Appendix A: Engineering Analysis

SECTION 1122

BENEFICIAL USE OF DREDGED MATERIAL (BUDM)

HALE‘IWA SMALL BOAT HARBOR

August 2020

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Appendix A: Engineering Analysis

Contents

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1.0 Introduction

This appendix summarizes the engineering design elements of the Section 1122 Hale‘iwa Boat Harbor Maintenance Dredging and Beach Restoration study. It describes the process and analysis used for feasibility-level design of the Beneficial Use of Dredged material, including natural forces, existing conditions, alternatives considered and construction methods. Hale‘iwa is located on the central north coast of the island of O‘ahu, Hawaii, approximately 30 miles northwest of Honolulu. The project location is shown below in **Error! Reference source not found.**. The non-federal partners for the feasibility study are the Department of Land and Natural Resources, Division of Boating and Ocean Recreation and the Office of Conservation of Coastal Lands.

1.1 Project Background and Authority

Hale‘iwa Small Boat Harbor (HSBH) is the center for recreational boating activities on the north shore of O‘ahu. The original federal navigation project which was completed in November 1966 consisted of the entrance channel and revetted mole. The stub breakwater and wave absorber were added in 1975. Non-federal project features include 64 berths, 26 moorings, 2 loading docks, and 3 ramps. Shore side facilities include a harbor office, vessel wash down area, dry land storage, and a fish hoist. Several commercial operations operate out of the harbor, including fishing charters, shark encounters, diving charters, whale watching tours, snorkeling tours, sailing cruises, and other boat tours. The beaches surrounding the harbor are frequented by swimmers, surfers, stand-up paddle boarders, and other recreational ocean users. In the winter, several surf contests are held in this area due to the large surf.

This feasibility study is being conducted under authority granted by Section 1122 of the Water Resources Development Act (WRDA) of 2016 (Public Law 114-322), as amended. Section 1122 of WRDA 2016 requires USACE establish a pilot program to carry out 10 projects for the beneficial use of dredged material, including projects for the purposes of— (1) Reducing storm damage to property and infrastructure; (2) promoting public safety; (3) protecting, restoring, and creating aquatic ecosystem habitats; (4) stabilizing stream systems and enhancing shorelines; (5) promoting recreation; (6) supporting risk management adaptation strategies; and (7) reducing the costs of dredging and dredged material placement or disposal.

1.2 Existing Federal Projects

The current general navigation features at HSBH consist of (a) an entrance channel (740 feet (ft) long, 100–120 ft wide, 12 ft deep), (b) a revetted mole (1,310 ft long), (c) a stub breakwater (80 ft long), and (d) a wave absorber (140 ft long). The outer breakwater, approximately 840 ft long, was constructed by the State of Hawaii. The non-federal sponsor for the harbor is the State of Hawaii, Department of Land and Natural Resources, Division of Boating and Ocean Recreation.

The Hale‘iwa Shore Protection Project (HBSPP) consists of (a) a sand beach (1,600 ft long and 140–265 ft wide), (b) an offshore breakwater (160 ft long), and (c) a groin (500 ft long) which defines the southern limit of the beach improvements. The nonfederal sponsor for the beach restoration project is the State of Hawaii, Department of Transportation, and the project fronts Hale‘iwa Beach Park (HBP), which is the responsibility of the City and County of Honolulu. Construction of the beach restoration project was completed in April 1965 and repaired under the authority of Public Law 84-99 in 1978. Approximately 50,000 cu yd of sand were placed within the project limits as part of initial construction and the emergency repair. The project authorization states that the non-federal sponsor is responsible for ongoing maintenance of the project and that USACE may conduct emergency repairs to the project in accordance with Public Law 84-99. Features of the federal navigation project and shore protection project are shown in Figure A1.

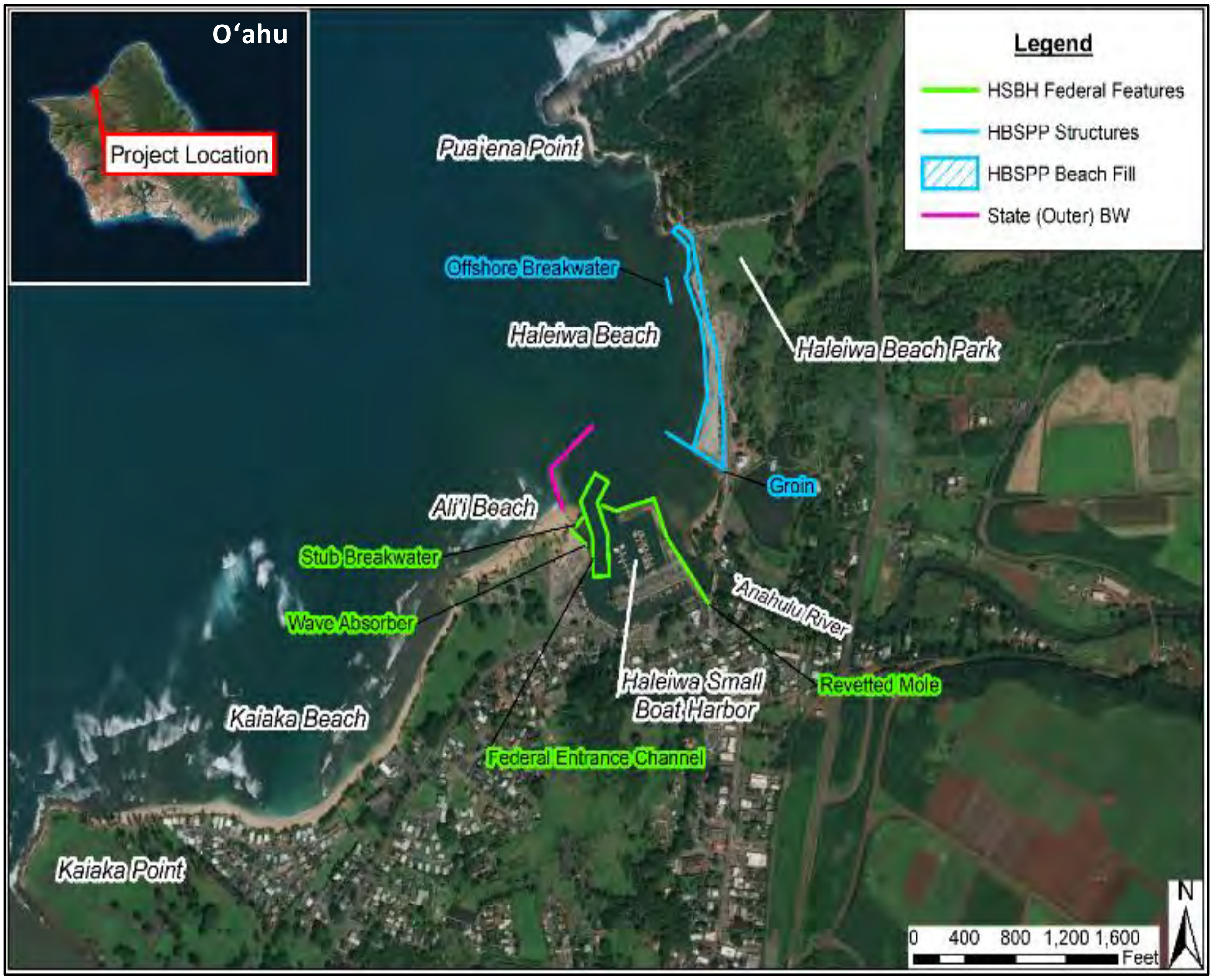

Figure A1. Project Location and study area for HSBH and HBSPP

2.0 Previous Studies and Investigations

2.1 Regional Sediment Management Investigations

Regional Sediment Management (RSM) refers to the effective use of littoral, estuarine, and riverine sediment resources in an environmentally sensitive and economical efficient manner. RSM changes the focus of engineering activities from the local or project-specific scale to a broader scale that is defined by natural sediment processes. A prime motivator for the implementation of RSM principles and practices is the potential for reducing construction, maintenance and operation costs of federally authorized projects. Implementing RSM principles also has the potential to positively impact multiple projects in their ability to realize authorized purposes.

A Coastal and Hydraulics Engineering Technical Note, ERDC/CHL CHETN-XIV-38 (Podoski, 2014), reviews the development of conceptual regional sediment budgets (RSB) for the Hale‘iwa region as part of the Hawaii RSM Program. The CHETN document discusses the methodology used for determining volume change rates as well as numerical models utilized, including the Particle Tracking Model (PTM), in support of identifying sediment pathways in the region. The results of these investigations were used to create the pre- (1922–1948) and post-Hale‘iwa Harbor (1988–2006) sediment budgets for the Hale‘iwa Region using the Sediment Budget Analysis System (SBAS) software. The post-Hale‘iwa Harbor sediment budget is provided later in this document in the section “Currents and Littoral Sediment Transport”.

An RSM Technical Note , ERDC/TN RSM-18-9 (Molina, 2018), documents information to prepare for the next maintenance dredging event at HSBH. The RSM-TN reviews previous work in the region including maintenance dredging and sediment budgets, evaluates sediment quality data, and projects future sediment volumes and shoaling rates. Additionally, this RSM-TN identifies environmental coordination requirements and permits and documents discussions with the non-federal sponsors and other stakeholders to identify stockpile, beneficial reuse, and disposal options. This TN was also used to inform the current study and is referenced in this appendix.

2.2 City and County of Honolulu Conceptual Design Study

In August 2019, the City and County of Honolulu Department of Design and Construction finalized a report titled, *Concept Designs for Selected Beach Parks, Volume 1 – Hale‘iwa Beach Park* (Sea Engineering, Inc., 2019). The study was completed as part of a larger program to address erosion problems at City and County beach parks on O’ahu, with Hale‘iwa Beach Park identified as one of a few parks in a higher priority category that moved forward for a conceptual design phase.

The objective of the study, completed by Sea Engineering, Inc. was to conduct a more in-depth site investigation at Hale‘iwa Beach Park and develop concept designs to address the priority problem at the beach park. The conceptual report design objectives for Hale‘iwa Beach Park are two-fold: protect the backshore facilities and improve the recreational beach. The report documents the results of the study and includes sections on existing conditions, historical shoreline trends, oceanographic design criteria, and discussions of the concept design alternatives.

As noted in the study, “The backshore in this area is protected from erosion by a vertical wall that was built in the 1950s as part of the park development. The vertical wall extends along approximately 550 ft of shoreline… The severe loss of sand fronting the wall, however, has resulted in the undermining of the wall, and the wall shows signs of settling, spalling, and cracking.” A photo from the report showing the damaged seawall is shown in Figure A2.

Figure 2-17 Damaged north end of wall (2008)

Figure A2. Photo of damaged seawall at Hale'iwa Beach Park (Sea Engineering, Inc., 2019)

The study also identified a sand deposit approximately 3,400 ft offshore of Hale'iwa Beach Park. Scuba divers performed a reconnaissance-level investigation of the sand deposit. Jet probing was conducted to determine the thickness of sediments overlying consolidated or hard bottom substrate within an area covering approximately 80,000 square yards, or about 16.5 acres. The preliminary investigations in this area indicate that the sand deposit contains in excess of 200,000 cubic yards (cy) of sand in the area identified. The depth of the area investigated varies from 35 to 54 feet.

Finally, the study presented five alternative designs that include varying measures such as: replacing/repairing the vertical seawall, attaching the existing detached federal breakwater to land by a rubblemound groin, adding a new T-head groin structure, various volumes of beach fill, and sand tightening the existing federal groin. The City and County of Honolulu considers Hale'iwa Beach Park a high priority and has initiated the planning phase of an improvement project in 2020.

3.0 Existing Conditions

3.1 Water Levels, Tides, and Sea Level Change

Tides

Tides in Hawaii are semi diurnal with pronounced diurnal inequalities (i.e. two high and low tides each 24-hour period with different elevations). Water level data established for a temporary HSBH tidal station is show below.

Table A1. Water level data for Hale'iwa Harbor

Datum	Elevation (MLLW)	Elevation (MSL)
Mean Higher High Water	1.9 ft	1.0 ft
Mean High Water	1.6 ft	0.7 ft
Mean Sea Level	0.9 ft	0.0 ft
Mean Low Water	0.3 ft	-0.6 ft
Mean Lower Low Water	0.0 ft	-0.9 ft

Hawaii is subject to periodic extreme tidal levels due to large scale oceanic eddies that propagate through the islands. These eddies produced tide levels up to 0.5 to 1 ft higher than normal for periods of up to several weeks.

Water Levels

Water level plays a critical role in design of coastal projects, particularly in those locations where waves are depth limited. The super-elevation of water level near the coast can be a controlling factor in determining the amount of wave energy affecting the harbor and shorelines. It can significantly affect coastal processes such as harbor seiching, wave breaking, wave generated currents, wave runup and inundation, and sediment transport.

Water level is a combination of many factors that can occur over different temporal and spatial scales. Longer-term water level increases may be due to sea level changes, and/or annual or decadal anomalies such as El Niño/La Niña or the Pacific Decadal Oscillation. These phenomena will be discussed in the next section. Shorter-term effects on nearshore still water level are astronomic tide (presented above), storm surge (which includes wind setup and localized increase due to low pressure), and wave setup. Wave runup can be added to the still water level in areas where inundation along the shoreline or overtopping of a structure is a concern.

Extreme water levels calculated at the Honolulu Harbor tide gauge (shown in Figure A3) can be viewed as a generalized representation of still water level conditions at HSBH. However, since wave and storm exposure can vary dramatically on different coasts of O'ahu, actual still water level probabilities at HSBH are likely different than those shown below. Figure A3 shows that the 1% annual exceedance probability still water level is 2.5 feet (0.76m) above Mean Sea Level for the period between 1983 -2001. This type of short-term water surface elevation in combination with longer-term increases such as sea level rise will cause increasing erosion, wave runup, and threats to habitat, recreation and coastal infrastructure at Hale'iwa Beach Park.

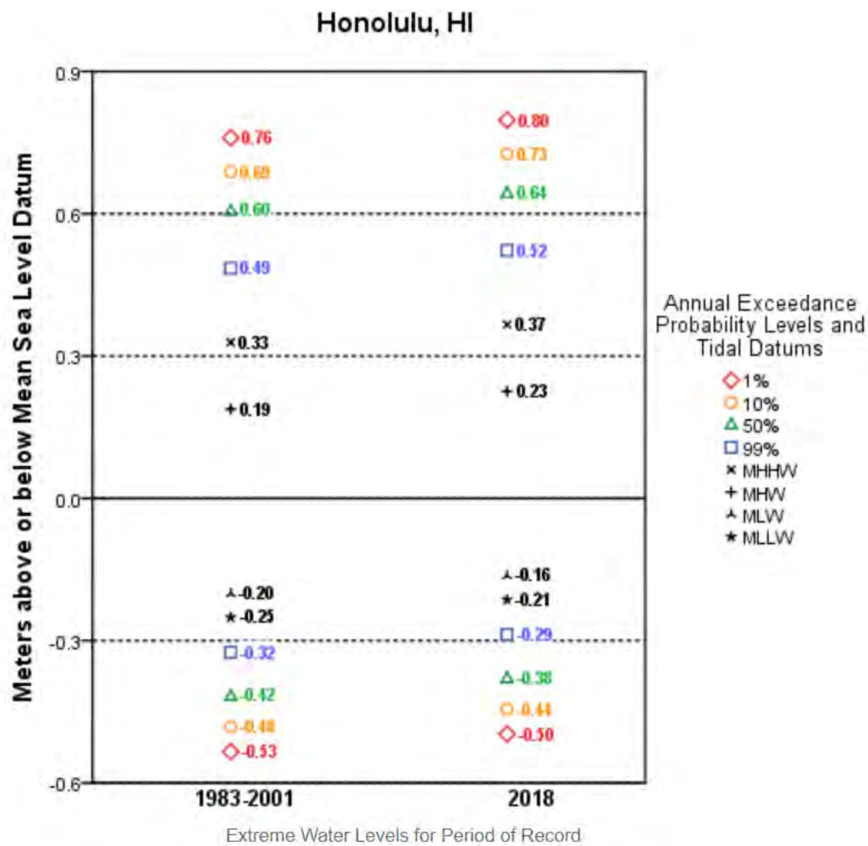

Figure A3. Extreme water levels at Honolulu Harbor, O'ahu

Sea Level Change

Relative sea level change (SLC) is the local change in sea level relative to the elevation of the land at a specific point on the coast, including the lowering or rising of land through geologic processes such as subsidence and glacial rebound. Relative SLC is a combination of both global and local SLC caused by changes in estuarine and shelf hydrodynamics, regional oceanographic circulation patterns (often caused by changes in regional atmospheric patterns), hydrologic cycles (river flow), and local and/or regional vertical land motion (subsidence or uplift). Thus, relative SLC is variable along the coast.

At Honolulu Harbor (on the south coast of O'ahu), relative sea level has risen at an average rate of 0.0049 ft/year (1.51mm/yr) over the 114-year period of record for the long-term NOAA tide station at this location. This is equivalent to an increase of 0.50 feet over the past century (Figure A4). This long-term trend of relative sea level rise exacerbates hazards such a coastal erosion, impacts from seasonal high waves, and coastal inundation due to storm surge and tsunamis. It has also increased the impact of short-term fluctuations such as extreme tides along coastlines of O'ahu.

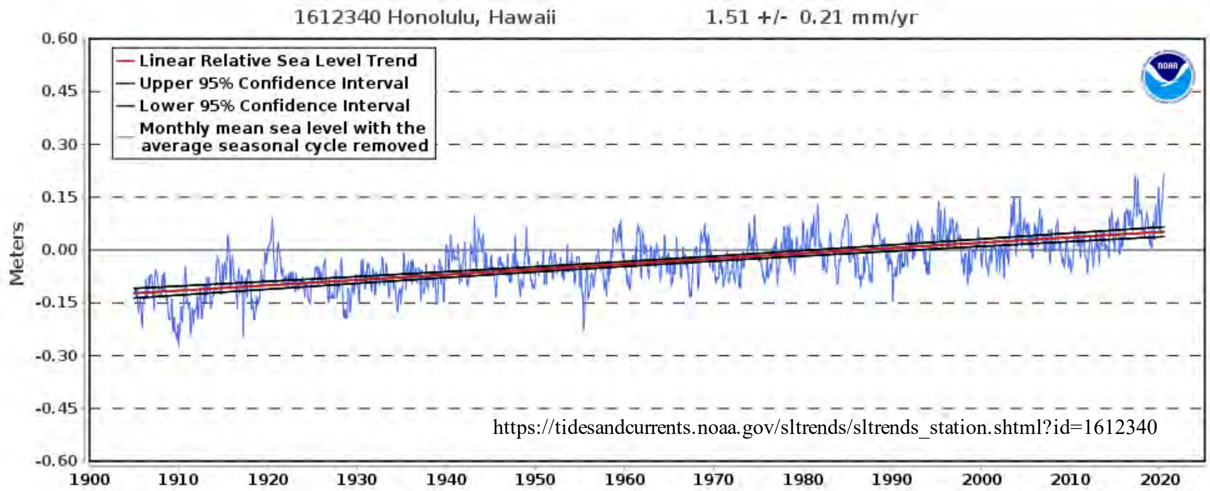

Figure A4. Sea level trend for Honolulu, Hawaii.

Multi-decadal tradewind shifts in the Pacific (1950-1990 had weak tradewinds, while 1990-present have shown strong tradewinds) are likely related to the Pacific Decadal Oscillation (Merrifield et al., 2012), a recurring pattern of ocean-atmosphere climate variability centered over the mid-latitude Pacific basin. These low frequency tradewind changes can contribute on the order of 1 cm variations in sea level in the tropical Pacific. Multi-decadal variations such as these can lead to linear trend changes over 20 year time scales that are as large as the global SLC rate, and even higher at individual tide gauges, such as Honolulu, Hawaii (Merrifield, 2011 and Merrifield et al., 2012).

In addition, higher frequency interannual variations in Pacific water levels can be caused by the effect of the El Niño Southern Oscillation (ENSO); the climate phenomenon in the Pacific evidenced by alternating periods of ocean warming and high air pressure in the western Pacific (El Niño) and cooler sea temperatures accompanied by lower air pressure in the western Pacific (La Niña). In fact, it is the largest interannual variability of sea level around the globe occurs in the tropical Pacific, due to these climate patterns (Widlansky et al., 2015). Additionally, and throughout the tropical Pacific, prolonged interannual sea level inundations are also found to become more likely with greenhouse warming and increased frequency of extreme La Niña events, thus exacerbating the coastal impacts of the projected global mean sea level rise (Widlansky et al., 2015).

These phenomena are documented here to emphasize the large variability in sea level that is experienced in the tropical Pacific, and to indicate that sea level trends reported by the nearest NOAA tide gage at Honolulu, Hawaii are affected by this variability. Figure A5 shows the interannual variation of monthly mean sea level at Honolulu Harbor and the 5-month running average, with average seasonal cycle and linear sea level trend have been removed. Variability of up to +/- 0.5 feet (+/- 0.15 m) in the trend is comparable to the relative SLC over the past century.

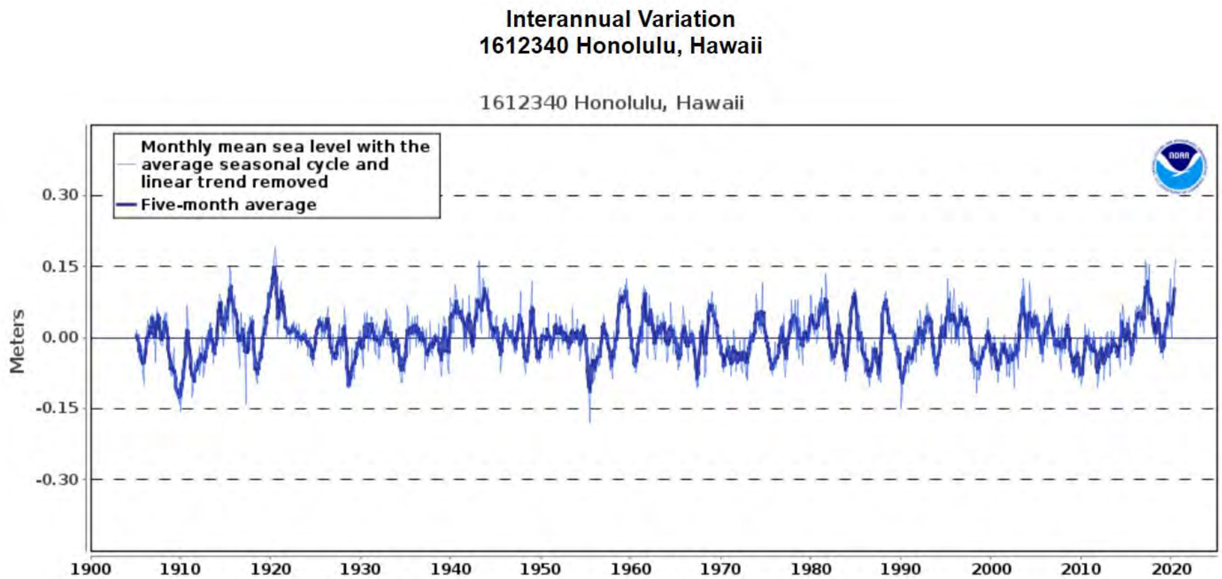

Figure A5. Interannual variation at Honolulu Harbor NOAA tide station

To incorporate the direct and indirect physical effects of projected future sea level change on design, construction, operation, and maintenance of coastal projects, USACE has provided guidance in the form of Engineering Regulation, ER 1110-2-8162 (USACE, 2019). ER 1100-2-8162 provides both a methodology and a procedure for determining a range of sea level change estimates based on global sea level change rates, the local historic sea level change rate, the construction (base) year of the project, and the design life of the project. Three estimates are required by the guidance, a Baseline (or "Low") estimate, which is based on historic sea level change and represents the minimum expected sea level change, an Intermediate estimate (NRC Curve I), and a High estimate (NRC Curve III) representing the maximum expected sea level change. These projections are shown in Figure A6, with annotations for year 2024 (project start year), 2074 (50-year planning horizon) and 2124 (100-year adaptation horizon), and their impacts on the project alternatives are discussed later in this appendix.

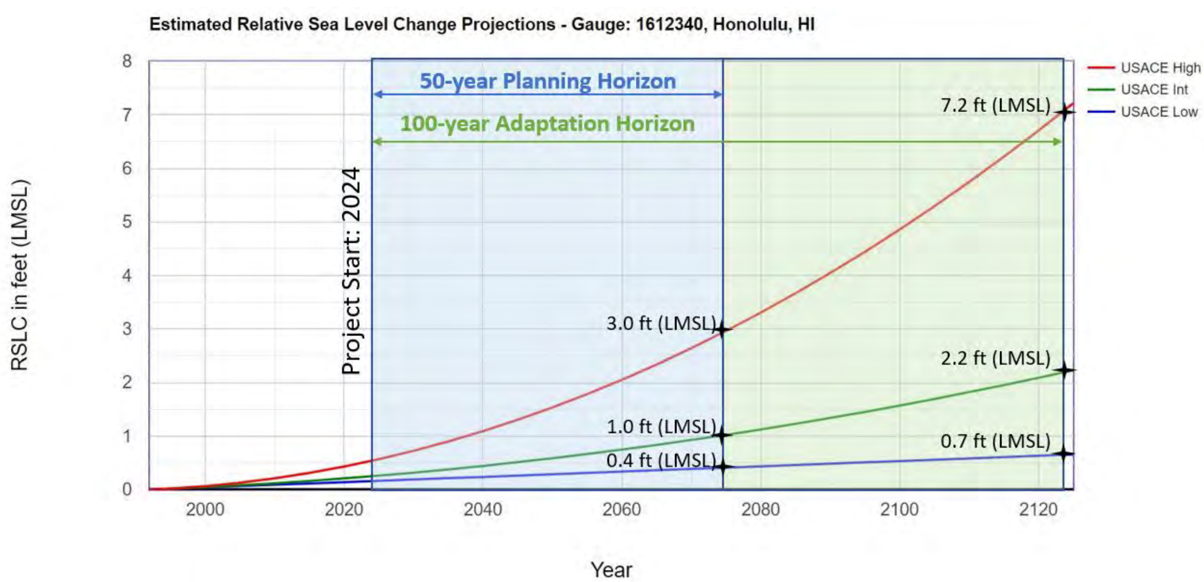

Figure A6. Relative Sea Level Change curves at Honolulu Harbor NOAA tide station

3.2 Wind and Wave Climate

Winds

The prevailing wind direction in the Hawaiian Islands is the northeasterly trade wind. During the summer period (May through September) the trades are prevalent 80 to 95 percent of the time. During winter/spring months (October through April), the trade wind frequency is 50 to 80 percent in terms of average monthly values. Locally generated low pressure systems known as Kona lows situated to the west of the island chain can generate winds from a southerly to southwesterly direction, but this condition is relatively infrequent.

Figure A7 shows a wind rose diagram from a Wave Information Study (WIS) Hindcast station located off the north shore of O'ahu.

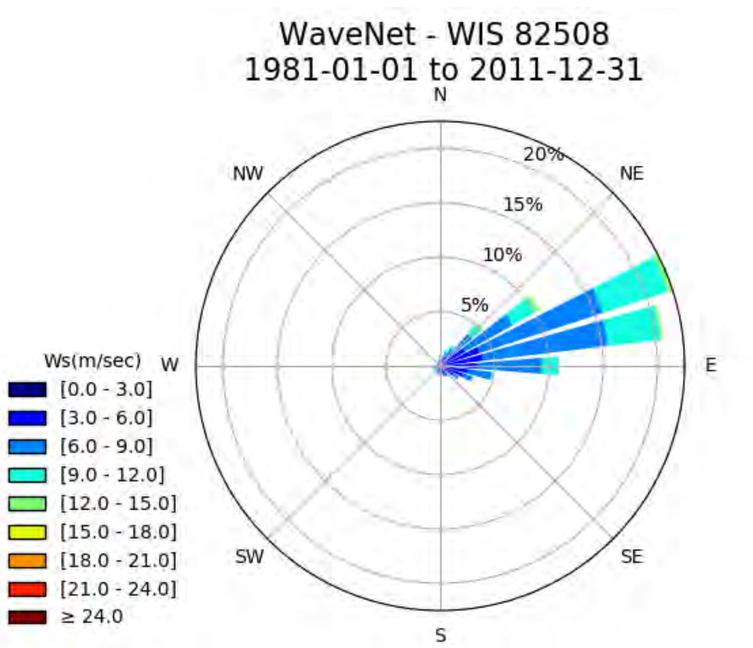

Figure A7. Wind Rose from WIS Station 82508

Waves

The Hawaiian Island chain is subject to a wide variety of incident wave conditions. Consistent tradewinds generate local wind waves while distant storms in the North and South Pacific Ocean generate significant swell energy that travels thousands of miles before reaching Hawaii's coastline. Nearshore exposure to these wave conditions is highly dependent on location as well as shoreline orientation, due to the significant wave sheltering by adjacent islands and land features such as peninsulas and headlands. Refraction due to wave propagation over rapid changes in bathymetry also greatly affects wave climate in the islands.

Hale'iwa SBH and Hale'iwa Beach are exposed to north swell during the winter months and refracted tradewind waves year-round. Measured directional wave data is available for Buoy 106 of the Coastal Data Information Program (CDIP), which is located about five miles north of Hale'iwa. A wave rose plot from this buoy data is shown in Figure A8, and a wave period rose plot is shown in Figure A9. These plots show that longer period swell arrives from the west-northwest to north directions, while trade wind generated shorter-period seas arrive from north-northeast through northeast.

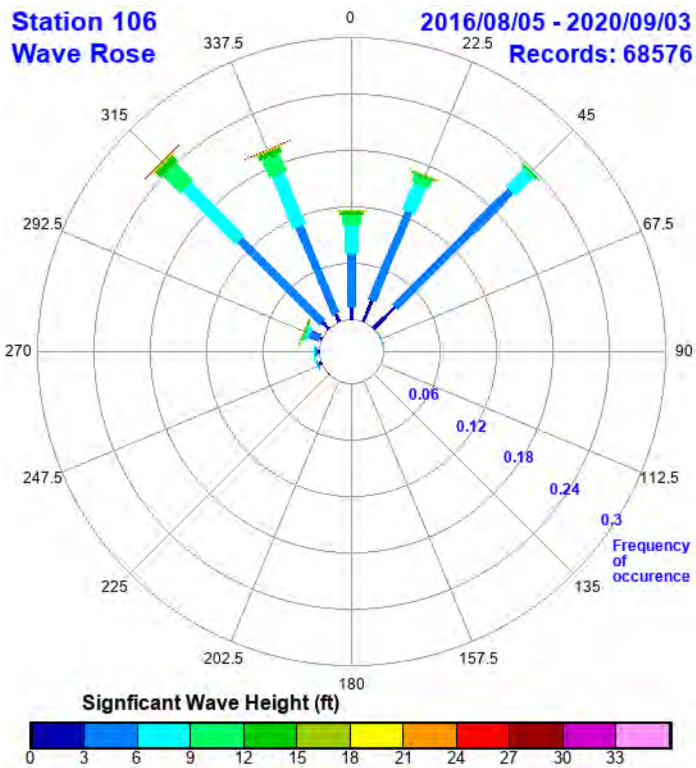

Figure A8. Wave height rose from CDIP buoy 106

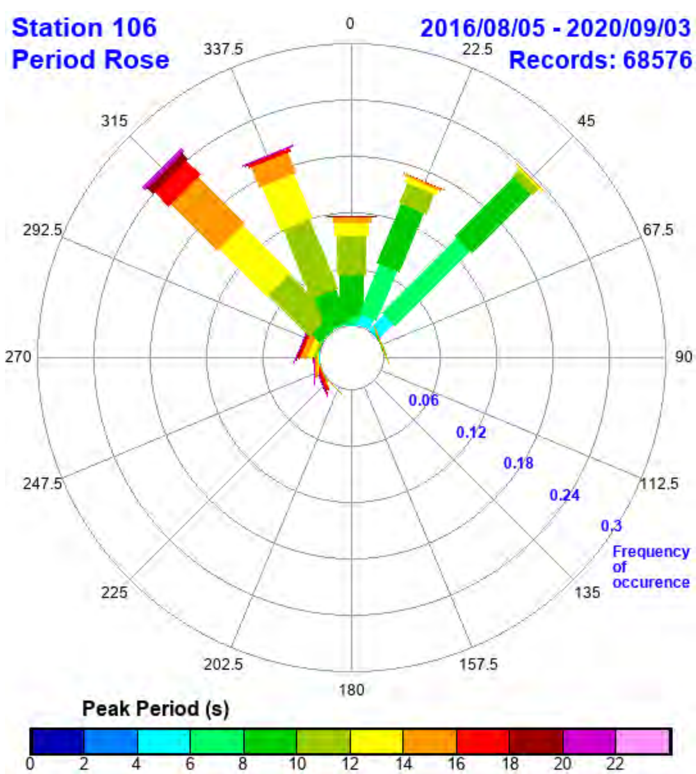

Figure A9. Wave period from CDIP buoy 106

3.3 Currents and Littoral Sediment Transport

The general circulation patterns in the Hale‘iwa region are dictated by the presence of the relic stream channels offshore of Kaiaka Beach and HSBH. An example of the dominant current regime, determined by circulation modeling presented in CHETN-XIV-38, is shown in Figure A10. The small black arrows in the figure indicate the direction of flow while current velocities are color coded in accordance with the legend in the top left corner of the figure (ranging from 0 m/sec in blue to 2 m/sec in red). The large black arrows represent the generalized current patterns of the region. Interpretation of the modeling results suggest that flow enters the Kaiaka Beach channel from both the reef and the nearshore waters. Flow also enters the adjacent channel offshore of HSBH from the reef fronting Alii Beach and also from the Hale‘iwa Beach Park shoreline. A strong, shore-parallel current from southwest to northeast is evident in the vicinity of the outer state breakwater, emptying into the harbor channel.

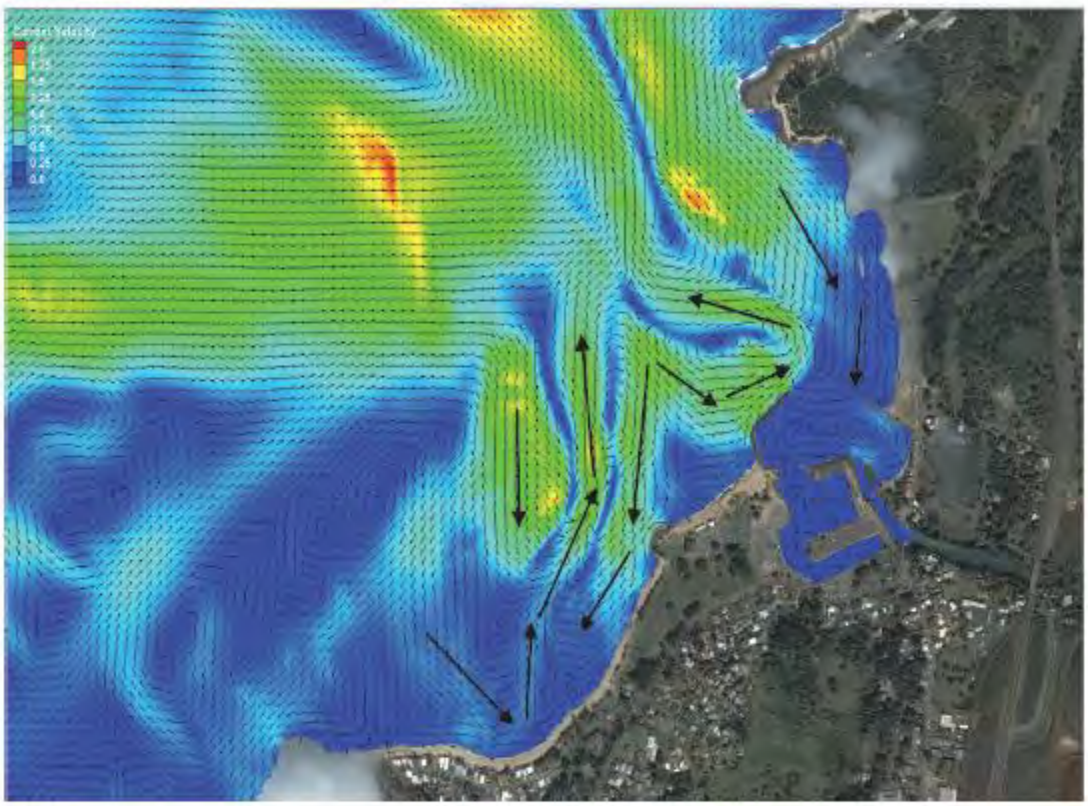

Figure A10. Regional circulation patterns in project area (Podoski, 2014)

The wave and circulation modeling completed was used with the Particle Tracking Model to visualize sediment transport pathways, and this in combination with shoreline change analysis and dredging records were used to develop a regional sediment budget, shown in Figure A11. The post-harbor construction sediment budget presented in this CHETN indicates that the Puaena Point, Hale‘iwa Beach, and Alii Beach littoral cells are historically negative (or erosive). The Hale‘iwa Harbor cell is positive (accretive), being fed by sand transported from Alii Beach over the harbor breakwater root and from Hale‘iwa Beach through both the harbor channel and the permeable groin along this cell boundary. There is also a small, assumed transport from the Anahulu River since terrestrial sediments have been observed in dredged material. The harbor cell volume change is positive (+200 cu yd/yr), which is in general agreement with the shoaling rate presented in the next section.

Figure A11. Sediment budget for the Hale'iwa region (Podoski, 2014)

The Alii Beach cell is losing sand over the breakwater and into the harbor as well as along the outside of the breakwater and into the harbor entrance channel. A structural improvement at the root of the breakwater could reduce some of the erosion in this cell as well as reducing maintenance dredging requirements in the harbor channel; however, this action would be required by the State of Hawaii.

A portion of the sand from Alii Beach and Hale'iwa Beach is being directed offshore into the channel at the harbor entrance, a phenomenon that may have been caused or amplified by the construction of Hale'iwa Harbor. Some of this sand may be staying within the littoral system, but based on increased erosion rates in recent years, it is likely that some of this sand is being moved into deep water by the offshore current in the channel and is being lost from the system. This observation is in agreement with the large sand field in 35 to 50 feet of water that was identified in the 2019 City and County of Honolulu Conceptual Design Study conducted by Sea Engineering, Inc.

In the Hale'iwa Beach cell, there is strong transport from north to south, as evidenced by the wide beach at the terminal groin (which allows some sand to leak through). This also leaves the section in front of the comfort station severely eroded. Sand leaving the Hale'iwa Beach cell but not moving offshore is ending up in the harbor channel in the lee of the State breakwater and nearby areas. This is adding to the maintenance dredging requirement in the channel. In addition, terrestrial sediment enters the back of the harbor from `Anahulu Stream. This explanation of regional processes correlates with the sediment analysis described in the next section, which identified fine grained terrestrial sediment in the back of the harbor and coarse-grained sand in the outer harbor.

Tightening the permeable groin at the south end of Hale'iwa Beach and/or determining whether beach-quality sand can be recovered from areas adjacent to the harbor (near Anahulu Stream mouth) may be viable ways of reducing maintenance requirements and keeping sand within the littoral system. Another method to address channel maintenance is the establishment of a settling basin between Alii Beach and the federal channel, that would be dredged periodically in order to intercept sand before it migrates into the channel. These methods are discussed later in the Alternatives section of this appendix.

3.4 Historical Dredging, Shoaling Rates, and Sediment Characterization

Hale‘iwa Harbor has been dredged twice since initial construction: (1) 7,214 cy in 1999 and (2) approximately 4,500 cy in 2009. Both times, the material was disposed of upland. Some of the clean, sandy material from the 2009 dredging was used at the HBP for repair work, and some was made into concrete. At the time, placing suitable dredged material on Hale‘iwa Beach was identified as a potential beneficial reuse option. The necessary environmental permits were not in place, however, and the maintenance dredging schedule and budget did not allow for them to be acquired at that time. At the time, it was noted that some of the material dredged from portions of the navigation channel could be suitable for direct beach placement, however the quantity of material available per dredging cycle would not be enough to provide long-term stability to the regions beaches.

By evaluating past dredging events and survey data, shoaling rates can be calculated and future dredging requirements can be projected. See Table A2 for a summary of past dredging events and surveys from the past 20 years. The volume is the amount of material that shoaled above the authorized depth of 12 feet (identified by hydrosurvey), or the amount that was dredged during maintenance dredging. The shoaling rate is calculated as the difference in volume from the previous survey/dredge, divided by the number of years since that event. The high shoaling rate between 1999 and 2009 suggests that the harbor may fill in episodically, such as during storm events, rather than steadily over many years. The average shoaling rates show that over the long term, the harbor shoals at a rate of about 238 cy/yr.

Table A2. Dredging and hydrosurvey volumes, and calculated shoaling rates

Shoaling rate based on dredging and hydrosurvey history			
YEAR	**TYPE OF WORK**	**VOLUME (CY)**	**SHOALING RATE (CY/YR)**
1999	Maintenance Dredging	7,214	219
2009	Maintenance Dredging	4,554	455
2011	Hydrosurvey	311	155
2014	Hydrosurvey	800	160
2018	Hydrosurvey	1600	200

Prior to the 2009 maintenance dredging, shoaled areas were sampled for both grain size and chemicals of concern by Marine Research Consultants, Inc. (MRCI, 2008). MRCI conducted two rounds of sampling: the first for grain size analysis (Samples H1-H6) and the second for chemicals of concern (Samples H1-H5, and H7). Composite Sample H123 was in the interior non-federal berthing area, which is the state’s dredging responsibility. Composite Sample H45 and discrete Sample H6 are in the federal channel as shown in Figure A12. Table A3 shows the grain size results.

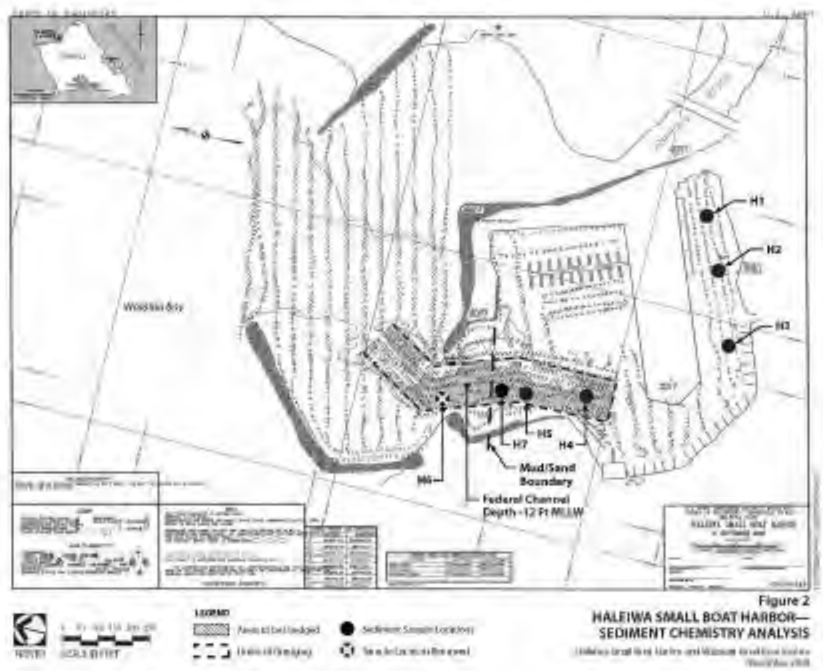

Figure A12. Haleʻiwa Harbor with sediment sampling locations and estimated sand/silt boundary (MRCI, 2008).

Table A3. Particle size distribution of Haleʻiwa Harbor sediment samples

Sample	H123 (%)	H45 (%)	H6 (%)
Gravel (>2 mm)	1.63	1.74	7.29
Sand (>63 µm)	8.11	43.67	92.35
Silt/Clay (<63 µm)	91.89	54.59	0.37

These data show the gradation from very fine-grained material in the berthing area (Sample H123), to clean, well-sorted coarse-grained sand in the outer channel (Sample H6). Based on these results, Figure A12 shows the approximate boundary between the sand/silt areas in the entrance channel (dashed line). Since Sample H6 was found to be <1% fines (silt/clay), it was not used for the second round of testing, which was a chemical analysis on material with greater than 15% fines. Instead, another sample location (Sample H7) was added to create composite Sample H457 as shown in Figure A12.

Although chemical concentrations were detected in Sample H457, they were determined to be below the Department of Health Environmental Action Limits for unrestricted uses. They were also below the maximum limits for landfill acceptance. Thus, contaminates did not restrict disposal options in 2009. Though the amount of dredged material suitable for beach placement was not quantified in 2009, based on the sample data and observations during dewatering, an assumption was made that approximately 60% (3,900 cy) of the material dredged from this section of the federal channel (dashed box in Figure A12) was sand similar to that found in Sample H6. Figure A13 is a photo of the sediment removed by mechanical dredging in 2009, placed in two distinct piles – on the left is silty/fine material dredged from the interior of the harbor, and on the right is material dredged from the outer harbor near the entrance, which is overwhelmingly coarse grained sand.

Figure A13. Sediment dredged from Hale'iwa Harbor 2009 maintenance dredging

More recent sediment sampling and analysis has not been conducted, as this is typically done in the design and permitting stage just prior to maintenance dredging. If maintenance dredging funds are received for Hale'iwa Harbor as part of the requested FY22 budget package, sampling and analysis will be completed to determine the suitability of dredged material for beach placement, placement at an Ocean Dredged Material Disposal Site (ODMDS), or other disposal options during construction in FY23. For the purposes of this feasibility study, it is assumed that the dredged material will be of similar grain size and chemical makeup as the 2009 dredged material. Based on an average shoaling rate of 238 cy/year derived from the data in Table A2, it is anticipated that the volume of material above project depth by the time of construction (early calendar year 2024) will be approximately 3,028 cy. Addition of the estimated volume of material due to sloughing of side slope material and allowable overdepth dredging increases the total estimated dredging volume to 4,433 cy. Based on the previous boundary between sand and silt/fines found in 2009 and shown in Figure A12 (dashed line), it is assumed that approximately 2,433 cy of the dredged material will be coarse grained sand, suitable for beach placement. The remaining 2,000 cy dredged from the interior of the harbor is assumed to be fine/silty material that will not be suitable for beach placement and would have to be disposed of in the South O'ahu ODMDS or upland, depending on the results of chemical analysis.

3.5 DMMP and Federal Standard for Maintenance Dredging

Historically, maintenance material dredged from HSBH was required to be disposed of by contractors in adherence with all applicable local, state, and federal laws and regulations. Most of the material has been relegated to upland disposal sites with occasional beneficial reuse which takes material out of the system (e.g., landfill cover and road construction), and, in combination with high costs of mobilization and relatively low dredge volume, has resulted in high costs per cubic yard as indicated in Table A4.

Table A4. Maintenance dredging historical volumes and costs

Year	Type of Work	Type of Disposal	Volume (cy)	Total Cost	Unit Cost ($/cy)
1999	maintenance	upland	7,200	$208,000	$29.00
2009	maintenance	upland	4,556	$1,300,000	$252.00*

*(Mob/Demob costs removed from Total Cost for unit cost calculation when known)

In September 2018, a Dredged Material Management Plan (DMMP) Preliminary Assessment (USACE, 2018) was completed in accordance with ER 1105-2-100 (USACE, 2000). A DMMP is a comprehensive, long-term plan for management of dredged material removed from channels and berths to provide safe navigation.
The Federal Standard is defined in USACE regulations as the least costly dredged material disposal or placement alternative identified by USACE that is consistent with sound engineering practices and meets all federal environmental requirements. It is also USACE policy to fully consider all aspects of the dredging and placement operations while maximizing benefits to the public. Beneficial use options for the dredged material should be given full and equal consideration with other alternatives.

A rough order of magnitude cost estimate completed as part of the DMMP is presented in Table A5 to compare the different disposal options. For each option, it is assumed that the channel will be dredged to authorized depth using mechanical means and that all material will be disposed of with a single disposal method (i.e. stockpile, beach placement, landfill, or ODMDS). The estimate showed that disposing of the material at the ODMDS is the least cost option, at $33/cy (based on an assumed 6,500 cy of dredged material). When an economy of scale is considered, this reasonably compares to a unit cost of $57 - $72/cy for offshore disposal for costs presented in this report (which assume 2,000 to 4,000 cy of dredged material, depending on the alternative). Taking the material to the ODMDS eliminates the need for landside equipment, and dewatering and trucking the material.

Stockpiling and beach placement are very similar in unit cost ($91 - $96/cy), indicating that for construction cost there is not much difference with placing the material at HBP in stockpile vs. placing it on the beach. These DMMP estimated costs also compare very well with the average unit cost of $95/cy estimated in this report (which assume 7,166 to 11,071 cy of dredged material, depending on the alternative). Trucking the material to the landfill is the most expensive option, about double the stockpile/beach placement options (i.e. $188/cy vs. $91-96/cy). This ROM cost estimate for upland placement is in general agreement with the unit cost for the 1999 maintenance dredging shown above ($188/cy vs. $252/cy). The Federal Standard (or Base Plan) for management of material dredged from Hale‘iwa Harbor determined by the 2018 DMMP is the use of the existing EPA designated South O‘ahu ODMDS for all suitable dredged material. It is not expected that any material will have contaminates of concern above EPA’s limits, nor that it will exceed the ODMDS grain size requirements.

