLING:

- Deliver Water Storage Tank, Systems & Accessories in original manufacturers packaging. Take necessary precautions to prevent damage to the system. Protect from damage during delivery, storage & handling.

PART V – PRODUCTS & MATERIALS:

A) Water Tank Engineering

WATER SYSTEMS ENGINEERING

WATER TANK COMPLETE WITH ROOF SCOPE AND SPECIFICATIONS PROJECT SPEC MUST INCLUDE: 20 YEAR WARRANTY, G115 GALVANIZING, MINIMUM 40 MIL NSF 61 APPROVED POTABLE WATER LINER WITH REINFORCMENTS & MINIMUM 165 MPH WIND LOADS.

- Estimation exceeds AWWA D103-09 Codes & Standards (American Water Works Association - Standards for bolted steel tanks) CWSI estimations are in compliance with all OSHA Codes & Standards, Seismic Zones 4D (most stringent) ASCE Structural design considerations, 165 MPH Wind Rating. 30 PSF Live Roof Loads. Designed to IBC 2015. NBC 2015, NSF 61 / ANSI Standards are also included.
- This water storage tank is a water storage product that uses a G115 corrugated galvanized steel cylindrical tank in conjunction with a liquid-tight 40 MIL NSF 61 Approved PVC liner. The tanks are built with a conical galvanized G115 steel roof. Tanks are designed to be constructed and anchored to a concrete foundation.
- The tank is designed to store water with a density of 62.4 lbs / cubic foot.
- Wall sheets are continuous 4" pitch x 1/2" depth corrugated galvanized steel with a minimum yield strength of 40,000 psi and a minimum tensile strength of 55,000 psi for 20 and 18 gauge

sheets. All heavier gauges have a minimum yield strength of 50,000 psi and a minimum tensile strength of 65,000 psi. The wall sheets are manufactured from G115 galvanized steel conforming to ASTM A653. Wall sheets have a 44" nominal coverage. Wall sheets have a coverage length of 9' 4-1/2" long. The wall sheets are connected with GR8.2 bolts along both the vertical and horizontal seams.

a. Vertical seams are punched for a staggered, double, triple or quad row connection at 2" on center.

b. Horizontal seams are a single lap connection with spacing of 9-3/8".

- Tanks are supplied with anchor brackets which bolt at the vertical seams and the center of the wall sheets.
- Water tank roofs have either a 30 degree slope, flat roof, dome roof, inverted roof or open top roof design and are made up of self-supporting roof sheets, and are designed for 30 PSF roof snow loads minimum.
- 12' through 48' diameter 30 degree roof panels are triangular in shape and have formed structural ribs along the radial edges to provide stiffness and strength. The 12' through 48' 30 degree roof panels extend past the eave to allow for drainage and are attached to the wall sheets with top ring angle sections that bolt around the entire circumference of the tank opening.
- The 27' through 48' diameter 30 degree roof panels are manufactured from G115 galvanized steel conforming to ASTM A653 GR40.
- The 15' to 48' diameter tanks come with formed steel roof ladder rungs that bolt between the roof ribs of a single panel, extending from eave to peak.
- The center opening for the 33' through 48' diameter tanks the opening is 53" in diameter.
- Each 15' through 48' diameter water tank comes complete with one roof panel complete with an inspection hatch, to be located at the eave next to the roof ladder. 24" minimum.
- The 21' through 48' diameter roofs inspection hatch is circular with a 24" diameter.
- Water tanks are designed for 165 MPH wind speed, UBC Exposure C. With engineering packages to exceed higher seismic zones.
- Water tanks are designed for Seismic Zone 3 as standard. (Most stringent).
- All bolts and nuts are galvanized with JS-500 coating. Roof bolts are hex-head and have factory installed PVC washers under a wide-flange shoulder. Wall sheet bolts have slotted round heads with PVC washers for ease of installation and minimal interaction with the liner.
- All bolts meet SAE Grade 8.2 or stronger.
- The liner shall be made from a flexible NSF 61 Approved Potable PVC material capable of containing water. Minimum liner thickness shall be 0.040 inches & reinforced to comply with a 65 year life expectancy. All seams in tank liners are factory welded.
- The liner shall be suspended around the inside perimeter of the tank structure at the eaves with liner clips.
- Erection and installation manuals are supplied with each tank.

B) Valve & Drain Fittings

C) Overflow Piping

D) Clean Out

E) Pump

PART VI – EXECUTION & PREPERATION:

A) Install Water Storage System In accordance with manufacturer's specifications & instructions.

- Tanks to be field erected on customer supplied foundation. Engineering & design by others.
- Foundation recommendations are available from CWS.
- Water must be provided for the leak test at the expense of the customer. Water for the leak test should be considered as a part of the installation cost. If water is not made available to fill the tank immediately upon completion of the construction than the client will be responsible for re-mob costs for the repair. Water testing is a part of the completion of the tank.
- CWSI is installing a NSF 61 Approved Potable Water Liner, however, all potable systems must be disinfected prior to use. Without proper disinfecting within a 72 hour period the liner is no longer considered NSF 61 / ANSI Potable compliant. Additionally, all potable water storage tank customers must consult with a professional conveyance contractor to include U.V sterilization, chlorine rinse upon initial use, water circulation system, aerator and ozone generator. Without a proper system in place as mentioned above - this water storage tank is not considered compliant with NSF 61 / ANSI Potable Water Storage Standards and should not be used for human, animal or food irrigation consumption. Quality Control Steel provides a NSF 61 Potable Water Storage Tank but cannot guarantee the quality of water added nor the usability of the water without the proper conveyances listed above.

B) Foundation should be designed to support the weight of the water storage tank (full) & should be designed to meet local building codes.

C) Plumbing code

D) Piping

E) Refer to mechanical drawings

F) Refer to civil drawings

G) Refer to site drawing

PART VII – FINAL NOTES AND WARNINGS:

- Twenty Year Manufacturer's Structural Warranty on materials and workmanship when assembled by CWSI or certified experts.
- One year Manufacturer's Workmanship Warranty when assembled by CWSI or certified experts.
- One year structural warranties are available for tanks sold as supply only and installed by others.
- All Water Tanks are installed as per manufactures installation instructions and therefore a Water Test and a Sign Off by the customer are required at the completion of the installation with the understanding the water tank has been installed to the best of CWS's ability and within the guidelines set out by the manufacture.
- Further mobilizations to site for potential Warranty work will be as per standard warranty description guidelines.
- Permits, soils testing, foundation engineering, or inspections if required, are not included in this proposal, unless otherwise stated.

Vertical Water Storage Tanks

IW Series

- Economical way to store potable (drinking) water for Residential and Commercial applications.
- Resin complies with U.S. Food and Drug Administration regulation 21CFR 177.1520(1) 3.1 and 3.2 for storage of potable water. These tanks are designed for water use only.
- Green color reduces algae growth and blends with the environment.
- Comes complete with threaded inlet/outlets and a vented twist entry.



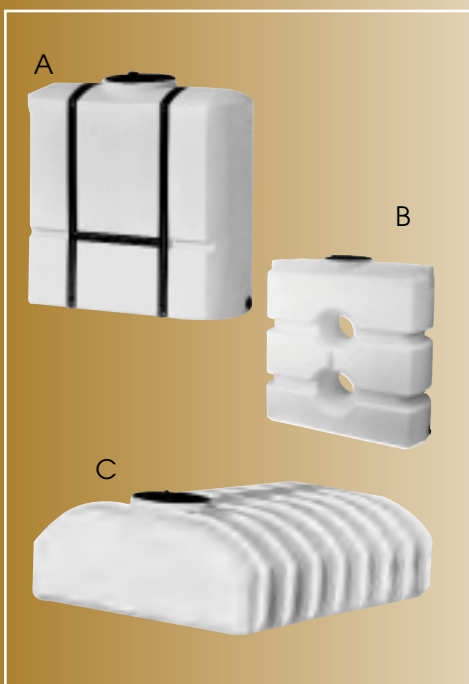
CAPACITY (GAL)	SIZE DIA. X HT (IN.)	VENTED MANWAY (IN)	FOB POINTS (1)
45	18 x 51 (3)	4	CIP,Tn
65	23 x 42	8	CIPF,Tn
100	23 x 64	8	CIPF,Tn
110	35 x 36 (5)	8	CIPF,Tn
130	23 x 76	8	C
165	31 x 58	8	CIPF,Tn
200	31 x 72	16	CIP,Tn
300	35 x 81	16	CIP,Tn
500	64 x 42	16	CIPF,Tn
500	46 x 76	16	CFP,Tn
550	45 x 94	16	CF
650	56 x 70	16	C
750	46 x 119	16	CIP,Tn
850	48 x 124	16	CIP,Tn
1000	64 x 81	16	CIPF,Tn
1000	69 x 74	16	C
1500	64 x 121	16	CIPF,Tn
1550	87 x 65	16	CIP,Tn
1700	86 x 74	16	Tn
2000	64 x 144	16	CIPF,Tn
2500	95 x 89	16	CI,Tn
3000	95 x 107	16	CI,Tn
4000	95 x 140	16	CI,Tn
4000	102 x 125	16	C
5000	102 x 152	16	CIP,Tn
10000	141 x 160	16	C