Table A5. Dredging and hydrosurvey volumes, and calculated shoaling rates

Disposal Method	Mob/ Demob	Dredging Project Costs	Total Project Costs	Dredging Unit Costs ($/cy)
Stockpile	$501,121	$593,948	$1,095,069	$91
Beach Placement	$501,121	$621,450	$1,122,571	$96
Landfill	$501,121	$1,220,902	$1,722,023	$188
South Oahu ODMDS	$626,888	$212,880	$839,768	$33

Beneficial use project costs exceeding the cost of the Federal Standard (or “base plan”) option become either a shared federal and non-federal responsibility, or entirely a non-federal responsibility, depending on the type of beneficial use. Section 145 of WRDA 1976, as amended by Section 933 of WRDA 1986, Section 207 of WRDA 1992, and Section 217 of WRDA 1999, authorizes USACE to place suitable dredged material on local beaches if a state or local government requests it. Although placement for restoration purposes may be authorized under it, this provision is primarily used for storm damage control purposes. Typically, the incremental costs of beach nourishment are shared on a 65 percent federal and 35 percent non-federal basis. Under Section 1122 of the Water Resources Development Act (WRDA) of 2016 (Public Law 114-322), as amended, the costs of beneficial use projects in excess of the Base Plan will be 100% federally funded.

4.0 Measures and Methods Considered for Beneficial Use

4.1 Dredging Locations and Sediment Volumes

This section describes the various locations proposed for dredging as part of the Section 1122 Beneficial Use of Dredged Material project. Approximate dimensions and volumes of each area are outlined. Beneficial reuse of material from any of these areas is contingent upon sediment sampling an analysis to confirm that material meets the requirements of the State of Hawaii for beach placement. These requirements are, in general: no more than 6% fine sediment, no more than 10% coarse sediment, grain size compatibility within 20% of the existing beach sand, no more than 50% of material as fine sand, a composition of naturally occurring carbonate, and free of contaminants such as organic matter. This sampling and analysis will be conducted during the design phase of this project, if authorized.

Federal Navigation Channel

This is the primary source of dredged material and is a federal channel with regular O&M requirements. As noted in the previous chapter, it is anticipated that the volume of material above project depth (12 ft MLLW) by the time of construction (early calendar year 2024) will be approximately 3,028 cy. Addition of the estimated volume of material due to sloughing of side slope material and allowable overdepth dredging increases the total estimated dredging volume to 4,433 cy. It is assumed that approximately 2,433 cy of the dredged material will be coarse grained sand, suitable for beach placement. The remaining 2,000 cy dredged from the interior of the harbor is assumed to be fine/silty material that will not be suitable for beach placement and would have to be disposed of in the South O'ahu ODMDS or upland, depending on the results of chemical analysis.

Dredging beyond the authorized depth is permitted (if done solely for the purpose of the pilot project and not for the purposes of advanced maintenance) under Section 204 of the Continuing Authorities Program. If sampling and analysis of channel sediments done as part of the design phase of the O&M dredging project show that sandy sediment exists below the authorized channel depth (as is expected), one foot of additional dredging (to a depth of 13 ft MLLW) could be conducted in the outer harbor (between Sta 0+00 and Sta 4+00), in the area shown in Figure A14. This would result in an additional volume of approximately 1,705 cy and would be placed on Haleʻiwa Beach Park with the additional suitable dredged material. Based on the estimated channel shoaling rate of 238 cy/year, this would delay the requirement for future dredging by about 7 years. The additional cost of this dredging would be cost shared between the federal government and the Hawaii Department of Land and Natural Resources, Division of Boating and Ocean Recreation (DLNR/DOBOR).

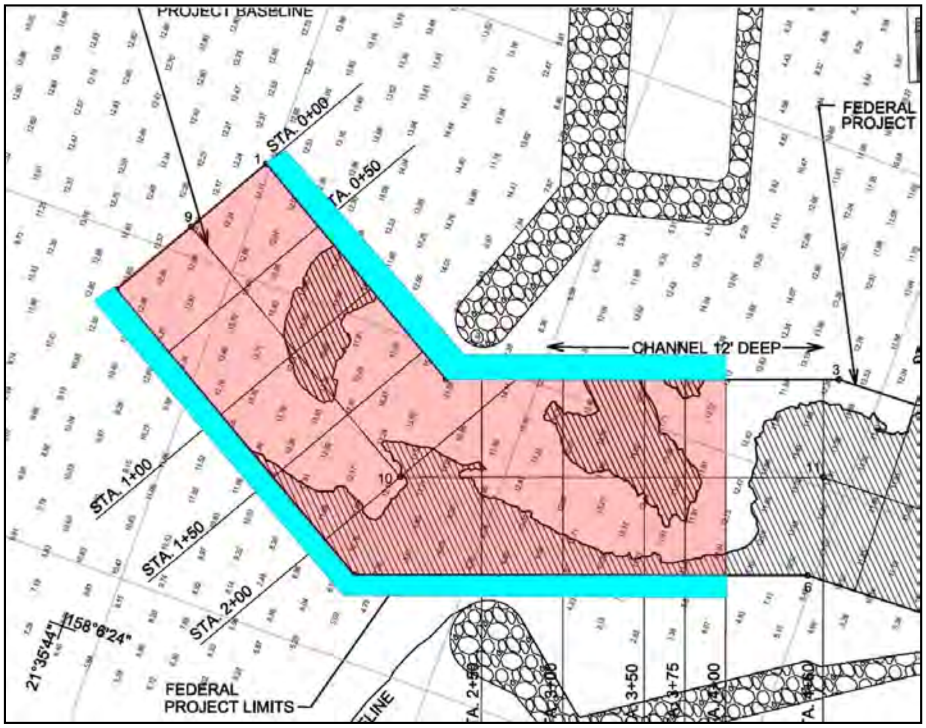

Figure A14. Area of additional dredging to 13 ft MLLW

State Breakwater Settling Basin

Previous RSM efforts (Podoski, 2014 and Molina, 2018) identified sediment shoaling between the federal stub breakwater and the State of Hawaii owned outer breakwater, as indicated in Figure A15. Sand is transported by wind and high waves from Alii Beach over the root of the outer breakwater and is deposited on the harborside of the breakwater.

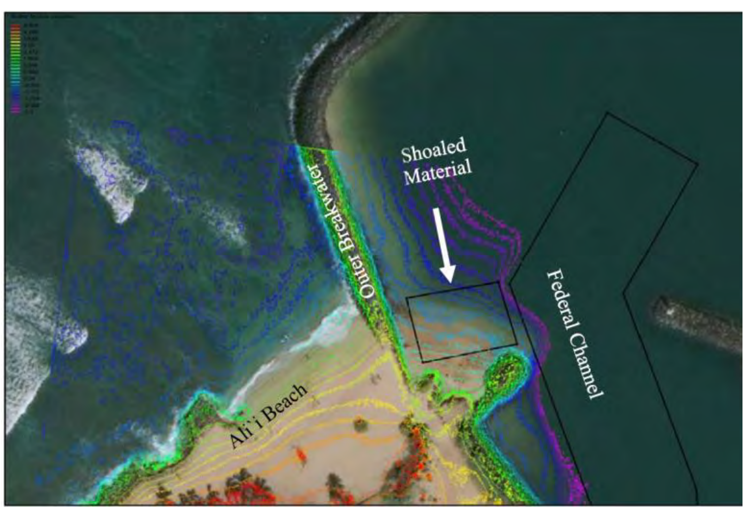

Figure A15. Sediment from Aliʻi Beach overtopping State breakwater

A 2018 multibeam hydrosurvey of the harbor shown in Figure A16 (depths shown in feet relative to MLLW) indicates that a significant portion of this material is ultimately transported around the stub breakwater and into the federal channel (shown as gray lines in the figure). A cross-section of survey data (location indicated by red line in Figure A16) in the area between the stub breakwater and revetted mole shows that the incoming material is causing over half of the 120 ft-wide channel to shoal above the 12 ft MLLW authorized project depth (Figure A16 inset). Also evident in the figure is that depth in the other half of the channel is significantly greater than authorized depth, up to 23 ft MLLW. This "scour hole" is being created by the narrowing of the cross-sectional channel area between the shoaled material and the revetted mole on the other side, resulting in high current velocities through this constricted area. There is also concern that this scouring process may begin to threaten the stability of the revetted mole by undermining its foundation if the scour hole continues to deepen and/or migrate toward the structure. For the purposes of navigation safety, navigation structure stability, and reducing channel maintenance costs, this influx of sand to the federal channel is a problem that must be addressed.

RSM program funds were used in FY19 to investigate the feasibility of seeking authorization to establish a settling basin in the shoaled area updrift of the channel. The intent would be to allow federal dredging of the area outside the currently authorized project, in order to intercept the sediment before it reaches the federal channel, and beneficially reuse the material (if suitable) at Hale'iwa Beach Park. The RSM investigation determined that establishing the settling basin and removing sand between maintenance dredge events would reduce O&M life cycle costs by extending the required interval between maintenance dredging from approximately 10 years to 17 years.

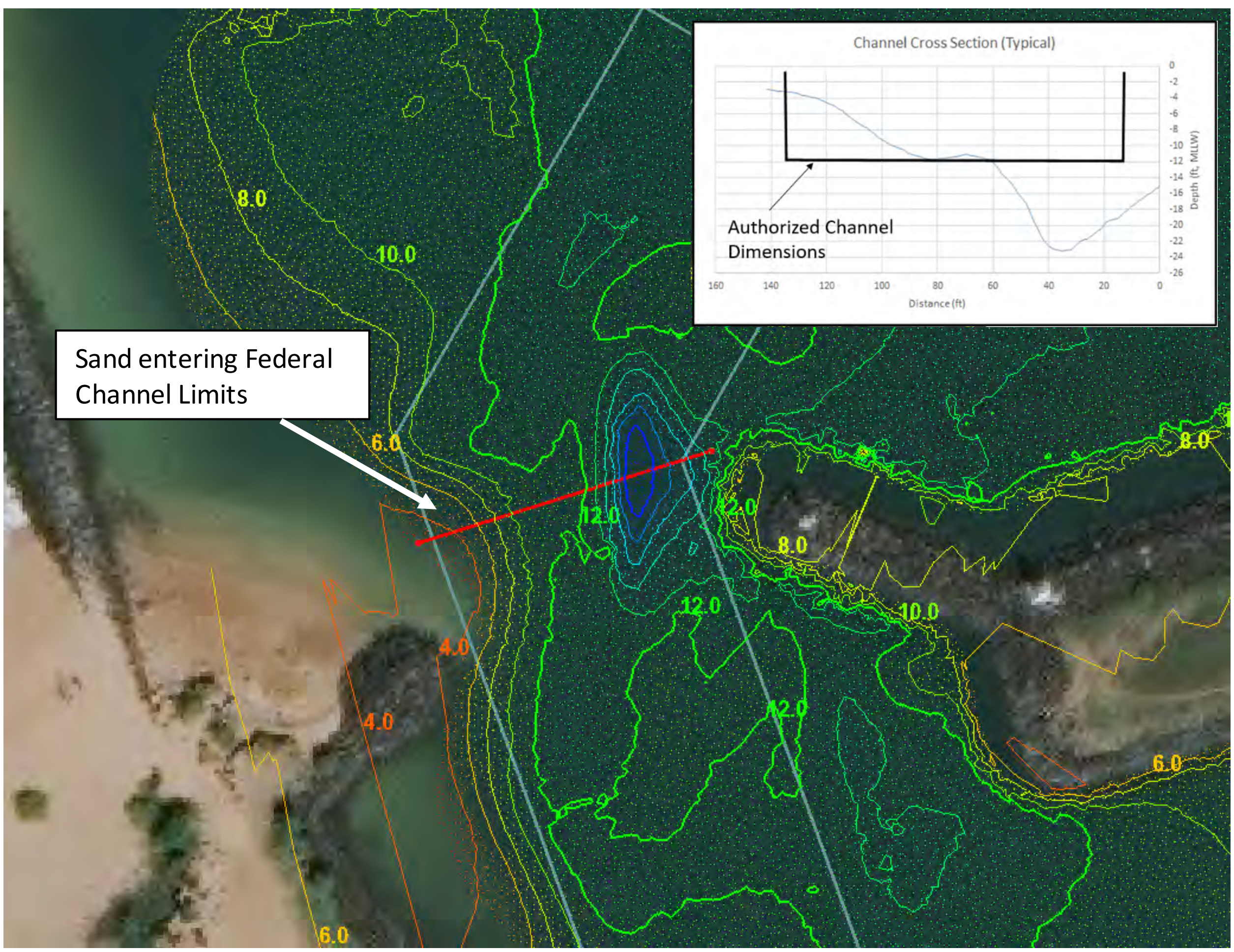

Figure A16. 2018 survey data indicating channel shoaling and channel cross-section (Inset)

The authorization could occur in accordance with ER 1130-2-520, paragraph 8-2.a. (7) Navigation and Dredging Operations and Maintenance Policies, 29 Nov 1996 which states that,

> *Advance maintenance dredging, to a specified depth and/or width, may be performed in critical and/or fast-shoaling areas to avoid frequent redredging and ensure the least overall cost of maintaining the project. MSC commanders are authorized to approve advance maintenance dredging for new work dredging and maintenance dredging of the project.*

The proposed State Breakwater Settling Basin footprint would be a polygon of approximately 140 feet by 110 feet, or 13,000 feet (0.3 acre) in area, as shown in Figure A17. The basin would dredged to a depth of approximately 8 ft MLLW, with side slopes of 1V:2H, yielding approximately 2,200 cy of sediment. Based on the sediment budget in Figure A11 showing approximately 131 cy/year coming over the breakwater and into the channel, and the existing total shoaling rate of 238 cy/year, it can be concluded that dredging the settling basin would reduce the shoaling rate to 107 cy/year (reduction of 55%) over the next 17 years, until the settling basin fills up again. The sediment would need to be sampled and analyzed for grain size to determine it suitability for beach placement. In addition, during design phase, geotechnical surveys would be required to determine the location of the toe of the state breakwater, to ensure that any dredging of the settling basin would not impact the stability of this structure's foundation.

Ultimately, the authorization of a State Breakwater Settling Basin in this location was not supported by the Major Subordinate Command (MSC), which for Honolulu District is the Pacific Ocean Division, because Hale'iwa Harbor is not considered a "fast-shoaling area", due to its relatively infrequent maintenance dredging cycle of approximately 10 years. For this reason, the State Breakwater Settling Basin is being included as a measure in this feasibility study as a 100% non-federal feature, to be completed during maintenance dredging of the federal channel, but paid for by DLNR/DOBOR. This agency, as non-federal sponsor of HSBH, is supportive of the Section 1122 project and beneficial use of dredged material at Hale'iwa Beach park to the maximum extent practicable.

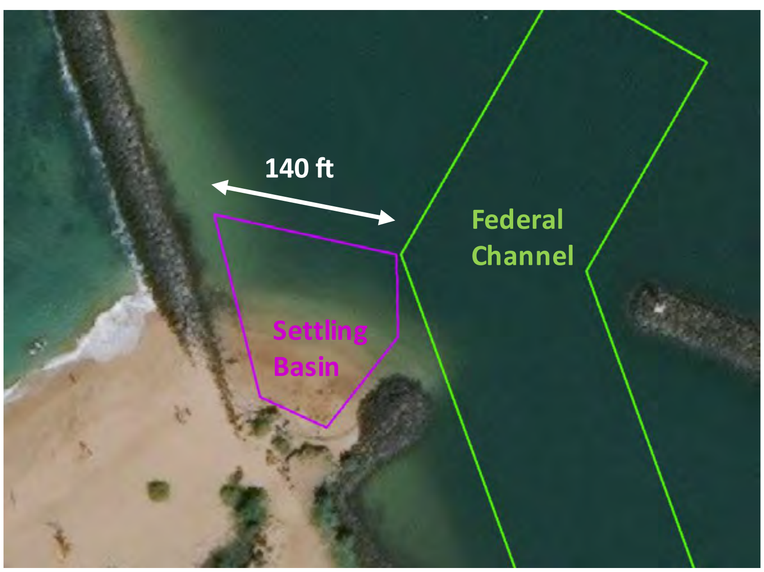

Figure A17. State Breawater Settling Basin limits

Offshore Sand Borrow Area

The 2019 City and County of Honolulu Conceptual Design Study ((Sea Engineering, Inc., 2019) identified a sand deposit approximately 3,400 ft offshore of Hale'iwa Beach Park. Scuba divers performed a reconnaissance-level investigation of the sand deposit. Jet probing was conducted to determine the thickness of sediments overlying consolidated or hard bottom substrate within an area covering approximately 80,000 square yards, or about 16.5 acres. The preliminary investigations in this area, including reconnaissance-level cores of approximately 3 to 4 feet depth, indicate that the sand deposit contains in excess of 200,000 cy of sand in the area identified. Grain size distributions from these core samples are shown in Figure A18, indicating a composite mean grain size diameter (D_{50}) of 0.4mm (thick blue line in figure), which would be considered compatible with the composite mean grain size diameter of sand on the beach at 0.6mm (thick black line in figure). The depth of the area investigated varies from 35 to 54 feet. A portion of this identified area could be used as an offshore sand borrow area, in order to supplement the volume obtained from the federal channel and the settling basin. It is anticipated that approximately 15,000 cy of material from this offshore site would be sufficient to fully restore Hale‘iwa Beach, contingent upon sediment sampling to confirm its suitability for beach placement.

The dredging of sand from this area and placement at HBSPP would require the use of a barge mounted crane and clamshell dredge. The sand would be dewatered during excavation using an environmental clamshell bucket, placed on a scow, and barged to the access channel where it would be mechanically placed on the beach. This dredging and placement would be completed during maintenance dredging of the federal channel, but paid for by DLNR/OCCL. This agency, as non-federal sponsor of the Hawaii Regional Sediment Management Program, is supportive of the Section 1122 project and beneficial use of dredged material at Hale‘iwa Beach park to the maximum extent practicable.

Figure A18. Offshore Sand Borrow Area (SEI, 2019)

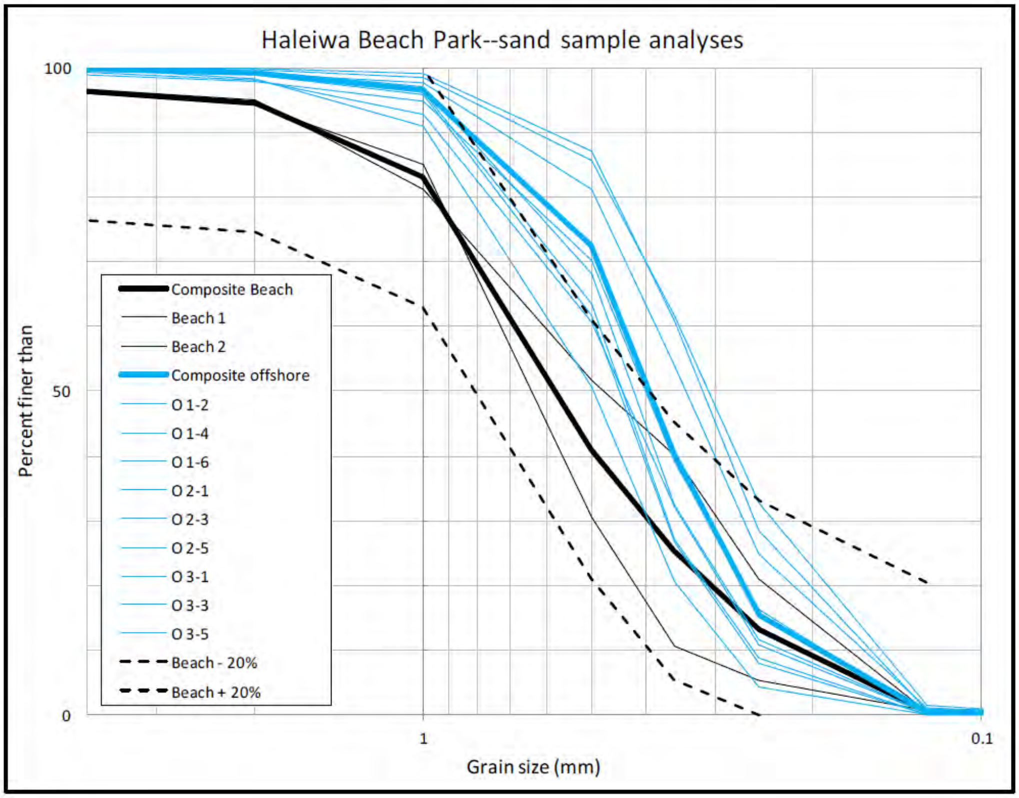

Figure A19. Grain size distribution, Hale'iwa Beach and Offshore Sand Borrow Area (Sea Engineering, Inc., 2019)

Barge Access Zone

As noted in the following section, the most efficient method for transporting dredged material to HBSPP for beneficial use involves excavating a barge access zone adjacent to the groin on the south end of Hale'iwa Beach Park, to a depth of 10 ft MLLW (Mean Lower Low Water). This barge access zone will allow for scow unloading (via long reach excavator) directly to the beach. This was determined to be a more cost-effective method of transport and placement compared to trucking via roads. Excavation of the barge access zone is anticipated to produce an additional 4,733 cy of beach suitable sand based on visual observations. Suitability of the material will be confirmed by sediment sampling conducted in the design phase. The navigational depth requirement is -10 MLLW for the barge to effectively place the material at the site without re-handling. The existing condition is approximately -3 MLLW. Consideration was given to light loading, and actively loading and unloading at high tide; however, it is more efficient and therefore more cost effective to make the site access improvements for the scow.

4.2 Dredging and Placement Methods Considered

- **Hydraulic dredging** – This method of dredging would be an efficient way to dredge and transport material from the dredging locations (using a suction dredge and pipeline) to the beach placement location in a sand/water slurry, without having to dewater sediment, or load the material onto trucks or barges. It is not an efficient way to dredge material that will go to an ODMDS, due to the excess water that would have to be removed from the dredged material to ensure efficient transport offshore.

- **Mechanical dredging –** This method of dredging is the typical method used for the Hale'iwa Small Boat Harbor navigation channel. It would require using a barge mounted crane and clamshell or hydraulic excavator to dig the dredged material and place into a scow barge (see Figure A20), and then barging and/or trucking the material to the placement location. A larger crane will be necessary to dredge areas deeper than approximately 20 feet, such as the offshore sand borrow area.

- **Truck Hauling –** This method of dredged material transportation would involve dewatering sediment in a basin, then loading dredged material onto trucks in HSBH for transport to HBSPP.

- **Barge Haul via Scow –** This is the existing transportation means for the Federal Standard, with disposal at the South O'ahu ODMDS. For beach nourishment purposes under Section 1122, this transportation means requires site access improvements (i.e. a barge access zone) and those costs are accounted for in project costs for economic evaluation. The navigational depth requirement is -10 MLLW for the barge to effectively place the material at the site without re-handling. The existing condition is approximately -3 MLLW. Consideration was given to light loading, and actively loading and unloading at high tide; however, it is more efficient and therefore more cost effective to make the site access improvements for the scow.

Figure A20. Typical method of mechanical dredging at Hale'iwa Harbor (from 2009 construction)

Placement of dredged material at Hale'iwa Beach, whether by offloading from a scow barge or trucked from Hale'iwa SBH, will require that the sand is dewatered prior to placement, such that no runoff of water will return to the ocean. This requirement exists to remain in compliance with the Section 401 Water Quality Certification for the State of Hawaii. If a barge is used, dewatering will occur during placement from the excavator or crane to the scow using an environmental bucket, which minimizes the uptake of water during the dredging process. If trucking is used, and environmental bucket may be used, in addition to a bermed dewatering area if needed. When sand is transported to the beach, it will be offloaded to a single location (dependent on the method of transport) and spread across the beach using equipment such as bulldozers or bobcats, which is considered part of placement and would be conducted under the federal dredging contract. The Section 1122 authority does not allow for the "shaping" of beach features such as dunes or berms, but for the purposes of estimating the coverage area of the placed sand, a typical placement template was assumed, and is presented in the following section. The City and County of Honolulu has indicated that it has the equipment and labor necessary to complete further shaping or spreading of the sand as needed, and could complete this using existing parks maintenance funding.

4.3 Typical Beach Placement Cross-Sections

The various locations potential dredging outlined in Section 4.1 are anticipated to yield varying quantities of sand suitable for beach placement. Depending on the final quantity that is dredged, the area of beach to be restored can be estimated using a simple calculation of approximate volume per linear foot of beach. A baseline and stationing was established for the southern portion of Hale‘iwa Beach Park (Figure A21). For the purposes of the feasibility study it was assumed that any placement, regardless of the quantity, would be centered at Station 3+00, in front of the war memorial at the beach park. This is an area of continued erosion, and any material placed in this location would spread to the north and south by adjusting to an equilibrium due to wave action in the short-term. In the longer-term, placed sand would move to the south in accordance with the direction of dominant longshore transport along this beach.

Figure A21. Primary stationing for beach placement

Typical cross-sections for beach placement were designed using a berm crest elevation of +9 ft MLLW (+8.1 ft MSL), a berm width of 35 to 50 feet, and a slope of 1V:8H (Figures A22a through A22d). These parameters were based on the original beach placement template used for the HBSPP, as well as the existing features of the area, including the backshore elevation and existing beach slope. Data from a 2013 USACE LiDAR survey of O'ahu shorelines was the most recent topography available to represent the existing beach. A new topographic survey should be conducted during the design phase of the project to evaluate and revise the beach placement template and fill volume calculations.

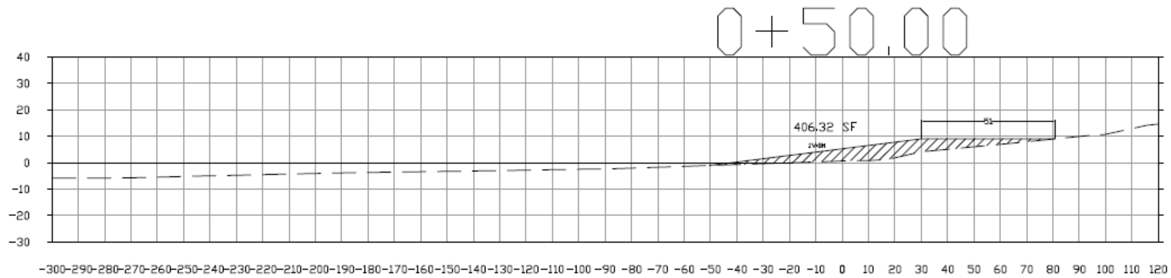

Figure A22 (a). Typical beach fill cross-section at Sta 0+50

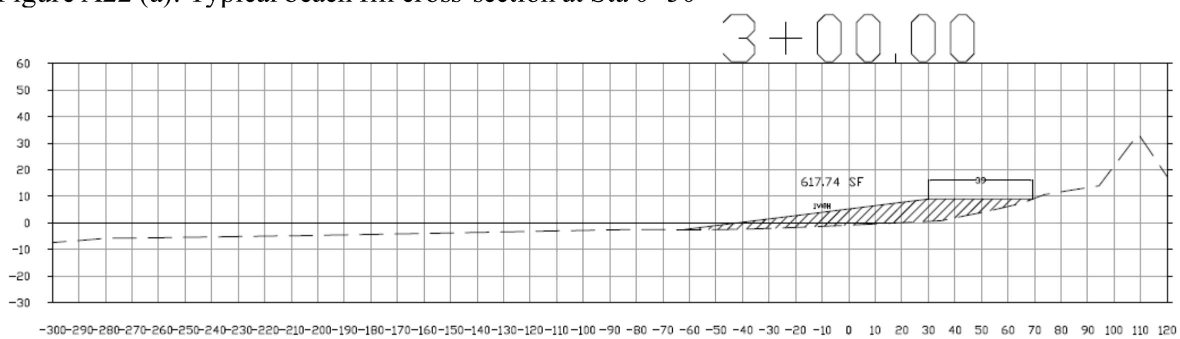

Figure A22 (b). Typical beach fill cross-section at Sta 3+00

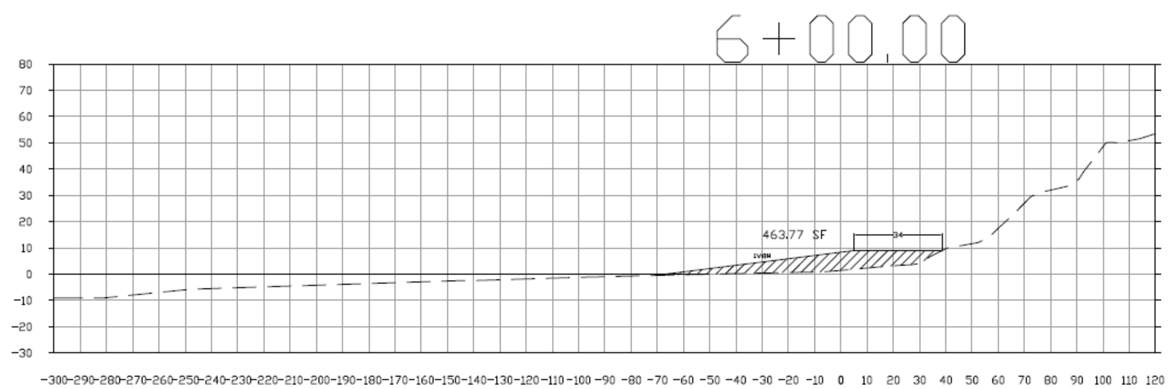

Figure A22 (c). Typical beach fill cross-section at Sta 6+00

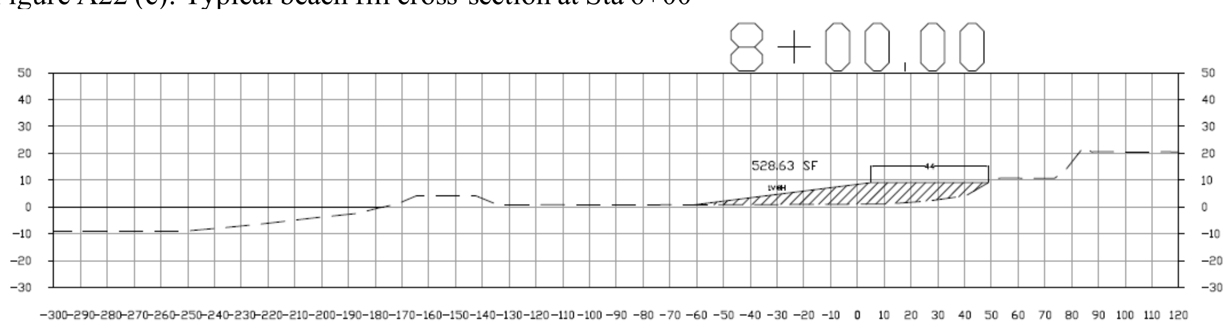

Figure A22 (d). Typical beach fill cross-section at Sta 8+00

5.0 Alternative Plans

5.1 Alternative 1- No Action Alternative

No federal actions for beneficial use of dredged material would be implemented using dredged sediments from Haleʻiwa Harbor. O&M dredging of the navigation channel (Figure A23) would occur on its current cycle and sediment would be disposed of per the Federal Standard. The Federal Standard for sediment is open water placement at the South Oʻahu ODMDS.

Under the No Action Alternative, conditions in the project area are anticipated to develop as described in the Future Without Project Condition (Section **Error! Reference source not found.**). Specifically, no beneficial use of dredged material for beach restoration would occur leading to continued beach erosion at Haleʻiwa Beach Park and likely increases in storm damage to the public infrastructure located there. The No Action Alternative serves as the basis against which the project alternatives are compared against.

Alternative 1 also serves as the Base Plan for operation and maintenance of HSBH. Under the Base Plan, O&M dredging of the Federal Navigation Channel would occur and sediments would be disposed of per the Federal Standard. The next dredging maintenance cycle is anticipated for FY23. Under the Base Plan, approximately 4,400 cy will be dredged from the Federal Navigation Channel and taken offshore to the South Oʻahu ODMDS.

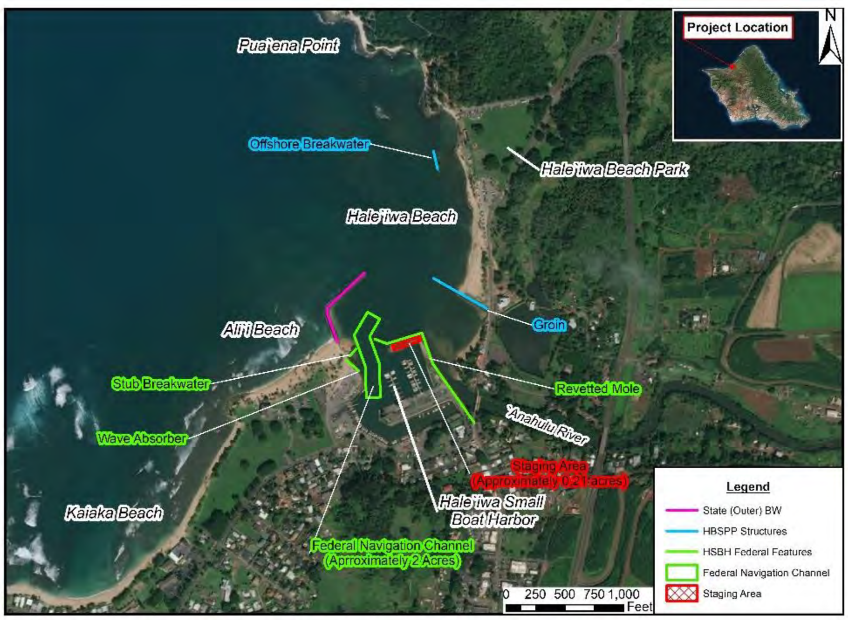

Figure A23. Alternative 1: No Action Alternative. Federal Navigation Channel shown in green.

5.2 Alternative 2 – Beneficial Use of Dredged Material From Federal Navigation Channel to 12' Depth

Alternative 2 consists of mechanically dredging the HSBH within the Federal Navigation Channel to its authorized depth of 12', and beneficially using the beach-suitable dredged material to partially restore the beach in front of HBP (Figure A24).

Under this alternative 4,433 cy of shoaling would be dredged from the Federal Navigation Channel. An estimated 2,433 cy of the dredged material is anticipated to be sand, and suitable for beach placement. This beach-suitable dredged material would be transported from the HSBH to HBSPP (a distance of approximately 1700 ft) for beach nourishment.

The most efficient method for transporting these sediments to HBSPP for beneficial use involves excavating a barge access zone adjacent to the groin on the south end of HBP, to a depth of 10 ft MLLW (Mean Lower Low Water). This Barge Access Zone will allow for scow unloading directly to the beach. This was determined to be a more cost-effective method of transport and placement compared to trucking via roads. Excavation of the Barge Access Zone is anticipated to produce an additional 4,733 cy of beach suitable sand, resulting in a total of 7,166 cy of beach suitable sand (Table A6A6). The 7,166 cy of beach suitable sand will be used to restore 1.2 acres of beach south of the comfort station. This beach is part of the federal authorized project, and nourishment with dredged material will help restore the beach to part of its original extent. The remainder of silt or silty sand dredged from the navigation channel, approximately 2,000 cy, would be placed in a scow and taken to the ODMDS.

Table A6. Alternative 2 dredged material volume and uses

Alt 2: Plan Components	Dredged Material Placement	
	Beach Suitable/ Beneficial Use (CY)	Fed Standard ODMDS (CY)
Fed Channel to 12’	2,433	2,000
Barge Access Zone	4,733	-
TOTAL	**7,166**	**2,000**

Figure A24. Alternative 2: beneficial use of dredged material beach restoration area

5.3 Alternative 2a- Beneficial Use of Dredged Material From Federal Navigation Channel to 13’ Depth

Alternative 2a consists of all the activities described in Alternative 2 (dredging and beneficial use from Federal Navigation Channel to 12’), with 1 foot of additional mechanical dredging in parts of the navigation channel with sandy material to a total depth of 13’ (Figure A25). The purpose of this additional foot of dredging is to increase the volume of beach-suitable sandy material available for beach nourishment, and it is conducted solely for the purpose of the pilot project.

Under this alternative, the additional one foot of dredging is anticipated to produce an additional 1,705 cy of beach suitable sand material that will be used for nourishment of HBSPP. This increases the total volume of dredged material available for beach nourishment to 8,871 cy (Table A7). The 8,871 cy of beach suitable sand will be used to restore 1.6 acres of beach south of the comfort station (Figure A26). This beach is part of the federal authorized project, and nourishment with dredged material will help restore the beach to part of its original extent. The remainder of silt or silty sand dredged from the navigation channel, approximately 2,000 cy, would be placed in a scow and taken to the ODMDS.

Table A7. Alternative 2a dredged material volume and uses

Alt 2A: Plan Components	Dredged Material Placement	
	Beach Suitable/ Beneficial Use (CY)	Fed Standard ODMDS (CY)
Fed Channel to 12'	2,433	2,000
Additional Fed Channel to 13'	1,705	-
Barge Access Zone	4,733	-
TOTAL	**8,871**	**2,000**

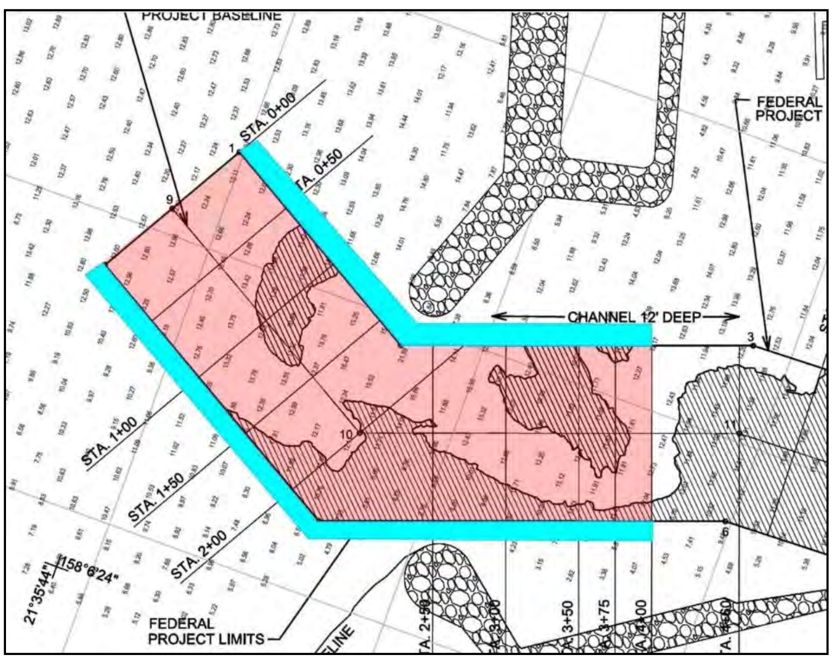

Figure A25. Alternative 2a: additional dredging area to 13'

Figure A26. Alternative 2a: beneficial use of dredged material beach restoration area

5.4 Alternative 3– Beneficial Use of Dredged Material From Federal Channel to 13' and Settling Basin

Alternative 3 consists of all the activities described in Alternative 2a (dredging and beneficial use from Federal Navigation Channel to 13'), with additional mechanical dredging and beneficial use of dredged sediments from a 0.3 acre area (State Breakwater Settling Basin) adjacent to the State of Hawaii breakwater within the Hale'iwa Small Boat Harbor, but outside of the Federal Navigation Channel (Figure A27).

Under this alternative, excavation of the 0.3 acre State Breakwater Settling Basin is anticipated to produce an additional 2200 cy of beach suitable sand that will be used for nourishment of HBSPP. This increases the total volume of dredged material available for beach nourishment to 11,071 cy (Table A8) that will be used to restore 2.1 acres of beach south of the comfort station at HBSPP **Error! Reference source not found.**A28). This beach is part of the federal authorized project, and nourishment with dredged material will help restore the beach to its original extent. As in alternative 2a, the remainder of silt or silty sand from the Federal Navigation Channel dredging, approximately 2,000 cy, would be placed in a scow and taken to the ODMDS.

The 6000 sq. ft proposed settling basin would be excavated to a depth of 8 feet below mean low water in a shoaled area west of the federal stub breakwater. Once created, this State Breakwater settling basin will act a sink for sand originating from Ali'i beach, preventing it from migrating into the Federal Navigation Channel, and ultimately reduce the rate of shoaling in the HSBH and Federal Navigation Channel. Furthermore, the dredged material from this area is anticipated to be beach quality sand and therefore would be beneficially used at HBSPP.

Table A8. Alternative 3 dredged material volume and uses

Alt 3: Plan Components	Dredged Material Placement	
	Beach Suitable/ Beneficial Use (CY)	Fed Standard ODMDS (CY)
Fed Channel to 12'	2,433	2,000
Additional Fed Channel to 13'	1,705	-
Barge Access Zone	4,733	-
Settling Basin	2,200	-
TOTAL	**11,071**	**2,000**

Figure A27. Alternative 3: beneficial use of dredged material beach restoration area

5.5 Alternative 4: Beneficial Use of Dredged Material From Federal Channel to 13', State Breakwater Settling Basin, and Offshore Sand Borrow Area

Alternative 4 consists of all the activities described in Alternative 3 (dredging and beneficial use from Federal Navigation Channel to 13' and State Breakwater Settling Basin), with additional mechanical dredging and beneficial use of dredged sediments from an Offshore Sand Borrow Area located 3,400 feet offshore of HBSPP (Figure A29).

Under this alternative, excavation of the Offshore Sand Borrow Area is anticipated to produce an additional 15,000 cy of beach suitable sand that will be used for nourishment of HBSPP. This measure increases the total volume of dredged material available for beach nourishment to 26,071 cy (Table A9) and allows for 4.4 acres of beach restoration south of the comfort station at HBSPP (Figure A29). This beach is part of the federal authorized project, and nourishment with dredged material will help restore the beach to its full original extent. As in alternative 3, the remainder of silt or silty sand from the navigation channel dredging, approximately 2,000 cy, would be placed in a scow and taken to the ODMDS.

The Offshore Sand Borrow Area is 16.5 acres in size, is located depth of depth of approximately 60 ft, and is 3,400 feet offshore of HBSPP (FigureA29). This area will function as a borrow area for the procurement of large quantities of beach suitable sand. The dredging of sand from this area and placement at HBSPP would require the use of a barge mounted crane and clamshell dredge. The sand would be dewatered during excavation using an environmental clamshell bucket, placed on a scow, and barged to the access channel where it would be mechanically placed on the beach.

Table A9. Alternative 4 dredged material volume and uses

Alt 4: Plan Components	Dredged Material Placement	
	Beach Suitable/ Beneficial Use (CY)	Fed Standard ODMDS (CY)
Fed Channel to 12'	2,433	2,000
Additional Fed Channel to 13'	1,705	-
Barge Access Zone	4,733	-
Settling Basin	2,200	-
Offshore Sand Borrow Area	15,000	-
TOTAL	**26,071**	**2,000**

Figure A28. Alternative 4: beneficial use of dredged material beach restoration area

5.6 Beach Length and Area Calculations

Using the volumes per linear foot for each typical cross-section (ft^3/ft) and multiplying by the length of fill over which this cross-section applies provides a total volume that can be placed in that area. The volumes per linear foot for each typical section shown in Figures A22a through A22d were interpolated at 50 foot intervals and incremental volumes in each 50 foot section were calculated using the average end area method. The volumes of material available for each alternative were multiplied by a bulking factor of 1.3 (since dredge volumes are in-situ) and were applied over the maximum length of beach possible. It was also assumed that the fill would be tapered back to the existing shoreline over 50 feet on either end of the placement.

It was assumed that since the majority of the material placed would be above MLLW, the area of beach created for each alternative would be the alongshore length of beach placement, multiplied by the full cross-shore width of the beach placement template. Based on these assumptions, the following table presents the conversions from dredged volume to alongshore beach length and beach area. These areas were used to calculate environmental and recreational benefits.

Table A10. Placement Volumes and Calculation of Beach Length and Area

Volume of sand (cy) (in situ)	Bulk Volume (cy) (in place)	Length of Fill (ft)	Station Limits	Beach Area (acre)
7,166	9,316	500	1+50 to 6+50	1.2
8,871	11,532	600	1+50 to 7+50	1.6
11,071	14,392	750	0+50 to 8+00	2.1
26,071	33,892	1600	-3+50 to 12+50	4.4

5.7 Estimated Duration of Beach Fill at HBSPP and Sea Level Change Impacts

The sediment budget for the Hale‘iwa region (Figure A11) estimates that the Hale‘iwa Beach littoral cell erodes at a rate of approximately 976 cy/year. In order to estimate how long a volume of placed sand is expected to remain, the total volume of beach fill (cy) can be divided by 976 cy/year. With the assumption that this erosion rate remains consistent, and no changes to the area (such as sand tightening of the terminal groin or additional beach fill) are made, Alternative 2 fill of 7,166 cy would be slowly be reduced over 7 years, before returning to the existing conditions. Similarly, Alternative 2a fill (8,871 cy) would be eroded over approximately 9 years, Alternative 3 fill (11,071 cy) would erode gradually over approximately 11 years, and Alternative 4 (26.071 cy) would be reduced over approximately 26 years.

When potential for future sea level change is considered, the rate of erosion along Hale‘iwa Beach (either with or without the project) will likely increase due the inability of much of the shoreline to shift landward to reach an equilibrium with higher water levels. This is due to the backshore development such as the comfort station, the parking areas, and the highway, that are unlikely to be relocated or removed in the near future; as well as the lack of a backshore dune to allow natural landward migration of the shoreline and provide additional sediment to the shoreline under rising sea levels. The ability for larger waves to reach the shoreline under higher sea levels would also lead to greater erosion of the sand along the shoreline. With future SLC and a higher erosion rate, the estimated duration of all of the beach fill alternatives stated above would be reduced, making each an upper-bound estimate. Though future SLC will reduce the longevity of any beach fill completed, this also highlights the fact that any addition of sand to the chronically eroding shoreline will delay the impacts of SLC to the infrastructure in an around HBP.

As shown in Figure A6, the estimated SLC under low, intermediate, and high scenarios is 0.4 ft, 1.0 ft, and 3.0 ft above local MSL in 2074 (50-years post-construction). This typical planning horizon is well outside the estimated duration of even the greatest volume of beach fill under the proposed alternatives based on existing conditions (Alternative 4 - 26,071 cy and 26 years). It is useful, however, to evaluate the effects of future SLC on the with and without project conditions, including potential elevation thresholds.

Existing backshore elevations at the beach park are between +8 and +12 ft MLLW (+7 to +11 ft MSL) and the proposed crest elevation of the beach fill is of +9 ft MLLW (+8.1 ft MSL). Based on the estimated SLC at Honolulu Harbor, the mean sea level water elevation under non-storm conditions would not reach this threshold until after 2124, and only under the highest SLC scenario. However, when the effect of increased water levels under storm conditions are considered (e.g. - wave setup and wave runup), as well as the annual to decadal-scale variability of water levels in the Hawaiian Islands and astronomical tides (as discussed in paragraph 3.1 of this appendix), the impacts of sea level change may reach this elevation threshold much sooner. The SEI 2019 report estimated an annual still water level (99% annual exceedance probability) at HBP as 1.7ft MSL (0.7 ft tide + 0.5 ft water level variability + 0.5 ft wave setup). Adding a typical wave runup value of approximately 5 feet would result in a total water level of around 6.7 ft MSL for an annual wave event. With only a 1.4 feet of additional sea level rise (in approximately 2050 under the high scenario), overtopping of the beach fill crest and backshore areas will begin to occur on an average annual basis.

The alternatives for this project were formulated with fill volumes based on the availability of sand, rather than specific dimensions of the proposed beach fill. However, this cursory evaluation of SLC and its future impacts illustrates that the larger the volume of sand placed (up to the limit that the littoral cell can hold), the longer the backshore infrastructure will be protected from SLC and storm damage impacts, including increased frequency of overtopping and increased erosion.

6.0 References

Marine Research Consultants, Inc. (MRCI). 2008. *Final Sampling and Analysis Report for Maintenance Dredging: Haleiwa and Waianae Small Boat Harbors*. Prepared in association with Belt Collins Hawaii, Ltd. for the U.S. Army Engineer District, Honolulu, HI.

Merrifield, M. A. 2011. A shift in western tropical Pacific sea level trends during the 1990s. *In Journal of Climate*, Vol. 24, 4126–4138, doi:10.1175/2011JCLI3932.1.

Merrifield, M. A., P. R. Thompson, and M. Lander. 2012. Multidecadal sea level anomalies and trends in the western tropical Pacific. In *Geophysical Research Letters,* Vol. 39, L13602, doi:10.1029/2012GL052032.

Molina, L. K., and J. H. Podoski. 2018. *Hawaii RSM: Advance Planning for the Beneficial Reuse of Dredged Material at Haleiwa Harbor, Island of Oahu, Hawaii.* ERDC/TN RSM-18-9. Vicksburg, MS: U.S. Army Engineer Research and Development Center. *http://dx.doi.org/10.21079/11681/29729*

Podoski, J. H. 2014. *Hawaii RSM: Regional sediment budgets for the Haleiwa Region, Oahu, HI*. ERDC/CHL CHETN-XIV-38. Vicksburg, MS: US Army Engineer Research and Development Center.

Sea Engineering, Inc. 2019. *Concept Designs for Selected Beach Parks, Volume 1 – Haleʻiwa Beach Park.* Prepared for City and County of Honolulu, Department of Design and Construction.

U.S. Army Corps of Engineers (USACE). 1996. "Navigation and Dredging Operations and Maintenance Policies". Engineering Regulation, ER 1130-2-520.

U.S. Army Corps of Engineers (USACE). 2000. "Planning Guidance Notebook". Engineering Regulation, ER 1105-2-100.

U.S. Army Corps of Engineers (USACE). 2019. "Incorporating Sea Level Change in Civil Works Programs". Engineering Regulation, ER 1110-2-8162.