(1) Subject to stocking inventory

(3) 45 Gal. has inverted calibrations

(5) 110 Gal. has side indents for fork lift handling

45 - 165 Gals: have 1" inlet and 1.5" outlet standard 300 Gals and up: have 1.5" inlet and 2" outlet standard. Outlets are located close to top and bottom, in line.



Specialty Water Tanks

- 375 and 400 gallon tanks allow fit through conventional doorway. The 400 gallon tank is designed to be free standing and self-supporting.

CAPACITY (GAL)	SIZE W X H X L (IN.)	OUTLET SPECS.	VENTED MANWAY (IN.)	FOB POINTS (1)
375 (A)	30 x 60 x 62	1.25"	16	CIP,Tn
400 (B)	29 x 65 x 60	1.25"	16	CIP,Tn
1250 (C)	80 x 35 x 132	2"	16	CIP,Tn
1500 (C)	81 x 41 x 130	2"	16	CIP,Tn
2400 (C)	90 x 51 x 149	2"	16	CIP,Tn

(1) Subject to stocking inventory

IMPORTANT- Review tank handling, installation & use guidelines, pg. 20.

- The degree of translucency varies with wall thickness and tank color.
- Tank sizes are nominal. Capacities indicate approximate volume.
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1) Polyethylene

A high quality thermoplastic that has outstanding resistance to both physical and chemical degradation. The overall general toughness and excellent chemical resistance to a wide array of wet and dry industrial chemicals and food products make polyethylene ideally suited for storage tanks and containers. Polyethylene is translucent and its natural color ranges from slightly off white to creamy yellow, depending on wall thickness and type. Ultraviolet light stabilizers are added for use in outdoor applications. Colors are available on request for a nominal up charge.

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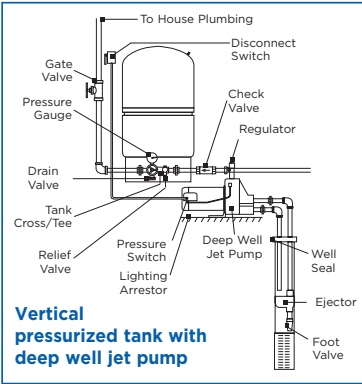
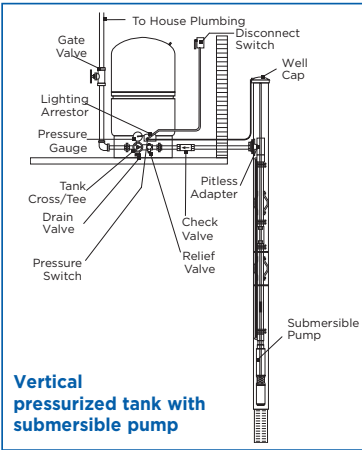
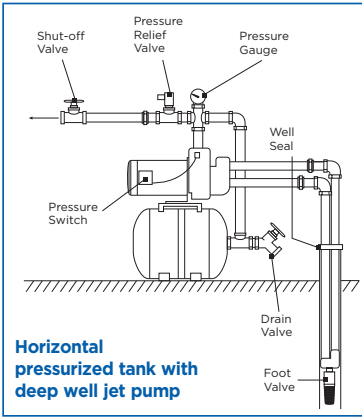
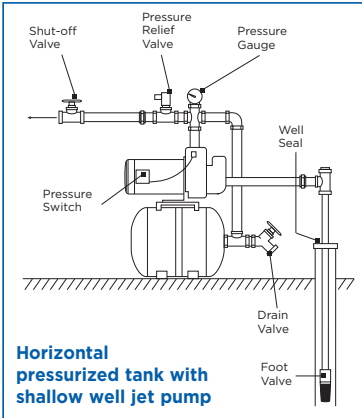
B) Crosslinkable Polyethylene

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2) Polypropylene

Polypropylene is a rigid plastic that has a higher operating temperature limit than polyethylene: 212° F. It offers good chemical resistance, has a high resistance to stress crack, and is autoclavable. Polypropylene (PP) is not recommended for applications in sub-freezing temperature or where high impact strength is needed. A rough, irregular interior surface is common characteristic of molded polypropylene. Available only in limited sizes and styles. Please contact sales office.

Typical Tank Installations



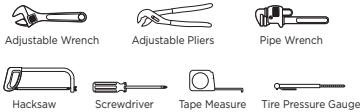
Tank Selection Guide

Tank Volume	2	4-4 1/2	6-9	14-16	20-24	25-29	30-36	37-46	47-65	85-96	109-120
Water Worker	HT-2B	HT-4B	HT-8B	HT-14B	HT-20B	HT-30B	HT-32B	HT-44B	HT-62B	HT-86B	HT-119B
Champion	-	-	-	CH3001	CH4202	CH6000	CH8003	CH10050	CH12051	CH17002	CM22050
Challenger	PJR6	PJR15	PJR25	PC44	PC66	PC88	PC122	PC144	PC211	PC266	PC366
Con-Aire	-	-	-	CA15	-	CA42	-	CA82T	CA120	CA220	-
Flo-Tec	FP7105	FP7100	-	-	FP7110	-	FP7120	FP7125	-	FP7130	FP7135
Goulds Hydro-Pro	VP6	V15P	V25P	V45	V60	V80	V100	V140	V200	V250/V260	V350
H2 Pro	PJR6	PJR15	PJR25	WWT-14	WWT-20	WWT-25	WWT-35	WWT-45	WWT-65	WWT-85	WWT-120
Mark Series	CM1001	CM1002	CM1003	CM3001	CM4202	-	CM8003	CM10050	CM12051	CM17002	CM22050
Pro-Source/Plus	-	-	-	PS30	PS42/PSP19	-	PS82/PSP32/PSP35	PS120	PS200/PSP50-PSP62	PS220/PSP85	PSP119
Red Lion	RL2	RL4	RL8	RL14	RL20	-	RL33	RL44	RL62	RL81	RL119
Standard Galvanized	5	12	18	30	42	82	82	120	220	220	315
State Perma-Air	PIL-2	PIL-5	PIL-7	PAD-14	PAD-20	-	PAD-31/PAD-36	-	PAD-52	PAD-86	PAD-119
Wel Flo	-	WF15	WF25	WF45	WF60	WF80	WF100	WF140	WF200	WF240	WF360
WellMate	WM-8L	WM-18L	WM-25L	WM-4	WM-6	-	WM-9	WM-14	WM-20	WM-25	WM-35
Well-Rite	PJR6	PJR15	PJR25	WR45	WR60	WR80	WR120	WR140	WR200	WR260	WR360
Well-X-Trol	WX-101	WX-102	WX-103	WX-201	WX-202	WX-202XL	WX-203	WX-250	WX-251	WX-302	WX-119

Additional Parts Required For Installation



Recommended Tools

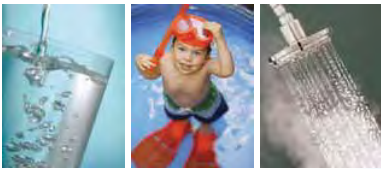


Drawdown

Model No	Water Worker Capacity (gal.)	Drawdown (gallons)		
		20/40	30/50	40/60
HT-2B	2.0	0.73	0.62	0.54
HT-4B	4.4	1.61	1.36	1.18
HT-8B	7.4	2.78	2.35	2.03
HT-6HB	5.3	1.94	1.64	1.42
HT-14HB	14.0	5.12	4.33	3.75
HT-14B	14.0	5.12	4.33	3.75
HT-20B	20.0	7.31	6.18	5.35
HT-30B	26.0	8.78	7.42	6.43
HT-32B	32.0	-	9.89	8.57
HT-44B	44.0	16.09	13.60	11.78
HT-62B	62.0	22.67	19.17	16.60
HT-86B	86.0	31.44	26.58	23.03
HT-119B	119.0	43.51	36.79	31.86