U.S. Army Corps of Engineers (USACE). 2018. *Haleiwa Harbor, Oahu, Hawaii, Dredged Material Management Plan, Preliminary Assesssment, September 2018*.

Widlansky, M.J., A. Timmermann, and W. Cai. 2015. *Future extreme sea level seesaws in the tropical Pacific*. Science Advances, 1 (8), e1500560, doi:10.1126/sciadv.1500560. IPRC-1128.

Appendix B: Haleiwa Section 1122
Haleiwa, Island of Oahu, Hawai’i

October 2020

Table of Contents

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List of Acronyms

ACE	Annual Chance Exceedance
BMP	Best Management Practice
BUDM	Beneficial use of dredged material
CAR	Coordination Act Report
CEQ	Council on Environmental Quality
CERCLIS	Comprehensive Environmental Response, Compensation, Liability Information System
CFR	Code of Federal Regulations
CO	Carbon monoxide
CORRACTS	Corrective Action Reports
CWA	Clean Water Act
CWB	Clean Water Branch
cy	Cubic Yards
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Program
dB	Decibel
dBA	A-weighted decibel
DFIRM	Digital Flood Insurance Rate Map
DLNR	Department of Land and Natural Resources
DNL	Day night level
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EO	Executive Order
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FPPA	Farmland Protection Policy Act
FWCA	Fish and Wildlife Coordination Act
FWOP	Future without Project
FWP	Future with Project
HAR	Hawai’i Administrative Rule
HBP	Haleiwa Beach Park
HCCS	Hawai’i Comprehensive Conservation Strategy
HRS	Hawai’i Revised Statutes
HSBH	Haleiwa Small Boat Harbor
HSDOH	Hawai’i State Department of Health
HTRW	Hazardous, Toxic, and Radioactive Waste
HUD	Housing and Urban Development
IFR/EA	Integrated Feasibility Report/Environmental Assessment
LUST	Leaking Underground Storage Tank
MBTA	Migratory Bird Treaty Act
MLLW	Mean Lower Low Water

MMPA	Marine Mammal Protection Act
MSFCMA	Magnuson Stevens Fishery Conservation and Management Act
NAAQS	National Ambient Air Quality Standard
NEPA	National Environmental Policy Act
NFWL	National Fish and Wildlife Laboratory
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NO_2	Nitrogen dioxide
NPDES	National Pollutant Discharge Elimination System
NPL	National Priority List
NRC	National Research Council
NRCS	National Resources Conservation Service
NWI	National Wetland Inventory
O_3	Ozone
ODMDS	Offshore Dredge Material Disposal Site
OEQC	Office of Environmental Quality Control
ORMP	Ocean Resources Management Plan
OSHA	Occupation Safety and Health Administration
Pb	Lead
PL	Public Law
PM_{10}	Particulate Matter – 10 micron
$PM_{2.5}$	Particulate Matter – 2.5 micron
RCRA	Resource Conservation and Recovery Act
RCRIS	Resource Conservation and Recovery Information System
RSLR	Relative Sea Level Rise
SHPO	State Historical Preservation Office
SIHP	State Inventory of Historic Place
SIP	State Implementation Plan
SLR	Sea Level Rise
SO_2	Sulfur dioxide
THPO	Tribal Historical Preservation Office
TMDL	Total Maximum Daily Load
TN	Total nitrogen
TP	Total phosphorus
TSD	Treatment, Storage, or Disposal
TSP	Tentatively Selected Plan
USACE	U.S. Army Corps of Engineers
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
UST	Underground Storage Tank
WRDA	Water Resources Development Act

1 Introduction

The U.S. Army Corps of Engineers (USACE), in partnership with the City and County of Honolulu, is assessing the beneficial use of dredged material on Haleiwa Beach, Island of Oahu, Hawai'i. The study is authorized under Section 1122 of the Water Resources Development Act (WRDA) of 2016 (Public Law 114-322). This environmental appendix supplements the Haleiwa Section 1122 Integrated Feasibility Report/Environmental Assessment (IFR/EA) in compliance with the National Environmental Policy Act (NEPA) of 1969, the Council on Environmental Quality (CEQ) regulations 40 CFR 1500-1508 and incorporates the laws and requirements of the Hawai'i Revised Statutes (HRS) and the Hawai'i State Office of Environmental Quality Control (OEQC). The IFR/EA meets the appropriate State filing and notification requirements, as applicable.

2 Study Area

The project is located on the northeastern shore of Oahu, approximately 30 miles north of Honolulu, Hawai'i (Figure 1). The study area (Figure 2) encompasses the federally authorized Haleiwa Small Boat Harbor (Harbor) and the Haleiwa Beach Park (HBP) located near the mouth of the Anahulu River (21° 35' 49.24" N, 158° 05' 47.50 W"). The study area also includes a 0.3 acre settling basin (Settling Basin) located immediately to the east of the state breakwater on Ali'i Beach, and a 1.7-acre offshore sand deposit (Offshore Sand Deposit) located 3,400 feet northwest of HBP.

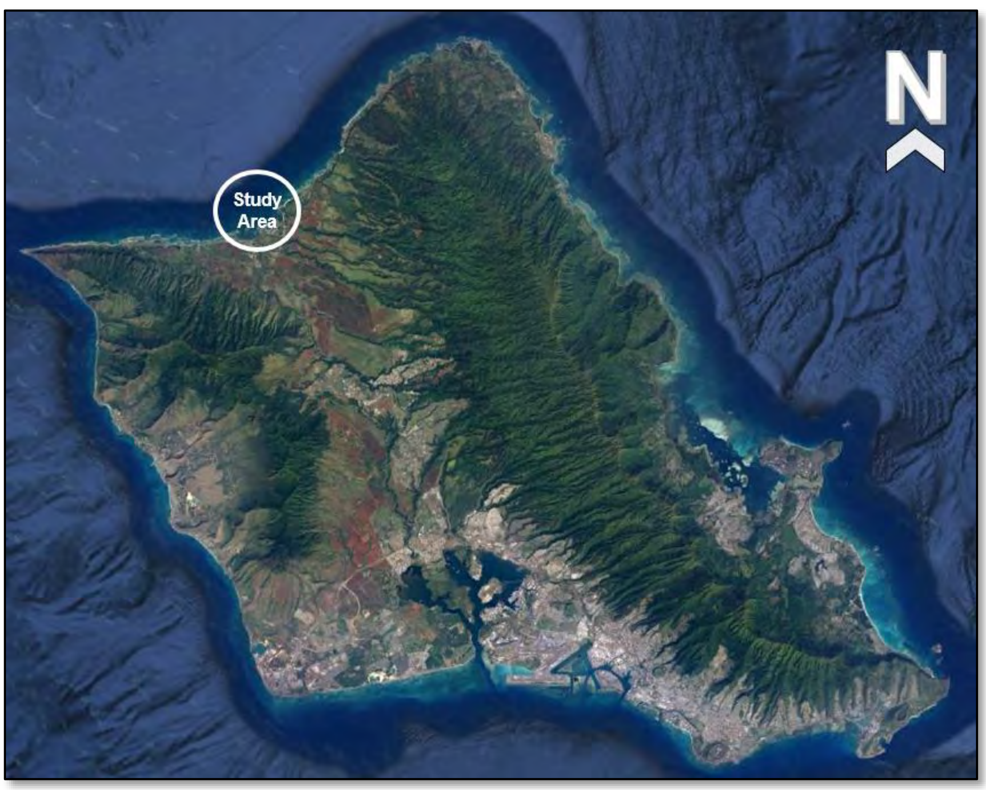


Figure 1. Project Location

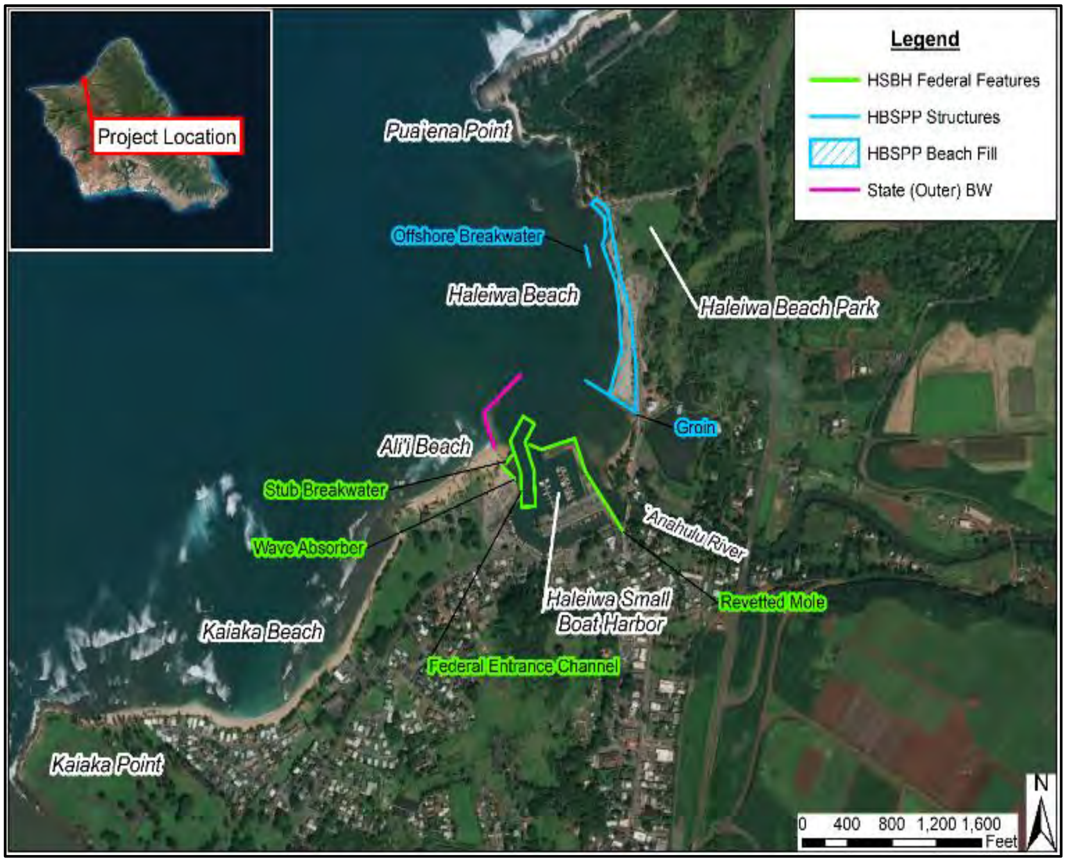


Figure 2. Project Location and Study Area

3 Alternatives

The objective of this study is to identify measures to beneficially use dredged material from the routine maintenance dredging of the Haleiwa Small Boat Harbor (HSBH). A total of five alternatives were assessed, including the No Action Alternative, also known as the Future without Project (FWOP) condition.

3.1 Federal Standard

Alternative 1, also known as the Federal Standard, entails continuing placement operations as they have been in the past. The dredged material from the HSBH federal navigation channel would be placed in the Oahu Offshore Dredge Material Disposal Site (ODMDS). Under this alternative the dredged material would not be utilized in a beneficial use scenario.

3.2 Federal Navigation Channel

3.1.1 Alternative 2

Alternative 2 would utilize approximately 7,166 cubic yards (cy) of dredged material by dredging the HSBH federal navigation channel to 12' depth Mean Lower Low Water (MLLW) and place that material on Haleiwa Beach over an area of approximately 1.20 acres (Figure 3).

Figure 3. Alternative 2

3.1.2 Alternative 2a

Alternative 2a would utilize approximately 8,871 cy of dredged material by dredging the HSBH federal navigation channel to 13' depth MLLW and place that material on Haleiwa Beach over an area of approximately 1.60 acres (Figure 4).

3.3 Federal Navigation Channel and Settling Basin

Alternative 3 builds off Alternative 2a by adding in material from advanced maintenance dredging of the settling basin to the west of the offshore breakwater (Figure 5). This alternative adds approximately 2,200 additional cy of material for a total of 11,071 cy that can be used beneficially on Haleiwa Beach. The additional material increases the placement area to 2.10 acres.

Figure 4. Alternative 2a.

Figure 5. Alternative 3.

3.4 Federal Navigation Channel, Settling Basin, and Offshore Sand Deposit

Alternative 4 utilizes an offshore sand deposit with beach quality sand that would provide an additional 15,000 cy of material for beneficial use on Haleiwa Beach. This would increase the total amount of material to be placed on the beach to 26,071 cy and increase the placement are to 4.40 acres (Figure 6).

Figure 6. Alternative 4

4 Existing Conditions

The following section describes the existing conditions of the study area. This analysis established a baseline, or existing condition, to provide a frame of reference to evaluate the performance of alternative plans.

4.1 Land Use

The area around the Haleiwa Beach bordered by the bay to the west and on the rest of the area is surrounded by residential areas and other urban and built up land, with some cropland and pasture on the periphery.

4.2 Climate

The region has a tropical climate with mild temperatures throughout the year, averaging 77.3º Fahrenheit (F). Persistent northeasterly trade winds prevail throughout the year, though it can vary from 90 percent in July to 50 percent in January. The humidity is generally moderate, though when the trade winds relax the humidity can feel much higher. Between 1989 and 2018 the average rainfall was 20.1 inches/yr. The predominance of this rain falls between October and April when intense rains can cause severe flooding.

4.3 Water Resources

Water resources include both surface water and groundwater resources, associated water quality, and floodplains. Surface water includes all lakes, ponds, rivers, streams, impoundments, wetlands and estuaries within the watershed. Subsurface water, commonly referred to as ground water, is typically found in certain areas known as aquifers. Aquifers are areas with high porosity rock where water can be stored within pore spaces. Water quality describes the chemical and physical composition of water affected by natural conditions and human activities.

4.3.1 Hydrology and Hydraulics

Haleiwa Beach sits on Waialua Bay and is exposed to wave action throughout the year, with larger more intense waves occurring in the winter. A general north to south longshore transport persists throughout the year which causes erosion of the beach.

Anahulu River originates in the Koolau Range and flows to Waialua Bay. It is approximately 7.1 miles in length and has become a popular kayaking and canoeing river. The 100-year peak discharge for the river is 16,200 cubic feet per second (cu. ft/s).

4.3.2 Floodplains

Federal Emergency Management Agency (FEMA) National Flood Insurance Maps were used to delineate the 100-year floodplains for the study area (FEMA, 2020). Additional Hydrology and Hydraulic models further refined the areas inundated at various annual chance exceedances (ACEs), including the 0.01 ACE. The FEMA Flood Maps delineate the watershed using different zone designations associated with the probability of flooding frequency for that area. The study area contains four different zone designations:

- AE – Areas subject to inundation by the one percent ACE,
- VE – Areas subject to inundation by the one percent ACE with additional hazards due to storm-induced velocity wave action
- X – Areas outside of the 0.2 percent floodplain.
- .

The floodplain contours associated with Haleiwa follow the shoreline and FEMA has designated the areas adjacent to the beach as VE with the designations transitioning to AE further landward and along the river (Figure 7).

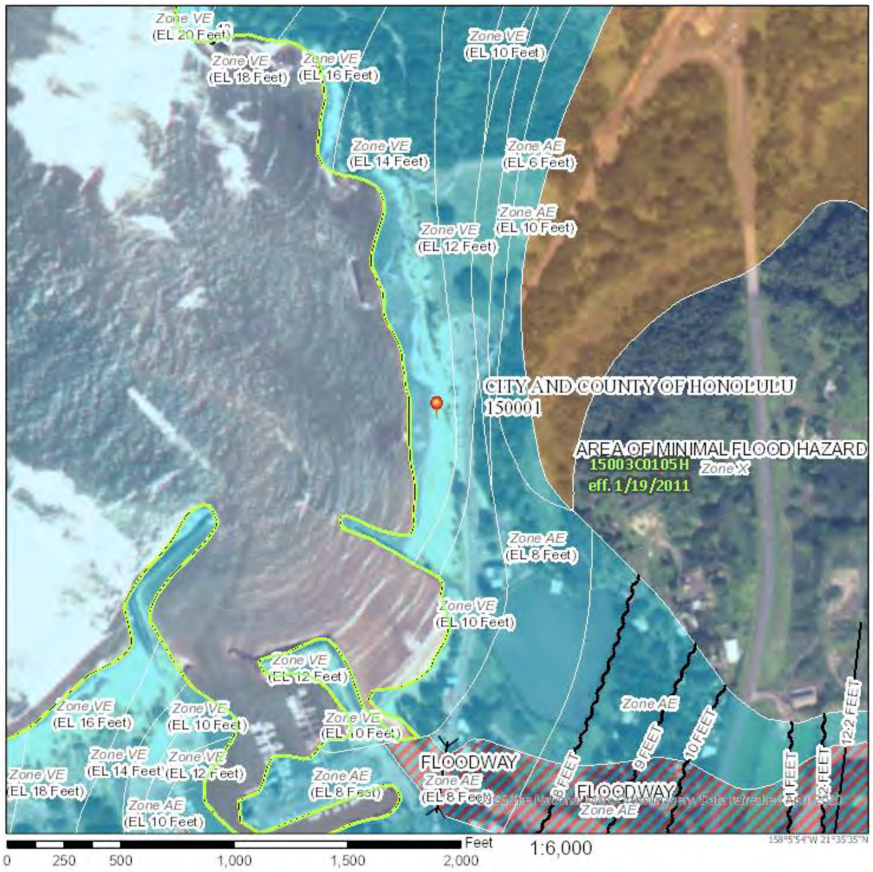


Figure 7. FEMA flood zones around the Haleiwa Beach Study Area.

4.4 Wetlands

Wetlands are often defined as areas where the frequent and prolonged presence of water at or near the soil surface drives the natural system. Wetland areas require specific hydrology, soil types (i.e. hydric soils), and plant species that are characterized as requiring wetland habitats.

The USFWS (2020) has mapped wetlands within the study area as part of the National Wetlands Inventory (NWI). Although the USFWS have identified several errors in the national NWI, the database provides a good baseline prior to field identification.

The NWI mapper identifies wetland areas surrounding the project area which include a large freshwater forested/shrub wetland (PSS3/EM1C), scattered freshwater emergent wetlands (PEM1F) adjacent to Anahulu River and Lokoea pond, and estuarine and marine wetland (M2USP, M2RSP, and M2RS/ABN) adjacent to the shoreline (Figure 8). The wetlands mapped along the Haleiwa Beach are not actually wetlands by USACE definitions, but are in fact sandy reaches of shoreline and hard-pack tidal zones.

4.5 Ground Water

The study area is geologically part of the Koolau Formation. Water in the study area's groundwater occurs as basal non-artesian water floating on sea water (Stearns and Vaksvik, 1935). A dike-impounded system holds water to heights as high as 1,600 feet above sea level, though the depth of the water is unknown in many places within this system. Horizontal shaft wells (sometimes called Maui shafts) are used to pump the water from by skimming from the upper levels of the freshwater lens (Gingerich and Oki, 1999).

4.6 Coastal Zone Management Resources

In 1972, Congress passed the Coastal Zone Management Act (CZMA), which established the federal Coastal Zone Management Program (CZMP; Public Law 92-583 Stat.1280, 16 §§ 1451-1464, Chapter 33). The CZMP is a federal-state partnership that provides a basis for protecting, restoring, and responsibly developing coastal resources. The CZMA defines coastal zones wherein development must be managed to protect areas of natural resources unique to coastal regions. Hawai‘i has developed and enacted the Hawai‘i Ocean Resources Management Plan (ORMP), in which any federal and local actions must be determined to be consistent with the management plan. The State of Hawai‘i Office of Planning enforces consistency of the plan for Hawai‘i.

States are required to define the area that will comprise their coastal zone and develop management plans that protect the unique resources through enforceable policies of the State ORMP. Hawai‘i defines its coastal zone as all lands of the state and the area extending seaward from the shoreline to the limit of the State's police power and management authority, including the U.S. territorial sea. Therefore, the study area lies within the coastal zone as defined by the State.

The ORMP goals and policies focus management efforts on 11 management priority groups:

- Appropriate Coastal Development
- Management of Coastal Hazards
- Watershed Management
- Marine Resources
- Coral Reef
- Ocean Economy
- Cultural Heritage of the Ocean
- Training, Education, and Awareness
- Collaboration and Conflict Resolution
- Community and Place-based Ocean Management Projects
- National Ocean Policy and Pacific Regional Objectives

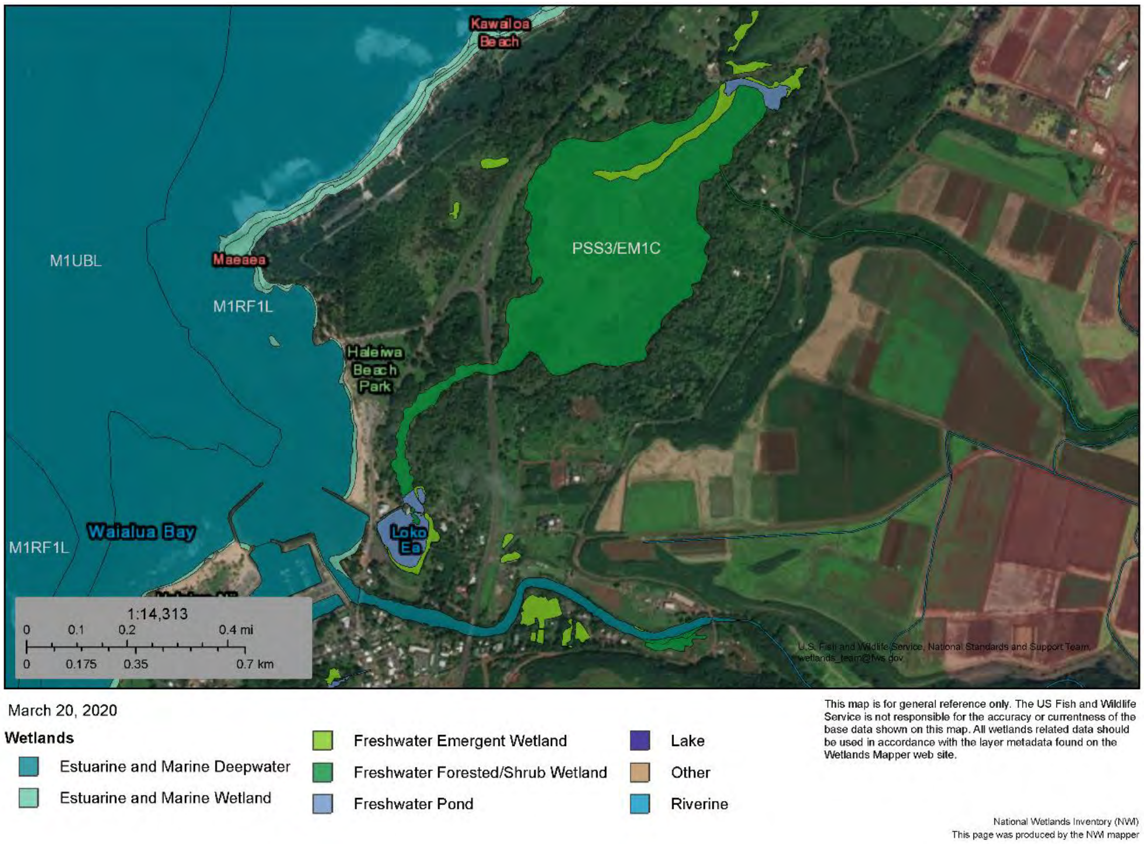


Figure 8. Wetlands around the Haleiwa Beach Study Area.

4.7 Air Quality

The U.S. Environmental Protection Agency (EPA) has the primary responsibility for regulating air quality nationwide. The Clean Air Act (42 U.S.C. 7401 *et seq.*), as amended, requires the EPA to set National Ambient Air Quality Standards (NAAQS) for wide-spread pollutants from numerous and diverse sources considered harmful to public health and the environment.

EPA has set NAAQS for six principal pollutants, which are called “criteria” pollutants. These criteria pollutants include carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter less than 10 microns (PM_{10}), particulate matter less than 2.5 microns ($PM_{2.5}$), sulfur dioxide (SO_2), and lead (Pb). If the concentration of one or more criteria pollutants in a geographic area is found to exceed the regulated “threshold” level, the area may be classified as a non-attainment area. Areas with concentrations of criteria pollutants that are below the levels established by the NAAQS are considered in attainment.

There are no non-attainment areas within the State of Hawai‘i (EPA, 2020).

4.8 Water Quality

Section 305(b) of the Clean Water Act (CWA) requires states to assess the water quality of the waters of the state and prepare a comprehensive report documenting the water quality. The report is to be submitted to the EPA every two years. In addition, Section 303(d) of the CWA requires states to prepare a list of impaired waters on which total maximum daily loads (TMDLs) where corrective actions must be implemented. The EPA has delegated the Hawai‘i State Department of Health (HSDOH), Clean Water Branch (CWB) as the agency in Hawai‘i responsible for enforcing the water quality standards and preparing the comprehensive report for submittal to the EPA. The CWB looks at both inland and marine sections of waterways.

Surface water quality in the study area is influenced by agricultural practices and residential, commercial, and industrial areas associated with urban development. The Anahulu River (Water Body ID 3-6-08-E) has been classified as an impaired waterbody due to elevated Total Nitrogen (TN), nitrite (NO_2) and nitrate (NO_3), and total phosphorous (TP). The HSDOH categorizes the priority for establishing TMDLs for streams as high, medium, or low. Anahulu River has been assigned as a low TMDL priority category.

4.9 Geologic Resources

Geologic resources are defined as the topography, geology, soils, and mining of a given area. The existing physiography, soils, and geomorphology of the study area is a result of complex interactions of geological, hydrological, and meteorological processes. The island of Oahu was created by eruptions from two volcanoes: the Koolau and Waianae. The Koolau Range forms the eastern side of the island while the Waianae Range forms the western side. The Koolau Volcano is comprised of two layers of lava extruded into thin beds of pohaehoe and aa. Its center of eruption occurred between Kaneohe and Waimanolo. The Waianae Volcano is comprised of three layers of lava extruded into thin beds of pohaehoe. Its center of eruption occurred near Kolekole Pass, at the head of the Lualualei Valley (Stearns and Vaksvik, 1935).

4.10 Soils

The Farmland Protection Policy Act of 1981 (FPPA) (P.L. 97-98) is intended to minimize the impact of Federal actions on the conversion of prime farmland, unique farmland, or land of statewide or local importance to non-agricultural uses. Farmland consists of cropland, forest land, rangeland, and pastures. Urban lands containing prime farmland soils are not covered under the FPPA.

Prime farmland is land that has the best combination of physical and chemical properties for producing food, feed, forage, fiber, and oilseed crops. In general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. Unique farmland is land other than prime farmland that is used for the production of specific high-value food and fiber crops, such as citrus, tree nuts, olives, cranberries, and other fruits and vegetables. Nearness to markets is also a consideration. Unique farmland is not based on national criteria. Farmland of statewide importance do not meet the qualifications of prime or unique farmland.

Table 1 lists the soil types found in the study area. None of the soils found in the study are hydric soils or meet the criteria for prime or unique farmland soils.

Soil Type	Acreage
Beaches	4.4
Coral Outcrop	5.4
Haleiwa silty clay, 0 to 2 percent slopes	11.5
Jaucus sand, 0 to 15 percent slopes, MLRA 163	27.3
Mamala cobbly silty clay loam, 0 to 12 percent slopes, MLRA 163	3.4
Typic Endoaquepts mucky silt loam, 0 to 1 percent slopes, MLRA 163	0.0
Water > 40 acres	1.0

Table 1. Soil types in the Haleiwa Beach Study Area (NRCS, 2019)

4.11 Biological Communities

4.11.1 Threatened and Endangered Species

Wildlife and plant species may be classified as threatened or endangered under the Endangered Species Act (ESA) of 1973. Protection of non-marine protected species is overseen by the USFWS and National Marine Fisheries Service (NMFS) is responsible for protected marine species. The purpose of the ESA is to establish and maintain a list of threatened and endangered species and establish protections for their continued survival. Section 7 of the ESA requires federal agencies to coordinate with USFWS and NMFS to ensure that any federal action is complaint with the ESA and that the action will not jeopardize the continued existence of threatened or endangered species or result in the destruction or adverse modification to their critical habitat. The State of Hawaiʻi has also developed a State list of threatened and endangered species and incorporated it in the Hawaiʻi Comprehensive Conservation Strategy (HCCS) (Mitchell et al., 2005).

Four ESA-listed species were identified in a 23 April 2019 informal consultation letter from the USFWS: Hawaiian coot (*Fulica alai*), Hawaiian gallinule (*Gallinula chloropus sandvicencis*), Hawaiian stilt (*Himantopus mexiancus knudseni*), and the Green sea turtle (honu, *Chelonia mydas*). Three ESA-listed species were identified in a 27 August 2019 informal consultation letter from the NMFS: green sea turtle, Hawksbill sea turtle (*Eretmochelys imbricata*), and Hawaiian monk seal (*Monachus schauinslandi*). Habitat and life requisites for these species are provided below. Critical habitat for the Hawaiian monk seal is found within the study area.

4.11.1.1 Hawaiian Coot

The ‘Alae ke‘oke‘o, or Hawaiian Coot is an endemic waterbird in Hawai‘i (Mitchell et al., 2005). The Hawaiian Coot is a generalist with a diet ranging from seeds and leaves, snails, crustaceans, insects, tadpoles, and small fish. The coots typically forage in water less than 12-inches deep. The coots create floating nests in open water, constructed of aquatic vegetation, and anchored to emergent vegetation. Open water nests are typically composed of water hyssop (*Bacopa monnier*) and Hilo grass (*Paspalum conjugatum*) while platform nests in emergent vegetation are comprised from buoyant stems of bulrushes (*Scirpus* spp.). The coot inhabits lowland wetland habitats with suitable emergent plant growth interspersed with open water. These habitats include freshwater wetlands, taro fields, freshwater reservoirs, canefield reservoirs, sewage treatment ponds, brackish wetlands, and rarely saltwater habitats. On Oahu the Hawaiian Coot can be found in coastal brackish and fresh-water ponds, streams and marshes.

4.11.1.2 Hawaiian Gallinule

The ‘Alae ‘ula or Hawaiian gallinule is an endemic waterbird in Hawaii. The Hawaiian gallinule is believed to be an opportunistic feeder with a diet consisting of algae, mollusks, aquatic insects, grasses and other plant material. The Hawaiian gallinule is a secretive bird that forages in dense emergent vegetation. Their habitat consists of freshwater marshes, wet pastures, reservoirs, streams, and lotus fields. They are less often found in brackish or saline waters. The optimum overall ratio of vegetation to open water is a 50:50 mix (Weller and Frederickson, 1973). Approximately half of all Hawaiian gallinules can be found on the Island of Oahu with the predominance being found in the north and east coasts of the island, particularly between Haleiwa and Waimanalo (USFWS, 2011).

4.11.1.3 Hawaiian Stilt

The Ae’o or Hawaiian stilt is an endemic waterbird in Hawaii. The Hawaiian stilt is an opportunistic feeder eating a variety of invertebrates and aquatic organisms, particularly water boatmen (family *Corixidae*), beetles (order *Coleoptera*), brine fly larvae (*Ephydra riparia*), small fish (Mozambique tilapia [*Oreochromis mossambica*] and mosquito fish [*Gambusia affinis*]), and tadpoles (*Bufo* spp.). They typically feed in shallow wetlands. Nesting occurs on freshly exposed mudflats with sparse vegetation, typically from mid-February through August. Oahu is home to the largest population of Hawaiian stilts within the Hawaiian Islands. They can be found at the James Campbell National Wildlife Refuge, the Pearl Harbor National Wildlife Refuge and scattered throughout fish ponds in beach parks as well as along the northern and eastern coasts (USFWS, 2011).

4.11.1.4 Green Sea Turtle

The green sea turtle primarily utilizes shallow habitats such as lagoons, bays, inlets, shoals, estuaries, and other areas with an abundance of marine algae and seagrasses.

Individuals observed in the open ocean are believed to be migrants en route to feeding grounds or nesting beaches (Meylan, 1982). Hatchlings often float in masses of sea plants (e.g., rafts of sargassum) in convergence zones. Coral reefs and rocky outcrops near feeding pastures often are used as resting areas. The adults are primarily herbivorous, while the juveniles consume more invertebrates. Foods consumed include seagrasses, macroalgae, and other marine plants, mollusks, sponges, crustaceans, and jellyfish (Mortimer, 1982).

Terrestrial habitat is typically limited to nesting activities, although in some areas, such as Hawaii and the Galápagos Islands, they will bask on beaches (Balazs, 1980). They prefer high-energy beaches with deep sand, which may be coarse to fine, with little organic content. At least in some regions, they generally nest consistently at the same beach, which is apparently their natal beach (Allard et al., 1994; Meylan et al., 1990), although an individual might switch to a different nesting beach within a single nesting season.

The green sea turtle is a circumglobal species in tropical and subtropical waters. The green sea turtles of the Hawaiian archipelago are a discrete population based on their range, movement, and genetics (Seminoff et al., 2015).

4.11.1.5 Hawksbill Sea Turtle

Hawksbills generally inhabit coastal reefs, bays, rocky areas, passes, estuaries, and lagoons, where they occur at depths of less than 70 feet (21.5 meters [m[). Like some other sea turtle species, hatchlings are sometimes found floating in masses of marine plants (e.g., sargassum rafts) in the open ocean (NFWL, 1980). Hawksbills reenter coastal waters when they reach a carapace length of approximately 7.9 to 9.8 inches (20 to 25 centimeters). Coral reefs are widely recognized as the resident foraging habitat of juveniles, subadults, and adults. This habitat association is undoubtedly related to their diet of sponges, which need solid substrate for attachment. Hawksbills also occur around rocky outcrops and high-energy shoals, which are also optimum sites for sponge growth.

While this species is omnivorous, it prefers invertebrates, especially encrusting organisms, such as sponges, tunicates, bryozoans, mollusks, corals, barnacles, and sea urchins. Pelagic species consumed include jellyfish and fish, and plant material such as algae, sea grasses and mangroves have been reported as food items for this turtle (Carr, 1952; Mortimer, 1982; Musick, 1979; Pritchard, 1977; Rebel, 1974). The young are reported to be somewhat more herbivorous than adults (Ernst and Barbour, 1972).

Terrestrial habitat is typically limited to nesting activities. The hawksbill, which is typically a solitary nester, nests on undisturbed, deep-sand beaches, from high-energy ocean beaches to tiny pocket beaches several meters wide bounded by crevices of cliff walls. Typically, the sand beaches are low energy, with woody vegetation, such as sea grape (*Coccoloba uvifera*), near the waterline (NRC, 1990).

Hawkbills nest primarily along the east coast of the island of Hawaii. The number of nesting females in the Hawaiian Islands seems to be stable at about 20 per year (NMFS and USFWS, 2013).

4.11.1.6 Hawaiian Monk Seal

Hawaiian monk seals spend the majority of their life in the water, as much as two-thirds of their time. They are benthic foragers and can dive to depths exceeding 500 m in search of food on coral reefs and terraces of atolls. They are generalist feeders that will eat a variety of prey, including fish, cephalopods, and crustaceans. When hauling out on to dry land to rest or to pup the Hawaiian monk seal prefers sandy beaches, but will utilize most any substrate, including emergent reefs and shipwrecks (NMFS, 2007).

The Hawaiian monk seal can be found throughout the Hawaiian archipelago, though most of the population are found in the Northwest Hawaiian Islands. An increase in numbers and births have been occurring in the Main Hawaiian Islands since the early 2000's.

Critical habitat for the Hawaiian monk seal was designated in 1986 and revised in 2015. There are two critical habitat designations: one marine and one terrestrial. The marine critical habitat extends out to the 200 m contour, while the terrestrial critical habitat extends five (5) m inland from the shoreline. The area around the Haleiwa Beach Park is included in the Marine Critical Habitat designation, but not the terrestrial designation.

4.11.2 Special Status Species and Protected Habitat

4.11.2.1 Migratory Birds

The Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703-712) prohibits the take of migratory birds resulting from activities unless authorized by the USFWS. Take includes pursuing, hunting, capturing, and killing of migratory birds or any part of their nests or eggs. The Act also prohibits the sale, purchase, or shipment of migratory birds, nests, or eggs. The MBTA is an international treaty with the U.S., Canada, Mexico, Japan and Russia. Non-native bird species are not protected under the MBTA.

4.11.2.2 Marine Mammals

The Marine Mammal Protection Act of 1972 (MMPA) (16 U.S.C. 1361-1407) prohibits the take of marine mammals in U.S. waters and the importation of marine mammals and marine mammal products into the U.S. Take incudes the harassment, feeding, hunting, capture, collection, or killing of any marine mammal or part of a marine mammal. All cetaceans, (whales, dolphins, porpoises), sirenians (manatees and dugongs) and several marine carnivores (seals, sea lions, otters, walrus, and polar bears) are protected under the MMPA. The Act also established the Marine Mammal Commission, the International Dolphin Conservation Program, and the Marine Mammal Health and Stranding Response Program.

There are a total of 26 marine mammals documented in the Hawaiian Islands:

- Bottlenose dolphin (*Tursiops truncatus*)
- Pacific white-sided dolphin (*Lagenorhynchus obliquidens*)
- Pan-tropical spotted dolphin (*Stenella attenuata*)
- Risso's dolphin (*Grampus griseus*)

- Rough toothed Dolphin (*Steno bredanensis*)
- Spinner Dolphin (*Stenella longirostris*)
- Striped Dolphin (*Stenella coeruleoalba*)
- Hawaiian monk seal (*Monachus schauinslandi*)
- Northern fur seal (*Callorhinus ursinus*)
- Northern elephant seal (*Mirounga angustirostris*)
- Blainsville's beaked whale (*Mesoplodon densirostris*)
- Blue whale (*Balaenoptera musculus*)
- Bryde's whale (*Balaenoptera edeni*)
- Cuvier's beaked whale (*Ziphius cavirostris*)
- Dwarf sperm whale (*Kogia simus*)
- False killer whale (*Pseudorca crassidens*)
- Fin whale (*Balaenoptera physalus*)
- Humpback whale
- Killer whale (*Orcinus orca*)
- Melon-headed whale (*Peponcephala electra*)
- North Pacific right whale (*Eubalaena japonica*)
- Pygmy killer whale (*Feresa attenuata*)
- Pygmy sperm whale (*Kogia breviceps*)
- Sei whale (*Balaenoptera borealis*)
- Short-finned pilot whale (*Globicephala macrorhynchus*)
- Sperm whale

4.11.2.3 Essential Fish Habitat

Congress enacted amendments to the Magnuson-Stevens Fishery and Conservation and Management Act (MSFCMA) (Public Law 94-265) in 1996 that established procedures for identifying Essential Fish Habitat (EFH) and required interagency coordination to further the conservation of federally managed fisheries. Rules published by NMFS (50 CFR Sections 600.805 – 600.930) specify that any federal agency that authorizes, funds or undertakes, or proposes to authorize, fund or undertake an activity which could adversely affect EFH is subject to consultation provisions of the MSFCMA and identifies consultation requirements.

EFH consists of those habitats necessary for spawning, breeding, feeding, or growth to maturity of species managed by the Regional Fishery Management Councils, as described in a series of Fishery Management Plans, pursuant to the Act. The EFH within the study area includes:

- Gray jobfish (*Aprion virescens)*
- Sea bass (*Epinephelus quernus)*
- Silver jaw jobfish (*Aphareus rutilans)*
- Longtail snapper (*Etelis coruscans)*
- Pink snapper (*Pristipomoides seiboldii)*
- Snapper (*Pristipomoides zonatus)*

4.11.2.4 Coral Reefs

Executive Order (EO) 13089, Coral Reef Protection, was enacted to preserve and protect the biodiversity, health, heritage, and ecological, social, and economic values of U.S. coral reef ecosystems and the marine environment. An interagency task force, the U.S. Coral Reef Task Force, was created in order to fulfill the EO's protection efforts. The task force works with State, territorial, commonwealth, and local government agencies, nongovernmental organizations, the scientific community, and commercial interests to develop and implement measures to restore damaged coral reefs and to mitigate further coral reef degradation (EPA, 2019).

Waialua Bay (Haleiwa Harbor) Fishery Management Area encompasses as 0.02 square kilometers (sq. km.) area of coral reef that is managed by the State of Hawai'i as part of the Marine Protected Areas Programmatic Management Plan (Gorstein et al., 2018). Coral species found on Oahu coral reefs include *Cyphastrea* spp., *Leptastrea purpurea*, *Montipora capitata*, *M. flabulata*, *M. patula*, *Palythoa* spp., *Pavona* spp., *Pocillopora grandis*, *P. meandrina*, *Porites evermanni*, and *P. lobata*.

4.12 Socioeconomics

Socioeconomics is defined as the basic attributes and resources associated with the human environment, particularly population, demographics, and economic development. Demographics entail population characteristics and include data pertaining to race, gender, income, housing, poverty status, and educational attainment. Economic development or activity typically includes employment, wages, business patterns, and area's industrial base, and its economic growth.

Honolulu is the largest city in the State of Hawaiʻi with a population of 401,549 based on the 2018 U.S. census estimate data (U.S. Census Bureau, 2020a). Honolulu is the County seat and the only metropolitan area of Honolulu County. Honolulu functions as the industrial, commercial, distribution, and population core of the island.

According to the 2010 census, the population of Honolulu County includes approximately 953,206 residents, which is approximately a 21.7 percent increase from the 2000 Census (U.S. Census Bureau, 2020b). The project area is located within census tract number 99.02. Census tract 99.02 had a population of 3,740 in the 2010 census, which is approximately 0.4 percent of the total population of Honolulu County. Persons aged 18 years and over account for 751,126 of the population of Honolulu County, or 78.8 percent, while this age group makes up about 76.6 percent of the census tract population. Honolulu County's 65 years and older population is approximately 168,717, or 17.7 percent of the County population, while this age group consists of 460 or 12.3 percent of the census tract population.

The Island of Oahu is divided into nine districts and the study area is in District 2. The Annual Stability Report of 2019 for the City and County of Honolulu lays out six goals to tackle climate change and increasing sustainability. These goals are achieving a carbon neutral economy, providing sustainable city operations, offering clean and affordable transportation options, transitioning to a 100 percent renewable energy future, increasing water security and building green infrastructure, and increasing climate resilience (City and County of Honolulu, 2019).

The median household income for the State of Hawai'i in 2018 was $95,569, while the County of Honolulu has a median household income of $82,906. The median income for Census Tract 99.02 was $75,486 (Table 2).

The income of approximately 7.7 percent of Honolulu County residents are considered as persons of poverty, compared to 9.5-percent for the State. Racial distribution for Census Tract 99.02, Honolulu County, and the State are provided in **Error! Reference source not found.**3.

4.12.1 Environmental Justice

In order to comply with EO 12898, ethnicity and poverty status in the study area were examined and compared to regional, state, and national data to determine if any minority or low-income communities could potentially be disproportionately affected by the implementation of the proposed action. No indication of disproportionately low income or minority specific populations were identified. The data provided in **Error! Reference source not found.**2 and **Error! Reference source not found.**3 below also supports this finding.

Geographic Unit	Median Household Income
Hawai'i	$95,569
County of Honolulu	$82,906
Census Tract 99.02	$75,486

U.S. Census Bureau 2020a

Table 2. Median Household income of the study area.

4.12.2 Protection of Children

EO 13045 requires that federal actions consider potentially health and safety risks to children resulting from that action. The locations of areas where children may congregate (e.g., child care centers, schools, parks, etc.) were identified within the study area. The study area is primarily comprised of a beach park and an area where children are likely to congregate.

Race	% Census Tract 99.02	% of Honolulu County	% of State of Hawai‘i
White	24.3	20.8	24.7
African American	-	3.4	2.9
American Indian/Alaska Native	3.4	2.2	2.5
	33.6	43.9	38.6
Native Hawaiian/Pacific Islander	29.3	9.5	9.9
Two or more races	29.5	22.3	23.6
Hispanic or Latino	11.3	8.1	8.9
White/Not Hispanic or Latino	22.3	19.1	22.7

U.S. Census Bureau 2020a

Table 3. Racial Distribution of the study area.

4.13 Hazardous, Toxic, and Radioactive Waste

To complete the Phase I HTRW survey, USACE reviewed existing environmental documentation and environmental regulatory databases. USACE contacted the HSDOH, Department of Land and Natural Resources (DLNR), and the Office of Environmental Quality Control (OEQC) to obtain information about property history, environmental conditions, and any HTRW incidents, violations, or permit actions which may have occurred within the areas encompassing the final array of alternatives.

Federal, state, and local agency environmental records and regulatory databases were searched to determine the existence of any license or permit actions, violations, enforcements, and/or litigation against property owners, and to obtain general information about potential past incidents of HTRW releases. Results of the database searches include:

- No U.S. EPA National Priority List (NPL) or Superfund sites are within a one-mile radius of the project alternative areas
- No Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) site is located within a 0.5-mile radius of the project alternative areas
- No Resource Conservation and Recovery Information System (RCRIS) treatment, storage, or disposal (TSD) facility is located with a 0.5-mile radius from the project alternative areas

- No Resource Conservation and Recovery Act (RCRA) Corrective Action Reports (CORRACTS) were identified within a one-mile radius of the project alternative areas
- No RCRA generators are located within the project alternative areas or adjacent properties
- One underground storage tanks (USTs) is located within a 0.25-mile radius of the project alternative areas
- No leaking underground storage tanks (LUST) are located within a one-mile radius of the project alternative areas
- No active landfills are located within a 0.5-mile radius of the project alternative areas

4.14 Cultural Resources

Research was conducted at the Hawaii State Historic Preservation Division library to determine the presence or absence of potential historic properties within or adjacent to the study area. Additionally, publicly available aerial photographs were examined to determine the potential for marine historic resources.

Aerial photographs provide reasonably good visibility for the relatively shallow areas proposed for dredging. Overall, the historically dredged Haleiwa Small Boat Harbor channel is unlikely to contain marine historic properties. Aerial photos indicate that the off-shore area consists strictly of sand deposits with no indication of anomalous features. Furthermore, the small literature available regarding shipwrecks in Hawaii indicates no known historical wrecks within or near the study area.

Based on records at the Hawaii State Historic Preservation Division, no traditional Hawaiian historic properties are known to exist within the terrestrial portion of the study area. Despite this, it is clear that the region is archaeologically active, containing a number of known sites in the general vicinity. There are two important cultural locales north of Haleiwa Beach Park, which including McAllister's Site 234 (Kahakakau Kanaka) and Site 235 (Curative Stone). East of the study area is Lokoea Fishpond (Site 233), known to contain subsurface deposits along its perimeter. *Loi* deposits (State Inventory of Historic Places (SIHP) 50-80-04-7152) have been recorded just south of Haleiwa Small Boat Harbor, apparently associated with a cluster of former Land Claim Award parcels. A potential pre-Contact cultural layer (SIHP 50-80-04-5916) was also recorded in this general area. Finally, Hawaiian skeletal remains (SIHP 50-10-04-7561) were recovered from the area of the former Haleiwa Hotel (current Haleiwa Joe's), adjacent to Haleiwa Small Boat Harbor. Thus, the evidence indicates that although no traditional Hawaiian historic properties are known to exist within the terrestrial portion of the study area, there is a relatively high potential for such properties to exist in the general area in the form of subsurface deposits, to include traditional human burials.

It is important to note that the strand along the immediate shoreline often consists of exposed beach-rock (limestone or sandstone), and that it is alternately exposed and then recovered with sand on an annual or semi-annual basis, weather depending. Judging from photographs dating to the 1950s, the original shoreline appears to have been much further out and the historical trend thus appears to be retrograde.

One "architectural" resource is present within the study area. The built components of Haleiwa Beach Park are contributing properties within a discontinuous "Art Deco Parks" historic district established in June 9, 1988 (SIHP No. 50-80-04-1388). Other properties within the historic district, are located throughout Oahu and include Ala Wai Park Clubhouse, Ala Moana Beach Park, Mother Waldron Playground, and Kawananakoa Playground.

4.15 Noise

Noise is generally defined as unwanted sound. Noise can be any sound that is undesirable because it interferes with communication, is intense enough to damage hearing, or is otherwise annoying. Human responses to noise vary depending on the type and characteristics of the noise, distance between the noise source and receptor, receptor sensitivity, and time of day.

Determination of noise levels are based on 1) sound pressure level generated (decibels [dB] scale); 2) distance of listener from source of noise; 3) attenuating and propagating effects of the medium between the source and the listener; and 4) period of exposure.

An A-weighted sound level, measured in dBA, is one measurement of noise. The human ear can perceive sound over a range of frequencies, which varies for individuals. In using the A-weighted scale for measurement, only the frequencies heard by most listeners are considered. This gives a more accurate representation of the perception of noise. The noise measure in a residential area, similar to conditions within the study area, is estimated at approximately 70 dBA. Normal conversational speech at a distance of five to ten feet is approximately 70 dBA. The decibel scale is logarithmic, so, for example, sound at 90 dBA would be perceived to be twice as loud as sound at 80 dBA. Passenger vehicles, motorcycles, and trucks use the roads in the vicinity of the project area. Noise levels generated by vehicles vary based on a number of factors including vehicle type, speed, and level of maintenance. Intensity of noise is attenuated with distance. Some estimates of noise levels from vehicles are listed in Table 4 (Cavanaugh and Tocci, 1998).