Well Tank Selection Guide

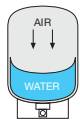


www.waterworkerdiy.com

Tank Operation

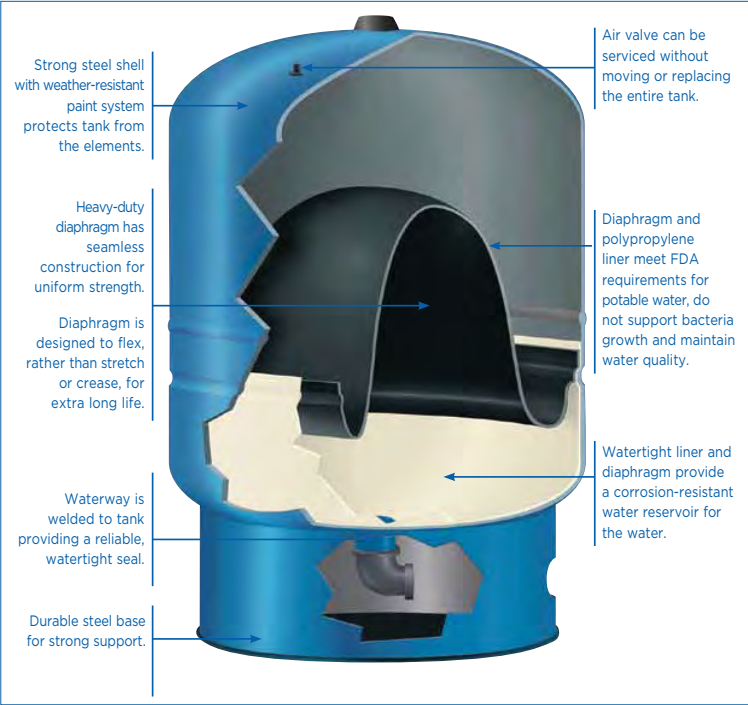
All well systems require a pre-pressurized well tank to provide a buffer of stored water. Without supplemental storage, small water uses like running a faucet or flushing a toilet would cause rapid pump cycling. This can lead to potential pump failure - an expensive repair or replacement often costing thousands of dollars.

1. As the pump fills the tank with water, the air above the diaphragm is compressed. This increases the pressure in the tank and causes the pressure switch to turn off the pump.
2. When water is drawn from the tank, pressure inside the tank decreases until the pressure switch starts the pump. The amount of water delivered between pump cycles is called drawdown. The greater the drawdown capacity, the less the pump needs to run, saving energy and money, and extending pump life.
3. As water is drawn from the tank, the reduced pressure starts the pump and refills the tank.



Tank Features

Water Worker® Well Tanks are made in the USA, easy to install and specifically designed for years of dependable, trouble-free, energy-saving operation.



Tank Selection

Count the number of water fixtures and select the closest tank size according to the chart.

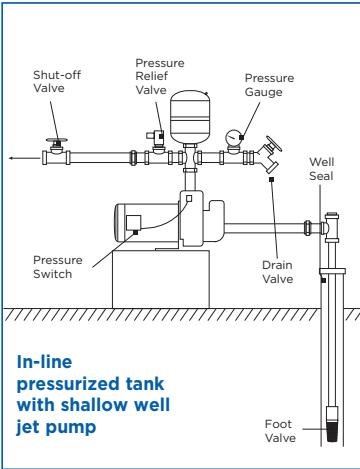
Example: For a home with 3 sinks, 3 toilets, a dishwasher, shower, bathtub, washing machine and an outside faucet, (11 water fixtures) the correct tank size would be: HT-44B.

There are no disadvantages to having a larger well tank. The larger the tank, the fewer pump cycles - extending pump life and saving electricity. Larger tank sizes will also increase the water storage volume to provide more consistent pressure.

Number of Water Fixtures	WaterWorker Capacity (gal)	Model No.	Epoxy Tank Equivalent (gal)
2	2.0	HT-2B	—
2	4.4	HT-4B	12
2	5.3	HT-6HB	12
3	7.4	HT-8B	20
4	14	HT-14B	30
4	14	HT-14HB	30
6	20	HT-20B	42
6	20	HT-20HB	42
8	26	HT-30B	—
10	32	HT-32B	82
14	44	HT-44B	120
20	62	HT-62B	—
28	86	HT-86B	220
40	119	HT-119B	315

The design of a Water Worker tank is much more efficient than an epoxy tank. This allows a smaller Water Worker tank to deliver the equivalent performance as compared to a much larger galvanized or epoxy tank.