Source	**Distance (ft)**	**Noise Level (dba)**
Automobile, 40 mph	50	72
Automobile Horn	10	95
Light Automobile Traffic	100	50
Truck, 40 mph	50	84
Heavy Truck or Motorcycle	25	90

Source: Cavanaugh and Tocci, 1998

Table 4. Typical Noise Sources

State of Hawai'i Administrative Rule (HAR) Title 11, Chapter 46 Community Noise Control, sets permissible noise levels in order to provide for the prevention, control, and abatement of noise pollution in the State. The regulation creates noise districts based on land use that dictate acceptable noise levels. The study area is located in a conservation/open space within the vicinity of residential use. Therefore, the study area is in a Class A zoning district, as defined by HAR 11-46. The maximum permissible sound level in a Class A district is 55 dBA from 7:00am-10:00pm and 45 dBA from 10:00pm-7:00am.

The EPA has identified a range of yearly day-night sound level (DNL) standards that are sufficient to protect public health and welfare from the effects of environmental noise (EPA, 1977). The EPA has established a goal to reduce exterior environmental noise to a DNL not exceeding 65 dBA and a future goal to further reduce exterior environmental noise to a DNL not exceeding 55 dBA. Additionally, the EPA states that these goals are not intended as regulations as it has no authority to regulate noise levels, but rather they are intended to be viewed as levels below which the general population will not be at risk from any of the identified effects of noise.

The U.S. Occupational Safety and Health Administration (OSHA) has established acceptable noise levels for workers. Table 5 shows permissible noise levels for varying exposure times.

Duration per day-hours	Sound level dBA slow response
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25 or less	115

Source: OSHA, 2011

Table 5. OSHA Permissible Noise Exposures

The Noise Control Act of 1972 (42 U.S.C. 4901 to 4918) established a national policy to promote an environment for all Americans free from noise that jeopardizes their health and welfare. To accomplish this, the Act establishes a means for the coordination of Federal research and activities in noise control, authorizes the establishment of Federal noise emissions standards for products distributed in commerce, and provides information to the public respecting the noise emission and noise reduction characteristics of such products (42 U.S.C. 4901). The Act authorizes and directs that Federal agencies, to the fullest extent consistent with their authority under Federal laws administered by them, carry out the programs within their control in such a manner as to further the policy declared in 42 U.S.C. 4901.

Federal workplace standards for protection from hearing loss allow a time-weighted average level of 90 dBA over an 8-hour period, or 85 dBA averaged over a 16-hour period. Noise annoyance is defined by the EPA as any negative subjective reaction on the part of an individual or group (EPA, 1976). For community noise annoyance thresholds, a day-night average of 65 dBA has been established by the United States Department of Housing and Urban Development (HUD) as eligibility for federally guaranteed home loans. (Federal Interagency Committee on Noise, 1992).

The study area is located in residential and recreational land in the suburban town of Haleiwa on the Island of Oahu. The noise environment in Haleiwa is characteristic of a suburban environment; the setting is dominated by vehicular and residential noise. The proposed project area is not significantly affected by airfield noise. The closest airfield to the proposed project area is Dillingham Airfield, which is approximately five miles northwest of the proposed project area.

4.16 Visual Aesthetics

Visual resources are defined as the natural and manufactured features that comprise the aesthetic qualities of an area. These features form the overall impressions that an observer receives of an area or its landscape character. Landforms, water surfaces, vegetation, and manufactured features are considered characteristic of an area if they are inherent to the structure and function of a landscape.

The study area is moderately urbanized, including residential and public lands. Relatively undeveloped lands are found in the areas adjacent to the study area with increasing development towards the town of Haleiwa. The visual aesthetics of these areas is typical of suburban and recreational environments.

4.17 Recreation

Recreation is comprised of terrestrial- and water-based activities associated with the local population or visitors to the island. Recreation may consist of aquatic activities such as swimming, windsurfing, surfing, fishing, jet skiing, kayaking, snorkeling, scuba diving, and water skiing. Terrestrial recreational activities may consist of hiking trails, biking trails, parks, golf courses, and ball fields.

Haleiwa Beach Park is a county managed park 15.67 acres in size that offers water-related recreation in the form of paddling/canoeing, shore-fishing, swimming, and beach activities. In addition, the developed land setting offers playgrounds, picnic areas, restrooms, and a pavilion. Sports activities that can be enjoyed at the park include baseball/softball, basketball, volleyball, and soccer.

5 Environmental Consequences

The environmental consequences chapter describes the probable effects or impacts of implementing any of the action alternatives (the Future with Project condition or FWP). Effects can be either beneficial or adverse and are considered over a 50-year period of analysis (2022-2072).

Environmental impacts will be assessed according to state environmental regulations (HRS 343 and HAR 11-200), as well as federal guidelines (NEPA). Descriptions of the assessment criteria under both state and federal guidelines are presented below.

5.1 Federal Environmental Guidelines

The CEQ regulations (40 CFR 1508.7 and 1508.8) define the impacts that must be addressed and considered by Federal agencies in satisfying the requirements of the NEPA process, which includes direct, indirect and cumulative impacts.

Direct impacts are caused by the action and occur at the same time and place. Indirect impacts are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable. Indirect impacts may include growth inducing impacts and other impacts related to induced changes in the pattern of land use, population density or growth rate, and related effects on air, water and other natural systems, including ecosystems.

Impacts include ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historical, cultural, economic, social, or health, whether direct, indirect, or cumulative. Impacts may also include those resulting from actions which may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial (40 CFR 1508.8).

According to the CEQ regulations (40 CFR 1500-1508), the determination of a significant impact is a function of both context and intensity. This means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the Proposed Action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant.

Intensity refers to the severity of impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action. The following should be considered in evaluating intensity:

1. Impacts that may be both beneficial and adverse. A significant impact may exist even if the Federal agency believes that on balance the effect will be beneficial.
2. The degree to which the Proposed Action affects public health or safety.
3. Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.
4. The degree to which the effects on the quality of the human environment are likely to be highly controversial.
5. The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.
6. The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.
7. Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.
8. The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.
9. The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.
10. Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment (40 CFR 1508.27).

To determine significance, the severity of the impact must be examined in terms of the type, quality and sensitivity of the resource involved; the location of the proposed project; the duration of the effect (short or long-term) and other consideration of context. Significance of the impact will vary with the setting of the Proposed Action and the surrounding area (including residential, industrial, commercial, and natural sites).

5.2 State Environmental Guidelines

A "significant effect" is defined by HRS Chapter 343 as "the sum of effects on the quality of the environment, including actions that irrevocably commit a natural resource, curtail the range of beneficial uses of the environment, are contrary to the State's environmental policies or long-term environmental goals as established by law, or adversely affect the economic welfare, social welfare, or cultural practices of the community and State."

5.3 Alternatives Considered

The No Action Alternative and three action alternatives, as described in the Plan Formulation section of the study's Integrated Feasibility Report/Environmental Assessment (IFR/EA) were considered in analyzing impacts from the implementation of any beneficial use of dredged material measures:

1. No Action Alternative
2. Federal Navigation Channel
3. Federal Navigation Channel and Settling Basin
4. Federal Navigation Channel, Settling Basin and Offshore Sand Deposit

The future without project condition (FWOP), also known as the "No Action Alternative", is the most likely condition expected to occur in the future in the absence of the proposed action or action alternatives. As with the Future with Project Conditions, the impacts to resources are projected over a 50-year window, or the designed life of the proposed project. Therefore, the FWOP conditions project changes that would occur until the year 2072. For the study area, the No Action Alternative means that no beneficial use of dredged material (BUDM) measures will be implemented in the future, and erosion of the beach will continue at its present rate.

5.4 Future Without Project

5.4.1 Land Use

Under the FWOP conditions, land use is expected to remain recreational in nature. The continued erosion of the beach and the loss of land will jeopardize the structural soundness of the retaining wall between the beach and the park area.

5.4.2 Climate

Projected climate change caused by man-made increases in greenhouse gases will result in changes under the FWOP condition. Scientific research indicates that the Global Mean Sea Level has been increasing since the 1990s, which has seen a sea level rise (SLR) rate of approximately 0.14 inches per year or roughly twice the rate seen in the past 100 years. Rise in sea levels is linked to several climate-related factors, all induced by the ongoing global climate change including water thermal expansion and melting of glaciers and ice sheets.

Relative sea level rise (RSLR) for Honolulu were calculated using methods described by Sweet et al. (2017) and presented on the National Oceanic and Atmospheric Administration (NOAA) Sea Level Trend mapper (NOAA, 2020). RSLR for Honolulu is expected to increase 0.2 to 0.7 feet by 2030, 0.6 to 4.2 feet by 2050, and 3.0 to 7.5 feet in 2100 (NOAA, 2019) (**Error! Reference source not found.**). Sea level rise not only results in the inundation of coastal areas and infrastructure, but can also exacerbate the encroachment of saline groundwater into freshwater aquifers. Climate change is predicted to influence weather patterns leading to an increase in periods of drought, higher temperatures and evaporation rates for soil and water bodies, and more intense storms and weather events. For the FWOP conditions, these factors will lead to an increased intensity of flood events within the study area.

5.4.3 Water Resources

Under the FWOP conditions, water resources would be predominantly affected by climate change as increased drought, evaporation, and intensity of storm events would alter streams, ponds, and coastal bays and estuaries.

5.4.3.1 Hydrology and Hydraulics

The predominant longshore flow would continue under the FWOP conditions. The Haleiwa Beach would continue to be exposed to wave action throughout the year and the beach would continue to erode.

No changes to Anahulu River would be expected under the FWOP conditions. The river would remain a prime recreational area for canoers and kayakers.

5.4.3.2 Floodplains

Under FWOP conditions the floodplain would continue to be susceptible to inundation by one percent ACE events.

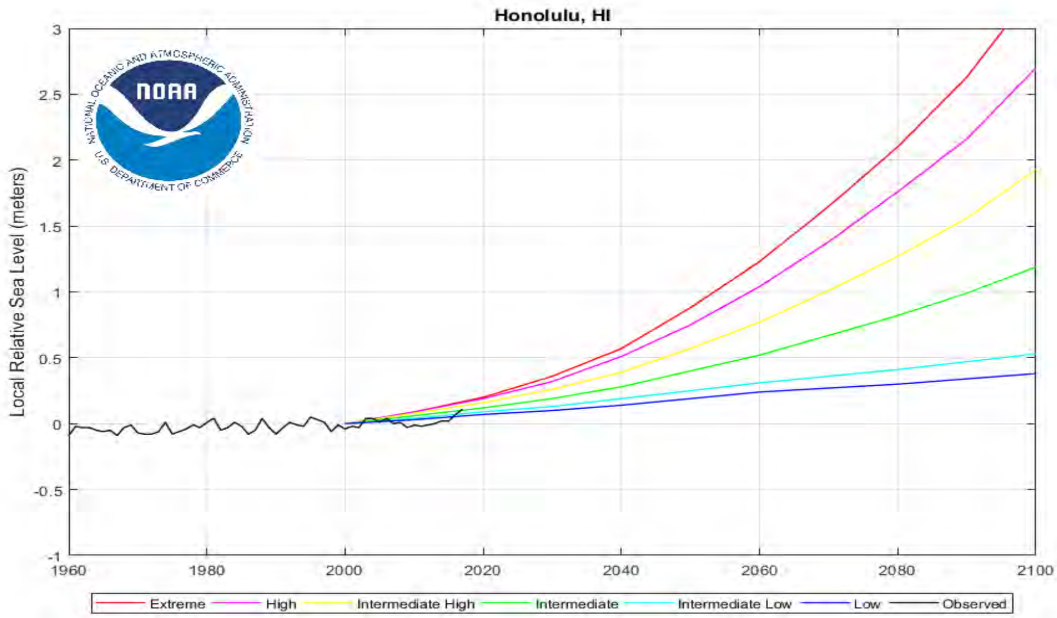


Figure 9. Annual Mean Relative Sea Level Trends for Honolulu, Hawai'i.

5.4.4 Wetlands

The wetlands in the study area are not expected to be affected under the FWOP conditions. The freshwater forested/shrub wetland and the freshwater emergent wetlands are either part of currently undeveloped land or lie along Anahulu River.

5.4.5 Ground Water

No changes to the ground water are anticipated under FWOP conditions.

5.4.6 Coastal Zone Management Resources

The State of Hawai'i Office of Planning is responsible for ensuring natural resources are managed and protected under CZMA. The office will continue to determine whether actions in the study are consistent with the CZMA and Hawai'i's ORMP under the FWOP.

5.4.7 Air Quality

The project area is currently in attainment of all EPA air quality standards. This status of attainment is not expected to change under the FWOP conditions.

5.4.8 Water Quality

The CWB and the HSDOH will continue to monitor the Anahulu River under the FWOP conditions. No changes to the river are expected under the FWOP conditions.

5.4.9 Geologic Resources

No changes to the geologic resources are anticipated under the FWOP conditions.

5.4.10 Soils

Under the FWOP conditions the beach soils will continue to erode away from Haleiwa Beach through the process of longshore transport and wave induced erosion. No other changes to soils are expected under the FWOP conditions.

5.4.11 Biological Communities

5.4.11.1 Threatened and Endangered Species

5.4.11.1.1 Hawaiian Coot

The Hawaiian coot is found in coastal brackish and fresh-water ponds, streams and marshes on the Island of Oahu. The presence of this species will not be changed under the FWOP conditions.

5.4.11.1.2 Hawaiian Gallinule

While the Hawaiian gallinule is a secretive bird whose population on the Island of Oahu is predominantly in the area between Haleiwa and Waimanalo. Under the FWOP conditions, there are no expected impacts to this species.

5.4.11.1.3 Hawaiian Stilt

The Hawaiian stilt can be found scattered throughout fish ponds in beach parks as well as along the northern and eastern coasts of the Island of Oahu. Under the FWOP conditions, there are no expected impacts to this species.

5.4.11.1.4 Green Sea Turtle

Green sea turtles are not known to nest in the study area, so the continued erosion of the beach under the FWOP conditions should not impact the species. There are not expected to be any impacts to the species foraging or resting areas under the FWOP conditions.

5.4.11.1.5 Hawksbill Sea Turtle

Hawksbill sea turtles are not known to nest in the study area, so the continued erosion of the beach under the FWOP conditions should not impact the species. There are not expected to be any impacts to the species foraging or resting areas under the FWOP conditions.

5.4.11.1.6 Hawaiian Monk Seal

The beach at Haleiwa Beach Park is not included in the terrestrial critical habitat designation for the species, though the open water region is included in the marine critical habitat designation for the Hawaiian Monk Seal. There are not expected to be any impacts to the critical habitat of the species under the FWOP conditions. As the beach erodes under longshore transport and wave forcing the Hawaiian Monk Seal may lose resting space.

5.4.11.2 Special Status Species and Protected Habitat

5.14.11.2.1 Migratory Birds

Migratory birds will continue to be protected under the MBTA, though no impacts are expected under the FWOP conditions to these species.

5.4.11.2.2 Marine Mammals

Marine mammals will continue to be protected under the MMPA, though no impacts are expected under the FWOP conditions to any of the 26 marine mammal species known to be present on the Hawaiian Islands.

5.4.11.2.3 Essential Fish Habitat

EFH exists for fourteen species and the coral reef ecosystem (Table 6) within the study area and these species will continue to be monitored and protected by the Regional Fishery Management Council and NMFS. As no dredging would be conducted there are not expected to be any impacts to these species or habitats under the FWOP conditions.

5.4.11.2.4 Coral Reefs

Waialua Bay (Haleiwa Harbor) Fishery Management Area encompasses as 0.02 sq. km. area of coral reef that is managed by the State of Hawai'i as part of the Marine Protected Areas Programmatic Management Plan. This area will continue to be protected under the FWOP conditions and no impacts are expected to the coral species.

5.4.12 Socioeconomics

The population, demographics, and economic development of the study area are not expected to significantly change under the FWOP conditions. Nor is the median income of the population with Census Tract 99.02, which encompasses the study area.

Species/Management Unit	**Scientific Name**	**Life Stage(s) Found in Area**
Main Hawaiian Islands Coral Reef Ecosystem		All
Amberjack	*Seriola dumerili*	Eggs Post-hatch
Blackjack	*Caranx lugubris*	Eggs Post-hatch
Sea Bass	*Epinephelus quernus*	Eggs Post-hatch
Blue Stripe Snapper	*Lutjanus kasmira*	Post Settlement/ Post Adult/ Adult/ Eggs Post-Hatch
Gray Jobfish	*Aprion virescens*	Post Settlement/ Post Adult/ Adult/ Eggs Post-Hatch
Giant Trevally	*Caranx ignobilis*	Post Settlement/ Post Adult/ Adult/ Eggs Post-Hatch

Pink Snapper	*Pristipomoides filamentosus*	Eggs Post-hatch
Red Snapper	*Etelis carbunculus*	Eggs Post-hatch
Longtail Snapper	*Etelis coruscans*	Eggs Post-hatch
Yellowtail Snapper	*Pristipomoides auricilla*	Eggs Post-hatch
Silver Jaw Jobfish	*Aphareus rutilans*	Eggs Post-hatch
Thicklip Trevally	*Pseudocaranx dentex*	Eggs Post-hatch
Pink Snapper	*Pristipomoides seiboldii*	Eggs Post-hatch
Snapper	*Pristipomoides zonatus*	Eggs Post-hatch

Table 6. Species managed by the Western Fishery Management Council

5.4.12.1 Environmental Justice

The study area does not have specific populations of disproportionately low income or minority identified within its boundaries. Therefore, the FWOP conditions are not expected to have an impact on low income or minority populations.

5.4.12.2 Protection of Children

The study area contains the Haleiwa Beach Park which is frequented by children as a recreation area. This will continue under the FWOP conditions. The Beach Park is set up with the safety of its visitors, particularly children, in mind. The health and safety of children will not be further endangered under the FWOP conditions.

5.4.13 Hazardous, Toxic, and Radioactive Waste

Only one underground storage tank (UST) was found to be located within a 0.25-mile radius of the project area. This UST will remain in place under the FWOP conditions. No additional HTRW impacts are anticipated under the FWOP conditions.

5.4.14 Cultural Resource

Under the FWOP conditions, cultural resources will remain unchanged. Any undocumented archaeological deposits along the shoreline will remain vulnerable to erosion due to seasonal and extreme weather events. Architectural components of the Art Deco Parks historic district (SIHP No. 50-80-04-1388) at Haleiwa Beach Park, being largely tangential to the project footprint, will be unaffected under FWOP conditions.

5.4.15 Noise

The study area is located among residential and recreational land. The noise environment is not anticipated to change from that of the typical suburban environment under the FWOP conditions.

5.4.16 Visual Aesthetics

The study area is moderately urbanized, including residential and public lands. Relatively undeveloped are found in the areas adjacent to the study area with increasing development towards the town of Haleiwa. The visual aesthetics of these areas is typical of suburban and recreational environments. This is not anticipated to change under the FWOP conditions.

5.4.17 Recreation

Haleiwa Beach Park offers water-related recreation such as paddling/canoeing, shore-fishing, swimming, and beach activities. In addition, the developed land setting offers playgrounds, picnic areas, restrooms, and a pavilion. Sports activities that can be enjoyed at the park include baseball/softball, basketball, volleyball, and soccer. The land-based activities will be unaffected as a result of the FWOP conditions. The beach activities may suffer due to erosion of the beach from longshore transport and wave forces under the FWOP conditions.

5.5 Alternatives 2, 2a, and 3

Alternatives 2, 2a, and 3 were the plans not demonstrating the highest level of benefits to cost. Alternative 2 would place 7,166 cy of beach quality sand (material) over 1.2 ac. Alternative 2a would place 8,871 cy of material over 1.6 ac. And Alternative 3 would place 11,071 cy of material over 2.1 ac. These plans would have similar impacts on the environment and will be examined together in this section to the greatest extent possible. Where a plan has an impact that would be different from the others it will be highlighted below.

5.5.1 Land Use

Under each of these alternatives sand would be placed on Haleiwa Beach to create a larger beach footprint than currently exists. The use of the project area would remain recreational in nature.

5.5.2 Climate

The placement of dredged material on Haleiwa Beach under each of these alternatives would have no effect on the climate of the area. The placement of the material would not significantly offset the projected relative sea level rise for the area (see Figure 9).

5.5.3 Water Resources

5.5.3.1 Hydrology and Hydraulics

The longshore tidal flow along Haleiwa Beach would continue under each of these alternatives. The placement of material on the beach would not affect the movement of the current. The waves used by surfers in the Northshore area would be unaffected by these alternatives.

5.5.3.2 Floodplains

The dredging of material from the Haleiwa Small Boat Harbor and the Ali'i Settling Basin along with its placement on Haleiwa Beach would have no adverse effect on the floodplains in the study area under each of these alternatives. No alterations to the floodplain are proposed under any of the three alternatives.

5.5.4 Wetlands

No work is proposed in the freshwater forested/shrub wetland and the freshwater emergent wetland areas within the study area under any of the three alternatives. No impacts would occur to the freshwater wetlands. The National Wetlands Inventory (NWI) defines the area just offshore of Haleiwa Beach as an Estuarine Marine Wetland. This area would have some material placed in it under each of the three alternatives; however, the material would be of the same quality as the material already present and the effect on the wetland would be nonsignificant.

5.5.5 Ground Water

No impacts would occur to the groundwater of the study area. No wells or drilling are proposed under the alternatives that would impact the groundwater zones.

5.5.6 Coastal Zone Management Resources

The State of Hawai'i Office of Planning is responsible for ensuring natural resources are managed and protected under CZMA. The actions of the three alternatives are consistent with the CZMA and Hawai'i's ORMP, in particular, Appropriate Coastal Development, Marine Resources, Coral Reef, and Community and Place-based Ocean Management Projects.

5.5.7 Air Quality

There are no non-attainment areas within the State of Hawai'i. During construction of the alternatives heavy equipment would be needed, including tugs, front-end loaders, bulldozers, and the personally-owned vehicles of the employees of the construction company. The temporary increase of exhaust from these vehicles would not be expected to impact the attainment status of the region.

5.5.8 Water Quality

No work is proposed to the Anahulu River under the three alternatives. No impact would occur to the water quality of the river as a result of the three alternatives. The dredging of the ship channel and the settling basin along with placement of material on Haleiwa Beach would cause temporary turbidity increases in the harbor and the area adjacent to the beach. These impacts would be temporary and negligible.

5.5.9 Geological Resources

The geological resource impacted under the three alternatives is primarily the material dredged from the ship channel and settling basin. Under Alternative 2 there would be 7,166 cy of beach quality sand dredged from the ship channel and placed on the beach. Under Alternative 2a that volume would increase to 8,871 cy. Alternative 3 would harvest additional sand from the Ali'i settling basin for a total of 14,400 cy of material to be placed on the beach. This is material that likely eroded from Haleiwa and Ali'i beaches so net loss of material to the system would occur.

5.5.10 Soils

There are no prime or unique farmland soils within the study area, so no impacts to these resources would occur under the three alternatives. Beach quality sand would be dredged from the ship channel under all three alternatives and from the Ali'i settling basin under Alternative 3 to be placed on Haleiwa beach. This is material that likely eroded from Haleiwa and Ali'i beaches so net loss of material to the system would occur.

5.5.11 Biological Communities

5.5.11.1 Threatened and Endangered Species

5.5.11.1.1 Hawaiian Coot

No work would be performed in the habitat for the Hawaiian coot under the three alternatives. The Hawaiian coot's habitat on Oahu includes coastal brackish and fresh-water ponds, streams and marshes. The three alternatives would have no effect on the Hawaiian coot.

5.5.11.1.2 Hawaiian Gallinule

No work would be performed in the habitat for the Hawaiian gallinule under the three alternatives. The Hawaiian gallinule's habitat on Oahu includes freshwater marshes, wet pastures, reservoirs, streams, and lotus fields. The three alternatives would have no effect on the Hawaiian gallinule.

5.5.11.1.3 Hawaiian Stilt

No work would be performed in the habitat for the Hawaiian stilt under the three alternatives. The Hawaiian stilt's habitat on Oahu includes shallow wetlands and freshly exposed mudflats with sparse vegetation. The three alternatives would have no effect on the Hawaiian stilt.

5.5.11.1.4 Green Sea Turtle

The Hawaiian archipelago has a discrete population of Green sea turtles. They are not known to nest on Haleiwa Beach or on the Ali'i settling basin. Green sea turtles have been seen in Waialua Bay. The dredging and placement of materials under all three alternatives would cause temporary turbidity increases in the nearshore waters. This increase of turbidity may temporarily interfere with feeding activities of the Green sea turtle. Due to this turbidity the alternatives may affect, but is not likely to adversely affect the Green sea turtle.

5.5.11.1.5 Hawksbill Sea Turtle

Hawksbill sea turtles nest on undisturbed beaches, which makes Haleiwa Beach an unsuitable location for Hawksbill nesting. Sightings of Hawksbill sea turtles in Waialua Bay are rare. The dredging and placement of materials under all three alternatives would cause temporary turbidity increases in the nearshore waters. This increase of turbidity may temporarily interfere with feeding activities of the Hawksbill sea turtle. Due to this turbidity the alternatives may affect, but is not likely to adversely affect the Hawksbill sea turtle.

5.5.11.1.6 Hawaiian Monk Seal

The marine habitat adjacent to Haleiwa Beach and Ali'I settling basin, as well as the ship channel are designated as critical habitat for the Hawaiian Monk Seal. The dredging of material from these areas under the three alternatives would cause a temporary increase in turbidity and may impact activities of the seal. Due to this turbidity the alternatives may affect, but is not likely to adversely affect the Hawaiian monk seal and its critical habitat.

5.5.11.2 Special Status Species and Protected Habitat

5.5.11.2.1 Migratory Birds

The protection of migratory birds under the MBTA is enforced by the USFWS. Under the three alternatives the dredging of material from the ship channel or the settling basin would have no effect on migratory birds. The placement of material on Haleiwa Beach may affect migratory shorebirds depending on the timing of placement. Determination of the presence of migratory shorebirds would need to be surveyed in consultation with USFWS and, if present, the timing of placement would need to be coordinated in order to minimize impacts to the birds. Haleiwa Beach is a highly frequented beach by human visitors and the likelihood of migratory bird impacts from the three alternatives is low, though the brown booby (*Sula leucogaster*) and the Laysan albatross (*Phoebastria immutabilis*) have been documented in the area.

5.5.11.2.2 Marine Mammals

The dredging and placement equipment utilized under the three alternatives may cause marine mammals to temporarily move away from the project area, but not likely to entirely leave Waialua Bay. The increased turbidity caused by dredging activities, though temporary, may affect feeding activities of marine mammals in Waialua Bay. No takes of marine mammals are anticipated under the three alternatives.

5.5.11.2.3 Essential Fish Habitat

The only species/management unit that would be of concern in the project area would be the Main Hawaiian Islands Coral Reef Ecosystem. This management unit is primarily concerned with threatened and endangered species of corals but looks to protect reef habitat in general. The USFWS surveyed the project area for the presence of corals in August, 2020. Their report and data can be found in the Coordination Act Report in Attachment 1 of this appendix. While the surveyors found the presence of multiple species of corals, no threatened or endangered species were found. The three alternatives would have no effect on EFH.

5.5.11.2.4 Coral Reefs

As discussed in 5.5.11.2.3 the presence of small coral reefs was found throughout the project area. The dredging and placement of sand would temporarily increase the turbidity of the water where the reefs exist. This may temporarily interfere with the feeding of the corals. Silt curtains would need to be utilized to minimize this impact. The three alternatives would each temporarily impact the coral reef community.

5.5.12 Socioeconomics

5.5.12.1 Environmental Justice

The study area does not have specific populations of disproportionately low income or minority identified within its boundaries. Therefore, the three alternatives would not be expected to have an impact on low income or minority populations.

5.5.12.2 Protection of Children

The study area contains the Haleiwa Beach Park which is frequented by children as a recreation area. This would continue under the three alternatives. Measures would be incorporated to ensure the safety of children in the project area such as exclusion fencing, signage, and securing construction equipment. With these mitigative measures in place, the alternatives would not have substantial adverse impacts on the local population of children.

5.5.13 Hazardous, Toxic, and Radioactive Waste

Only one UST was found to be located within a 0.25-mile radius of the project area. This UST would not be impacted by any of the three alternatives. Testing of the dredged material for contaminants would be conducted to ensure suitability for placement on the beach under each of the alternatives. No impacts would be anticipated with regards to HTRW from any of the three alternatives.

5.5.14 Cultural Resources

For each of the three alternatives, there are expected to be no adverse impacts to cultural resources. Since there will be no significant ground-disturbing activities, any potential coastal archaeological sites (none have been documented in the study area) will not be impacted. Project activities under the three alternatives also will not impact the architectural components of the Art Deco Parks historic district (SIHP No. 50-80-04-1388) present at Haleiwa Beach Park.

5.5.15 Noise

For each of the three alternatives short-term noise impacts from construction activities may occur. The sensitive receptors closest in proximity to the proposed project area are primarily residences. Construction-related noise would be generated from equipment and vehicles. However, noise exposure from construction activities would not be continuous throughout the entire construction process and BMPs would be implemented to reduce or eliminate noise. Buffer zones between construction activities and sensitive receptors would be created, and construction work would be limited to the weekdays. In addition, sound barriers, mufflers, and other structures would be erected to reduce noise levels if they exceed Federal and State standards. Heavy truck and equipment staging areas would be located as far from noise sensitive properties as possible. As a result, short-term impacts from construction activities would be less than significant to the surrounding environment.

5.5.16 Visual Aesthetics

The study area is moderately urbanized, including residential and public lands. Relatively undeveloped lands are found in the areas adjacent to the study area with increasing development towards the town of Haleiwa. The visual aesthetics of these areas are typical of suburban and recreational environments. The visual aesthetics of the project area would benefit from the placement of sand under all three alternatives as the size and profile of Haleiwa Beach would be improved.

5.5.17 Recreation

The land-based recreation around the project area may be temporarily impacted by the placement of material under each of the three alternatives on the beach due to noise from the construction equipment. The beach area, where placement would occur, would need to be closed temporarily for safety reasons limiting its use. Once completed the placement of material under each of the three alternatives would provide an improvement to the water-related recreation such as paddling/canoeing, shore-fishing, swimming, and beach activities.

5.6 Tentatively Selected Plan (Alternative 4)

Alternative 4 was selected as the Tentatively Selected Plan (TSP) for the project. This alternative entails dredging the Haleiwa Small Boat Harbor Channel to a depth of 13’ MLLW, dredging material from the Ali’i settling basin, and dredging additional material from an offshore sand deposit. Under this alternative approximately 26,071 cy of beach quality sand would be placed on Haleiwa Beach over an area of approximately 4.4 acres.

5.6.1 Land Use

Under the TSP, beach quality sand would be placed on Haleiwa Beach to create a larger beach footprint than currently exists. The use of the project area would remain recreational in nature.

5.6.2 Climate

The placement of dredged material on Haleiwa Beach under the TSP would have no effect on the climate of the area. The placement of the material would not significantly offset the projected relative sea level rise for the area (see Figure 9).

5.6.3 Water Resources

5.6.3.1 Hydrology and Hydraulics

The longshore tidal flow along Haleiwa Beach would continue under the TSP. The placement of material on the beach would not affect the movement of the current. The waves used by surfers in the Northshore area would be unaffected by the TSP.

5.6.3.2 Floodplains

The dredging of material from the Haleiwa Small Boat Harbor, the Ali'i Settling Basin, and the offshore sand deposit along with its placement on Haleiwa Beach would have no adverse effect on the floodplains in the study area under each of these alternatives. No alterations to the floodplain are proposed under the TSP.

5.6.4 Wetlands

No work is proposed in the freshwater forested/shrub wetland and the freshwater emergent wetland areas within the study area under the TSP. No impacts would occur to the freshwater wetlands. The NWI defines the area just offshore of Haleiwa Beach as an Estuarine Marine Wetland. This area would have some material placed in it under the TSP, however the material would be of the same quality as the material already present and the effect on the wetland would be nonsignificant.

5.6.5 Ground Water

No impacts would occur to the groundwater of the study area. No wells or drilling are proposed under the TSP that would impact the groundwater zones.

5.6.6 Coastal Zone Management Resources

The State of Hawai'i Office of Planning is responsible for ensuring natural resources are managed and protected under CZMA. The actions of the TSP are consistent with the CZMA and Hawai'i's ORMP, in particular, Appropriate Coastal Development, Marine Resources, Coral Reef, and Community and Place-based Ocean Management Projects. An application for a Coastal Zone Management Determination will be made with the ORMP for compliance with the CZMA.

5.6.7 Air Quality

There are no non-attainment areas within the State of Hawai'i. During construction of the TSP heavy equipment would be needed, including tugs, front-end loaders, bulldozers, and the personally-owned vehicles of the employees of the construction company. The temporary increase of exhaust from these vehicles would not be expected to impact the attainment status of the region.

5.6.8 Water Quality

No work is proposed to the Anahulu River under the TSP. No impact would occur to the water quality of the river as a result of the TSP. The dredging of the ship channel, the settling basin, and the offshore sand deposit along with placement of material on Haleiwa Beach would cause temporary turbidity increases in the harbor and the area adjacent to the beach. These impacts would be temporary and nonsignificant. A 404(b)(1) application will be submitted to HSDOH to obtain a water quality certificate in compliance with the Clean Water Act.

5.6.9 Geological Resources

The geological resource impacted under the TSP is primarily the material dredged from the ship channel, the settling basin, and the offshore sand deposit. The TSP will harvest approximately 26,071 cy of material to be placed on the beach. This is material that likely eroded from Haleiwa and Ali'i beaches so net loss of material to the system would occur.

5.6.10 Soils

There are no prime or unique farmland soils within the study area, so no impacts to these resources would occur under the TSP. Beach quality sand would be dredged from the ship channel, the Ali'I settling basin, and the offshore sand deposit to be placed on Haleiwa beach. This is material that likely eroded from Haleiwa and Ali'i beaches so net loss of material to the system would occur.

5.6.11 Biological Communities

5.6.11.1 Threatened and Endangered Species

5.6.11.1.1 Hawaiian Coot

No work would be performed in the habitat for the Hawaiian coot under the TSP. The Hawaiian coot's habitat on Oahu includes coastal brackish and fresh-water ponds, streams and marshes. The TSP would have no effect on the Hawaiian coot.

5.6.11.1.2 Hawaiian Gallinule

No work would be performed in the habitat for the Hawaiian gallinule under the TSP. The Hawaiian gallinule's habitat on Oahu includes freshwater marshes, wet pastures, reservoirs, streams, and lotus fields. The TSP would have no effect on the Hawaiian gallinule.

5.6.11.1.3 Hawaiian Stilt

No work would be performed in the habitat for the Hawaiian stilt under the TSP. The Hawaiian stilt's habitat on Oahu includes shallow wetlands and freshly exposed mudflats with sparse vegetation. The TSP would have no effect on the Hawaiian stilt.

5.6.11.1.4 Green Sea Turtle

The Hawaiian archipelago has a discrete population of Green sea turtles. They are not known to nest on Haleiwa Beach or on the Ali'i settling basin. Green sea turtles have been seen in Waialua Bay. The dredging and placement of materials under the TSP would cause temporary turbidity increases in the nearshore waters. This increase of turbidity may temporarily interfere with feeding activities of the Green sea turtle. Due to this turbidity the TSP may affect, but is not likely to adversely affect the Green sea turtle.

5.6.11.1.5 Hawksbill Sea Turtle

Hawksbill sea turtles nest on undisturbed beaches, which makes Haleiwa Beach an unsuitable location for Hawksbill nesting. Sightings of Hawksbill sea turtles in Waialua Bay are rare. The dredging and placement of materials under the TSP would cause temporary turbidity increases in the nearshore waters. This increase of turbidity may temporarily interfere with feeding activities of the Hawksbill sea turtle. Due to this turbidity the TSP may affect, but is not likely to adversely affect the Hawksbill sea turtle.

5.6.11.1.6 Hawaiian Monk Seal

The marine habitat adjacent to Haleiwa Beach and Ali'i settling basin, as well as the ship channel are designated as critical habitat for the Hawaiian Monk Seal. The dredging of material from these areas under the TSP would cause a temporary increase in turbidity and may impact activities of the seal. Due to this turbidity the TSP may affect, but is not likely to adversely affect the Hawaiian monk seal and its critical habitat.

5.6.11.2 Special Status Species and Protected Habitat

5.6.11.2.1 Migratory Birds

The protection of migratory birds under the MBTA is enforced by the USFWS. Under the TSP the dredging of material from the ship channel or the settling basin would have no effect on migratory birds. The placement of material on Haleiwa Beach may affect migratory shorebirds depending on the timing of placement. Determination of the presence of migratory shorebirds would need to be surveyed in consultation with USFWS and, if present, the timing of placement would need to be coordinated in order to minimize impacts to the birds. Haleiwa Beach is a highly frequented beach by human visitors, though the brown booby and the Laysan albatross have been documented in the area and the likelihood of migratory bird impacts from the TSP is nonsignificant.

5.6.11.2.2 Marine Mammals

The dredging and placement equipment utilized under the TSP may cause marine mammals to temporarily move away from the project area, but not likely to entirely leave Waialua Bay. The increased turbidity caused by dredging activities, though temporary, may affect feeding activities of marine mammals in Waialua Bay. No takes of marine mammals are anticipated under the TSP.

5.6.11.2.3 Essential Fish Habitat

The only species/management unit that would be of concern in the project area would be the Main Hawaiian Islands Coral Reef Ecosystem. This management unit is primarily concerned with threatened and endangered species of corals but looks to protect reef habitat in general. The USFWS surveyed the project area for the presence of corals in August, 2020. Their report and data can be found in the Coordination Act Report in Attachment 1 of this appendix. While the surveyors found the presence of multiple species of corals, no threatened or endangered species were found. The TSP would have no effect on EFH.

5.6.11.2.4 Coral Reefs

As discussed in 5.6.11.2.3 the presence of small coral reefs was found throughout the project area. The dredging and placement of sand would temporarily increase the turbidity of the water where the reefs exist. This may temporarily interfere with the feeding of the corals. Silt curtains would need to be utilized to minimize this impact. The TSP would temporarily impact the coral reef community.

5.6.12 Socioeconomics

5.6.12.1 Environmental Justice

The study area does not have specific populations of disproportionately low income or minority identified within its boundaries. Therefore, the TSP would not be expected to have an impact on low income or minority populations.

5.6.12.2 Protection of Children

The study area contains the Haleiwa Beach Park which is frequented by children as a recreation area. This would continue under the TSP. Measures would be incorporated to ensure the safety of children in the project area such as exclusion fencing, signage, and securing construction equipment. With these mitigative measures in place, the alternatives would not have substantial adverse impacts on the local population of children.

5.6.13 Hazardous, Toxic, and Radioactive Waste

Only one UST was found to be located within a 0.25-mile radius of the project area. This UST would not be impacted by any of the TSP. Testing of the dredged material for contaminants would be conducted to ensure suitability for placement on the beach under the TSP. No impacts would be anticipated with regards to HTRW from the project.

5.6.14 Cultural Resources

There are expected to be no adverse impacts to cultural resources under the TSP. Since there will be no significant ground-disturbing activities, any potential coastal archaeological sites (none have been documented in the study area) will not be impacted. Due to the replenishment of sand along the shoreline, there may be beneficial effects due to a reduction in erosional threat under the TSP. The TSP will not impact the architectural components of the Art Deco Parks historic district (SIHP No. 50-80-04-1388) present at Haleiwa Beach Park.

5.6.15 Noise

As part of the TSP short-term noise impacts from construction activities may occur. The sensitive receptors closest in proximity to the proposed project area are primarily residences. Construction-related noise would be generated from equipment and vehicles. However, noise exposure from construction activities would not be continuous throughout the entire construction process and BMPs would be implemented to reduce or eliminate noise. Buffer zones between construction activities and sensitive receptors would be created, and construction work would be limited to the weekdays. In addition, sound barriers, mufflers, and other structures would be erected to reduce noise levels if they exceed Federal and State standards. Heavy truck and equipment staging areas would be located as far from noise sensitive properties as possible. As a result, short-term impacts from construction activities would be less than significant to the surrounding environment.

5.6.16 Visual Aesthetics

The study area is moderately urbanized, including residential and public lands. Relatively undeveloped lands are found in the areas adjacent to the study area with increasing development towards the town of Haleiwa. The visual aesthetics of these areas is typical of suburban and recreational environments. The visual aesthetics of the project area would benefit from the placement of sand under the TSP as the size and profile of Haleiwa Beach would be improved.

5.6.17 Recreation

The land-based recreation around the project area may be temporarily impacted by the placement of material under the TSP on the beach due to noise from the construction equipment. The beach area, where placement would occur, would need to be closed temporarily for safety reasons limiting the use of that area. Once completed the placement of material under the TSP would provide an improvement to the water-related recreation such as paddling/canoeing, shore-fishing, swimming, and beach activities.

6 Cumulative Impacts

NEPA regulations require that cumulative impacts of the proposed action be assessed and disclosed in an Environmental Impact Statement (EIS) or EA. CEQ regulations define a cumulative impact as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time.

NEPA guidance (40 CFR 2508.25) identifies resources that would be considered in a cumulative impacts analysis that should be evaluated in an EIS or EA. For an action to have a cumulative action on a resource, the action must have a direct or indirect effect on that resource, unless that resource is in declining or in a significantly impaired condition. Only one other project was found to be in effect in the project area that should be considered under the cumulative impact analysis. The City and County of Honolulu have a project to restore the Comfort Station at Haleiwa Beach and to reinforce the seawall along the beach adjacent to the Comfort Station.

When taken in conjunction with the City and County of Honolulu's project, the TSP would have a beneficial effect on recreation and the visual aesthetics of the project area. These two projects would provide for a safer environment for the long term as the wider beach and the reinforced wall would protect the area adjacent to the beach where visitors congregate and park.

7 Environmental Compliance

Federal projects must comply with Federal and State environmental laws, regulations, policies, rules, and guidance. The DIFR/EA is compliant with NEPA, HRS 343, and ER 200-1-1 (Environmental Quality: Policy and Procedures for Implementing NEPA, 33 CFR 230). Significant coordination with local, state, and federal resource agencies has occurred from the beginning of the feasibility study. In implementing the TSP, USACE would follow provisions of all applicable laws, regulations, and policies related to the proposed actions. The following sections present summaries of federal environmental laws, regulations, and coordination requirements to this study.

7.1 Clean Water Act

USACE, under the direction of Congress, regulates the discharge of dredged and fill materials into waters of the U.S., including wetlands. USACE does not issue itself permits for construction activities affecting waters of the U.S. but must meet the legal requirements of the Act. A Section 404(b)(1) analysis (Attachment 2) will be conducted for the TSP and provided to HSDOH in order to obtain a water quality certification for the study in accordance with Section 401 of the CWA. Before construction, USACE, or its contractors, will obtain a National Pollutant Discharge Elimination System (NPDES) construction activities permit from HSDOH.

7.2 Clean Air Act

Federal agencies are required by this Act to review all air emissions resulting from federally funded projects or permits to ensure conformity with the State Implementation Plans (SIPs) in non-attainment areas. The Haleiwa area is currently in attainment for all air emissions; therefore, the proposed project would be in compliance with the Clean Air Act.

7.3 National Historic Preservation Act of 1966

Federal agencies are required under Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, to "take into account the effects of their undertakings on historic properties" and consider alternatives "to avoid, minimize, or mitigate the undertaking's adverse effects on historic properties" [(36 CFR 800.1(a-c)] in consultation with the State Historic Preservation Officer (SHPO) and appropriate federally recognized Indian Tribes (Tribal Preservation Officers – THPO)[(36 CFR 800.2(c)]. There are other applicable cultural resource laws, rules, and regulations that will inform how investigations and evaluations will proceed throughout the study and implementation phases (e.g., Archeological and Historic Preservation Act of 1974, NEPA, Native American Graves Protection and Repatriation Act, and ER 1105-2-100).

In accordance with Section 106 of the NHPA, USACE consulted with the Hawaii SHPO (there are no recognized Native American tribes in Hawaii) regarding the potential to impact properties from the proposed undertaking.

7.4 Endangered Species Act

Informal consultation began with the USFWS and NMFS regarding potential impacts to threatened and endangered species within the project area in April, 2019. The results of the consultations will be included with the EA upon completion. A Biological Assessment has been prepared and will be delivered to USFWS and NMFS as part of this Draft IFR-EA (Attachment 5).

7.5 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (FWCA) requires federal agencies that are impounding, diverting, channelizing, controlling, or modifying the waters of any stream or other water body to consult with the USFWS and appropriate state fish and game agency to ensure that wildlife conservation receives equal consideration in the development of such projects.

A charette and planning site visit was held on June 18-19, 2019 to introduce the project to the state and federal agencies. A formal request for FWCA consultation was submitted to USFWS by USACE on August 27, 2019. A draft Coordination Act Report (CAR) was provided to USACE on August 18, 2020 (Attachment 1). The CAR refers to Alternatives 1, 2, 3, 4, and 5. The numbering of the alternatives was changed after USFWS started their report. In the CAR Alternative 3 is called Alternative 2a in the DIFR-EA, Alternative 4 is called Alternative 3 in the DIFR-EA and Alternative 5 is called Alternative 4 in the DIFR-EA.

7.6 Executive Order 13112, Invasive Species

EO 13112 recognizes the significant contribution native species make to the well-being of the nation's natural environment and directs federal agencies to take preventative and responsive action to the threat of the invasion of non-native species. The EO establishes that federal agencies "will not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions."

Construction activities will implement Best Management Practices (BMPs) to ensure that the spread of the non-native species outside of the project area is avoided/minimized.

7.7 Executive Order 13690, Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input; and Amendment to Executive Order 11988, Floodplain Management

EO 13690 was enacted on January 30, 2015 to amend EO 11988 , enacted May 24, 1977, in furtherance of the NEPA of 1969, as amended (42 U.S.C. 4321 et seq.), the National Flood Insurance Act of 1968, as amended (42 U.S.C. 4001 et seq.), and the Flood Disaster Protection Act of 1973 (Public Law 93-234, 87 Star.975). The purpose of the EO 11988 was to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative. The EO 13690 builds on EO 11988 by adding climate change criteria into the analysis.

These orders state that each agency shall provide and shall take action to reduce the risk of flood loss, to minimize the impacts of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for (1) acquiring, managing, and disposing of federal lands and facilities; (2) providing federally undertaken, financed, or assisted construction and improvements; and (3) conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities. The FEMA Digital Flood Insurance Rate Map (DFIRM) of the study area was analyzed to establish the locations of the 100-year flood zones. The TSP would not increase the risk of flood to the surrounding community.

In accordance with ER 1165-2-26 the project was evaluated for compliance with EO 11988. The project area is within the floodplain, though there are no alternatives to perform the action outside the floodplain as determined by the evaluation of the project alternatives discussed in the Main Report. The potential impacts and benefits of the TSP are discussed Section 5.6.3.2. The action is not likely to induce further development in the floodplain. The public has been invited to comment on the project and will have further opportunities to comment on the draft report. The proposed action would remain in compliance with EO 11988 and EO 13690.

7.8 Migratory Bird Treaty Act, Migratory Bird Conservation Act, and Executive Order 13186, Migratory Birds

The importance of migratory non-game birds to the nation is embodied in numerous laws, executive orders, and partnerships. The Migratory Bird Treaty Act demonstrates the federal commitment to conservation of non-game species. Amendments to the Act adopted in 1988 and 1989 direct the Secretary to undertake activities to research and conserve migratory non-game birds. EO 13186 directs federal agencies to promote the conservation of migratory bird populations, including restoring and enhancing habitat. Migratory Non-Game Birds of Management Concern is a list maintained by the USFWS. The list helps fulfill the primary goal of the USFWS to conserve avian diversity in North America. The USFWS Migratory Bird Plan is a draft strategic plan to strengthen and guide the agency's Migratory Bird Program. TSP would not adversely affect migratory birds and is in compliance with the applicable laws and policies.

7.9 Executive Order 12898, Environmental Justice

EO 12898 "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" dated February 11, 1994, requires all federal agencies to identify and address disproportionately high and adverse effects of its programs, policies, and activities on minority and low-income populations. Data was compiled to assess the potential impacts to minority and low-income populations within the study area. Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Minorities do not account for a large portion of the local population and the low-income population is not above the national averages, therefore the TSP would not have a disproportionately high or adverse effect on these populations.

7.10 Executive Order 13045, Protection of Children

The EO 13045 "Protection of Children from Environmental Health Risks" dated April 21, 1997 requires federal agencies to identify and address the potential to generate disproportionately high environmental health and safety risks to children. This EO was prompted by the recognition that children, still undergoing physiological growth and development, are more sensitive to adverse environmental health and safety risks than adults.

Short-term impacts on the protection of children would be expected. Numerous types of construction equipment would be used throughout the duration of the construction of the proposed action. Because construction sites and equipment can be enticing to children, activity could create an increased safety risk. During construction, safety measures would be followed to protect the health and safety of residents as well as construction workers. Construction vehicles and equipment would be secured when not in use. Since the construction area would be flagged or otherwise fenced, issues regarding Protection of Children are not anticipated.

8 References

Allard, MW, MM Miyamoto, KA Bjorndal, AB Bolton, and BW Bowen. (1994) Support for natal homing in green turtles from mitochondrial DNA sequences. Copeia 1994:34–41.

Balazs, G. (1980) Synopsis of biological data on the green turtle in the Hawaiian Islands. NOAA Technical Memorandum. NMFS-SWFC-7.

Carr, AF. (1952) Handbook of turtles: the turtles of the United States, Canada and Baja California. Comstock Publ. Assoc., Cornell Univ. Press, Ithaca, New York.

Cavanaugh, WJ and GC Tocci. (1998) Environmental noise, the invisible pollutant. Environmental Excellence in South Carolina. 1(1):1-5

City and County of Honolulu. (2019) Annual Sustainability Report. 24 pp.

1976. EPA. About Sound. Office of Noise Abatement and Control, Washington, DC. EPA 20460.

EPA. (2019) What EPA is doing to protect coral reefs. https://www.epa.gov/coral-reefs/what-epa-doing-protect-coral-reefs#uscrtf. Accessed August 20, 2020.

EPA. (2020) Nonattainment areas for criteria pollutants (Green Book). https://www.epa.gov/green-book. Accessed March 20, 2020.

Ernst, CH, and RW Barbour. (1972) Turtles of the United States. University of Kentucky Press, Lexington.

Federal Interagency Committee on Noise. (1992) Federal Agency Review of Selected Airport Noise Analysis Issues. Washington D.C.

FEMA. (2020) FEMA Flood Map Service Center. https://msc.fema.gov/portal/search?AddressQuery=Haleiwa%2C%20hawaii#searchresultsanchor. Accessed April 8, 2020.

Gingerich, SB and DS Oki. (1999) Groundwater in Hawaii. US Geological Survey. Honolulu, Hawaii. 6 pp.

Meylan, AB. (1982) Sea turtle migration – evidence from tag returns. In: K. Bjorndal (editor), Biology and Conservation of Sea Turtles. Pp. 91–100. Smithsonian Institution Press, Washington, D.C. 583 pp.

Meylan, AB, BW Bowen, and JC Avise. (1990) A genetic test of the natal homing versus social facilitation models for green turtle migration. Science 248:724–727.

Mitchell, C, C Ogura, DW Meadows, A Kane, L Strommer, S Fretz, D Leonard, and A McClung. (2005) Hawaii's Comprehensive Wildlife Conservation Strategy. Department of Land and Natural Resources. Honolulu, Hawai'i. 722 pp.

Mortimer, JA. (1982) Feeding ecology of sea turtles. In: Biology and conservation of sea Turtles (K. Bjorndal, editor), 103–109. Smithsonian Institution Press, Washington, D.C.

Musick, J. (1979) The marine turtles of Virginia with notes on identification and natural history. Educational Series No. 24. Sea Grant Program, Virginia Institute of Marine Science, Gloucester Point.

National Fish and Wildlife Laboratory (NFWL). (1980) Selected vertebrate endangered species of the seacoast of the United States. U.S. Fish and Wildlife Service, Biological Services Program, Washington, D.C. FWS/OBS-80/01.

NMFS. (2007) Recovery plan for the Hawaiian Monk Seal (*Monachus schauinslandi*). Second revision. National Marine Fisheries Service, Silver Spring, MD. 165 pp.

NMFS and USFWS. (2013) Hawksbill sea turtle (*Eretmochelys imbricata*) 5-year review: Summary and evaluation. National Marine Fisheries Service, Silver Spring, MD and U.S. Fish and Wildlife Service, Jacksonville, FL. 92 pp.

OSHA. (2011) Enforcement Guidance for Personal Protective Equipment in General Industry. CPL 02-01-050. U.S. Department of Labor. Washington, D.C.

Pritchard, PCH. (1977) Marine turtles of Micronesia. Chelonia Press, San Francisco, California.

Rebel, TP. (1974) Sea turtles and the turtle industry of the West Indies, Florida, and the Gulf of Mexico. Rev. Ed. University of Miami Press, Coral Gables, Florida.

Seminoff, JA, CD Allen, GH Balazs, PH Dutton, T Eguchi, HL Haas, SA Hargrove, M Jensen, DL Klemm, AM Lauritsen, SL MacPherson, P Opay, EE Possardt, S Pultz, E Seney, KS Van Houton, and RS Waples. (2015) Status Review of the Green turtle (*Chelonia mydas*) under the Endangered Species Act. NOAA Technical Memorandum. NOAA-TM-NMFS-SWFSC-539. 571 pp.

Stearns, HT and KN Vaksvik. (1935) Geology and ground-water resources of the Island of Oahu, Hawaii. Bulletin 1. U.S. Geological Survey. Honolulu, Hawaii. 536 pp.

U.S. Census Bureau. (2020a) https://data.census.gov/cedsci/ Accessed April 8,2020.

U.S. Census Bureau. (2020b) https://factfinder.census.gov Accessed March 25, 2020.

USFWS. (2011) Recovery plan for Hawaiian waterbirds, second revision. U.S. Fish and Wildlife Service. Portland, Oregon. 233 pp.

USFWS. (2020). Wetlands Mapper. https://www.fws.gov/wetlands/data/mapper.html. Accessed March, 20,2020.

Weller, MW and LH Frederickson. (1973) Avian ecology of a managed glacial marsh. Living Bird. 12: 269-291.

Attachment 1

Fish and Wildlife Coordination Act

United States Department of the Interior

FISH AND WILDLIFE SERVICE
300 Ala Moana Boulevard, Rm. 3-122
Honolulu, Hawai'i 96850

In Reply Refer To:
2020-CPA-0023

Stephen N. Cayetano, P.E.
Deputy District Engineer for
Programs and Project Management
Honolulu District, U.S. Army Corps of Engineers
Fort Shafter, HI 96858-5440

Dear Mr. Cayetano:

In coordination with your staff, the U.S. Fish and Wildlife Service (Service) is providing this Draft Fish and Wildlife Coordination Act Report for the proposed Haleiwa Beach Park Re-nourishment project. The Fish and Wildlife Coordination Act of 1934 [16 U.S.C. 661 et seq.; 48 Stat. 401], as amended (FWCA), was established to provide a basic procedural framework for the orderly consideration of fish and wildlife conservation measures to be incorporated into Federal water resources development projects. This report has been prepared under the authority of and in accordance with provisions of the FWCA, the Federal Clean Water Act of 1977 [33 U.S.C. 1251 et seq.; 62 stat. 1155], as amended (CWA), and the Endangered Species Act [16 U.S.C 1531 et seq.], as amended (ESA). These comments are also consistent with the National Environmental Policy Act of 1969 [42 U.S.C. 4321 et seq.; 83 Stat. 852], as amended, and other authorities mandating the Service's review of projects and provision of technical assistance to conserve trust resources.

This report was prepared by the Service; however, we have also solicited comments from the State of Hawaii's Department of Land and Natural Resources, National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS), and U.S. Environmental Protection Agency (EPA).

We appreciate the opportunity to provide input on the proposed project. If you have questions regarding the report, please contact Marine Biologist Tony Montgomery (Tony_Montgomery@fws.gov or 808-792-9456).

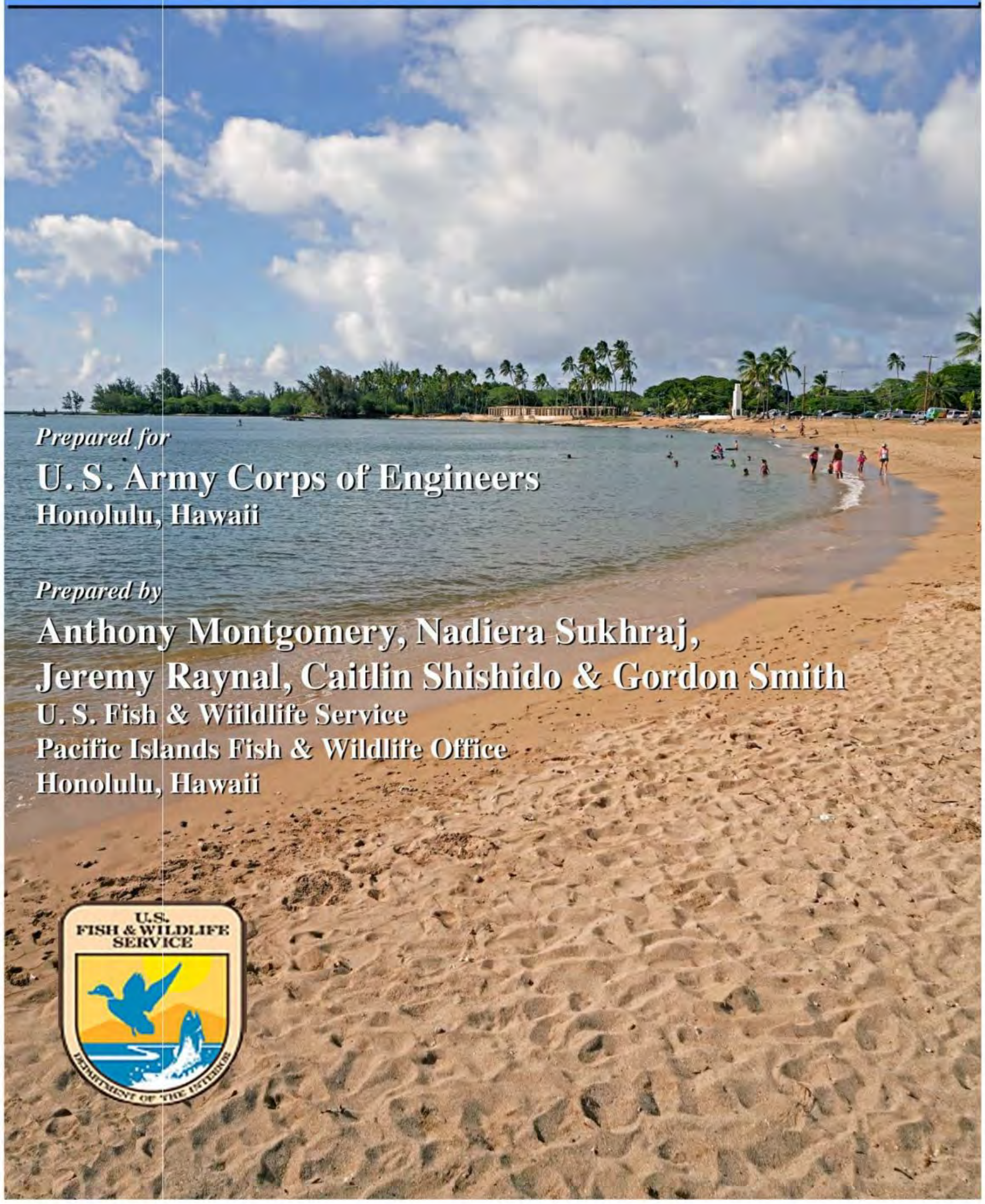
Sincerely,

DAN POLHEMUS Digitally signed by DAN POLHEMUS
Date: 2020.08.18 10:24:14 -10'00'

for Katharine Mullett
Field Supervisor

Phase 1 & 2 Marine Habitat Characterization
Haleiwa Beach Park, Oahu, Hawaii
Beach Renourishment
Fish & Wildlife Coordination Act Report

SECOND DRAFT REPORT **September 2020**



Prepared for
U. S. Army Corps of Engineers
Honolulu, Hawaii

Prepared by
Anthony Montgomery, Nadiera Sukhraj, Jeremy Raynal, Caitlin Shishido & Gordon Smith
U. S. Fish & Wiildlife Service
Pacific Islands Fish & Wildlife Office
Honolulu, Hawaii

U.S. FISH & WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR

Second Draft

FISH AND WILDLIFE COORDINATION ACT REPORT

PHASE I AND II MARINE HABITAT CHARACTERIZATION
HALEIWA BEACH PARK BEACH RE-NOURISHMENT

OAHU, HAWAII

Prepared by

Anthony Montgomery
Nadiera Sukhraj
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U.S. Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
Honolulu, HI

Prepared for

U.S. Army Corps of Engineers
Honolulu District, Civil and Public Works Branch

SEPTEMBER 2020

EXECUTIVE SUMMARY

The U.S. Army Corps of Engineers, Honolulu District's Civil Works Branch is proposing a pilot project under Section 1122 of the Water Resources Development Act of 2016 to place sand at Haleiwa Beach Park, Oahu, Hawaii. This project would beneficially reuse dredged material from the Haleiwa Small Boat Harbor as well as a sand deposition area adjacent to the harbor, a nearby offshore location, and an adjacent area south of the beach. This proposed action will provide services such as coastal protection and enhanced recreational and commercial opportunities for residents and tourists utilizing the beach area.

The U.S Fish and Wildlife Service has conducted a Fish and Wildlife Coordination Act investigation to assess the marine resources within the project area and the potential impacts associated with the proposed action. In order to complete a biological characterization of the project area, surveys were conducted to map the marine habitat and its resources at each of the project component sites. Based on that data, we divided the Haleiwa Beach Park area into five strata in order to develop a stratified, random sampling design for quantitative surveys. Quantitative surveys were then conducted at 29 sites across Sand, Pavement, Scattered Coral/Rock in Unconsolidated Sediment, Rocky Shoreline Intertidal, and Sandy Shoreline Intertidal strata. The quantitative data collected included species, size, and number of coral colonies and fishes, species and number of macroinvertebrates, estimate of benthic cover (substrate, algae, and invertebrate percent cover), and habitat rugosity.

The uncolonized bottom across all strata was high, being 100% of the Shoreline Intertidal – Sandy stratum, 99.1% of the Sand stratum, 81.9% of the Rocky Shoreline Intertidal stratum, 79.9% of the Scattered Coral/Rock in Unconsolidated Sediment stratum, and 66.7% of the Pavement stratum. This study documented a relatively low diversity of marine species, with 10 species of corals, 7 species of algae, 13 species of fishes, and 60 species of invertebrates across all 29 sites. Coral density was low across all sites, but was the most dominant in the Pavement and Scattered Coral/ Rock in Unconsolidated Sediment strata, with the most abundant species being *Psammocora stellata* (0.48 colonies/ m^2) in the Pavement stratum. The density and biomass of fishes were low across all sites, with the highest density in the Rocky Shoreline Intertidal stratum and highest biomass in the Pavement stratum. The most abundant fish species was *Acanthurus triostegus* (0.08/ m^2), while *Acanthurus nigrofuscus* had the highest biomass (0.03 tonnes/ hectare). The highest invertebrate density was in the Rocky Shoreline Intertidal stratum, while the Pavement stratum had the highest invertebrate density for subtidal habitats. The most abundant invertebrates were *Nerita picea* (10.24/ m^2) in the intertidal habitat and *Echinometra mathaei* (1.75/ m^2) among subtidal habitats. An invasive alga, *Acanthophora spicifera*, made up the highest benthic biological cover in subtidal habitats (13.3% in Pavement stratum and 12.7% in Scattered Coral/Rock in Unconsolidated Sediment stratum).

The potential impacts associated with this project are relatively small, but include possible impacts to corals, particularly *Psammocora stellata* in the northern portion of the beach park area. The most significant impact includes the loss of the majority of the Rocky Shoreline Intertidal habitat from sand placement under Alternative 5. The U.S. Fish and Wildlife Service recommends steps to minimize the impact to these two areas by avoiding sand placement in the northern section or across the Rocky Shoreline Intertidal habitat. Our position is supportive of this project with consideration of avoiding and minimizing these impacts.

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INTRODUCTION

Authority, Purpose and Scope

The U.S. Army Corps of Engineers (USACE) Civil Works Branch is proposing to place sand at Haleiwa Beach Park, Oahu, Hawaii as part of a beneficial reuse of dredged material from the Haleiwa Small Boat Harbor and nearby offshore sand sources. The USACE received funding under Section 1122 of the Water Resources Development Act of 2016 as a pilot project. The scope of this project requires consultation under the Fish and Wildlife Coordination Act of 1934 [16 U.S.C. 661 *et seq.*; 48 Stat. 401], as amended (FWCA). This report, in the form of a Fish and Wildlife Coordination Act Report (FWCAR), has been prepared under the authority of and in accordance with provisions of the FWCA (Section 2b); the Clean Water Act of 1977 [33 USC 1251 *et seq.*; 91 Stat. 1566], as amended (CWA); the Endangered Species Act of 1973 [16 U.S.C. 1531 *et seq.*; 87 Stat. 884], as amended (ESA); and other authorities that authorize the Service to provide technical assistance to conserve trust resources.

The FWCA provides the basic authority for the Secretary of the Interior, Secretary of Commerce, and the appropriate State fish and game agency to assist and cooperate with Federal, State and public or private agencies and organizations in the conservation and rehabilitation of aquatic wildlife. This authority provided to the Secretary of the Interior is through the U.S. Fish and Wildlife Service (and subsequently delegated to Ecological Services Program), for the Secretary of Commerce through the National Marine Fisheries Service (NMFS) via Reorganization Plan No. 4, and to the State of Hawaii through Department of Land and Natural Resources, Division of Aquatic Resources (DAR).

The Pacific Islands Fish and Wildlife Office (PIFWO) conducted this FWCA investigation to document the resources within the project area and analyze the potential impacts to marine resources, and as the lead agency has the responsibility of ensuring that concerns and recommendations of the other resource agencies are considered fully in FWCA reviews. The NMFS and DAR were invited to take part in the fieldwork, but were unable to participate. The draft report (August 2020) was sent to NMFS, the Environmental Protection Agency (EPA), and DAR. NMFS and EPA notified the Service they had no comments while DAR has provided comments (Appendix G). Those comments have been incorporated into this report. This report was prepared using the guidance described in Smalley (2004).

Description of Project Area and Proposed Action

The Haleiwa Beach Park is located on the island of Oahu, Hawaii, in the tropical north Pacific (Figures 1 & 2). The site lies along the northern coast of Oahu at Waialua Bay. The depths in this area range from 0 to 3 meters (m) (0 to 10 feet). The Haleiwa Beach Park is at the mouth of the Anahulu River and northeast of the Haleiwa Small Boat Harbor. The Beach Park is operated and maintained by City and County of Honolulu (CCH).

The Haleiwa Beach Shore Protection Project was authorized by the River and Harbors Act of 1965 and constructed in the same year. The project consisted of an offshore breakwater (160 feet by 520 feet), terminal groin on the southern edge of the beach, and beach fill 1,600 feet long and 140–265 feet wide. The USACE undertook emergency repairs of the project in the 1970s, consisting of repairs to the groin and offshore breakwater, as well as placing approximately 12,000 cubic yards of sand. The project authorization allows the USACE to undertake emergency repairs as needed, but the non-federal sponsor (State of Hawaii's Department of Transportation) is responsible for maintenance (USACE 2018).

The Haleiwa Small Boat Harbor was constructed in 1966 and modified in 1975 with the addition of the stub breakwater and wave absorber. It was dredged in 1999, with 7,214 cubic yards of material removed, and again in 2009 with 6,500 cubic yards removed. The material was disposed in an upland area, except for a small amount in 2009, which was used at Haleiwa Beach Park for repairs.

This proposed project aims to place beach quality sand within the existing beach and nearshore marine waters of Haleiwa Beach Park. The placement of additional sand will provide services such as coastal protection, as well as enhanced recreational and commercial opportunities for residents and tourists utilizing the beach area. Coastal erosion of this area has been severe, and most pronounced in front of the CCH comfort station. In 2019, the CCH repaired the wall of the comfort station due to concern of eminent collapse, but this wall will be subject to further erosion without additional protection. The USACE proposal for project funding reports that the area in front of the comfort station would receive sand first, as this is the most critical portion of the beach (USACE 2018). Please see below (section DESCRIPTION OF ALTERNATIVES UNDER CONSIDERATION) for the description of the five proposed alternatives.

Proposed sources of sand for the beach re-nourishment include an offshore sand area, the outer portion of the small boat harbor federal channel, a small sand deposition area adjacent to the channel, and a dredged access channel adjacent to the groin at the southern end of Haleiwa Beach Park. Dredging of the offshore sand area would remove 15,000 cubic yards of beach suitable sand. Routine Operations and Maintenance of the federal channel would dredge the channel to 13 feet below Mean Lower Low Waterline (MLLW) by removing an estimated 2,433 cubic yards beach suitable sand and 2,000 cubic yards of non-suitable material. Dredging of the sand deposition area adjacent the channel would remove 2,200 cubic yards beach quality sand to 8 feet below MLLW. In order to offload the sand, a dredged channel south of the southern beach groin will be dredged to 10 feet below MLLW by removing 4,733 cubic yards of material. The proposed dredging activities will be conducted with a barge-mounted crane and environmental clamshell bucket dredge, placed on a scow, and barged to the access channel to be mechanically placed on the beach. Material not suitable for the beach will be disposed at the South Oahu Ocean Dredged Material Disposal Site located 3 miles south of Pearl Harbor and 46 miles from Haleiwa Small Boat Harbor at depths of 1,300 to 1,650 feet.

Prior Fish and Wildlife Service Studies and Reports

The Service completed a Phase I habitat-mapping survey for Haleiwa Small Boat Harbor in August – September 2012 and sent a report to the USACE on September 14, 2012 (2012-CPA-0003). The report included a qualitative description of the resources within the federal channel and data on coral colonies growing on the rock revetment.

Prior Studies and Reports from other agencies

The Service is unaware of any other studies or resource investigations within the area.

Coordination with Federal and State Resource Agencies

USACE charrette planning site visit – June 18, 2019

USACE charrette planning meeting – June 19, 2019

USACE request for FWCA consultation – August 27, 2019

USFWS coordination with NMFS – August 28 – September 24, 2019

USFWS Scope of Work and Budget – October 2, 2019

USFWS Revised Scope of Work and Budget – January 29, 2020

Receipt of the Military Inter-department Purchase Request – February 25, 2020

Invitation to State of Hawaii, Division of Aquatic Resources to participate – March 11, 2020

Fieldwork conducted – May 30 and June 23–26, 2020

Draft data graphs to USACE – July 13, 2020

Draft report sent to NMFS – August 18, 2020

Draft report sent to DAR – August 18, 2020

Draft report sent to Environmental Protection Agency – August 18, 2020

Draft report sent to USACE – August 19, 2020

Comments on draft report from USACE – August 25, 2020

Comments on draft report from NMFS – August 26, 2020

Comments on draft report from EPA – September 8, 2020

Comments on draft report from DAR – September 22, 2020

FISH AND WILDLIFE RESOURCE CONCERNS AND PLANNING OBJECTIVES

U.S. Fish and Wildlife Service Planning Objectives

The mission of the Service consists of working with partners to conserve, protect, and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people. In 2016, the Service updated its 1981 mitigation policy to better meet this mission (USFWS, 2016), but has since rescinded the revised 2016 mitigation policy (USFWS, 2018) leaving the 1981 policy in effect. The Service's 1981 Mitigation Policy (USFWS, 1981) outlines internal guidance for evaluating project impacts affecting fish and wildlife resources. The Mitigation Policy complements the Service's participation under NEPA and the FWCA. The Service's Mitigation Policy was formulated with the intent of protecting and conserving the most important fish and wildlife resources while facilitating balanced development of this nation's natural resources. The policy focuses primarily on habitat values and identifies four resource categories and mitigation guidelines. The resource categories are shown in Table 1.

The Haleiwa Beach area is considered a coral reef and meets the description of Resource Category 3. This coral reef area should be considered medium to high value due to the marine resources documented in this survey. However, this reef has been classified as Category 3, based on its current condition described below, while most Hawaiian coral reefs are rated at Category 2. In general, coral reefs are considered scarce based on their local, national, and global decline (Williams et al., 2009; Walsh et al., 2010; Waddell (ed.), 2005; Waddell and Clarke (eds.), 2008; Wilkinson (ed), 1998; Wilkinson (ed), 2000; Wilkinson (ed), 2004; Wilkinson (ed), 2008) and their geographical constraints within the United States. Coral reefs have also been designated as Special Aquatic Sites under the Clean Water Act (CWA). Special Aquatic Sites are defined as "geographic areas, large or small, possessing special ecological characteristics of productivity, habitat, wildlife protection, or other important and easily disrupted ecological values." They are further described as "significantly influencing or positively contributing to the general overall environmental health or vitality of the entire ecosystem of a region" (40 CFR Part 230 §230.44/FR v.45n.249).

Table 1: Resource categories. Resource categories and mitigation planning goals.

Resource Category	Designation Criteria	Mitigation Planning Goal
1	High value for evaluation species and unique and irreplaceable.	No loss of existing habitat value.
2	High value for evaluation species and scarce or becoming scarce.	No net loss of in-kind habitat value.
3	High to medium value for evaluation species and abundant.	No net loss of habitat value while minimizing loss of in-kind habitat value.
4	Medium to low value for evaluation species.	Minimize loss of habitat value.

These designations of Resource Category 3 and Special Aquatic Site require the Service to recommend ways for the action agency to mitigate losses, through measures to avoid or minimize significant adverse impacts. In the event losses are unavoidable, measures to rectify immediately, reduce, or eliminate losses commensurate with project permitting or implementation will be recommended under the FWCA. Recommendations will focus on compensation for the replacement of in-kind habitat values and ecological functions. An effective and verifiable mitigation program planned and executed by the project proponent is required under NEPA and the CWA.

To this end, it is the policy of the Service to provide federal leadership for the conservation, protection, and enhancement of fish, wildlife, and their habitats by seeking to mitigate their losses with a facilitated, balanced approach to proposed water development actions. The Service's 1981 mitigation planning policies achieve this by the following: 1) State-Federal Partnership, 2) Resource Category Determinations, 3) Impact Assessment Principles, 4) Mitigation Recommendations, 5) Mitigation means and Measures, and 6) Follow-up.

Within these planning policies, *evaluation species* is a key term to describe the fish and wildlife resources selected for impact analysis. There are two basic approaches to the implementation of evaluation species: 1) selection of species with high public interest, economic value, or both, and 2) selection of species to provide a broad ecological perspective of an area. While some species may be appropriate for both approaches, we emphasize using species that provide a broad ecological perspective.

The evaluation species typically used for tropical Pacific marine ecosystems include stony corals, seagrasses, and certain benthic algal groups (*Halimeda* meadows or unique coralline algal communities). Some situations may dictate the use of additional species, and the Phase 1 protocols that the Service uses capture the key benthic resources that are of interest. Other situations may warrant considering key fish species as important evaluation species.

These evaluation species are important as they also relate to other federal agency policies. Coral reefs in general are considered high value habitat and have been defined in the CWA Section 404(b)(1) guidelines as "skeletal deposits, usually of calcareous or silicaceous materials, produced by the vital activities of anthozoan polyps or other invertebrate organisms present in growing portions of the reef." Stony corals are a foundation species to the development of coral reefs and hence are often the central focus of mitigation within the Pacific Island region. Coral reefs are further considered to be Special Aquatic Sites under the CWA 404(b)(1) guidelines. Finally, the 404(b)(1) guidelines also consider vegetated shallows to be Special Aquatic Sites. Within the Pacific Islands, the Service considers *Halimeda* meadows and seagrass communities to be vegetated shallows. Such Special Aquatic Sites are areas that possess special ecological characteristics and contribute to the overall benefit of the ecosystem.

This report is a Phase I and II investigation that addresses the Service's mitigation framework to the extent that the data are sufficient. A Phase I report aims to provide broad information for avoidance and minimization of negative environmental impacts, but does not include information necessary for scaling and planning a compensatory mitigation package. A Phase II investigation addresses the remaining components of the Service's mitigation framework and can also provide information for scaling and planning a compensatory mitigation package, if necessary.

Resource Concerns

The primary concerns associated with the proposed project include the direct impacts associated with the placement of sand on existing marine habitat, particularly the Shoreline Intertidal community. The proposed Alternative 5 would cover a significant amount of Shoreline Intertidal area as well as some portions of the Pavement and Scattered Coral/Rock in Unconsolidated Sediment habitats, although the latter is a much smaller portion of the total area. The specific planning objective is to provide technical assistance and recommendations to USACE to allow equal weight to be given to both project benefits and natural resources in decision-making. To achieve this goal, we provide the following: 1) biological and habitat data for the Haleiwa Beach Park area; 2) analysis of potential impacts of the proposed project to fish and wildlife resources and their habitats; and 3) recommendations for minimization and avoidance measures.

EVALUATION METHODOLOGY

Phase I Habitat Mapping

A team of two biologists using snorkel collected information on the habitats and biological communities within and adjacent to the project footprint. The survey team was equipped with digital cameras, dive watches, floated GPS units, and datasheets attached to a clipboard to record data. The time on the digital camera was synchronized with the GPS units by photographing the time of the GPS unit before entering the water. In addition, the time difference between the dive watch and GPS unit was recorded on the datasheet. The team was familiar with the proposed project area and had pre-determined starting points and areas for the initial survey. The number of survey transects was determined based on the time available and an estimated area covered.

A survey transect consisted of the team collecting habitat and biological information as described below along a swim path while towing a pair of floated GPS units. The floated GPS units were always maintained/aligned near the team to minimize spatial error between the biologists and the GPS. All survey transects were marked by a starting waypoint and an ending waypoint. GPS units were set to the local time and set to record a track log automatically at 5-second intervals.

The biologists on the survey team consisted of a habitat/coral surveyor and an algal/invertebrate surveyor. All biologists collected data on observed habitat zones, debris observations, and protected species as well as their respective biological groups. The visual observation area that was qualitatively evaluated was estimated by each biologist and recorded in meters. The estimation distance was influenced by water clarity, rugosity of habitat, complexity of habitat, water depth, and other environmental conditions that limit visual distance. One biologist was assigned as the navigator; this person followed a pre-determined compass bearing, depth contour, habitat boundary or other criteria that determined the survey transect path. Each biologist carried an underwater camera to document species and habitat types observed.

Habitat Terminology and Characterization

Habitat terminology used was modified from Battista et al. (2007) and detailed definitions ae available from the Pacific Islands Fish and Wildlife Office upon request. Although the classification of Battista et al. (2007) was not developed specifically for impact assessments, the terminology and characterization framework were deemed generally appropriate for the purposes of characterizing habitats for this Phase I survey. The framework described in Battista et al. (2007) included three data layers of habitat information, consisting of a classification of geographic zones, geomorphological structures, and biological cover. The terms for geographic zones, geomorphological structures, and major geomorphological structures are used here with slight modification. The "geographic zones" are subsequently called "habitat zones," the "geomorphological structures" are subsequently called "habitat structures," and the "major geomorphological structures" are subsequently called "major habitat structures." By contrast, the biological cover classification scheme of Battista et al. (2007) is not used. Instead, the biological cover classification scheme used here is modified and expanded substantially from Battista et al. (2007), as described below.

Habitat zones were generally determined prior to entering the water or after exiting from the water and were recorded by the habitat/coral and algae/invertebrate surveyors. Habitat structures were determined in the water to the best ability of the habitat/coral surveyor. Water clarity and conditions could impact the diver's ability to determine the specific habitat structure, but it was generally determined while in the water. Biologists, particularly the navigator, followed along a habitat structure boundary when appropriate in order to assist with further delineation between habitat structures. Care was taken when conducting the biological characterization along these boundaries. The biological characterization was focused on one side of the observed boundary so that it was applied appropriately to each particular habitat structure involved. This aspect was coordinated by the observers and noted on the datasheet. The boundaries between habitat structures were evaluated or refined during the data processing phase (see Habitat Map Production methods). The types of unconsolidated sediments observed were also recorded, being scored as present or absent. These included sand, mud, rubble, and cobble as described below.

In addition to characterizing the habitat structures, the habitat/coral surveyor also characterized habitat complexity. The categories of habitat complexity are the same as used by NOAA's Pacific Islands Fishery Science Center (Brainard et al. 2008; Brainard et al. 2012). As stated in Brainard et al. 2008, "Estimates of habitat complexity were subjective assessments of topographical diversity and complexity of the benthic habitat and were classified according to one of six categories: low, medium-low, medium, medium-high, high, and very high (Fig. 2.4.2b). As examples, low habitat complexity is often associated with flat sand plains or rubble habitats; medium habitat complexity is often associated with small to moderate spur and groove, coral or boulder habitats; and high or very high habitat complexity are often observed as high or extreme vertical relief associated with steep spur-and-groove canyons, pinnacles, and walls." These six categories were recorded on a 0-5 scale with 0 for low, 1 for medium-low, 2 for medium, 3 for medium-high, 4 for high, and 5 for very high.

Biotic Characterization

The biologists collected information on various biological groups/categories and species inventoried along the survey transect. The information on the various biological groups/categories (as described below) was recorded at a frequency of every 15 to 60 seconds depending on the habitat area and speed of swimming, but varied under different circumstances. The area that could be reasonably visually assessed was recorded at each point and varied based on water depth, water visibly, or other environmental factors. The biotic characterization included three main survey components (habitat/coral, algae/invertebrate, and ESA corals) and each main component had multiple data collection components.

Habitat/Coral Characterization

The habitat/coral surveyor (Tony Montgomery) collected information on habitat as described above, as well as six different components of the coral population within an area. These components included the relative abundance of stony coral, stony coral growth forms observed, estimated stony coral sizes present, and presence of non-stony corals. Details for each component are given below. Each observation was collected with the specific time (hh:mm:ss) that was later converted to a GPS coordinate by the closest GPS track log coordinate within a five second window. This conversion was completed in a Microsoft Access© database. The area that could be visually assessed reasonably for coral abundance was estimated as a visual distance in meters (in terms of a radius) and recorded on the datasheet. The observer also carried an underwater camera to take photographs of representative habitats, representative coral communities, coral colonies for species identification, or any other notable feature of interest.

Component 1 – Habitat structure and sediment were classified on a continual basis and with the same frequency as other data. Habitat zone was classified at the start of the dive or when a change of zone was found.

Component 2 – Relative abundance of coral was recorded utilizing a modified DACOR method. DACOR stands for dominant (5), abundant (4), common (3), occasional (2), or rare (1), and categories were recorded on a 1-5 scale with 1 being Rare and 5 being Dominant. Zero was used for coral absence. Each category was approximated to represent a broad range of percent coral cover such as 1 – <1% (scattered corals), 2 – <10%, 3 – 10-50%, 4 – 50-80%, and 5 – >80%.

Component 3 – The stony coral growth forms included: 1) lobate/massive, 2) conical, 3) small-branching, 4) medium-branching, 5) large-branching, 6) digitate, 7) columnar, 8) table, 9) plate, 10) foliaceous, 11) encrusting, 12) free-living, and 13) mixed. Possible mixed growth forms included forms like plates-and-column and plates-and-branched, but if other combinations existed, they were recorded. The distinction between small and medium branching colonies were made by using the approximate diameter of a pencil (< 1 cm) while the distinction between medium and large branching colonies were made by using the approximate diameter of a small wrist (< 5 cm). For data analysis, these growth forms were lumped into fewer categories including: 1) lobate, microatoll, branching, encrusting, plate-like, and free-living.

Component 4 – For each growth form observed, the sizes observed were recorded into broad size categories, including: 1) small included colonies estimated less than 50 cm, 2) large included colonies greater than 50 cm, 3) mixed included colonies of both small and large, and 4) extra-large included colonies greater than 2 m.

Component 5 – Non-stony coral groups were recorded as present or absent. The groups included: 1) soft corals, 2) zoanthids, 3) gorgonians or sea fans, and 4) black or wire corals.

Component 6 – If coral disease or bleaching were observed, it was noted in the comments section of the datasheet and recorded in the Access database. It was recorded as present or absent as coral stress, and then logged as disease, pale bleached, partial bleached, or complete bleached.

Algae/Non-Coral Invertebrate Characterization

The algal/invertebrate observer (Dr. Nadiera Sukhraj) collected information on up to eight different components. These components included relative abundances for seagrass, turf algae, coralline algae, filamentous algae, macroalgae, and several invertebrate groups. The observer also recorded observations of debris. Additionally, the observer developed an overall species list for algae and non-coral invertebrates. The details for each component are listed below. Each observation was collected with the specific time (hh:mm:ss) that was later converted to a GPS coordinate by the closest GPS track log coordinate within a five second window. This conversion was completed in a Microsoft Access© database. The area that could be reasonably assessed for algal/invertebrate abundance was estimated as a visual distance in meters (in terms of a radius) and recorded on the datasheet. The observer also carried an underwater camera to take photographs of representative habitats, representative algal and invertebrate communities, algae and invertebrates for species identification, or any other notable feature of interest.

Component 1 – Relative abundance for seagrass was recorded on a scale of 0–3. Zero was used for seagrass absence. Category 1 represented seagrass abundance that consisted of isolated patches and did not have continuous coverage within an area. Category 2 represented seagrass that had a semi-continuous or continuous coverage, but had a low density of blades. Category 3 represented seagrass with a continuous coverage and had a high density of blades or a tall canopy height. The species of seagrass was recorded.

Component 2 – Relative abundance for turf algae was recorded on a scale of 0–3. Zero was used for turf algae absence. Category 1 represented turf algae that had sparse or patchy coverage and/or low density of turf algae. Category 2 represented a moderate, semi-continuous coverage and a low to moderate density of turf algae. Category 3 represented a continuous coverage and a high density of turf algae. Turf algae for the purpose of this assessment were sparse to thick multi-specific assemblage of diminutive and juvenile algae less than 2–3 cm in canopy height.

Component 3 – Relative abundance for coralline algae was recorded on a scale of 0–3. Zero was used for coralline algae absence. Category 1 represented a sparse or patchy coverage of coralline algae. Category 2 represented a moderate or semi-continuous coverage of coralline algae. Category 3 represented a continuous coverage of coralline algae. Coralline algae were assessed for readily visible corallines mostly that are red or pink on the reef surface. The observer did not look in holes or under rocks to assess the coralline algae abundance.

Component 4 – Relative abundance of filamentous algae and cyanobacteria was recorded on a scale of 0–3. Zero was used for absence of filamentous algae or cyanobacteria. Category 1 represented a sparse or patchy coverage of filamentous algae or cyanobacteria. Category 2 represented a moderate or semi-continuous coverage of filamentous algae or cyanobacteria. Category 3 represented a continuous coverage and a high density of filamentous algae or cyanobacteria. Filamentous algae for the purposes of this assessment was defined as hair-like plants that do not form a substantial thallus or a coherent tissue (definition modified from Huisman et al. 2007, page 254). Common filamentous algae that are representative of this group include *Cladophora* spp. or *Bryopsis hypnoides* (not *Bryopsis pennata*). Common cyanobacteria that are representative of this category include *Lyngbya* spp. and *Hormothamnion* sp.

Component 5 – Relative abundance of macroalgae was recorded on a scale of 0–3. Zero was used for macroalgae absence. Category one classification represented sparse or patchy (even individual plants) and a low density of macroalgae. Category two classification represented moderate, semi-continuous coverage and a low to moderate density of macroalgae. Category 3 represented a continuous coverage with a high density of macroalgae. In addition to recording the relative abundance, four forms of macroalgae were recorded as being present or absent and included short frondose, tall frondose, *Halimeda* algae, or invasive macroalgae. Short frondose macroalgae was defined as having a maximum canopy height of 20 cm and tall frondose macroalgae was defined as a canopy minimum canopy height of 20 cm.

Component 6 – Relative abundance for all non-coral invertebrates was recorded on a scale of 0–3. Zero was used for invertebrate absence. Category one classification represented an observation of 1–2 individuals. Category two classification represented the observation of 3–10 individuals. Category 3 represented the observation of more than 10 individuals. If an aggregation of significantly more than 10 individuals was observed, this was recorded in the comments section. The invertebrate groups included grazing sea urchins, rock boring sea urchins, crown-of-thorns starfish, lobsters, *Pinctada margaritifera*, giant clams, anemones, sea cucumbers, mollusks (strombids, top or turbin shells, Triton's Trumpet, helmet shells, etc.), octopus, seastars (*Linckia* sp., *Culcita* sp., or others) and, crinoids. In addition, the presence and absence (but not relative abundance of) sponges and tunicates in all forms and shapes were recorded.

Component 7 – The observation of marine debris (deb) or remnant structure underwater was recorded as present or absent. The type of structure or debris was recorded (UXO, tires, misc., etc.).

Component 8 – The final component was the compilation of an overall species list for all algae and invertebrate species observed. Species were identified to the lowest taxonomic level possible, either *in situ* or by subsequent examination of photographs taken on-site. , but it is an estimate of species richness along one transect

Post-Field Work Data Processing

Data Preparation

At the end of each dive day, digital images and GPS data were downloaded using appropriate software. Images were placed into daily folders and GPS data were downloaded using DNRGPS 6.0© as a tab-delimited text file (.txt). Benthic data were entered into a Microsoft Access© database. After all data were entered into the Access database, the gps data, dive data, habitat-coral data, and algae-invert data were validated for errors or anomalies. All errors were corrected and the data was processed for geosyncronization. The final, validated, georeferenced data were outputted as a database file (.mdb).

Data Processing

Habitat map data layers were produced with a Service custom built scripts (Marine_Mapping_Model1_v4.R and Marine_Mapping_Model2_v4.R) using R software (R Core Team, 2020). These custom built scripts use several packages including RODBC (Ripley and Lapsley 2020), sf (Pebesma et al. 2020), raster (Hijmans et al. 2020), rgdal (Bivand et al. 2020a), dismo (Hijmans et al. 2017), deldir (Turner 2020), maptools (Bivand et al. 2020b), rgeos (Bivand et al. 2020c), smoothr (Strimas-Mackey 2020), spatialEco (Evans et al. 2020), and cleangeo (Blondel 2019). The first script (Marine_Mapping_Model1_v4.R) processes the raw survey data exported from the database file. External data can be incorporated into the data processing including NOAA's Benthic Habitat Maps (Battista et al. 2007), land classification layers, existing DEM layers, or habitat classification from Feature Analyst©. In this current project, NOAA's benthic classification data was incorporated into the classification layer produced from this projects field data that provided a comparative option for the final classification. After these individual datasets were processed, they were incorporated and combined into the draft classification layer. This draft layer was processed based on comparative criteria and manual interpretation of the results that produced a final classification layer in the second script (Marine_Mapping_Model2_v4.R). The second script also finalized the geoprocessing steps and incorporated a series of interpolations for all the biological groups as described previously. Currently, this script remains in development after transition the model from Modelbuilder in ArcGIS© 10.2.2 to R and the final interpretation layers are not available for this project.

Initial input layers used to begin the data processing included an area enclosure, target area shapefiles, land classification layer, and raw database output file. The target area shapefile represented the total, maximum area (inclusion of all potential alternatives) of the anticipated direct impact area of the proposed action. This layer was provided to the Service by the USACE. The area enclosure shapefile represented the area that bounds the total project area. The land classification layer was a layer developed prior to data collection that estimated the land boundary (including any dock area) from marine areas below the mean higher high waterline (MHHW) or estimated MHHW.

During the classification stage, there were set classification criteria as well as manual interpretation of the layer classifications used to make the final classification determination. The set classification criteria and manual interpretation determined the boundaries of the habitat structures by: 1) direct observation, 2) transects that were swum along habitat structure transition boundaries (i.e. scattered rock in unconsolidated sediment on one side and unconsolidated sediment-sand on the other side), 3) utilizing NOAA's Benthic Habitat Maps where deemed appropriate, or 4) other data sources as described previously (Feature Analyst outputs based on WorldView-2 imagery) that provided information on habitat structures. These boundaries may not represent the exact delineation between habitat structures, but serve as an estimate based on the available information. After the boundaries are drawn for each habitat character, the edited Theissen polygon was validated to reassure all changes are correct and complete.

The models also generated output tables that included all geodetic area calculations for each habitat major structure, habitat structure, sediment type, and habitat zones.

Phase II Quantitative Habitat Characterization

Stratified, Random Sampling Design

Prior to the quantitative field surveys, random survey locations were determined using a stratified, random sampling design across the project area. The project area includes the estimated area along the coastline and out to a 90–100 m offshore (estimated distance of potential sand impacts on the reef flat). Strata were developed based on the Phase I data describe above.

A total of four strata were initially determined based on different habitat characteristics (Figure 3) across the project area. These strata included the habitat structures of unconsolidated sediment (sand), pavement, and scattered Coral/Rock in unconsolidated sediment and the habitat zone of shoreline intertidal. Within the shoreline intertidal, the area was broken into four areas based on intertidal characteristics. After data collection, it was decided that the Shoreline Intertidal stratum should be split into Rocky and Sandy strata resulting in a total of 5 strata evaluated.

Five to 20 random points were placed in each stratum polygon using ArcGIS© and the Create Random Points tool. The points were limited to not be within 10 m of other points. Each point was assigned a bearing that was approximately parallel to the shoreline (approximately north or south based on distance to stratum edge) or in a direction that allowed for 25 m to remain within the stratum. If transects would cross due on location and bearing, the first assigned transect would be used and the crossing transect(s) would be deleted that represents sampling without replacement. These points were exported into a Microsoft Excel© table with a corresponding latitude and longitude. The pre-determined bearing was used to guide the direction of the transect line and reduce any bias by the diver. The result provided 35 potential transects across the project including 10 in Scattered Coral/Rock in Unconsolidated Sediment, 7 in Pavement, 5 in Sand, and 13 in Shoreline Intertidal strata.

Rapid Ecological Assessment Survey Protocols

Each day a survey team was assembled to collect reef fish, coral, marine plant, non-coral macroinvertebrate, and geomorphological data for subtidal surveys (intertidal surveys were modified as described below). The team was comprised of 3 biologists including one coral biologist, one reef fish biologist, and one non-coral macroinvertebrate and algal biologist. This fish biologist also collected rugosity and the coral biologist collected (at some sites) imagery for photogrammetry. Each survey team was equipped with digital cameras, GPS units (Garmin 64st), two red surface buoys with line reels, bottom transect reels, and clipboards with datasheets to record data.

For these surveys, there was no vessel available for support. A safety diver (on snorkel) was added to the overall team and provided surface support. The safety diver accompanied all divers during surveys to help support divers while swimming along the transect. Divers were not always in sight due to water visibility, so the safety diver remained on the surface to serve as a back-up buddy for the divers.

Before divers entered the water, small marker buoys were deployed at pre-determined sites to guide the divers where transects need to be placed. The team, then entered the water and swam to the surface marker buoy towing two red surface buoys. The team collected GPS waypoints to mark the starting point of the 25-m survey transect before descending. At the bottom, the team determined if the habitat observed in the pre-determined bearing direction was that expected for the stratum (e.g. not sand in an expected hard bottom habitat). If the habitat was not as expected, the reciprocal bearing was assessed and used, with changes noted in the site information list. The same protocol was repeated for every dive.

After descending at a survey point, the team secured one red buoy at the 3-lb weight marking the 0-m point of the first transect. The reef fish diver then led the team along a pre-determined compass bearing while laying out a 25-m transect line and towing a second red buoy. The surface support diver tracked the fish diver and kept visual contact during the survey. While swimming the line out, the diver identified and counted the number of reef fish species present. When the diver reached the end of the 25-m transect line, the reel and line with the second red buoy was secured to the substrate. The safety diver collected a GPS waypoint after the fish diver secures the float to the end of the transect. The fish diver then swam back to the 0-m mark and began to collect a rugosity measurement along the transect. After finishing, the fish diver retrieved the second red buoy and remained on the surface until the rest of the team was completed. The coral and invertebrate divers then started collecting coral and invertebrate data along the transect line soon after the fish diver started. The invertebrate diver collected quadrat point count data while swimming back along the transect line. After completing data collection, the divers rolled up the transect line and surfaced together at the first red buoy. The divers regrouped on the surface and moved to the next survey site.

Reef Fish Survey Protocols

The reef fish diver (Gordon Smith) identified to the lowest taxa level possible (usually species), counted, and sized of each fish observed within an estimated 4-m wide area (ie.,2-m wide on each side) while deploying the 25-m transect line. When the diver reached the end of the 25-m transect line, the line was secured to the substrate. The same diver then swam back toward the beginning of the transect, with the surface support diver following. Transect width was adjusted for water visibility as necessary. Each 25-m x 4-m transect (100 m^2), the survey station, was treated as a unit for summarization.

Rugosity Survey Protocols

The reef fish diver was also tasked with obtaining rugosity measurements from the 0-m to 10-m section of each transect. Rugosity (f_r) is a measurement of reef complexity and is an indication of reef relief and/or of the presence of coral, which creates a complex surface as it grows. A diver used a 25-m light brass chain marked at 0.5 m intervals and draped it over the bottom along the transect line. The length of chain was recorded for the 10-m section. Each rugosity measurement for each transect was treated as a separate unit for data analysis.

Coral Survey Protocols

The coral diver (Tony Montgomery) conducted surveys for coral number, size, and morphology. All coral colonies within a 25-m x 1-m belt transect were counted, sized, and assigned a morphological category. Corals were identified to the lowest possible taxonomic level (generally species), and two horizontal dimensions of each colony were measured and recorded on a data sheet. Coral colonies were counted and measured using the center-point rule; only colonies with their center falling within the 1-m belt width were included. Each 25-m (25 m^2) transect section was treated as a separate unit for data analysis.

In addition, colony condition was recorded, noting whether partial mortality, fragmentation, bleaching, and/or growth anomalies were present. Each colony that had undergone complete fission was also noted, sized as if the colony were whole across parts, and its percent of live/dead tissue visually estimated. Fission is the partial mortality of a coral colony that results in separation of a colony into pieces that are genetically identical (*i.e.*, ramets) and remain attached to the substratum. Unattached fragments were also noted and sized separately. Gross growth anomalies and/or anomalous patterns of tissue loss by taxa were photographed if encountered.

Non-coral Macroinvertebrate Survey Protocols

The non-coral macroinvertebrate and algal diver (Dr. Nadiera Sukhraj) conducted counts for non-coral macroinvertebrates while following the coral diver. The diver swam along the 25-m transect line and counted and identified unattached non-coral macroinvertebrates 1-m to either side of the line to the lowest possible taxonomic level. Time limitations reduced the ability to search for organisms in crevices and cavities, and turbidity reduced visibility in some cases. It is therefore likely the survey observations are an underestimate of true species density and diversity. Each transect (i.e. the station) is treated as a 50 m^2 (25-m x 2-m) unit for data analysis.