Typical Tank Installation



WATER WORKER
www.waterworkerdiy.com

SCALA2

PERFECT WATER PRESSURE

FULLY INTEGRATED - COMPACT DESIGN - EASY TO INSTALL



GRUNDFOS SCALA2 is a fully integrated water booster pump delivering perfect water pressure to all taps. It features pump, motor, tank, sensor, drive and non-return valve in one compact unit that installs quickly and easily.

With its intelligent pump control, SCALA2 adjusts performance to any demand – and with its water-cooled motor, it offers one of the lowest noise levels in its class. The result is maximum comfort with minimum effort.

Key features

- Intelligent pump control
- Water-cooled, permanent magnet motor
- Dry running protection
- Self-priming
- User friendly control panel
- Outdoor-ready
- Easy sizing and selection



APPLICATIONS

SCALA2 is designed for pressure boosting in single family houses and apartments.

Boosting from mains: Increases the water pressure delivered by city mains.

Boosting from tanks: Increases water pressure from roof tanks, break tanks and ground tanks, including rainwater tanks.

Boosting from wells: Pumps water from a depth of up to 26 feet (8 meters).

Indoor and outdoor installation: NEMA 3

BENEFITS

Perfect water pressure: Intelligent pump control adjusts operation to ensure perfect water pressure at all times.

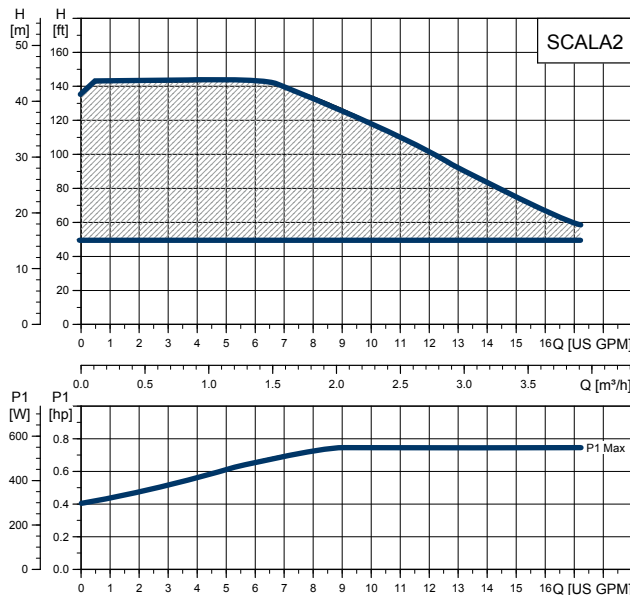
Low noise: With a noise level of 47 dB(A) in typical use, SCALA2 is one of the quietest boosters in its class.

Easy selection: One variant for all domestic applications.

Easy installation: Compact, all-in-one solution for perfect installation in no time.

Easy to operate: User-friendly control panel for easy set-up.

PERFORMANCE CURVE



TECHNICAL DATA

Max. ambient temperature 131°F / 55°C

Max. liquid temperature 113°F / 45°C

Max. system pressure 145 psi / 10 bar

Enclosure rating NEMA 3

Floors Max. 3

Taps Max. 8

Dimensions
H: 11.9 in / 302 mm
L: 15.9 in / 403 mm
W: 7.6 in / 193 mm

Weight 22 lbs / 10 kg

LPG

STEEL PORTABLE



SPECIFICATIONS

STANDARD

MODEL/SIZE (LBS)	4.25	11	20	30	40	43.5	60*	100*
HEIGHT (IN)	11.8	16.6	17.2	23.7	29.3	32.5	44.1	48
LPG CAPACITY (GAL)	1	2.6	4.7	7.1	9.4	10.3	14.2	23.6
WATER CAPACITY (LBS)	12	26.2	47.6	71.5	95.2	103.6	143	239
NOMINAL TARE WEIGHT (LBS)	11	13.3	17.0	23.3	28.7	33.9	48.1	68
CYLINDER DIAMETER (IN)	9.1	9.1	12.3	12.3	12.3	12.3	12	14.7
CYLINDER VOLUME (CU. IN)	332	725	1,318	1,980	2,635	2,868	3,955	6,616
COLLAR DIAMETER (IN)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
COLLAR HEIGHT (IN)	4	4	4	4	4	5.1	5.1	5.1
FOOTRING DIAMETER (IN)	9.1	7.8	7.8	7.8	7.8	12	12	14.5
HORIZONTAL DESIGN	-	-	Available	Available	Available	-	-	-
VALVE	CGA-791 w/OPD	CGA-791 w/OPD	CGA-791 w/OPD	CGA-791 w/OPD	CGA-791 w/OPD	CGA-510 NO OPD	CGA-510 NO OPD	CGA-510 NO OPD
STANDARD SPECIFICATION	DOT-4BA240	DOT-4BA240	DOT-4BA240	DOT-4BA240	DOT-4BA240	DOT-4BA240	DOT-4BW260	DOT-4BW240