Benthic Cover Survey Protocols

The non-coral macroinvertebrate and algal diver conducted benthic cover surveys as well as counts for non-coral macroinvertebrates while swimming back along the transect line. The diver placed three 0.5 m x 0.5 m (0.25 m^2) quadrats at three pre-determine points (5, 12, and 20 m mark) on the reef substrate along each of the 25-m survey transect line at each station. Using a point-intercept method, the diver identified all benthic taxa (*e.g.*, marine plants, urchins, sponges) and abiotic components (*e.g.*, rock, sand, mud) under each point and assigned each point a value of one (1) on the data sheet. If two benthic components existed under a point, each component was assigned a 0.5 value. For example, if the point fell on a coral colony that was colonized with sponge, coral would receive 0.5 and sponge would receive 0.5. Each quadrat contained of grid of 25 equally spaced points. There were a total of 75 points assigned at each station and these data were used to estimate the percent of benthic cover. Each quadrat is treated as a separate unit for data analysis.

Algae and non-coral macroinvertebrates were identified to the lowest possible taxonomic level in the field, but it was generally not possible to achieve the same level of taxonomic resolution for some groups (e.g. sponges) as was possible for other groups. No samples or specimens were collected. Photos of each photoquadrat were taken and archived for reference, but not used or analyzed for this report.

Intertidal Survey Protocols

Protocols for intertidal stations mirrored the above protocols, but only conducted the macro-invertebrate, fish density (no size data was collected), and benthic cover protocols while walking through the intertidal zone. The fish and macro-invertebrate surveys were completed by an expert in intertidal communities (Dr. Caitlin Shishido) and the benthic cover data was collected by Dr. Sukhraj.

DESCRIPTION OF FISH AND WILDLIFE RESOURCES AND HABITAT

General

Appendix A contains 10 maps depicting the habitats and biological resources within and around the Haleiwa Beach Park area.

- Figure A1 shows the Project Area.
- Figure A2 shows the area observed within the Project Area, highlighting the area directly observed versus not observed.
- Figure A3 shows the size and length of the dive tracks of the survey
- Figures A4 to A7 show the habitat zones, habitat major structures, sediment types, and habitat structures, respectively.
- Figure A8 shows the habitat structure clipped by Alternative 5.
- Figure A10 shows the location of debris.
- Figure A11 shows the location of protected species observed.

Appendix D, E, and F contains 10 (11 maps in Appendix F) maps depicting the habitats and biological resources within and around the Haleiwa Beach Park area.

- Figures D1, E1, F1 shows the Project Area.
- Figures D2, E2, F2 shows the area observed within the Project Area, highlighting the area directly observed versus not observed.

- Figures D3, E3, F3 shows the size and length of the dive tracks of the survey
- Figures D4–D7, E4–E7, F4–F7 show the habitat zones, habitat major structures, sediment types, and habitat structures, respectively.
- Figures D8, E8, F8 shows the habitat structure clipped by Alternative 5.
- Figures D10, E10, F10 shows the location of debris.
- Figures D11, E11, F11 shows the location of protected species observed.
- Figure F13 shows that coral morphology present

Details for each of these maps are discussed below. Not all figure numbers are sequential, because certain standardized maps were not appropriate or available for this project and subsequently not included in this report.

Table 3 shows the breakdown of Project Area (surveyed area) measurements for different habitat structures, zones, and sediment types. The total area is 43,765 m^2. It consists of three habitat zones: Land (4,538 m^2 or 10.4%), Shoreline Intertidal (5,977 m^2 or 13.7%), and Reef Flat (33.250 m^2 or 76%). The major geomorphological habitat structures of the area consist of 7,743 m^2 of Hard Bottom (17.7%), 24,274 m^2 of Mixed Bottom (55.5%), 7,210 m^2 of Unconsolidated Sediment (16.5%), and 4,538 m^2 of Land (10.4%). In the Unconsolidated Sediment areas, the sediment type consists of sand or sand/rubble mix. The geomorphological habitat structures of the artificial reef area consist of: 1) Pavement (7,743 m^2 or 17.7%), 2) Scattered Coral/Rock in Unconsolidated Sediment (24,274 m^2 or 55.5%), 3) Unconsolidated Sediment (7,210 m^2 or 16.5%), and 4) Land (4,538 m^2 or 10.4%). These habitat structures correspond exactly to the hard (represented by only Pavement), Mixed (represented only by Scattered Coral/Rock in Unconsolidated Sediment), and Unconsolidated Sediment major habitat structures. The Project Area represents the area surveyed and does not reflect sizes of alternatives or the total impact area. While the Project Area was intended to cover the likely area of both direct and indirect effects, it may be larger or smaller than actual impacts.

As described in the methods, the project area was split into five distinct strata for the purposes of the developing a quantitative sampling design. The description of the marine resources within this area will highlight those specific strata.

Sand

Habitat Characteristics

This stratum was characterized as sand and a sand/rubble mixture as shown in Figure 3 and Appendix A – Figure A6. However, quantitative evaluation of the bottom cover of this area shows 65% of the cover was mud and 33% was sand. The discrepancy is most likely a result of the low visibility during the mapping surveys and the specific locations of the three transects used to characterize the habitat. This area was entirely in the southern portion of the project area next to the southern groin bounding the beach park. The high percentage of mud is likely due to the area's proximity to the mouth of the Anahulu River.

Biological Resources

This area was fairly depauperate except for a few organisms observed on one transect. This transect (Sand-17, Appendix B - Figure B17) extended, in the last few meters, into the Scattered

Coral/Rock in Unconsolidated Sediment stratum (Figure 9). It is important to note that these surveys did not investigate the infaunal community, so the true diversity of the community is not considered at all biological community scales.

Pavement

Habitat Characteristics

This stratum was characterized by a low rugosity (1.03) hard bottom area. This area was mostly located in the northern section of the project area with some Pavement found adjacent to the middle section as shown in Figure 3 and Appendix A – Figure A5. Quantitative analysis of bottom cover consisted of 32% uncolonized hard bottom, 29% sand, and 6% rubble. Sand was sparsely interspered across the Pavement stratum, but did not constitute the underlying structure of the habitat.

Biological Resources

The biological diversity of the Pavement area was generally low compared to most coral reef areas. Four species of algae, 6 species of stony coral, 6 species of fishes, and 27 species of invertebrates were observed in this area (Figure 10). Of the corals observed, the most dominant species was *Psammocora stellata* (0.44 colonies/m^2), which is a small branching coral usually not attached to the substrate and most were small colonies of less than five centimeters (cm). It was abundant on some transects (Pav-11 and Pav-13). The two most dominant invertebrate species were the rock boring urchins, *Echinometra mathaei* (1.75 individuals/m^2) and *Echinometra oblonga* (0.46 individuals/m^2). The most abundant fish species was *Acanthurus nigrofuscus* (0.02 individuals/m^2 and 0.03 tonnes per hectare), which is a valuable fish for human consumption. However, the abundance of this species was very low compared to other coral reefs in Hawaii.

Green sea turtles, *Chelonia mydas*, were also regularly seen foraging and resting within this area (Appendix A – Figure A11).

Scattered Coral/Rock in Unconsolidated Sediment

Habitat Characteristics

This stratum was characterized by a slightly higher rugosity than the Pavement stratum, but still had a relatively low value of 1.09. This area was the most dominant habitat type through the project area (58%; Table 3). Most of the area consisted of small rocks (larger than rubble) and scattered hard bottom pavement mixed with sand (35%) and rubble (40%; Figure 11).

Biological Resources

The biological diversity of this stratum was slightly higher than the Pavement stratum, with 5 species of algae, 10 species of coral, 32 species of invertebrates, and 5 species of fishes. The most abundant alga observed was the non-native alga, *Acanthophora spicifera* at 13%. The top five coral species were *Pocillopora damicornis* (0.12 colonies/m^2), *Psammocora stellata* (0.11 colonies/m^2), *Porites lobata* (0.09 colonies/m^2), *Leptastrea purpurea* (0.08 colonies/m^2), and

Montipora capitata (0.07 colonies/m^2). The most abundant invertebrate was *Echinometra mathaei* (0.4 individuals/m^2). The three most abundant fishes were *Stethojulis balteata* (0.005 individuals/m^2 and 0.009 tonnes per hectare), *Acanthurus nigrofuscus* (0.004 individuals/m^2 and 0.009 tonnes per hectare), and *Rhinecanthus rectangulus* (0.001 individuals/m^2 and 0.015 tonnes per hectare). All of these abundances are relatively low compared to typical Hawaiian coral reefs.

Green sea turtles, *Chelonia mydas*, were also regularly seen foraging and resting within this area (Appendix A – Figure A11).

Shoreline Intertidal - Rocky

Habitat Characteristics

This stratum was characterized predominantly hard bottom (66%; Figure 12) area along the intertidal section of the coastline which is exposed air during low tide periods. The rugosity of this stratum was the highest observed at the project site due to boulders and large rocks along the shoreline (1.21). The rugosity varied depending on the exact location and depth within this zone and hence influenced on the community described below. There were two main sections of this stratum along the project area (Figure 3 and Appendix A – Figure A4). One section was in front the Haleiwa Beach Park parking lot, while the other was in front of the comfort station pavilion. These two sections were slightly separated by a small sandy/rocky beach.

Biological Resources

The biological diversity of this stratum was similar to the Pavement stratum with 2 species of algae, 22 species of invertebrates, and 3 species of fishes. No coral or fish size data was collected in this stratum, and no coral colonies were observed during the invertebrate counts. While the species richness was similar to other strata, the community species composition of this stratum was distinct. The most dominant invertebrate species were *Nerita picea* (10.2 individuals/m^2), a small intertidal gastropod snail, an unidentified Gastropod egg species (4.6 m^2), *Echinometra oblonga* (3.2 individuals/m^2), and *Siphonaria normalis* (2.8 individuals/m^2), a limpet or false opihi. *Nerita picea* was present predominantly as juveniles, and based on similar summertime surveys around Oahu, the observed density and ratio of juvenile to adults for this species has only been documented at two other sites (C, Shishido, Pers. Obs.) The majority of the unidentified Gastropod eggs observed may have been eggs of *N. picea*. The three fish species present were *Acanthurus triostegus* (0.08 individuals/m^2), *Gnatholepis knighti* (0.05 individuals/m^2), and *Istiblennius zebra* (0.02 individuals/m^2). *Acanthurus triostegus* is an important herbivore and valuable fish for human consumption. While size data was not collected, the individuals observed were juveniles indicating this habitat may be a nursery area for this species (Sale 1969). This species was not observed on transects in the other strata, but was broadly present.

Shoreline Intertidal - Sandy

Habitat Characteristics

This stratum was characterized as predominantly sand (86%) and rubble (11%) with a small amount of hard bottom (4%; Figure 13). The rugosity was very low at 1.01, which is typical of sandy areas. This stratum was present in three sections (Figure 3 and Appendix A – Figure A4): in the northern section of the project area near the inside parking lot; a small section in between the Shoreline Intertidal – Rocky stratum; and as a large section in the southern portion of the project area that represents the majority of the recreational beach used by the community. The limited hard bottom habitat observed in this stratum represents the area where the biological resources were observed.

Biological Resources

The biological diversity within this stratum was very low with no corals observed (they were not enumerated in the methods), no algae species, no fish species, and nine invertebrate species. Of the invertebrates observed, the four most dominant ones counted were an unidentified gastropod egg species (2 individuals/m^2), *Anthopleura nigrescens* (1.4 individuals/m^2), *Siphonaria normalis* (0.9 individuals/m^2), and *Nerita picea* (0.4 individuals/m^2). These invertebrates were only observed on the exposed rocks within the sandy area. It is important to note that these surveys did not capture the infaunal community, so the true diversity of the community is not considered at all biological community scales.

Green sea turtles, *Chelonia mydas*, were not observed on the beach within this area (Appendix A – Figure A11). Additionally, basking turtles have not been observed at Haleiwa Beach Park during the summer of 2020 based on U.S. Fish and Wildlife Service data. However, basking turtles are common at Haleiwa Alii Beach Park and Puaena Point Beach Park as well as around the mouth of Anahulu River (Sheldon Plentovich, pers. comm.).

Offshore Sand Area

Habitat Characteristics

This area consists entirely of sand except for a small area well outside the dredge footprint (Table 4; Appendix D – Figures D4–D8). The sand within this area appeared to be high quality beach sand (Appendix D – Figures D6).

Biological Resources

The diversity of this area was very low with few benthic organisms observed. We did not survey the infaunal community and it is expected there may be many mollusks and other infaunal communities present

Sand Deposition Area between Groins

Habitat Characteristics

This area consists of Unconsolidated Sediment sand and mud spanning from the water to areas above the high water mark (Table 4; Appendix F – Figures F4–F8). The sediment in this area consists of a mixture of sand and mud (Appendix F – Figures F6).

Biological Resources

The diversity of this area was very low with few benthic organisms observed.

Federal Channel

Habitat Characteristics

The outer portion of the federal channel consists of Unconsolidated Sediment as well as Scattered Coral/ Rock in Unconsolidated Sediment. The Scattered Coral/ Rock in Unconsolidated Sediment is mostly dominant in the outer portion while the central portion of the federal channel mostly consists of Unconsolidated Sediment (Table 4; Appendix F – Figures F4–F8). The sediment in this area varies across the channel with sand in the central section and a mixture of sand/mud or mud/rubble in other areas (Appendix F – Figures F6).

Biological Resources

The federal channel area has algae cover on the hard surfaces and coral colonies in the adjacent areas. There were large coral colonies (approximately 2 meters in diameter) outside the federal channel, but within the area in which dredge barges or other equipment may work or anchor. The location of these colonies are shown in Appendix F – Figure F13.

Barge Sand Offload Area

Habitat Characteristics

This area consists entirely of mud and leaf litter with no hard habitat structures present. Occasional driftwood debris was observed. A small area adjacent to the groin included sand that appeared to be leaking through the groin. (Table 4; Appendix E – Figures E4–E8). The sediment in this area is almost entirely mud with some sand adjacent to the groin (Appendix E – Figure E6).

Biological Resources

The diversity of this area was very low with few benthic organisms observed. No corals were observed and a few small mollusks were observed near the groin and an occasional anemone in the mud.

DESCRIPTION OF ALTERNATIVES UNDER CONSIDERATION

The proposed project is the beneficial reuse of dredged sand along the beach to re-nourish the shoreline at Haleiwa Beach Park, Oahu. The sand sources include the federal channel of the Haleiwa Small Boat Harbor, a sand deposition area to the west of the federal channel (~2,000 cubic yards), and an offshore sand location as shown in Figure 4. The sand source areas are not considered as individual alternatives, but rather project components that serve as potential sources of suitable quality beach sand. The components described in this report and the various sand placement alternatives do not match actual project alternatives analyzed by the USACE in the Integrated Feasibility Report and Environmental Assessment.

The offshore sand area represents an area of 6,698 m^2 while the shoaling of sand between the stub groin and the outer groin represents an area of 1,211 m^2. The federal channel represents an area of 8,250 m^2, but the entre channel is not slated to be dredged. Additionally, an area next to the southern groin at Haleiwa Beach Park may need to be dredged in order to efficiently offload dredged sand to the beach area. The estimated area by the USACE is 2,226 m^2.

The location for placement of sand along Haleiwa Beach will be determined by the amount of sand available from the above-mentioned sand sources. In order to assess the potential impacts of sand placement, the USACE has determined five potential sand placement alternatives. These alternatives are approximate and meant for scaling purposes and not exact delineation of sand placement. The five alternatives show a greater area of sand placement on the beach with Alternative 1 being a No Action alternative, and Alternatives 2 through 5 being the placement of sand from a small portion of the beach (Alternative 2) to the entire length of the beach (Alternative 5; for the size and location of the alternatives, please see Figures 5–8). The area of the alternatives (Table 2) include: 4,660 m^2 for Alternative 2, 6,356 m^2 for Alternative 3, 8,685 m^2 for Alternative 4, and 18,003 m^2 for Alternative 5.

PROJECT IMPACTS

The primary impacts from this project include the direct impact to benthic resources from the placement of sand along the coastline, as well as the indirect effects from sand shifting and migration after initial placement of sand. The direct impacts are straightforward, as the sand placement will cover portions of the project area. Of the strata assessed, the Shoreline Intertidal – Rocky stratum will be impacted most significantly. Of the estimated 2,907 m^2 of Shoreline Intertidal – Rocky area, the direct impacts to this area will be 1,506 m^2, 1,556 m^2, 2,088 m^2, and 2,799 m^2 for Alternatives 2, 3, 4,and 5, respectively. This represents impacts to 51%, 53%, 72%, and 96% of this area, respectively. Alternative 5 would remove the vast majority of this habitat from the rocky shoreline intertidal area. While surveys were not conducted in other shoreline intertidal areas, this would be expected to represent a significant impact to those marine resources. Given the depth profile of this area and its hard bottom characteristics, any sand placed in this area may not remain long, as high tides and higher swells could erode this section first. Sand placement in this area would have a large impact to the intertidal community, but may not persist, nor achieve its purpose of facilities protection. Of the resources present, the most significantly impacted would be juvenile *A. triostegus,* which use the hard bottom Shoreline Intertidal as a nursery and grazing area.

Impacts to corals are anticipated to be minimal across the area proposed in Alternative 5. However, the transect Pav-13 is within the footprint of Alternative 5 and had three species of corals: *Psammocora stellata* (0.28 m^2), *Leptastrea purpurea* (0.08 m^2), and *Pocillopora damicornis* (0.08 m^2). In order to calculate the number of colonies impacted, more analysis of the size of that specific area and additional transects may be needed, since only a single transect counted corals within this specific area. However, a rough estimate of that specific area indicates approximately 477 colonies would be impacted (304 colonies of *Psammocora stellata*, 87 colonies of *Leptastrea purpurea*, and 87 colonies of *Pocillopora damicornis*). Of these, approximately 90% of the colonies are less than 5 cm, and 10% are between 6 and 10 cm in size. *Psammocora. stellata* was petitioned to be listed under the endangered Species Act in 2014, but ultimately NMFS decided to not list this species.

The assessment of these impacts assumes that sand will not drift beyond the estimated boundary of the Alternative 5 footprint, nor to the north. Based on current sand deposition patterns, this may be a valid assumption, but future impacts to offshore areas may occur.

The impacts associated with the offshore sand dredging should be minimal if the operation is kept within the proposed boundaries. Corals are present in the nearby vicinity, but are far enough away that minimal to no impact should occur with proper sedimentation control measures.

The impacts associated with the sand deposition area near the channel should also be minimal if proper sediment control measures are taken. The habitat structures are more complicated within the outer federal channel because a mixture of Unconsolidated Sediment and hard bottom exists. Where hard bottom exists, coral colonies are often present. Within this portion of the federal channel, there were very few coral colonies within the federal channel limits. However, there were a few colonies of significant size (approximately 2 meters in diameter) in between the federal channel and the small sand deposition area. There is a reasonable chance these large colonies could be impacted without minimization measures. The location of these colonies is shown in Appendix F – Figure F13. Depending on conditions, these colonies are partially visible from the surface.

The impacts in the area of the barge sand offloading are expected to be minimal or less. Impacts associated with the operations in this area can be further minimized with proper sediment control measures.

State of Hawaii, Division of Aquatic Resources Concerns

Additional consideration of project impacts should include resources regulated under the State of Hawaii authority. These include all stony corals and live rock (see Appendix G). In this study, any hard bottom or rubble would likely qualify under the State of Hawaii's definition of live rock, and hence subject to State of Hawaii's jurisdiction for regulated resources. Table 5 shows the percent cover of hard bottom, rubble, and coral that indicates the amount of live rock and coral that may be subject to State of Hawaii regulatory consideration. Table 6 shows the coral density across the various strata. Size class data also exists, but is not shown within Table 6.

With refined estimates of the size and location of sand placement, additional calculations can be made to assist with navigating the State of Hawaii regulatory process.

If impacts to State of Hawaii regulation resources are not avoided, the USACE will need to make a determination that the impact to these resources cannot be avoided and minimized and may be subject to acquiring a Special Activity Permit from the Department of Land and Natural Resources. The Special Activity Permit may require transplantation of corals and live rock to a nearby site. For resources that cannot be transplanted, DAR may require as a condition of the permit an offset of these losses, possibly involving restoration of the coral and live rock in another area.

RECOMMENDATIONS

Based on the description of resources within the project area, the Service provides the following recommendations.

1) The Service recommends that measures be taken to minimize water from discharging back into the coastal area that could create a sediment plume. It is possible that placement of sand may occur directly from the water to the beach area. Minimization measures such as sand berms should be used to slow and pool water on the beach. In addition, silt curtains should be used to minimize sediment generated from the dewatering of dredged sediment.

2) The Service recommends avoiding placing sand in the Shoreline Intertidal – Rocky stratum given the unique intertidal community documented. Sand placement should avoid the northern section of the project area based on the amount of Shoreline Intertidal community impacted, and specifically a higher density of corals in the northern Pavement stratum. While the number of corals is generally low, more sand placement in this section may have increased impacts to the limited coral community.

3) The Service recommends that the amount of sand placed in the northern section and in the Shoreline Intertidal – Rocky stratum should be limited, or only nourished to the extent that is needed to protect the shore-side structures. Alternatives to sand should also be explored to protect the structures, but also maintain the integrity of the intertidal community.

4) The Service also recommends that annual quantitative surveys be conducted for a minimum of five years post sand placement in order to document the changes to the marine communities. This effort can also show any effects of movement of sand across the area and help determine if future re-nourishment initiatives will have continuing impacts.

5) During all dredging operations, sufficient sediment control measures must be taken. The proposed dredge areas are known for low water clarity, but sediment curtains and turbidity monitoring should be incorporated to minimize impacts to resources. We further recommend that some baseline turbidity monitoring be conducted in the area during

various weather cycles in order to develop appropriate turbidity thresholds to be used during dredging operations.

6) Extra measures must be taken to avoid impacts to large coral colonies adjacent to the small boat harbor federal channel shown in Appendix F – Figure F13. This small area should be delineated daily by small buoys if the barge is required to be anchored or will routinely move around the area.

7) The groin that is on the southern boundary of Haleiwa Beach Park should be grouted to minimize sand leaking through the boulders. This will help to retain the beach with less maintenance required.

8) All of the potential sand source areas should undergo extensive sediment and coring analysis. The surface sediment observed in the barge access area and the federal channel seem to consist mostly of mud and does not appear to be of suitable quality for a beach. Excess material that is not suitable for deposition on the beach will need to be disposed of in another manner and this will likely increase costs associated with the project.

9) DAR recommends the following:

   a) Make a formal determination of the areas that can be avoided, or not, and work with them to determine if a Special Activity permit can be issued or will be required;
   b) Provide more information on the potential increased turbidity in the area and the potential movement of such turbidity;
   c) Initiate a public outreach and education effort to effectively document and attempt to mitigate any on-going concerns brought forward from the community or local fisherman;
   d) Provide more details of the project delineation and the footprints of these areas as the project moves from the Feasibility Study to the Design Phase; and
   e) Provide BMPs which will minimize sedimentation and turbidity during the nourishment activities.

SUMMARY AND FWS POSITION

The service conducted extensive surveys across the nearshore area of Haleiwa Beach Park to document the natural resources within the area and the potential impacts associated with adding supplemental sand to the beach. Overall, the diversity of marine resources within this area was low and coral numbers were low compared to other areas in Hawaii. Within this area, the majority of corals were found in the northern section and represent an area where avoidance and minimization measures should be undertaken. The Service further documented the intertidal community across the area and notes that sand placement will have a significant impact to the Shoreline Intertidal – Rocky habitat. To minimize negative impacts associated with adding additional sand along the beach area, the Service recommends avoiding sand addition in the northern section of the beach park and minimizing the sand placement across the rocky portions of the intertidal communities. The overall position of the Service is supportive of the project moving forward, while incorporating all appropriate minimization measures.

REFERENCES CITED

Battista T.A., Dosta, B.M., and D. Anderson, S.M. 2007. Shallow-Water Benthic Habitats of the Main Eight Hawaiian Islands (DVD). NOAA Technical Memorandum NOS NDDOS 61, Biogeography Branch. Silver Spring, MD.

Bivand R., Keitt T., Rowlingson B., Pebesma E., Sumner M., Hijmans R., Rouault R., Warmerdam F., Ooms, J. & Rundel C. 2020. Package 'rgdal'. Bindings for the Geospatial Data Abstraction Library. 64 pp.

Bivand, R., Lewin-Koh, N., Pebesma, E., Archer, E., Baddeley, A., Bearman, N., Bibiko, H., Brey S., Callahan J., Carrillo G., Dray S. Forrest., & Friendly M. 2020. Package 'maptools'. Tools for Handling Spatial Objects. 90 pp.

Bivand, R., Rundel C., Pebesma E., Stuetz R., Hufthammer K.O., Giraudoux P., Davis M., & Santili S. 2020. Package 'rgeos'. Interface to Geometry Engine - Open Source ('GEOS'). 81 pp.

Blondel, E. 2019. Package 'cleangeo'. Cleaning Geometries from Spatial Objects. 11 pp.

Brainard R., Asher J., Gove J., Helyer J., Kenyon J., Mancini F., Miller J., Myhre S., Nadon M., Rooney J., Schroeder R., Smith E., Vargas-Angel B., Vogt S., Vroom P., Balwani S., Craig P., DesRochers A., Ferguson S., Hoeke R., Lammers M., Lundblad E., Maragos J., Moffitt R., Timmers M., Vetter O. 2008. Coral reef ecosystem monitoring report for American Samoa: 2002–2006. U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, SP-08-002, 472 p. + Appendices.

Brainard R.E., Asher J., Blyth-Skyrme V., Coccagna E.F., Dennis K., Donovan M.K., Gove J.M., Kenyon J., Looney E.E., Miller J.E., Timmers M.A., Vargas-Angel B., Vroom P.S., Vetter O., Zgliczynski B., Acoba T., DesRochers A., Dunlap M.J., Franklin E.D., Fisher-Pool P.I., Braun D.L., Richards B.L., Schopmeyer S.A., Schroeder R.E., Toperoff A., Weijerman M., Williams I., Withall R.D. 2012. Coral reef ecosystem monitoring report of the Mariana Archipelago: 2003–2007. Pacific Islands Fisheries Science Center, PIFSC Special Publication, SP-12-01, 1019 p.

Evans J.S., Murphy M.A., & Ram K. 2020. Package 'spatialEco'. Spatial Analysis and Modelling Utilities. 163 pp.

Hijmans R.J., Phillips S., Leathwick J., & Elith J. 2017. Package 'dismo'. Species Distribution Modeling. 68 pp.

Hijmans R.J., van Etten J., Sumner M., Cheng J., Baston D., Bevan A., Bivand R., Busetto L., Canty M., Forrest D., Ghosh A., Golicher D., Gray J., & Greenberg J.A. 2020. Package 'raster'. Geographic Data Analysis and Modeling. 249 pp.

Huisman, J.M., Abbott, I.A., Smith, C.M. 2007. Hawai'ian Reef Plants. University of Hawai'i Sea Grant College Program, report No. UHIHI-SEAGRANT-BA-03-02. 254 pp.

Pebesma E., Bivand R., Racine E., Sumner M., Cook I., Keitt T., Lovelace R., Wickham H., Ooms J., Muller K., Pedersen T.L., & Baston D. 2020. Package 'sf'. Simple Features for R. 115 pp.

Ripley B. & Lapsley M. 2020. Package 'RODBC'. ODBC Database Access. 28 pp.

Sale P.F. (1969). Pertinent stimuli for habitat selection by the juvenile manini, *Acanthurus triostegus sandvicensis*. Ecology, 50(4), 616–623.

Smalley, D.H. 2004. Water Resources Development Under the Fish and Wildlife Coordination Act. Report in collaboration with Allan J. Mueller. 503 pp.

Strimas-Mackey M. 2020. Package 'smoothr'. Smooth and Tidy Spatial Features. 16 pp.

Turner R. 2020. Package 'deldir'. Delaunay Triangulation and Dirichlet (Voronoi) Tessellation. 38 pp.

U.S. Army Corps of Engineers [USACE]. 2018. Beneficial Use of Dredged Material. Pilot Project Proposal under Section 1122 of the Water Resources Development Act of 2016. 7 pp.

U. S. Fish and Wildlife Service [USFWS], Department of the Interior. 1981. U.S. Fish and Wildlife Service Mitigation Policy. Notice of Final Policy. Federal Register Vol. 46, No. 5. Pgs. 7644–7663.

U.S. Fish and Wildlife Service [USFWS]. 2016. U.S. Fish and Wildlife Service Mitigation Policy. Docket Number FWS–HQ–ES–2015–0126, Federal Register: Vol. 81, No. 224. Pgs. 83440–83492.

U.S. Fish and Wildlife Service [USFWS]. 2018. U.S. Fish and Wildlife Service Mitigation Policy. Docket Number FWS–HQ–ES–2015–0126, Federal Register: Vol. 83, No. 146. Pgs. 36472–36475.

FIGURES

U.S. Fish & Wildlife Service

Pacific ocean showing location of Oahu, Hawaii

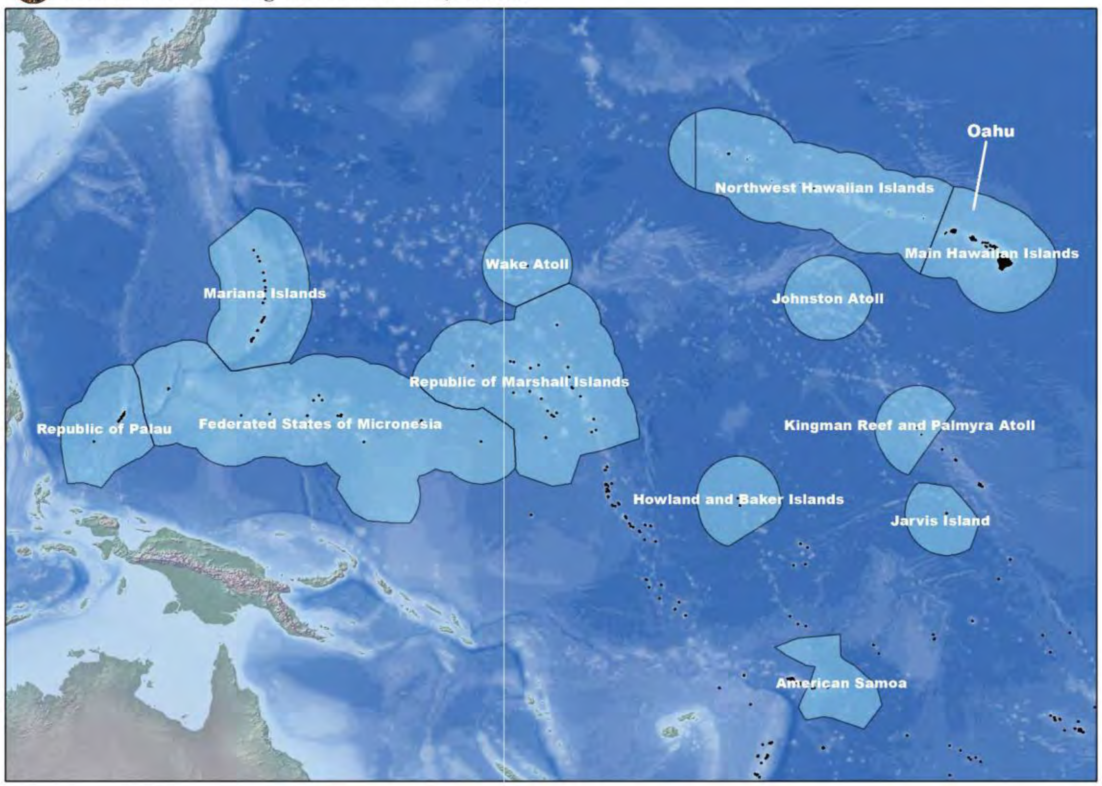

Figure 1: Pacific Ocean. Map of the Pacific Ocean showing the location of Oahu, Hawaii.

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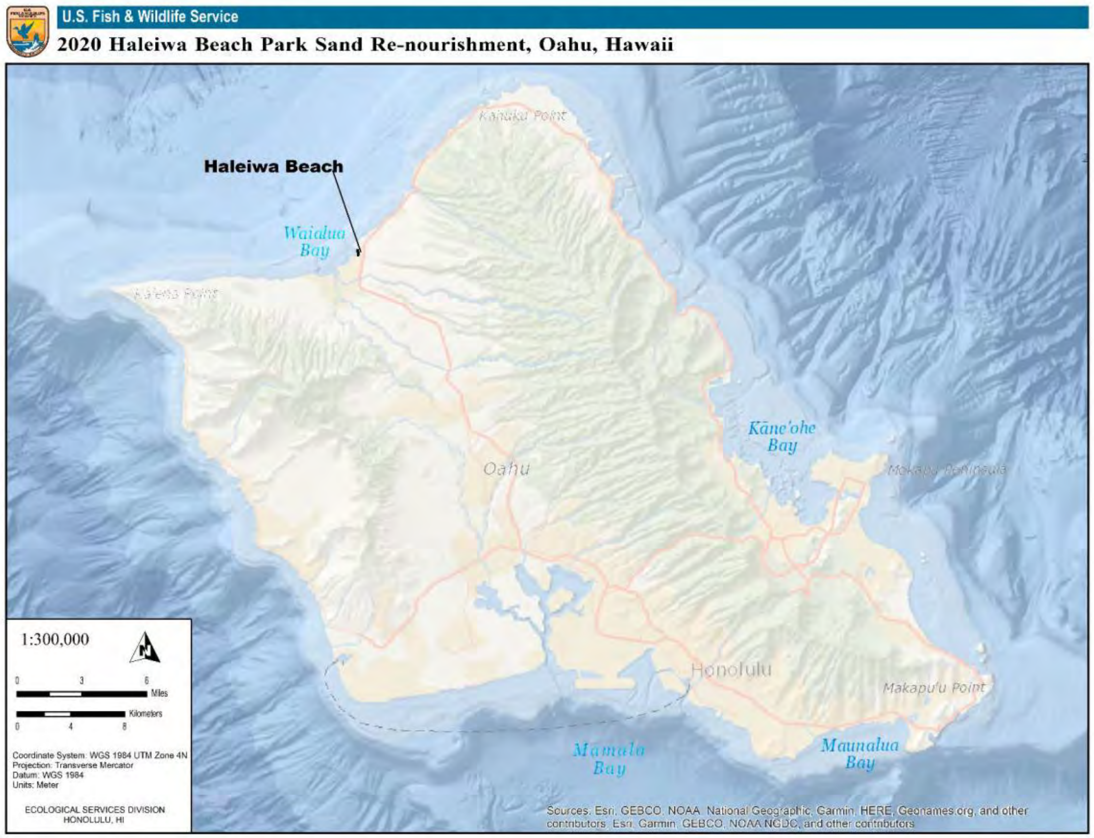

Figure 2: Oahu, Hawaii. Map of Oahu, Hawaii showing the location of Haleiwa Beach Park.

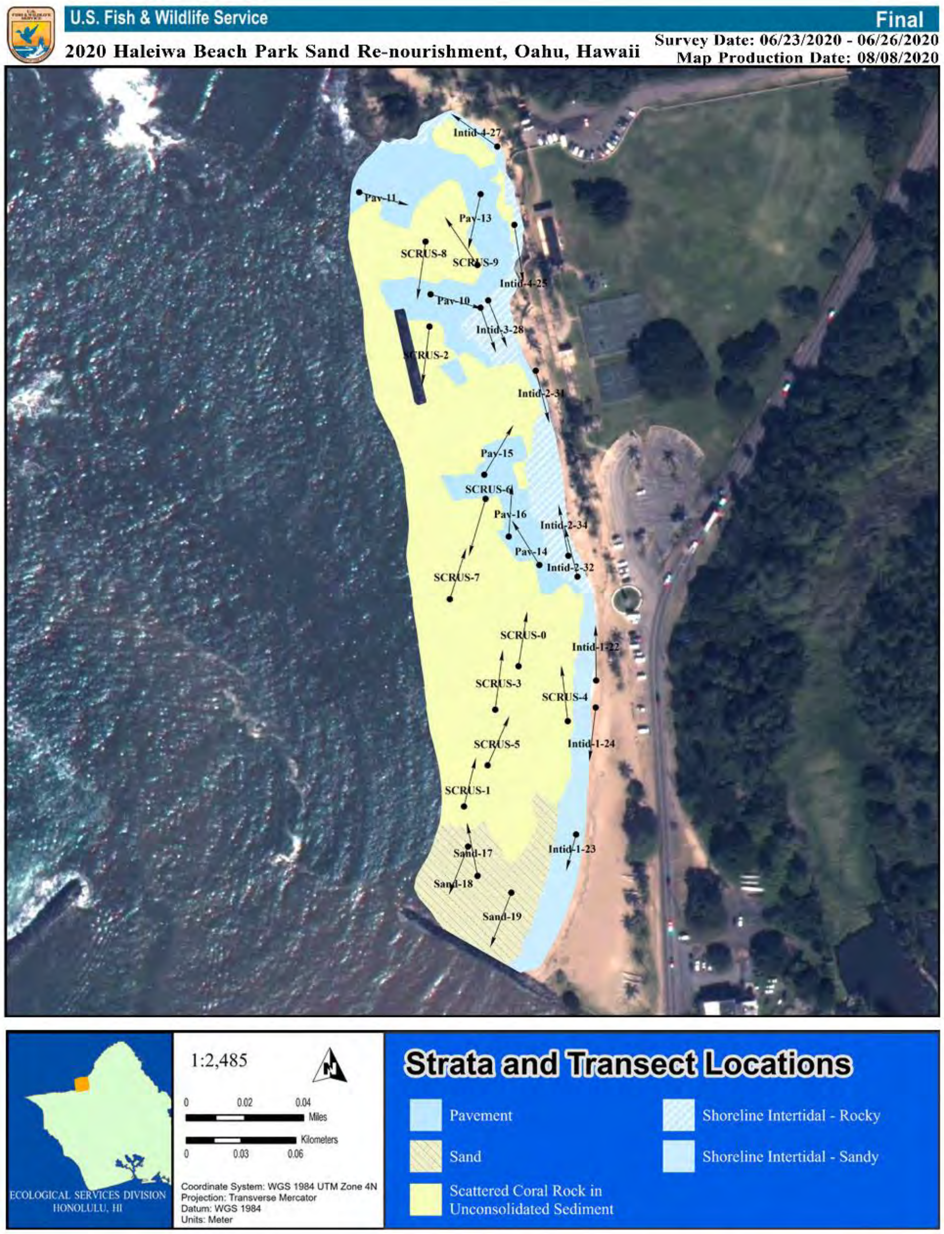

Figure 3: Strata and Transect Locations. The strata and transect locations surveyed for the project.

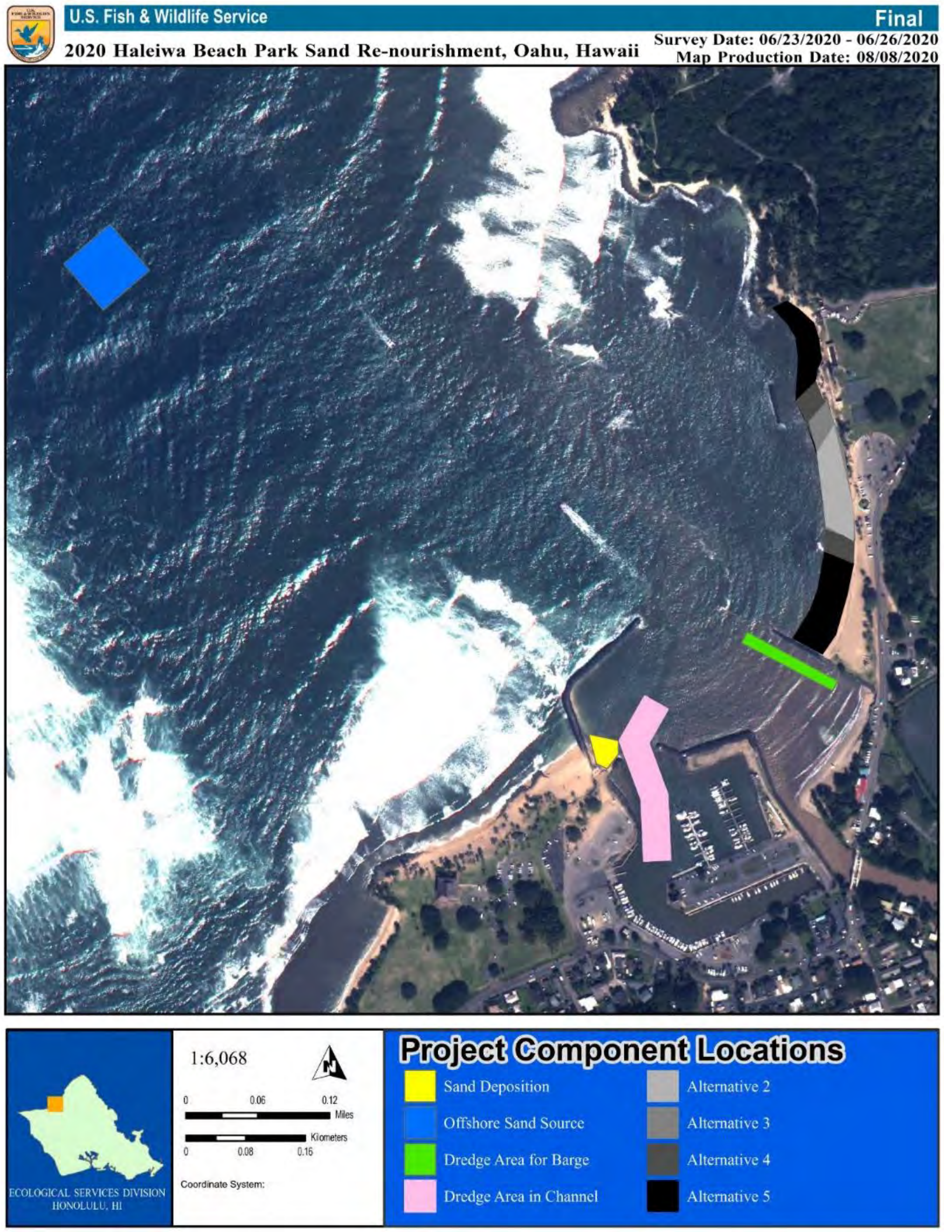

Figure 4: Project Components. The various project components for the beach re-nourishment project.

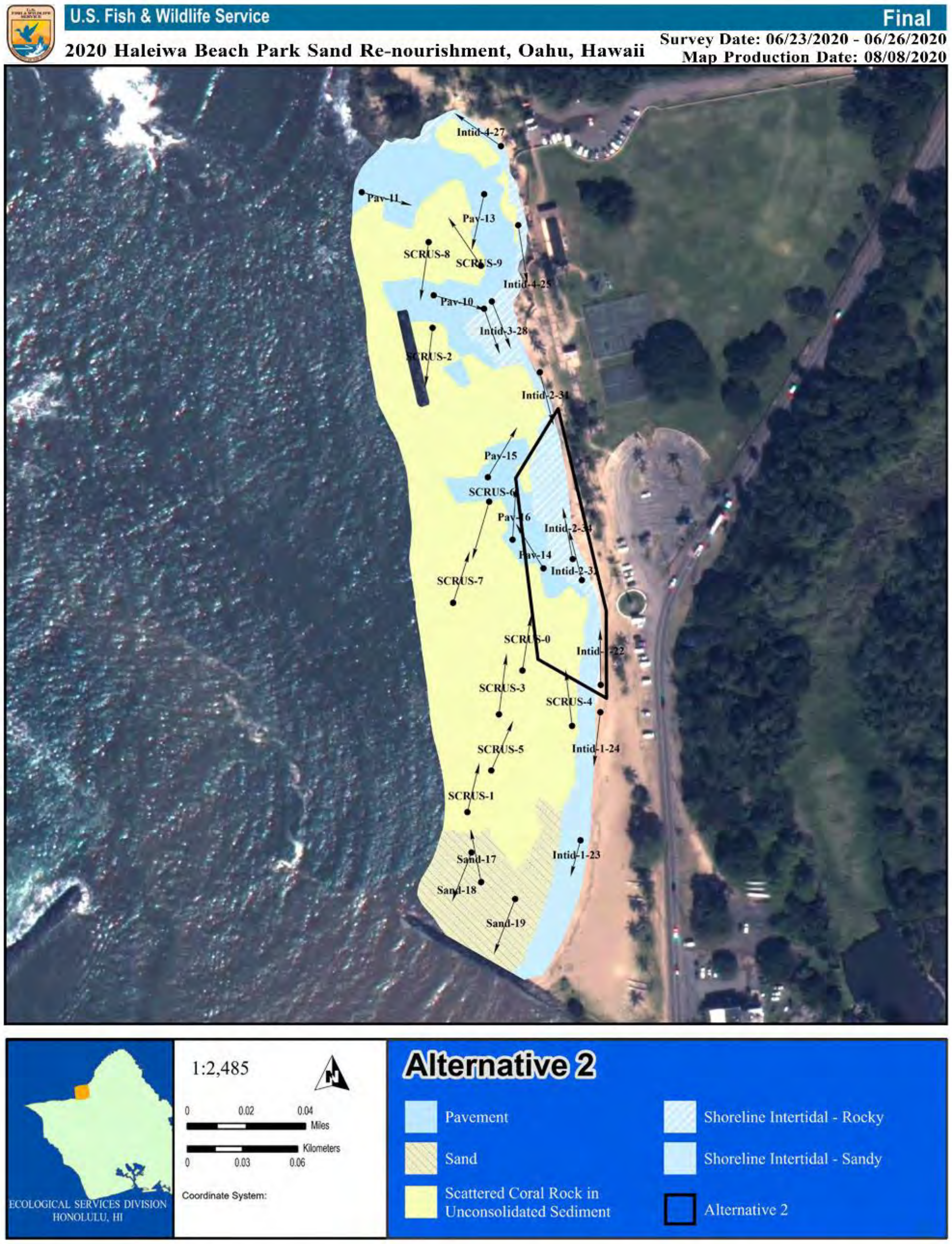

Figure 5: Alternative 2. The strata and transect locations in relationship to Alternative 2.

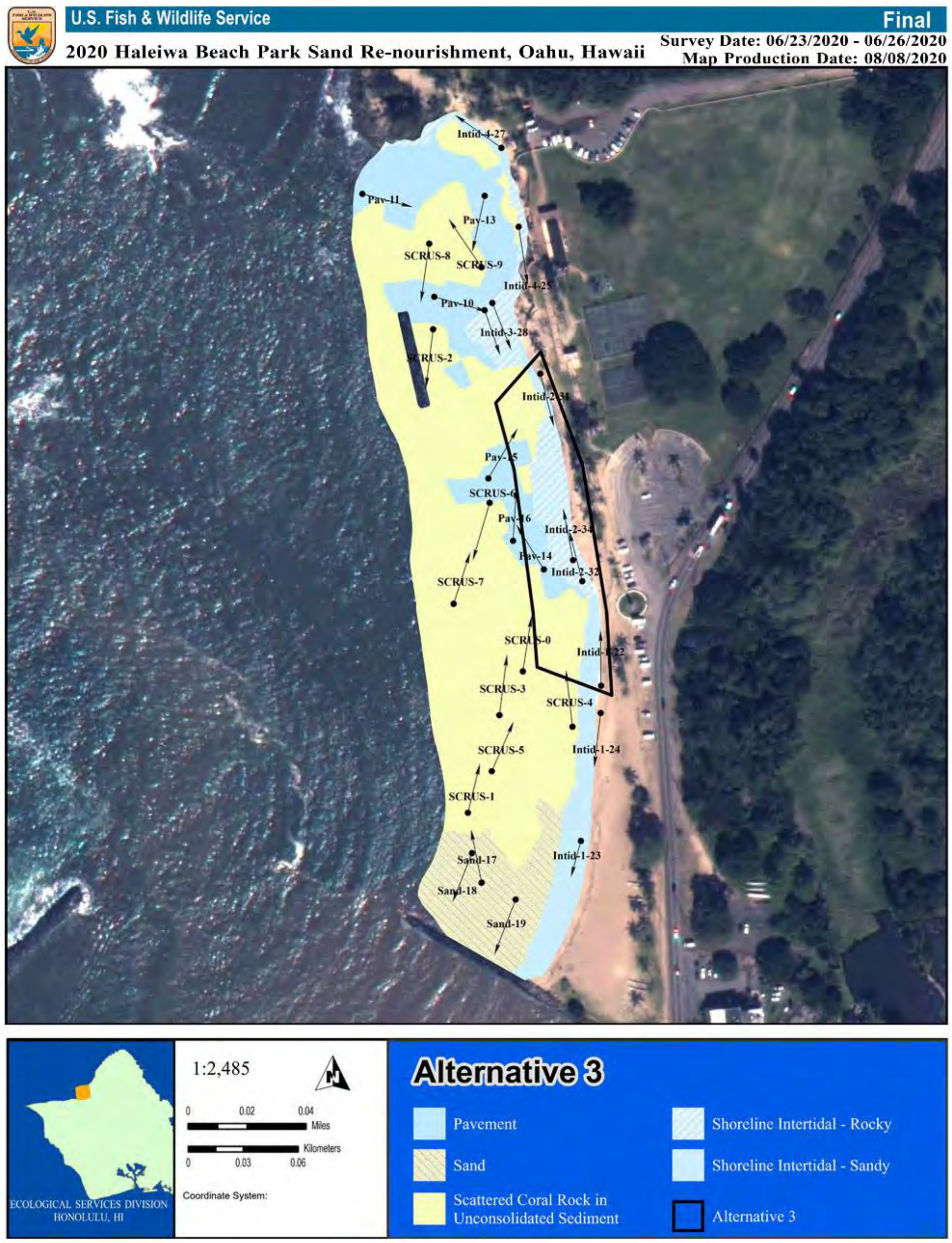

Figure 6: Alternative 3. The strata and transect locations in relationship to Alternative 3.

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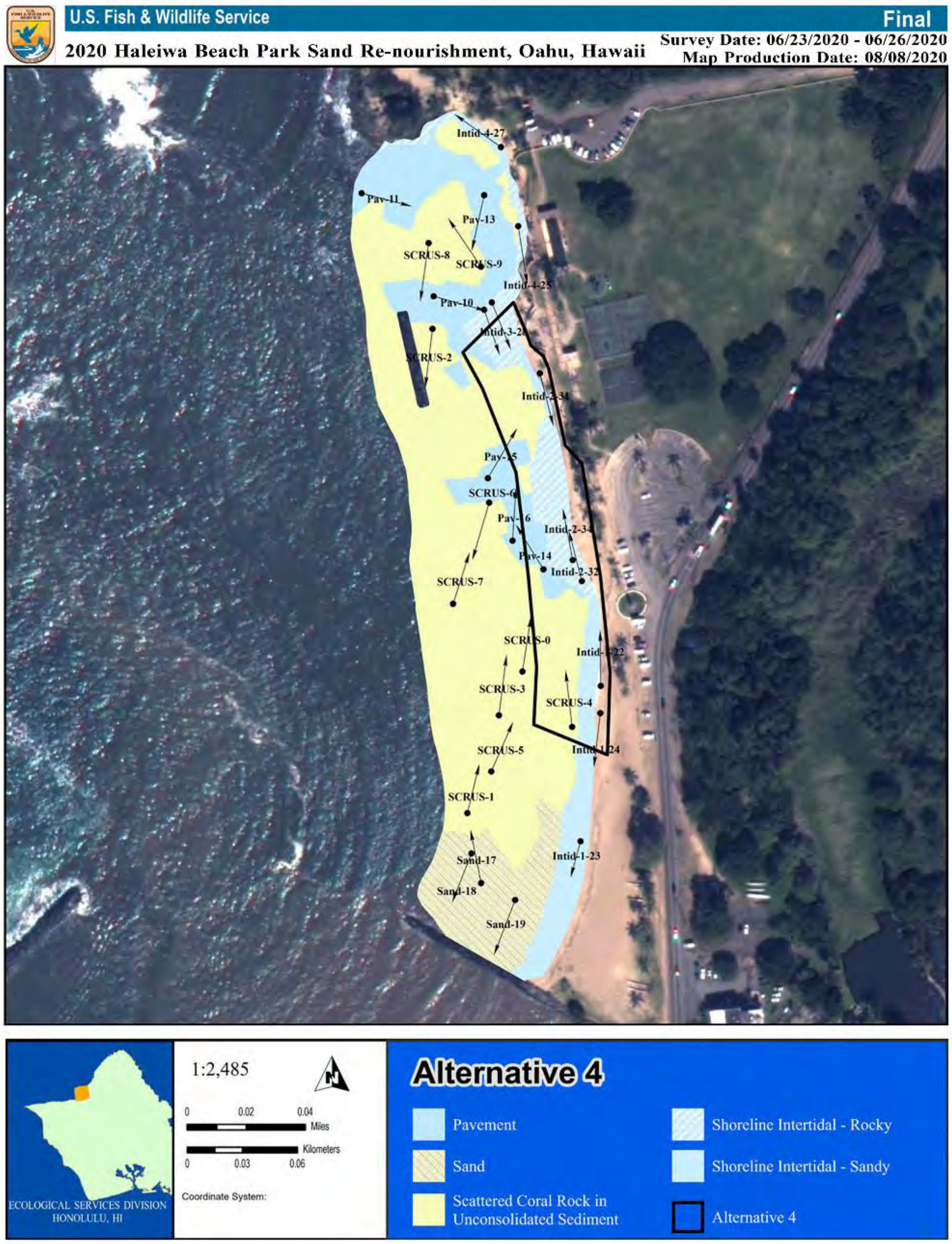

Figure 7: Alternative 4. The strata and transect locations in relationship to Alternative 4.

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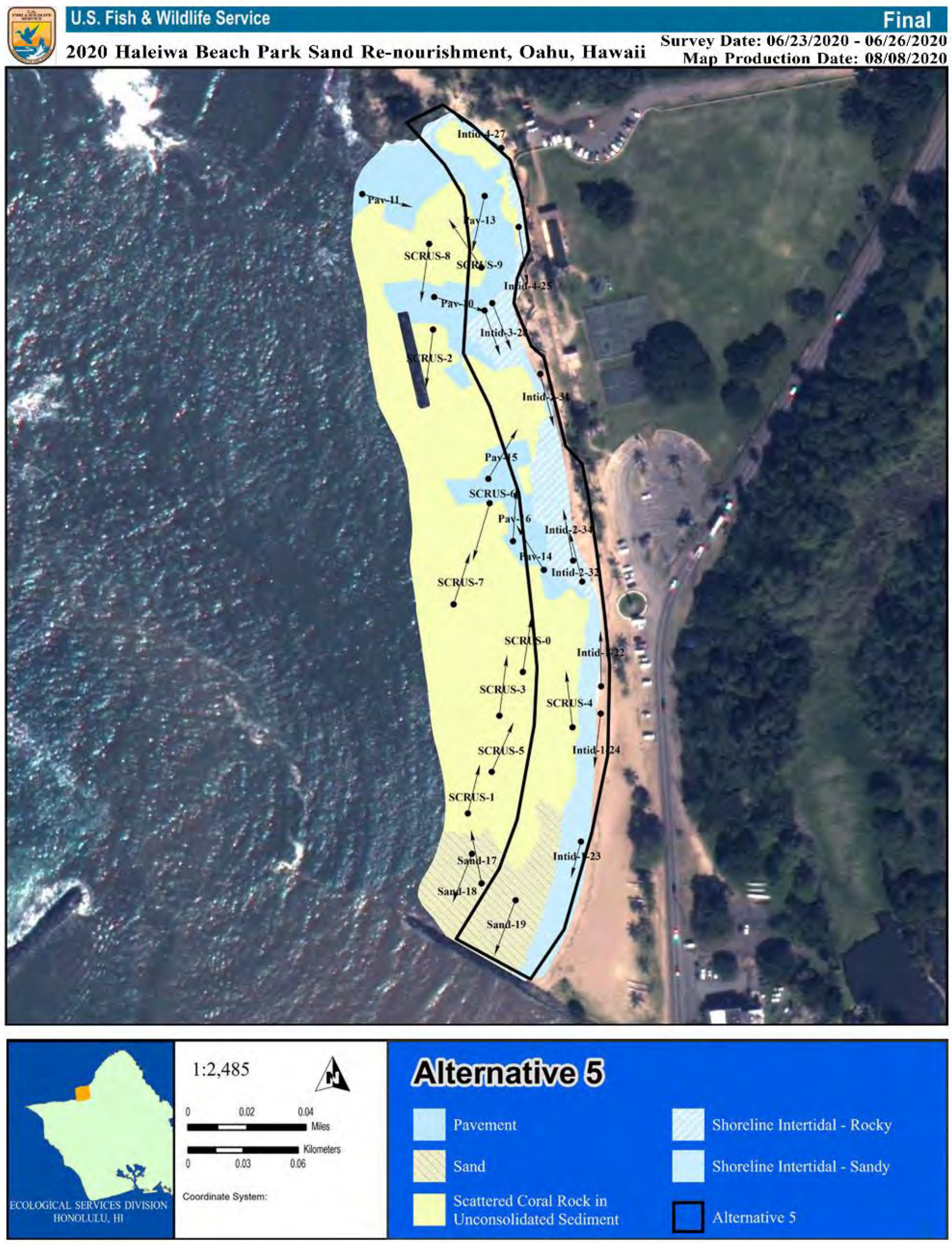

Figure 8: Alternative 5. The strata and transect locations in relationship to Alternative 5.

35

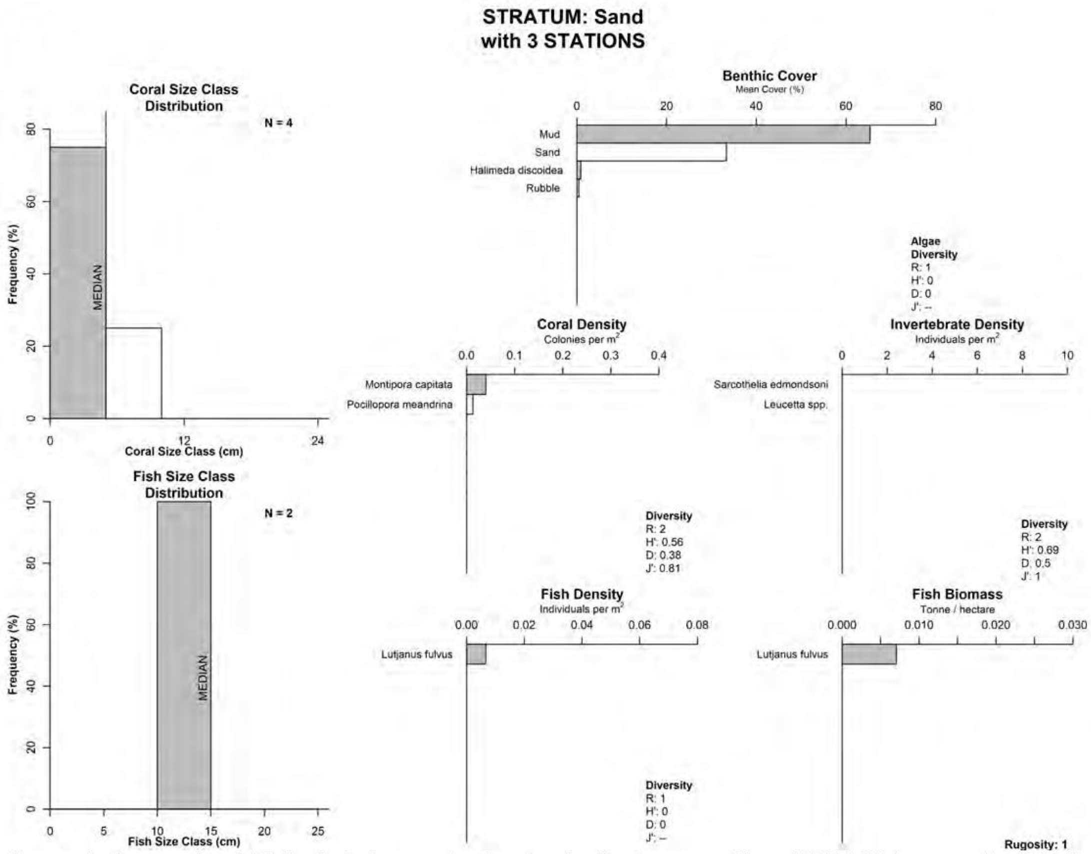

Figure 9: Stratum Sand. Biological characterization for the Sand stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

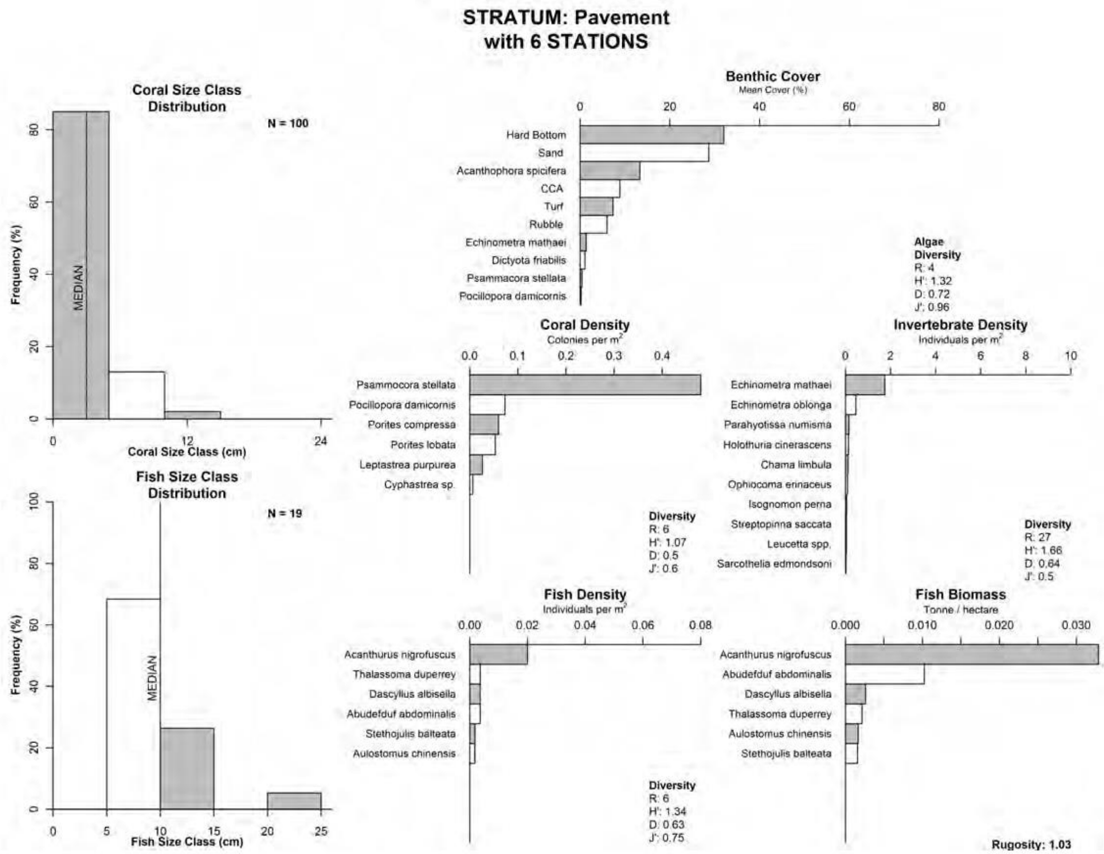

Figure 10: Stratum Pavement. Biological characterization for the Pavement stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

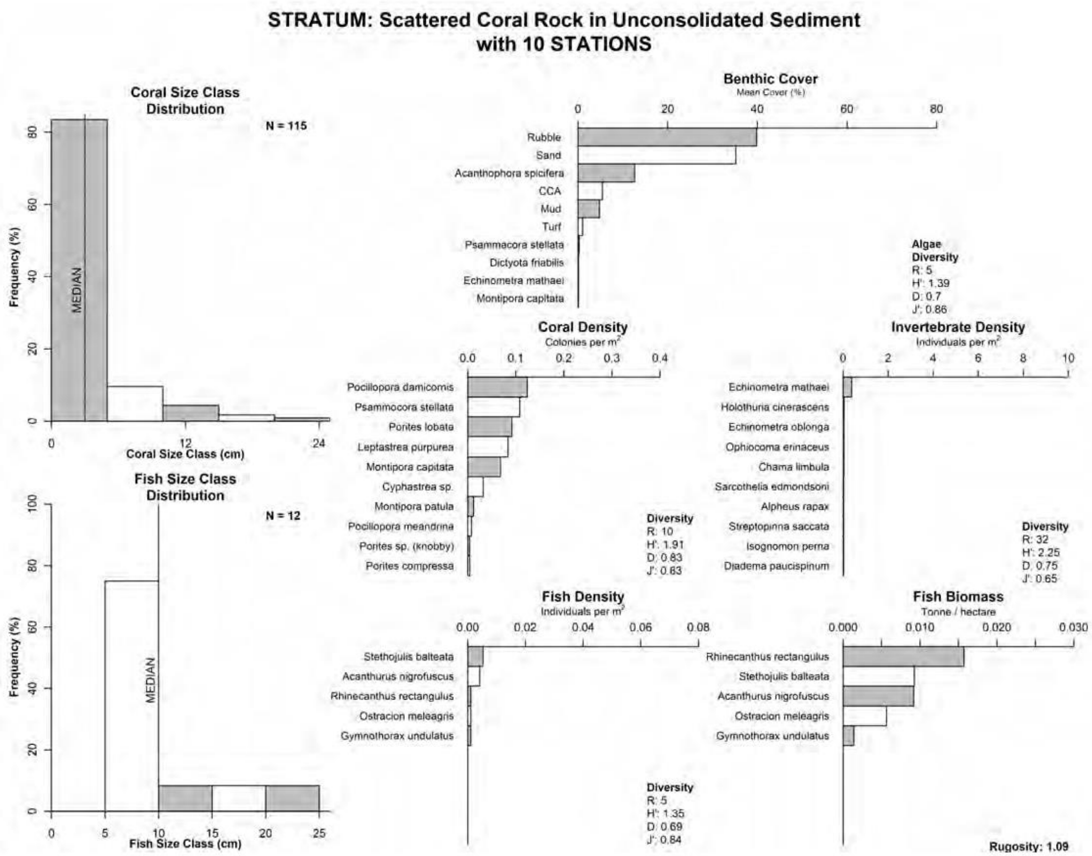

Figure 11: Stratum Scattered Coral/Rock in Unconsolidated Sediment. Biological characterization for the Scattered Coral/Rock in Unconsolidated Sediment stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

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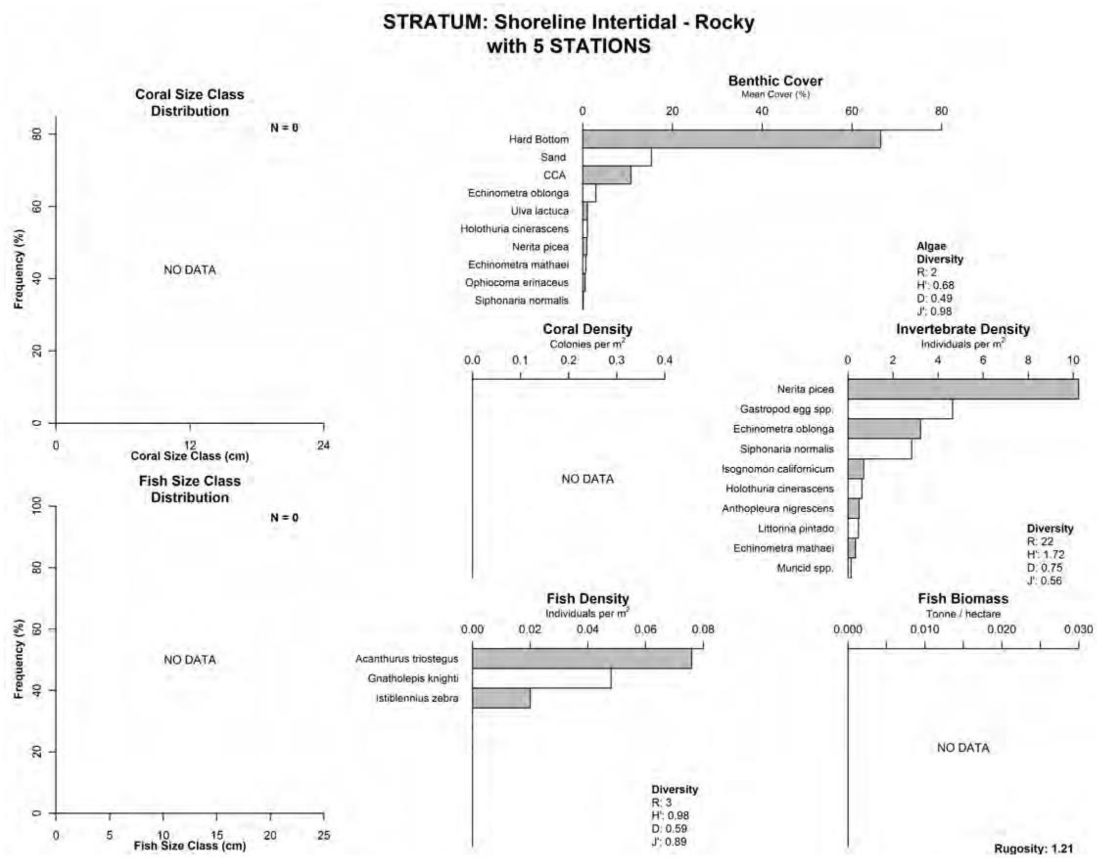

Figure 12: Stratum Shoreline Intertidal - Rocky. Biological characterization for the Shoreline Intertidal – Rocky stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

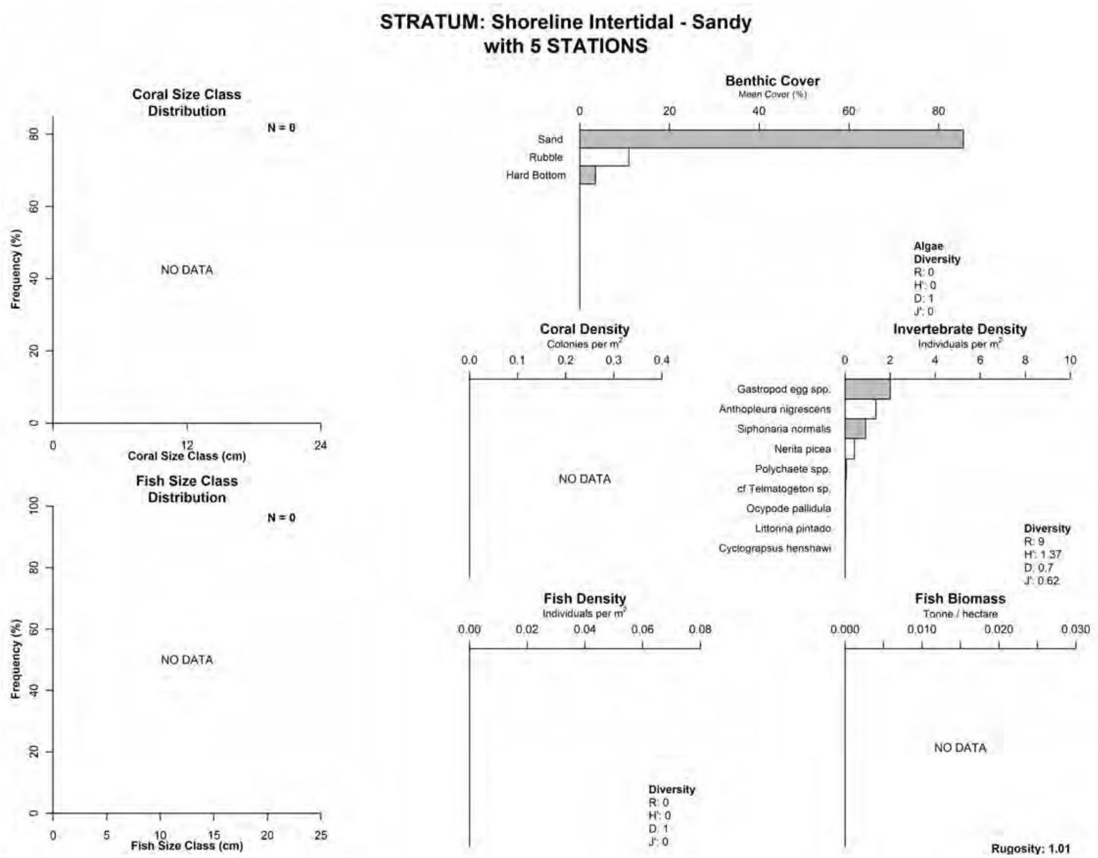

Figure 13: Stratum Shoreline intertidal - Sandy. Biological characterization for the Shoreline Intertidal – Sandy stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

TABLES

Table 2: Area calculations for each alternative. Area calculations for each alternative and stratum.

Alternative	Strata	Area (m^2)	Percent of Area
2	Pavement	663	14.2
	Scattered Coral Rock in Unconsolidated Sediment	1,342	28.8
	Shoreline Intertidal - Rocky	1,506	32.3
	Shoreline Intertidal - Sandy	449	9.6
	Land	700	15.0
	Total	**4,660**	
3	Pavement	825	13.0
	Scattered Coral Rock in Unconsolidated Sediment	2,133	33.6
	Shoreline Intertidal - Rocky	1,556	24.5
	Shoreline Intertidal - Sandy	652	10.3
	Land	1,190	18.7
	Total	**6,356**	
4	Pavement	901	10.4
	Scattered Coral Rock in Unconsolidated Sediment	3,303	38.0
	Shoreline Intertidal - Rocky	2,088	24.0
	Shoreline Intertidal - Sandy	920	10.6
	Land	1,473	17.0
	Total	**8,685**	
5	Pavement	2,688	14.9
	Sand	2,305	12.8
	Scattered Coral Rock in Unconsolidated Sediment	5,694	31.6
	Shoreline Intertidal - Rocky	2,799	15.5
	Shoreline Intertidal - Sandy	2,721	15.1
	Land	1,796	10.0
	Total	**18,003**	

Table 3: Area calculations for project area. Area calculations for surveyed project area.

	Area Type	Area (m^2)	Percent of Area
Strata	Pavement	6,442	16.4
	Sand	4,071	10.4
	Scattered Coral Rock in Unconsolidated Sediment	22,737	58.0
	Shoreline Intertidal - Rocky	2,907	7.4
	Shoreline Intertidal - Sandy	3,069	7.8
	Total	**39,226**	

Zones	Land	4,538	10.4
	Reef Flat	33,250	76.0
	Shoreline Intertidal	5,977	13.7
	Total	**43,765**	

Major Structures	Land	4,538	10.4
	Hard Bottom	7,743	17.7
	Mixed	24,274	55.5
	Unconsolidated Sediment	7,210	16.5
	Total	**43,765**	

Structures	Land	4,538	10.4
	Pavement	7,743	17.7
	Scattered Coral Rock in Unconsolidated Sediment	24,274	55.5
	Unconsolidated Sediment	7,210	16.5
	Total	**43,765**	

Table 4: Area calculations for sand source areas and barge offload area. Area calculations for estimated area of various sand sources and sand offloading area.

	Barge Offload Area	Area (m^2)	Percent of Area
Zones	Bank/ Shelf	2,225	100.0
	Total	**2,225**	
Major Structures	Unconsolidated Sediment	2,225	100.0
	Total	**2,225**	
Structures	Unconsolidated Sediment	2,225	100.0
	Total	**2,225**	

	Channel Area	Area (m^2)	Percent of Area
Zones	Channel	6,003	100.0
	Total	**6,003**	
Major Structures	Unconsolidated Sediment	4,265	71.1
	Mixed	1,738	28.9
	Total	**6,003**	
Structures	Scattered Coral Rock in Unconsolidated Sediment	1,738	28.9
	Unconsolidated Sediment	4,265	71.1
	Total	**6,003**	

	Offshore Sand Area	Area (m^2)	Percent of Area
Zones	Bank/ Shelf	6,694	100.0
	Total	**6,694**	
Major Structures	Unconsolidated Sediment	6,694	100.0
	Total	**6,694**	
Structures	Unconsolidated Sediment	6,694	100.0
	Total	**6,694**	

Table 5: Percent cover of Live Rock and Stony Corals. The percent cover of hard bottom, rubble (live rock) and four coral species observed during the quadrat surveys.

Strata	**Hard Bottom**	**Rubble**	***Montipora capitata***	***Pocillopora damicornis***	***Porites compressa***	***Psammacora stellata***
Shoreline Intertidal - Sandy	3.5	11.0	0.0	0.0	0.0	0.0
Shoreline Intertidal - Rocky	66.4	0.1	0.0	0.0	0.0	0.0
Pavement	32.0	6.0	0.0	0.2	0.2	0.4
Sand	0.0	0.4	0.0	0.0	0.0	0.0
Scattered Coral Rock in Unconsolidated Sediment	0.0	39.9	0.1	0.0	0.0	0.3

Table 6: Stony Coral Density. The density of coral colonies (colonies per meter squared) observed during coral transects.

Strata	***Cyphastrea sp.***	***Leptastrea purpurea***	***Montipora capitata***	***Montipora patula***	***Pocillopora damicornis***	***Pocillopora meandrina***	***Porites compressa***	***Porites lobata***	***Porites sp. (knobby)***	***Psammocora stellata***
Shoreline Intertidal - Sandy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shoreline Intertidal - Rocky	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pavement	0.01	0.03	0.00	0.00	0.07	0.00	0.06	0.05	0.00	0.48
Sand	0.00	0.00	0.04	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Scattered Coral Rock in Unconsolidated Sediment	0.03	0.08	0.07	0.01	0.12	0.01	0.00	0.09	0.00	0.11

APPENDIX A: Maps of Haleiwa Beach Re-nourishment Area

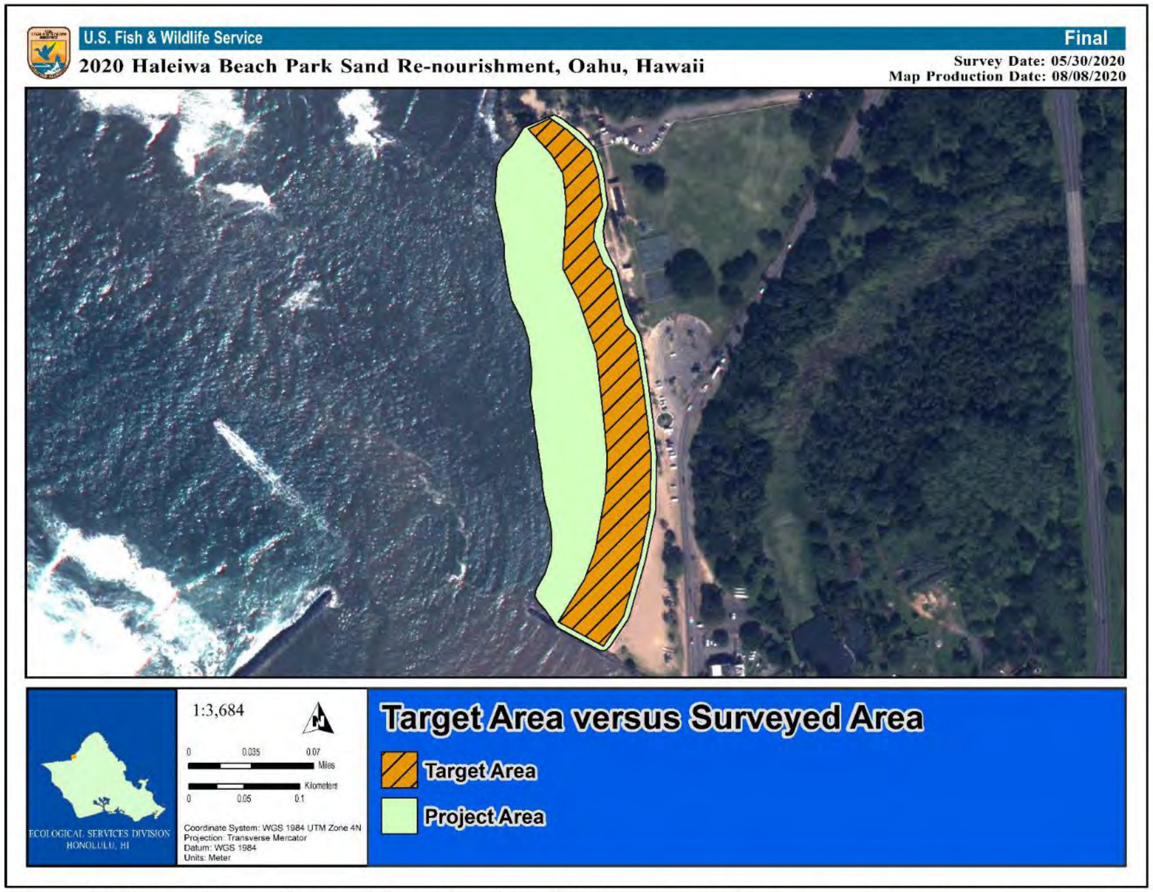

Figure A1: Target Area vs. Surveyed Area. Overview of the Project Area (total surveyed area plus project footprint) versus the Target Area (project footprint).

Figure A2: Area Observed. Overview of the area observed by in-water observers versus the area interpolated in all maps.

48

Figure A3: Dive Tracks. Overview of the dive tracks within the project area contains.

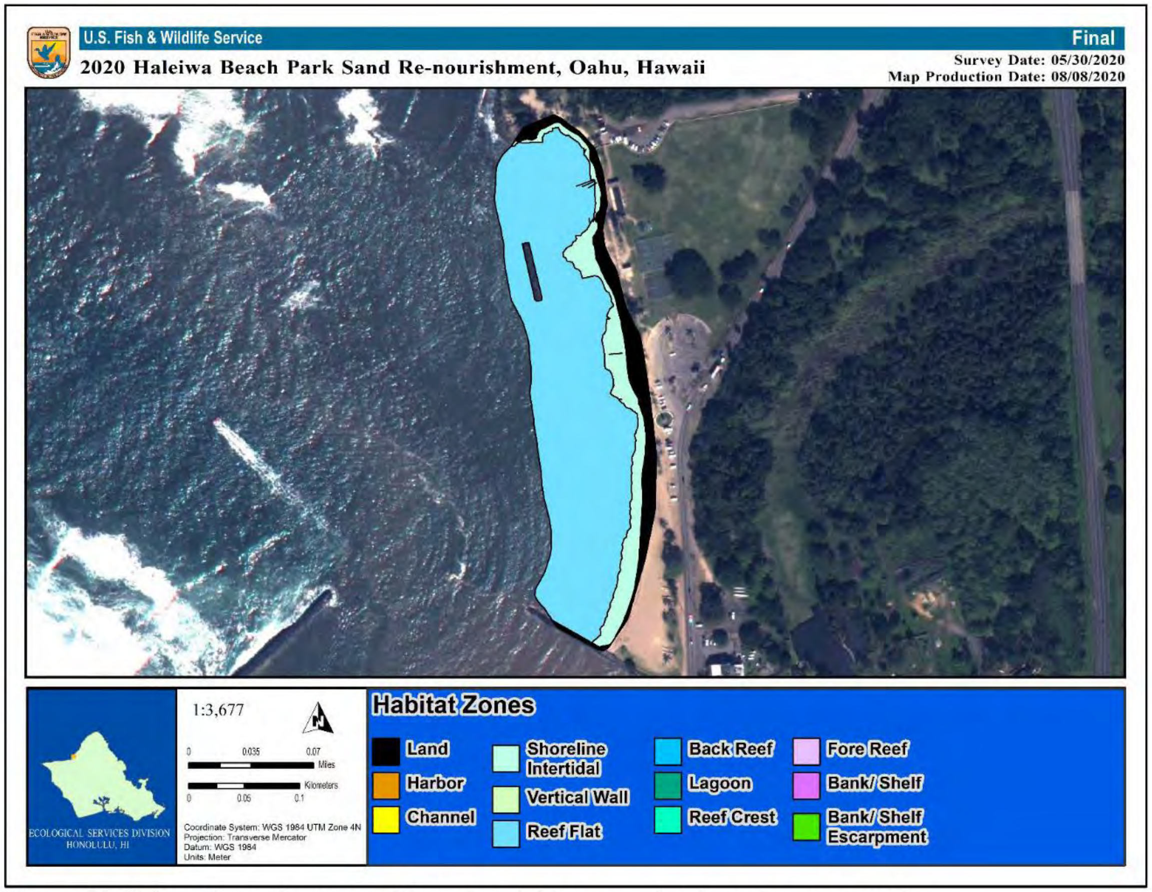

Figure A4: Habitat Zones. Overview of the various habitat zones that the project area contains.

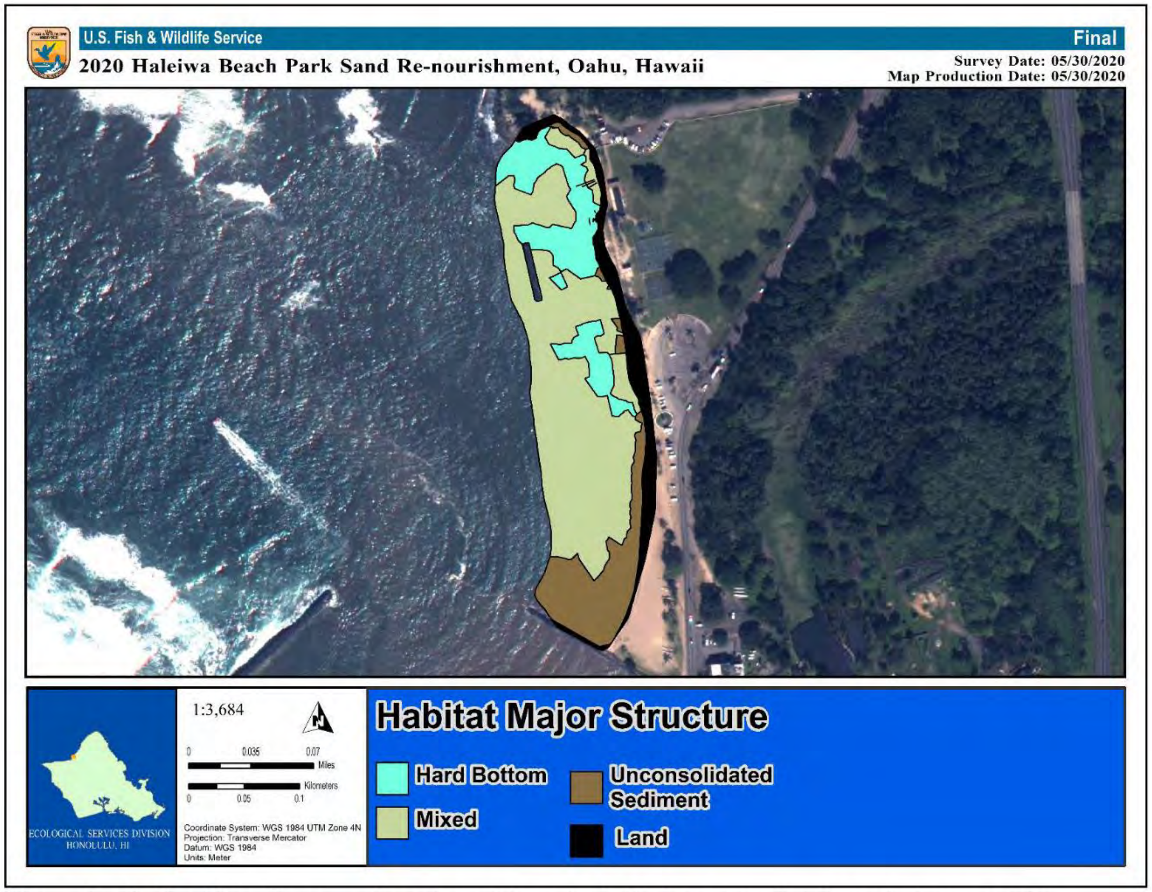

Figure A5: Habitat Major Structure. Overview of the major habitat structures that the project area contains.

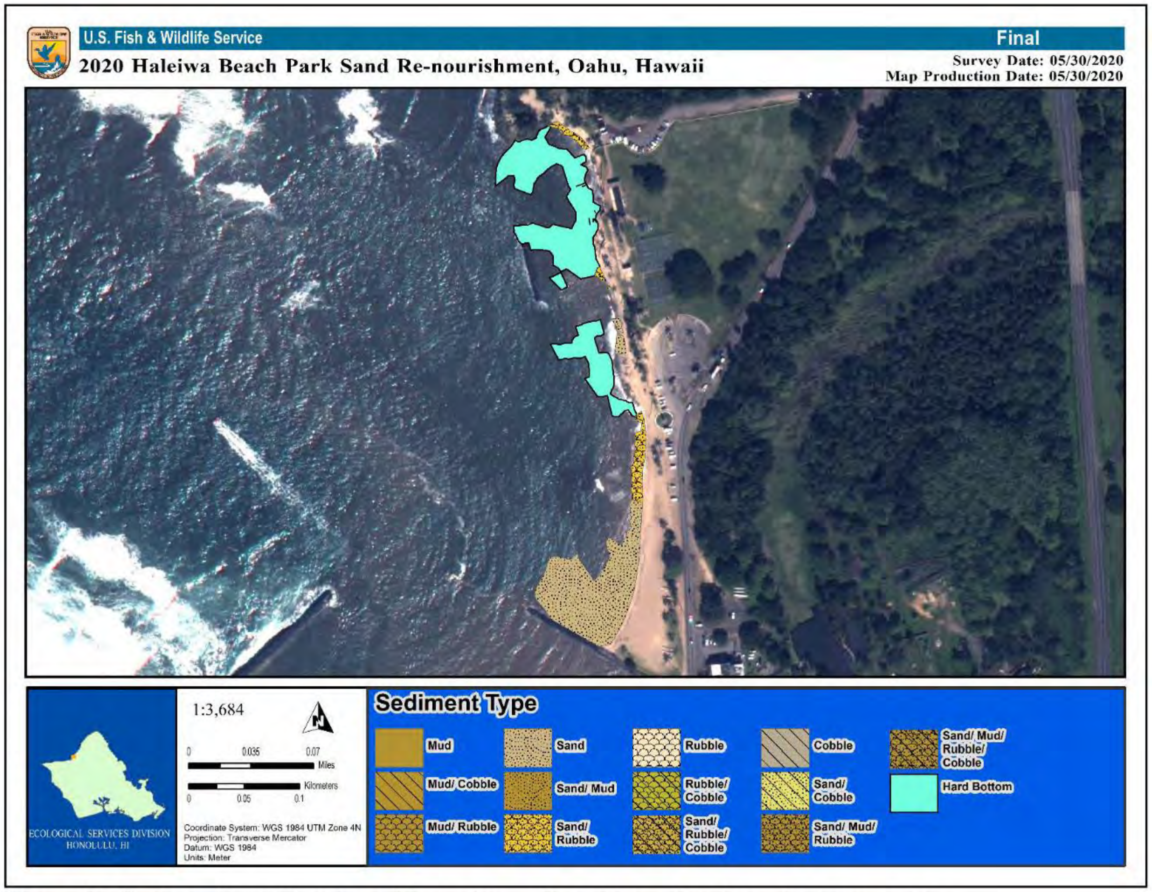

Figure A6: Sediment Type. Overview of the various sediment types that the project area contains.

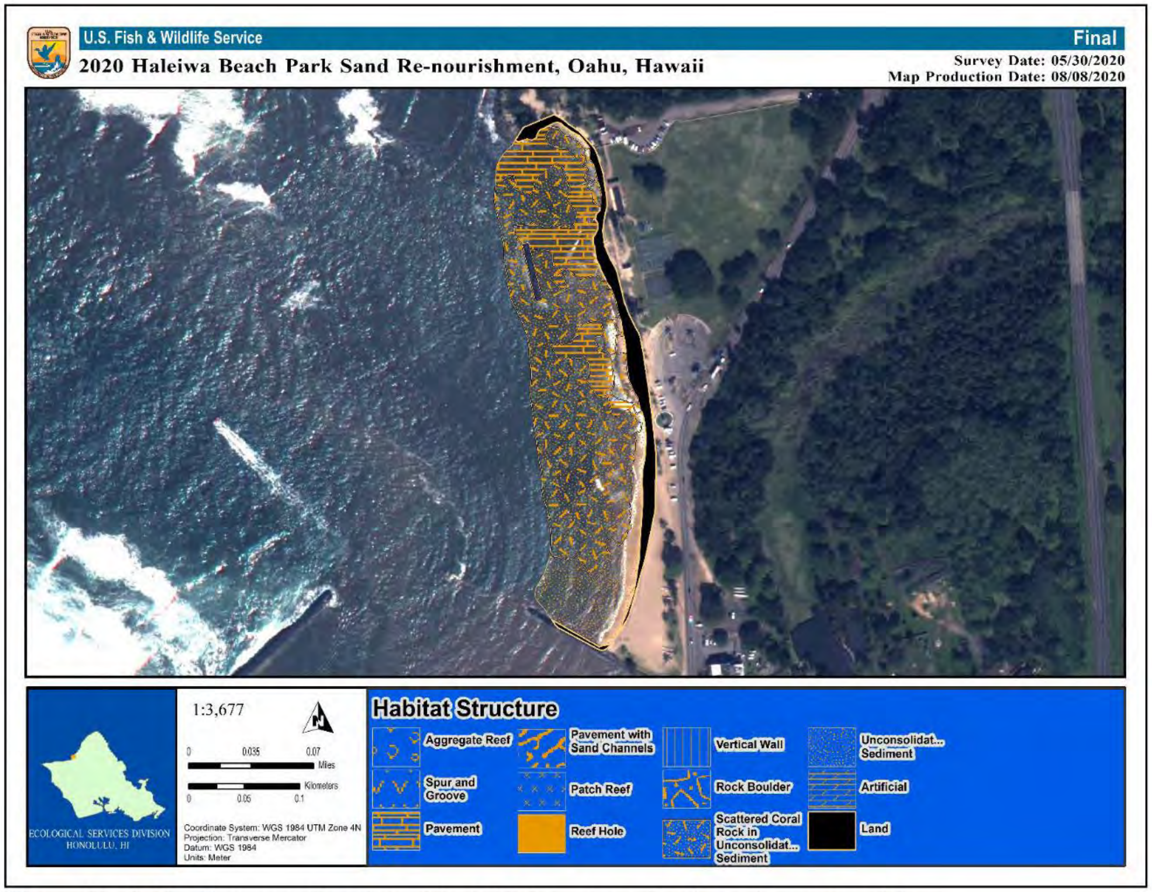

Figure A7: Habitat Structure. Overview of the habitat structures that the project area contains.

53

Figure A8: Habitat Structure within Target Area. Overview of the habitat structures within the Target Area.

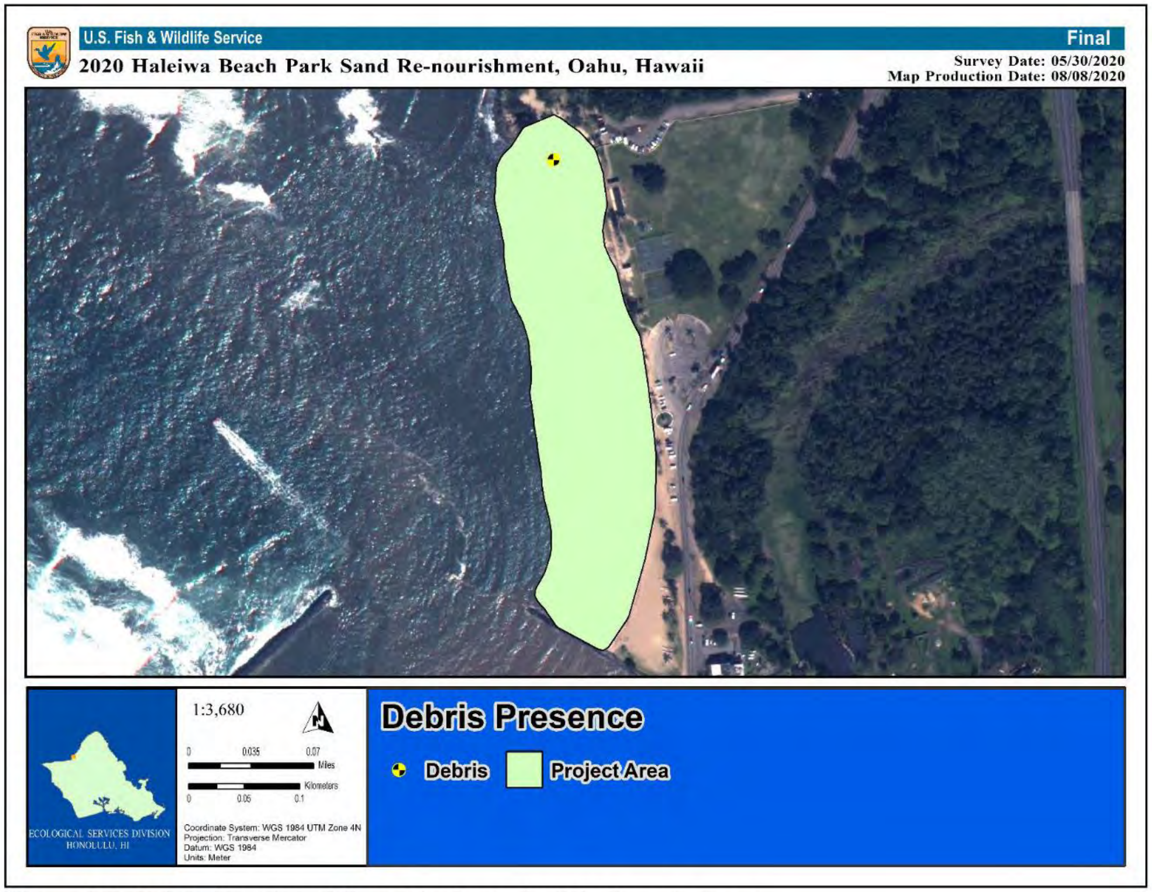

Figure A10: Debris. Overview of the debris observed within the project area.