METRIC

MODEL/SIZE (LBS)	4.25	11	20	30	40	43.5	60*	100*
HEIGHT (MM)	300	427	450	602	744	825.5	1,120	1,219
LPG CAPACITY (L)	3.8	9.8	17.3	26.9	35.6	39	53.8	86.7
WATER CAPACITY (KG)	5.4	11.9	21.6	32.4	42.2	47	65	108.4
NOMINAL TARE WEIGHT (KG)	5	6.0	7.7	10.5	13.0	15.4	21.8	30.8
CYLINDER DIAMETER (MM)	231	231	312	312	312	312	305	373
CYLINDER VOLUME (L)	5.4	11.9	21.6	32.4	42.2	47	65	108.4
COLLAR DIAMETER (MM)	165	165	165	165	165	165	165	165
COLLAR HEIGHT (MM)	102	102	102	102	102	130	130	130
FOOTRING DIAMETER (MM)	231	198	198	198	198	305	305	368
HORIZONTAL DESIGN	-	-	Available	Available	Available	-	-	-
VALVE	CGA-791 w/OPD	CGA-791 w/OPD	CGA-791 w/OPD	CGA-791 w/OPD	CGA-791 w/OPD	CGA-510 NO OPD	CGA-510 NO OPD	CGA-510 NO OPD
STANDARD SPECIFICATION	DOT-4BA240	DOT-4BA240	DOT-4BA240	DOT-4BA240	DOT-4BA240	DOT-4BA240	DOT-4BW260	DOT-4BW240

All dimensions are approximate.

*Available with cap and flange

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LPG

ALUMINUM PORTABLE



SPECIFICATIONS

STANDARD

MODEL/SIZE (LBS)	6	10	20	30	40
HEIGHT (IN)	22.5	15.9	20.2	25.9	32.1
LPG CAPACITY (GAL)	1.4	2.4	4.7	7.1	9.4
WATER CAPACITY (LBS)	15	23.8	47.6	71.5	95.2
NOMINAL TARE WEIGHT (LBS)	8.1	9.7	13.0	16.5	19.5
CYLINDER DIAMETER (IN)	6.3	10.3	12.3	12.3	12.3
CYLINDER VOLUME (CU. IN)	415	664	1,318	1,999	2,635
COLLAR DIAMETER (IN)	5.7	7.9	7.9	7.9	7.9
COLLAR HEIGHT (IN)	6.5	5.5	5.5	5.5	5.5
FOOTRING DIAMETER (IN)	6.2	8	8	8	8
HORIZONTAL DESIGN	-	Available	Available	Available	Available
VALVE	CGA-791 w/OPD	CGA-791 w/OPD	CGA-791 w/OPD	CGA-791 w/OPD	CGA-791 w/OPD
STANDARD SPECIFICATION	DOT-4E260	DOT-4E240	DOT-4E240	DOT-4E240	DOT-4E240

METRIC

MODEL/SIZE (LBS)	6	10	20	30	40
HEIGHT (MM)	571	404	513	658	814
LPG CAPACITY (L)	5.4	9.1	17.3	26.9	35.6
WATER CAPACITY (KG)	6.8	10.8	21.6	32.4	43.2
NOMINAL TARE WEIGHT (KG)	3.7	4.4	5.9	7.5	8.8
CYLINDER DIAMETER (MM)	160	261	312	312	312
CYLINDER VOLUME (L)	6.8	10.8	21.6	32.7	43.5
COLLAR DIAMETER (MM)	144.8	200	200	200	200
COLLAR HEIGHT (MM)	165	140	140	140	140
FOOTRING DIAMETER (MM)	158	203	203	203	203
HORIZONTAL DESIGN	-	Available	Available	Available	Available
VALVE	CGA-791 w/OPD	CGA-791 w/OPD	CGA-791 w/OPD	CGA-791 w/OPD	CGA-791 w/OPD
STANDARD SPECIFICATION	DOT-4E260	DOT-4E240	DOT-4E240	DOT-4E240	DOT-4E240

All dimensions are approximate.

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