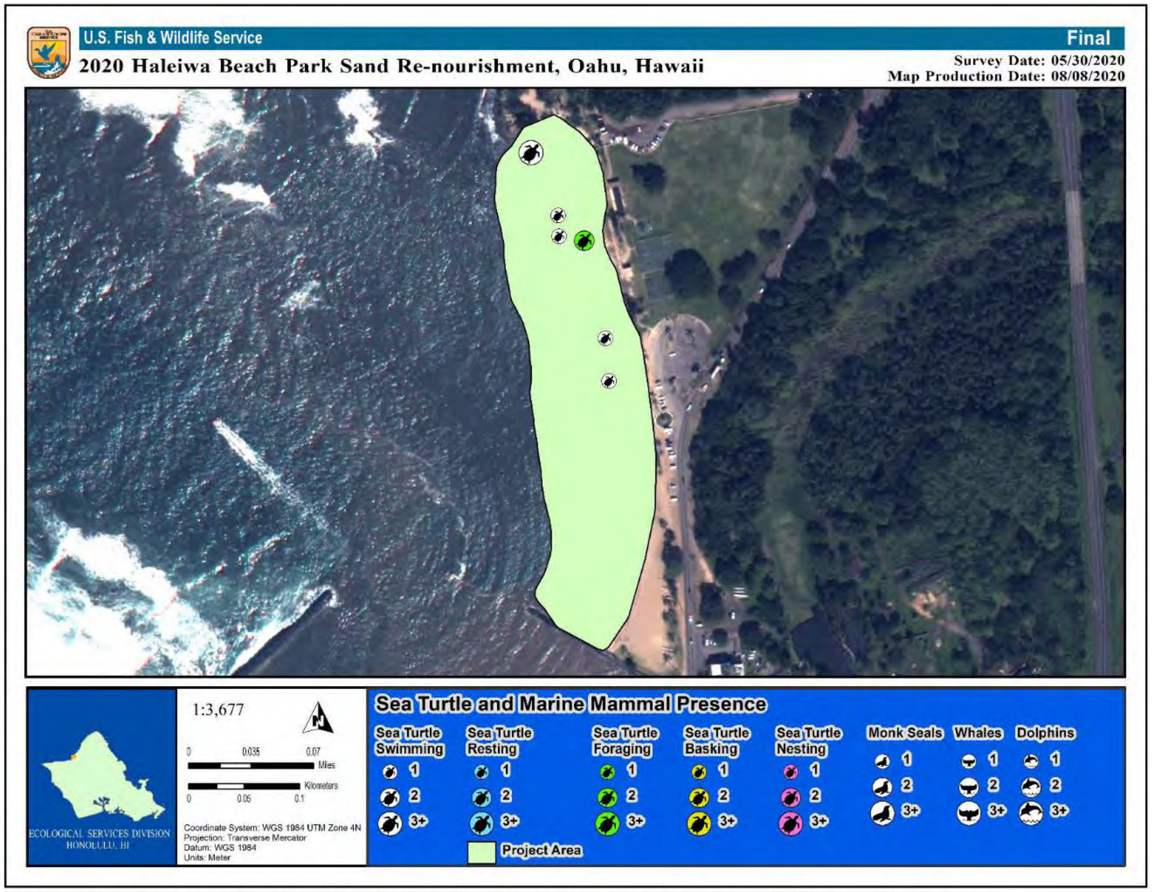

Figure A11: Protected Species. Overview of the observed protected species within the project area.

APPENDIX B: Quantitative summary of Individual Survey Stations

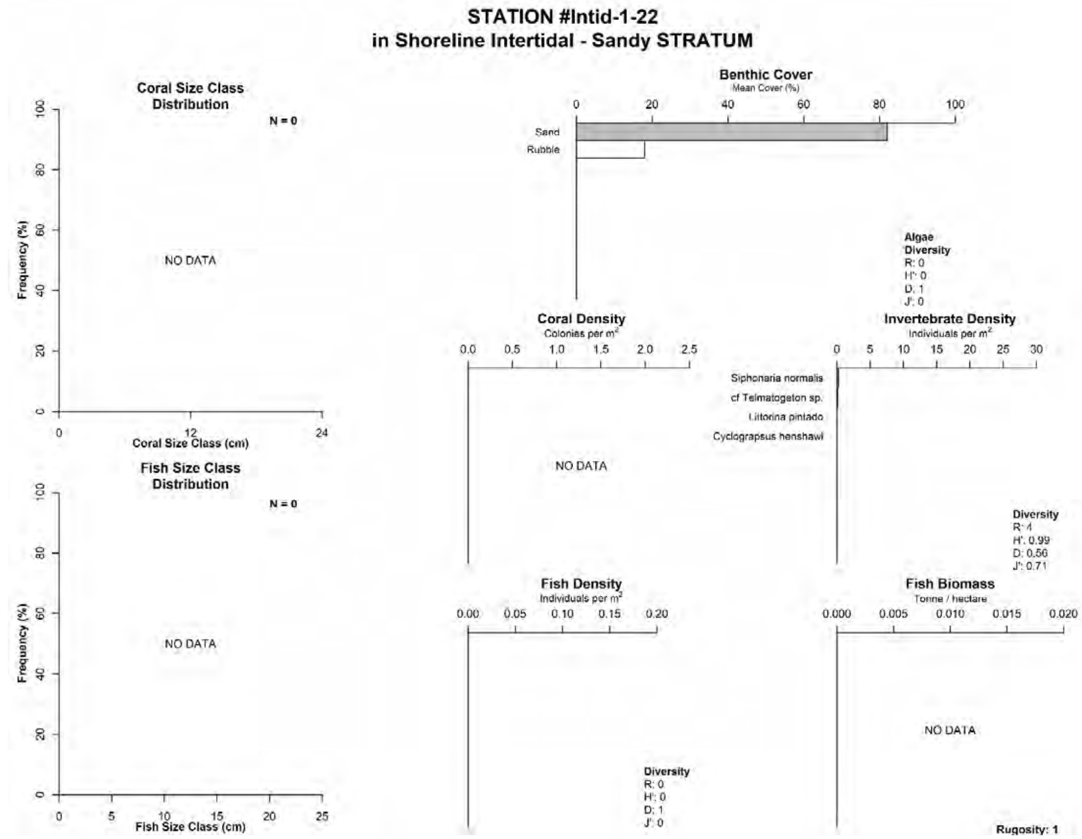

Figure B1: Station Intid-1-22. Biological characterization for station Intid-1-22 in the Shoreline Intertidal – Sandy Stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

58

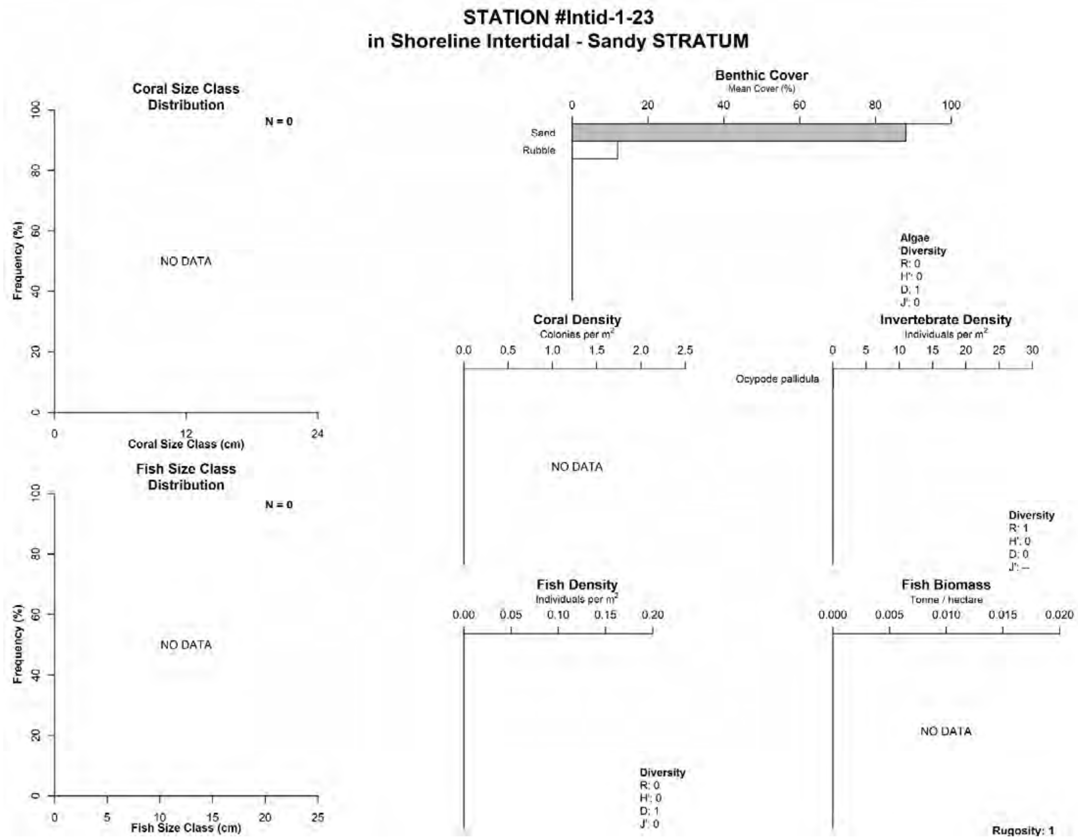

Figure B2: Station Intid-1-23. Biological characterization for station Intid-1-23 in the Shoreline Intertidal – Sandy Stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

59

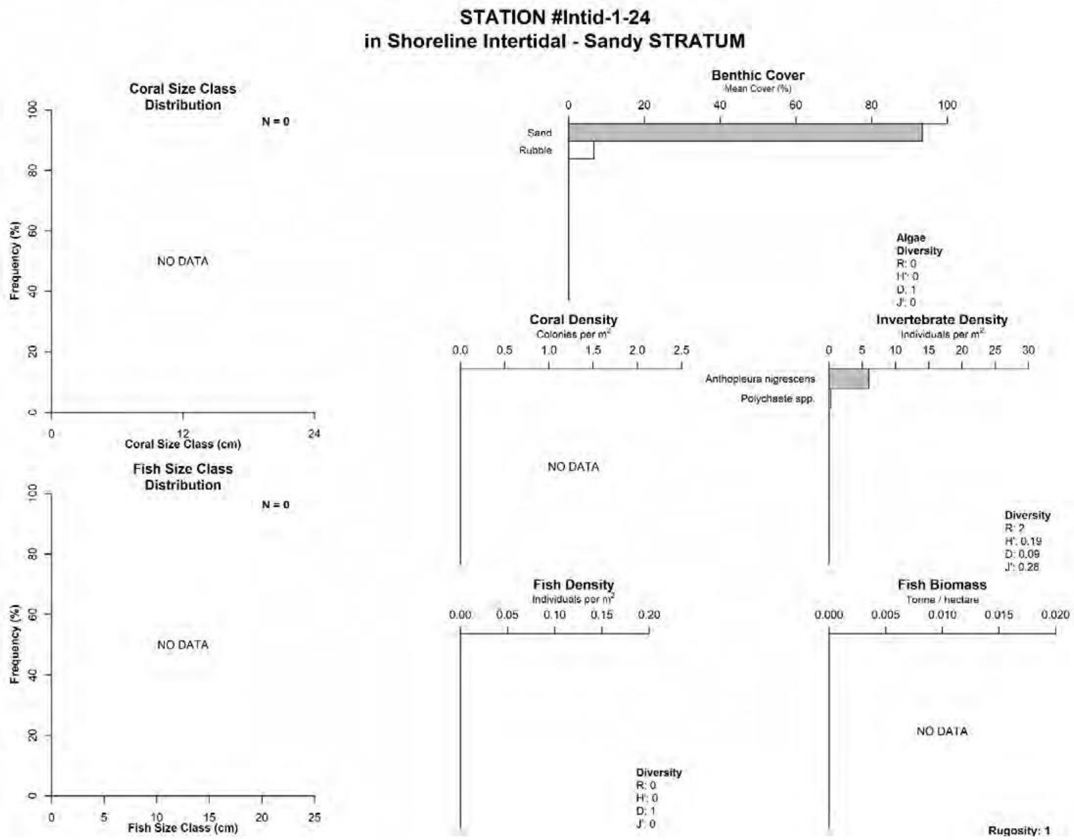

Figure B3: Station Intid-1-24. Biological characterization for station Intid-1-24 in the Shoreline Intertidal – Sandy Stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

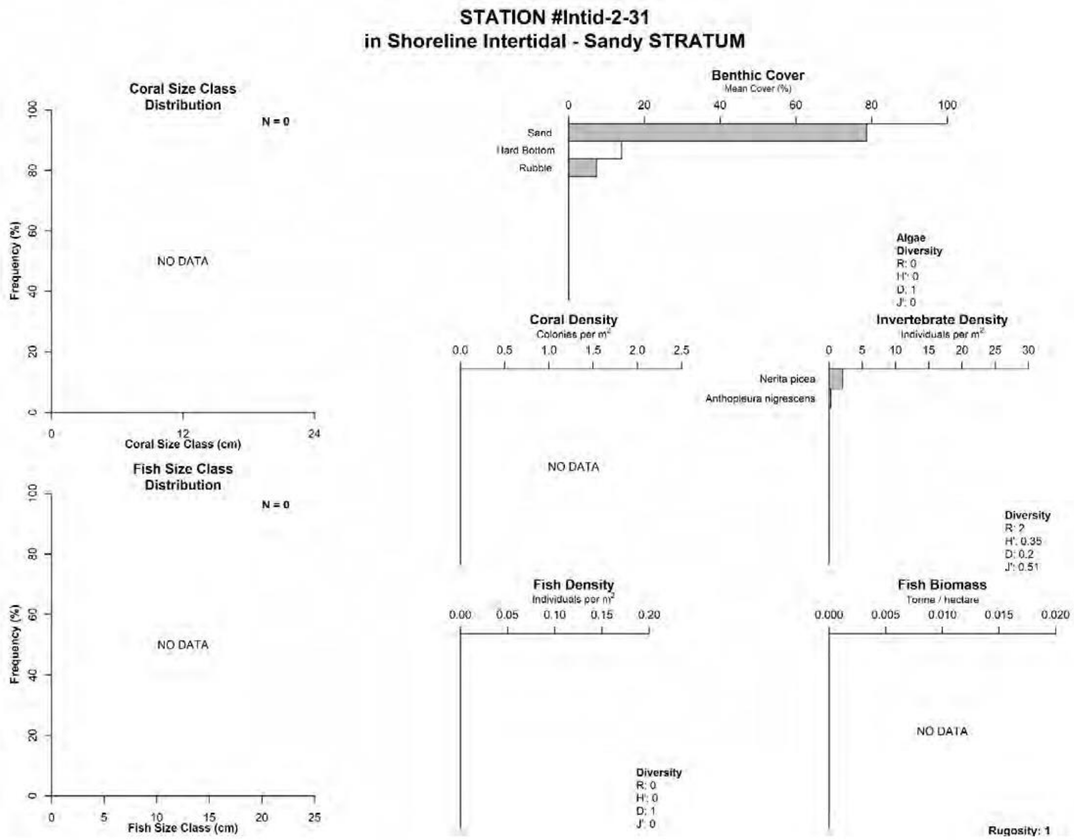

Figure B4: Station Intid-2-31. Biological characterization for station Intid-2-31 in the Shoreline Intertidal – Sandy Stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

61

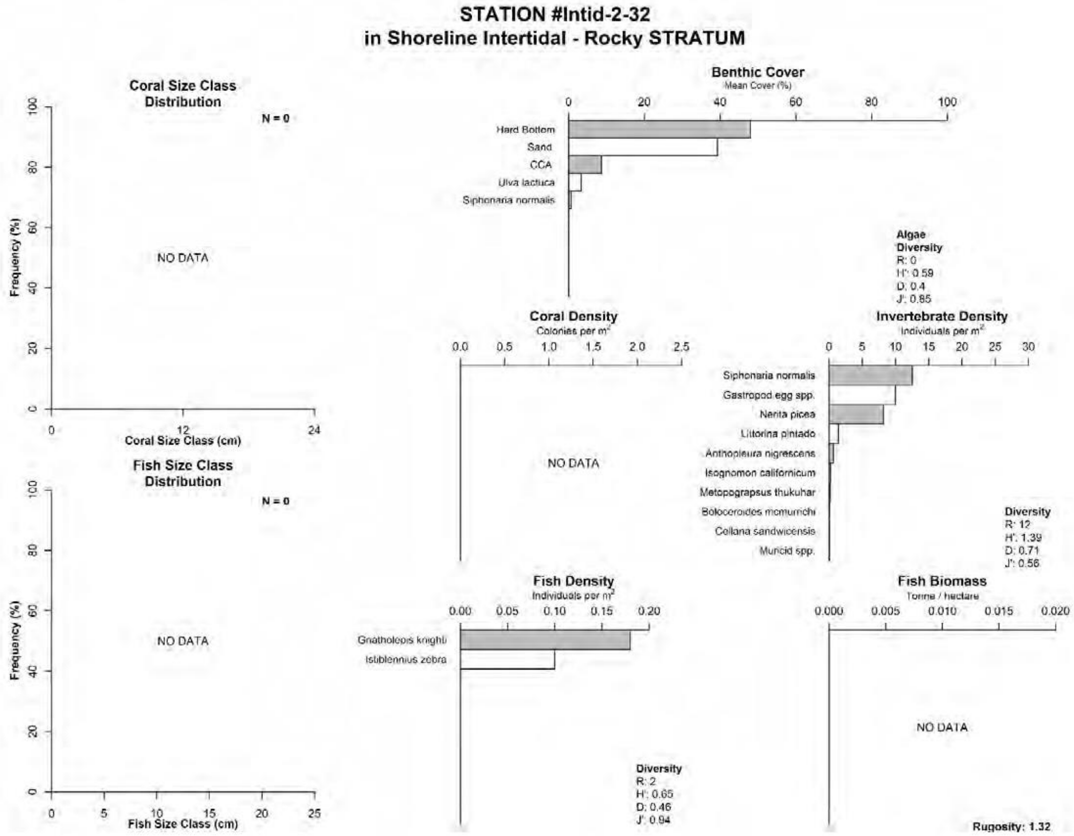

Figure B5: Station Intid-2-32. Biological characterization for station Intid-2-32 in the Shoreline Intertidal – Rocky Stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

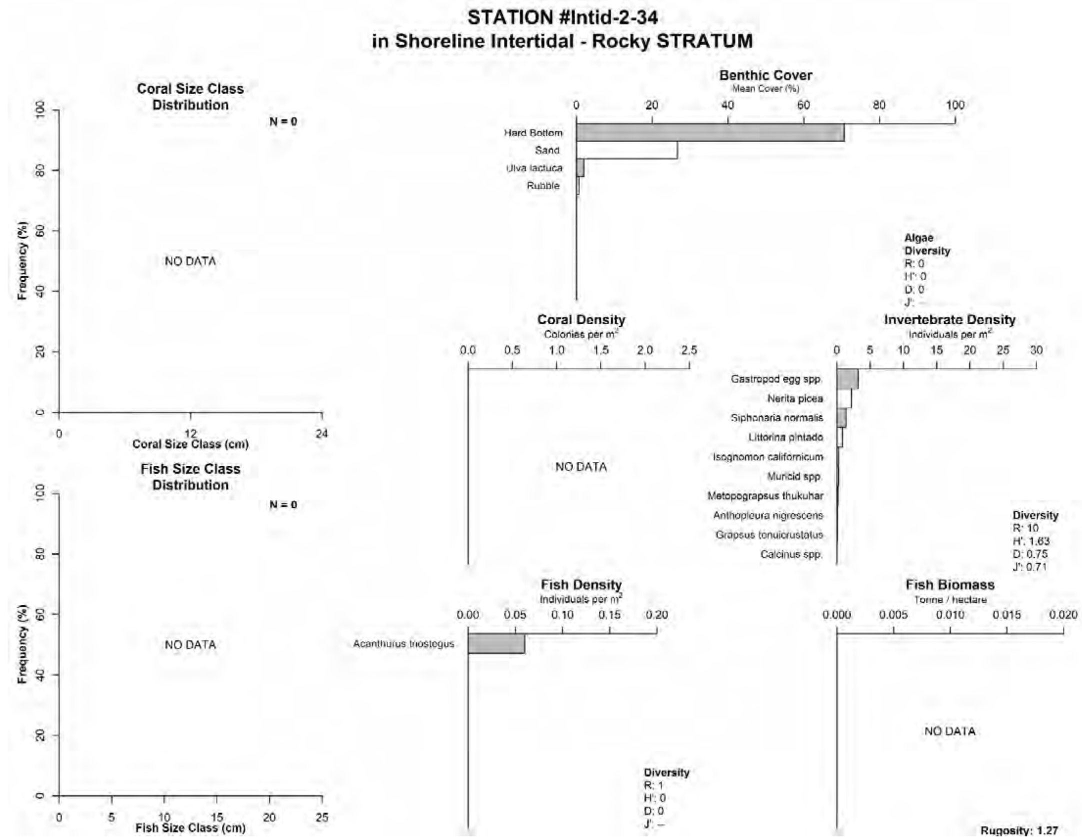

Figure B6: Station Intid-2-34. Biological characterization for station Intid-2-34 in the Shoreline Intertidal – Rocky Stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

63

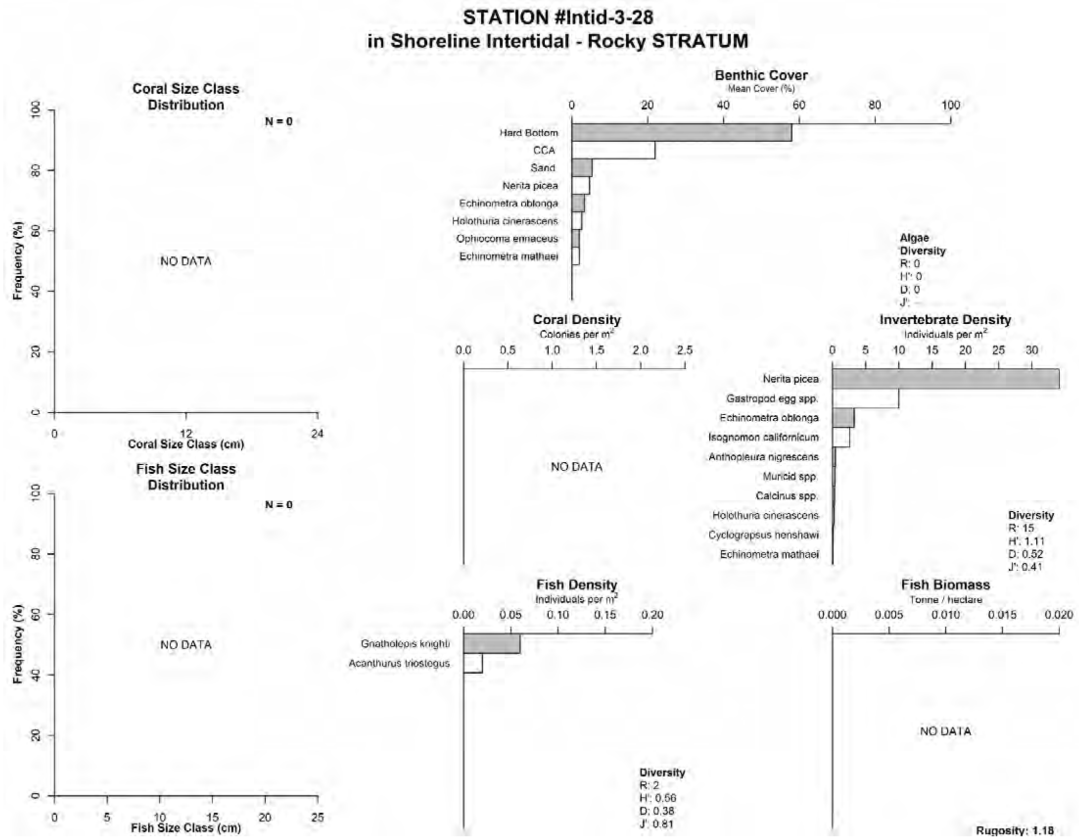

Figure B7: Station Intid-3-28. Biological characterization for station Intid-3-28 in the Shoreline Intertidal – Rocky Stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

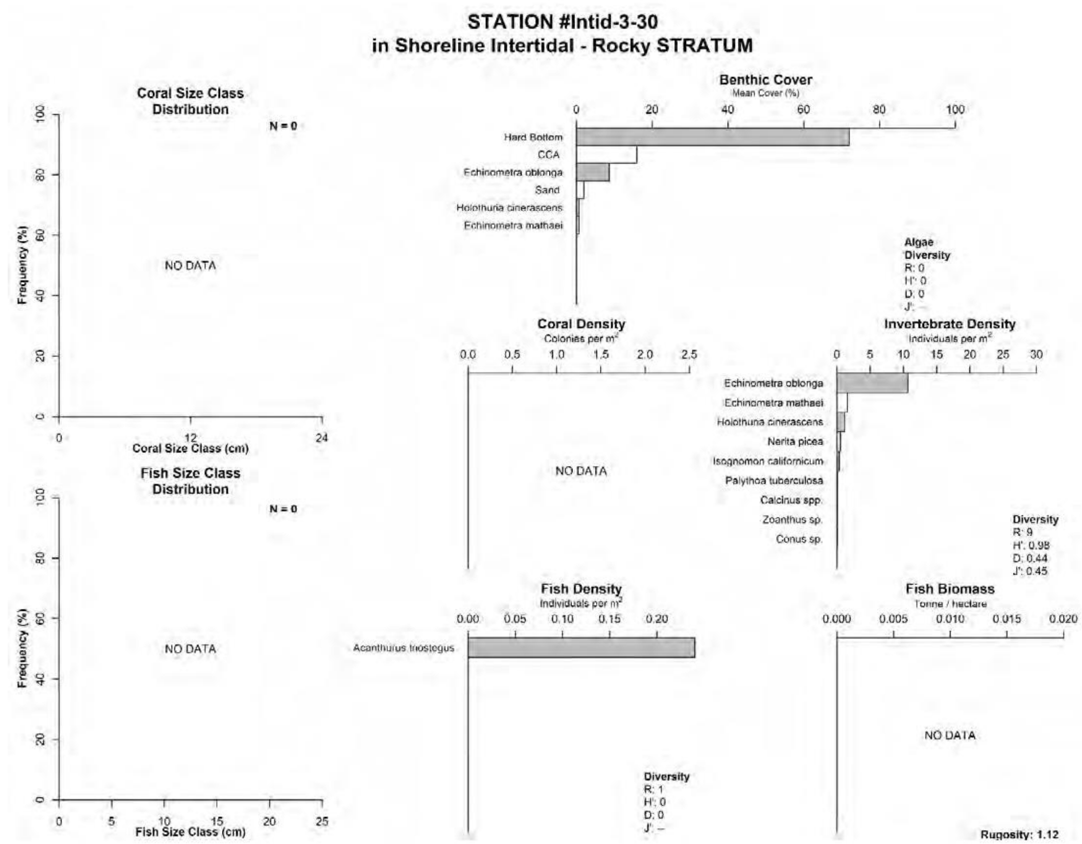

Figure B8: Station Intid-3-30. Biological characterization for station Intid-3-30 in the Shoreline Intertidal – Rocky Stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

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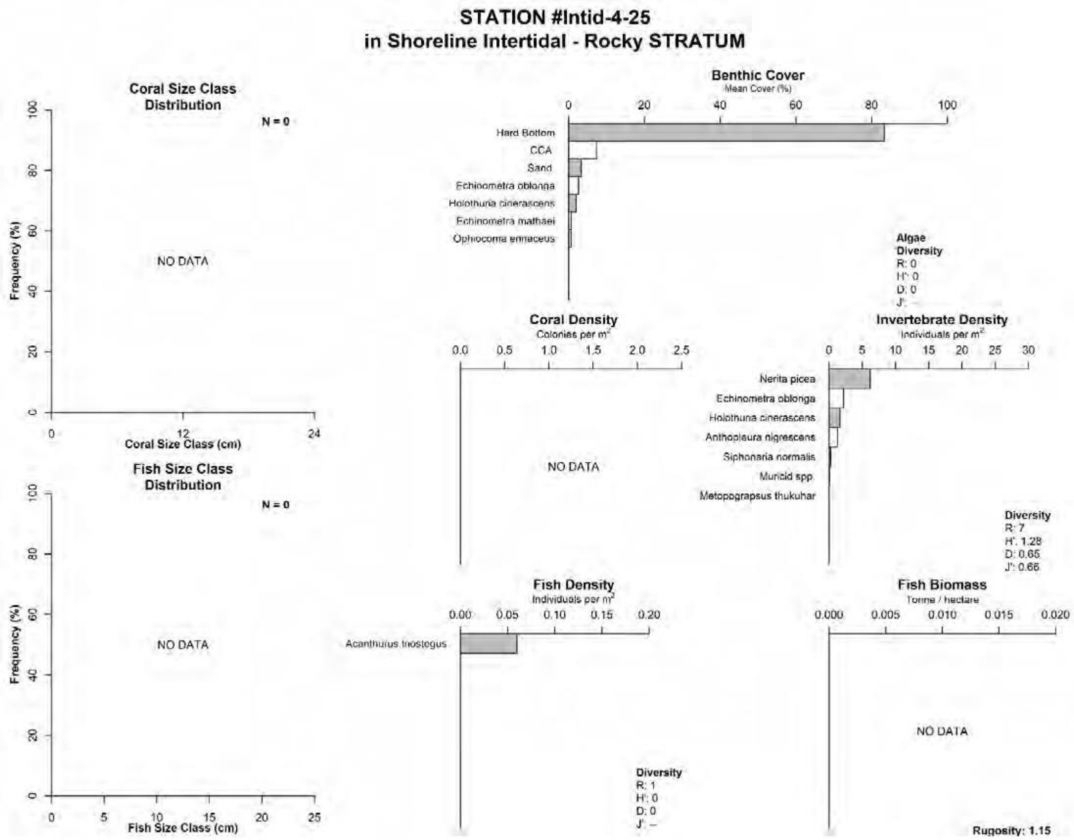

Figure B9: Station Intid-4-25. Biological characterization for station Intid-4-25 in the Shoreline Intertidal – Rocky Stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

66

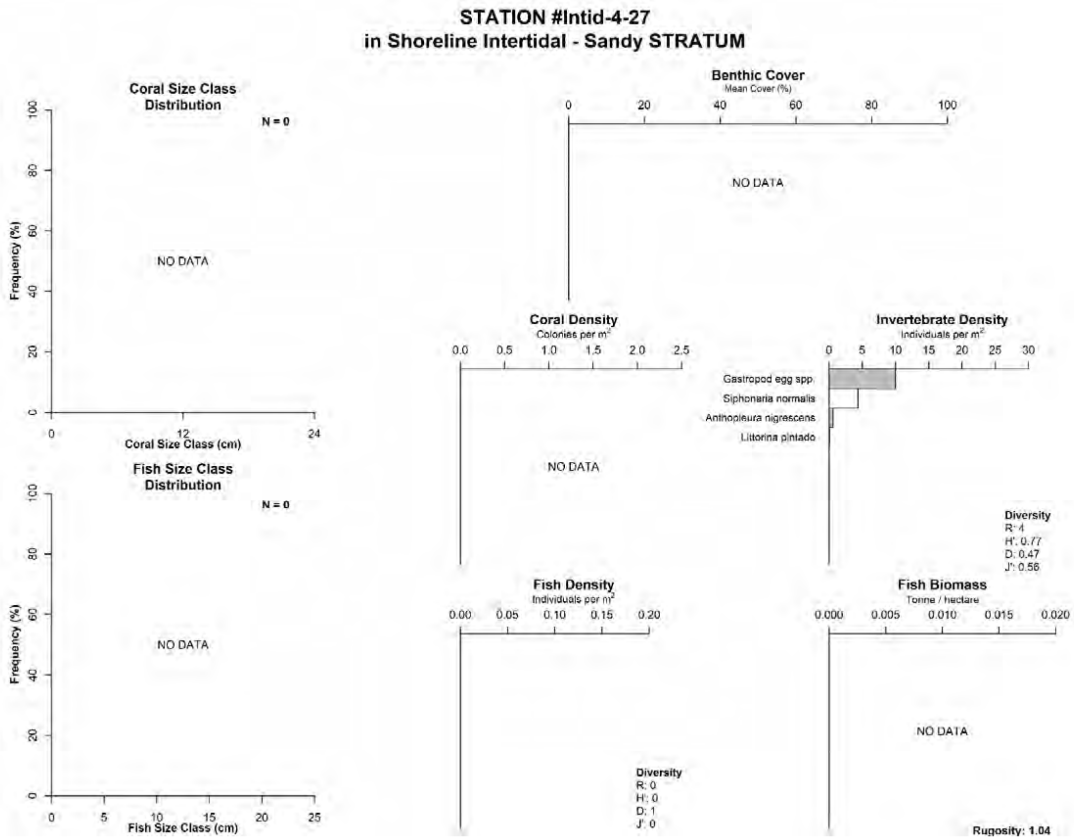

Figure B10: Station Intid-4-27. Biological characterization for station Intid-4-27 in the Shoreline Intertidal – Sandy Stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

67

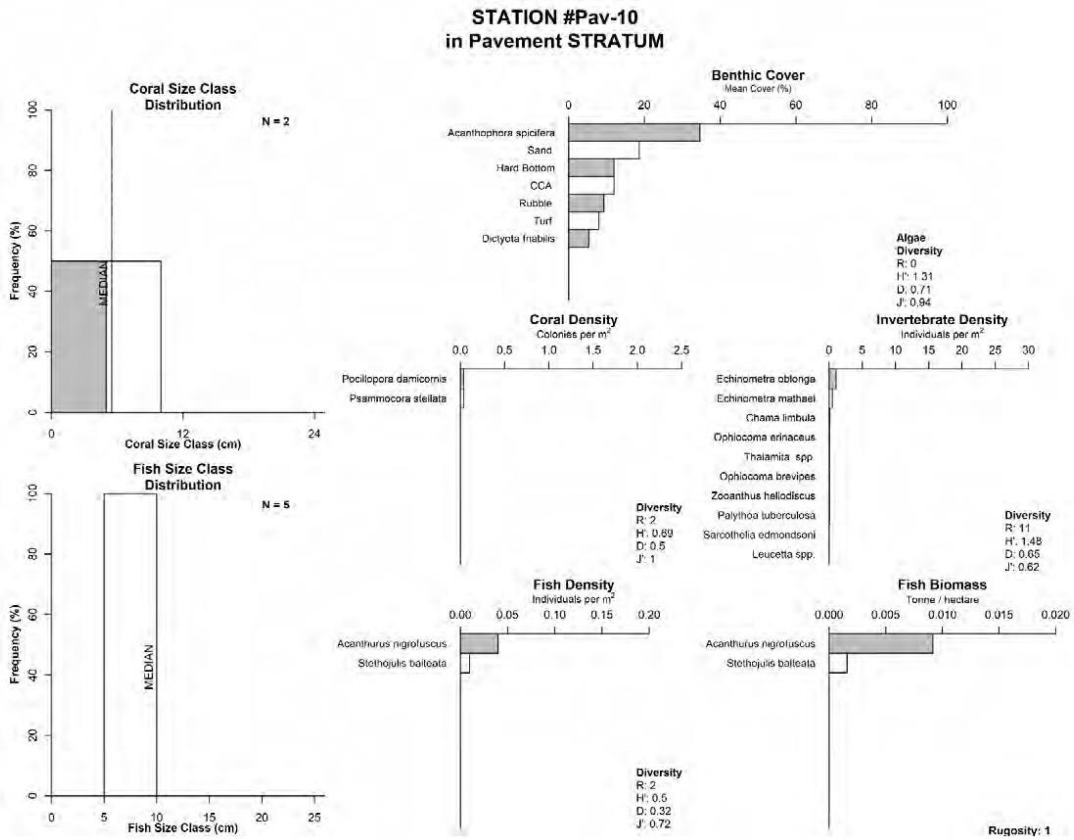

Figure B11: Station Pav-10. Biological characterization for station Pav10 in the Pavement Stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

68

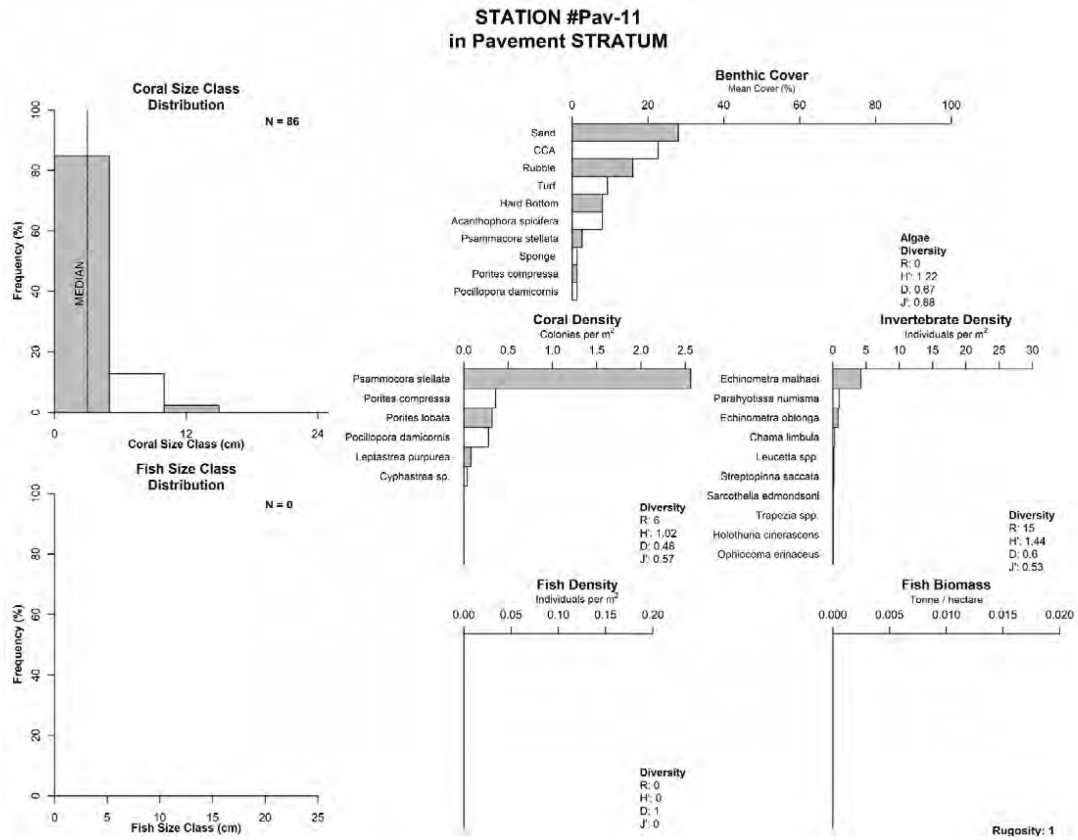

Figure B12: Station Pav-11. Biological characterization for station Pav-11 in the Pavement Stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

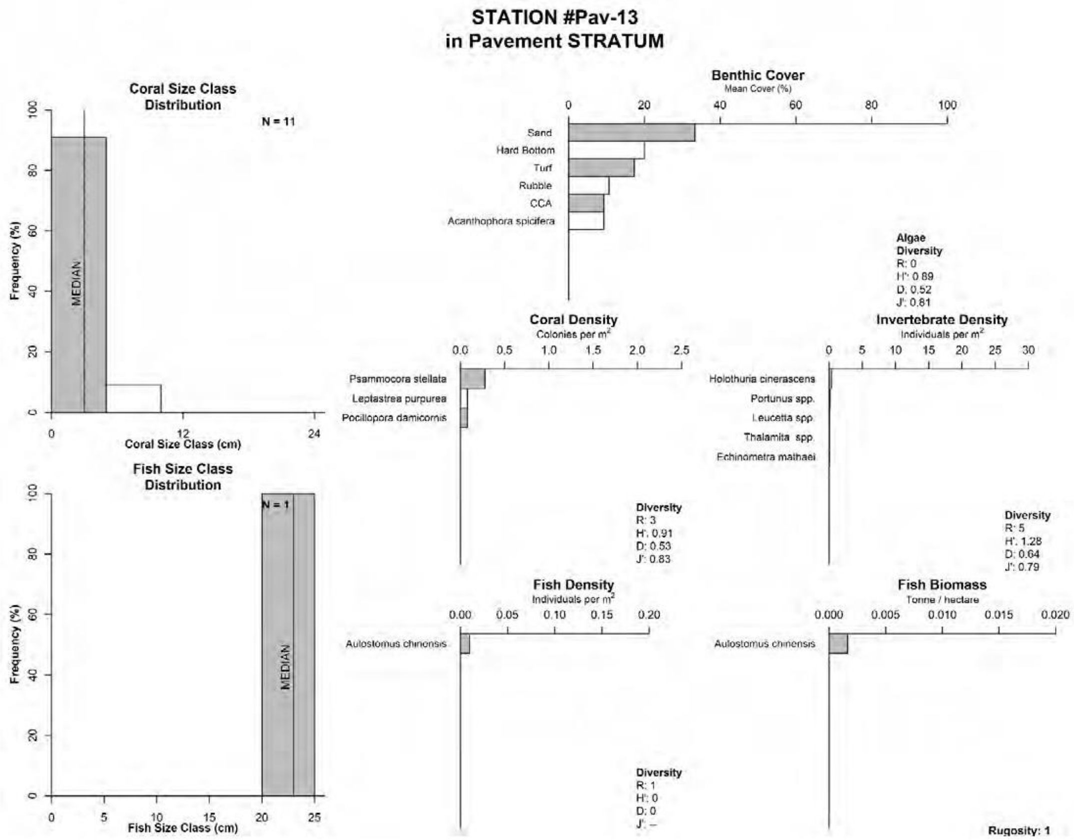

Figure B13: Station Pav-13. Biological characterization for station Pav-13 in the Pavement Stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

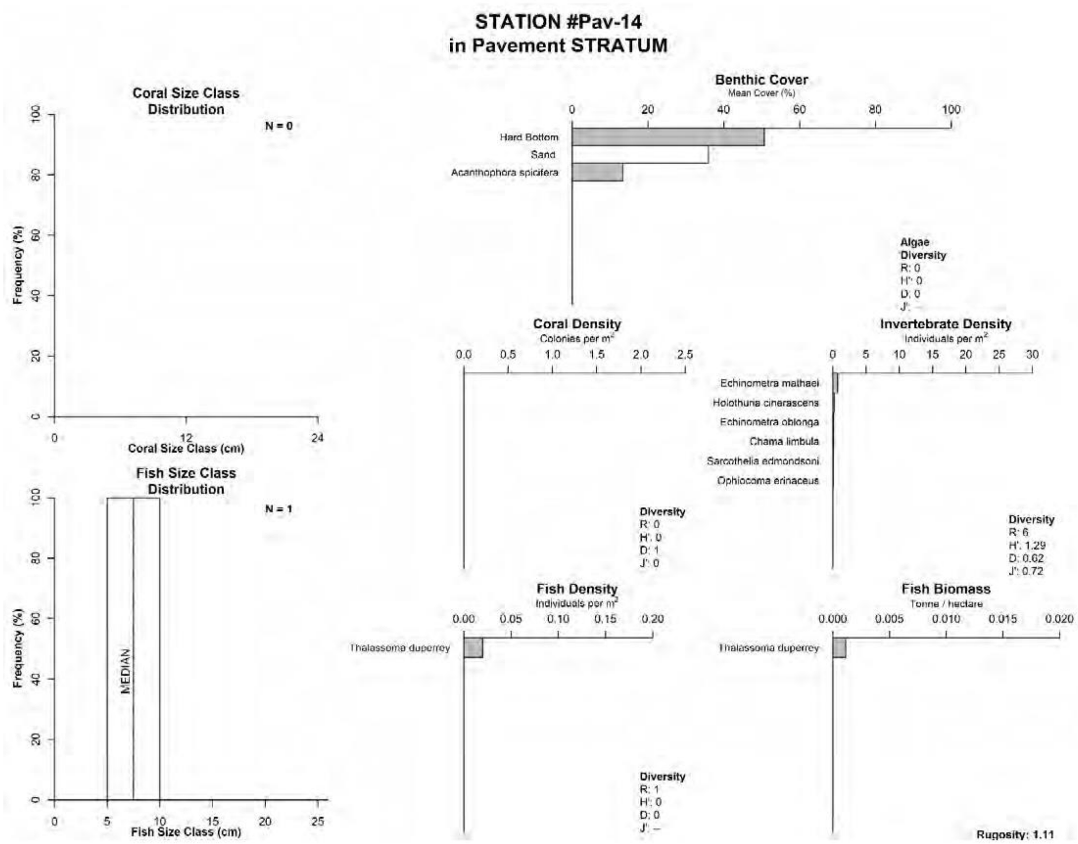

Figure B14: Station Pav-14. Biological characterization for station Pav-14 in the Pavement Stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

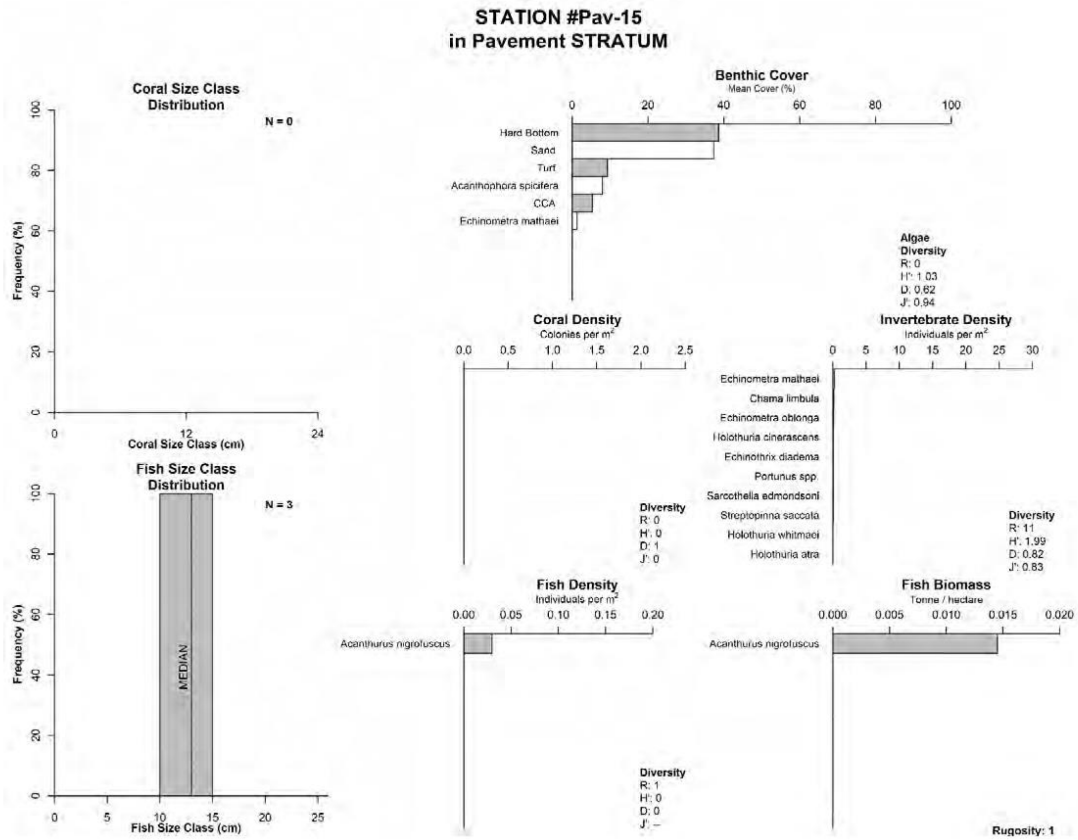

Figure B15: Station Pav-15. Biological characterization for station Pav-15 in the Pavement Stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

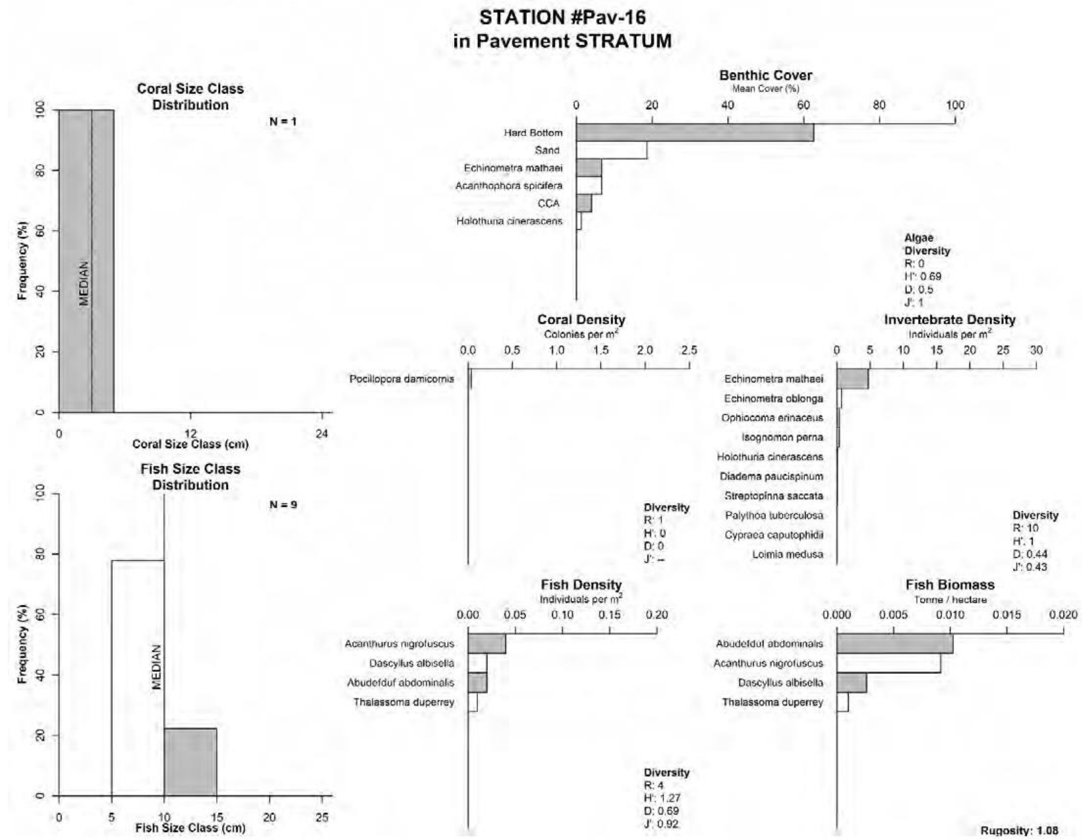

Figure B16: Station Pav-16. Biological characterization for station Pav-16 in the Pavement Stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

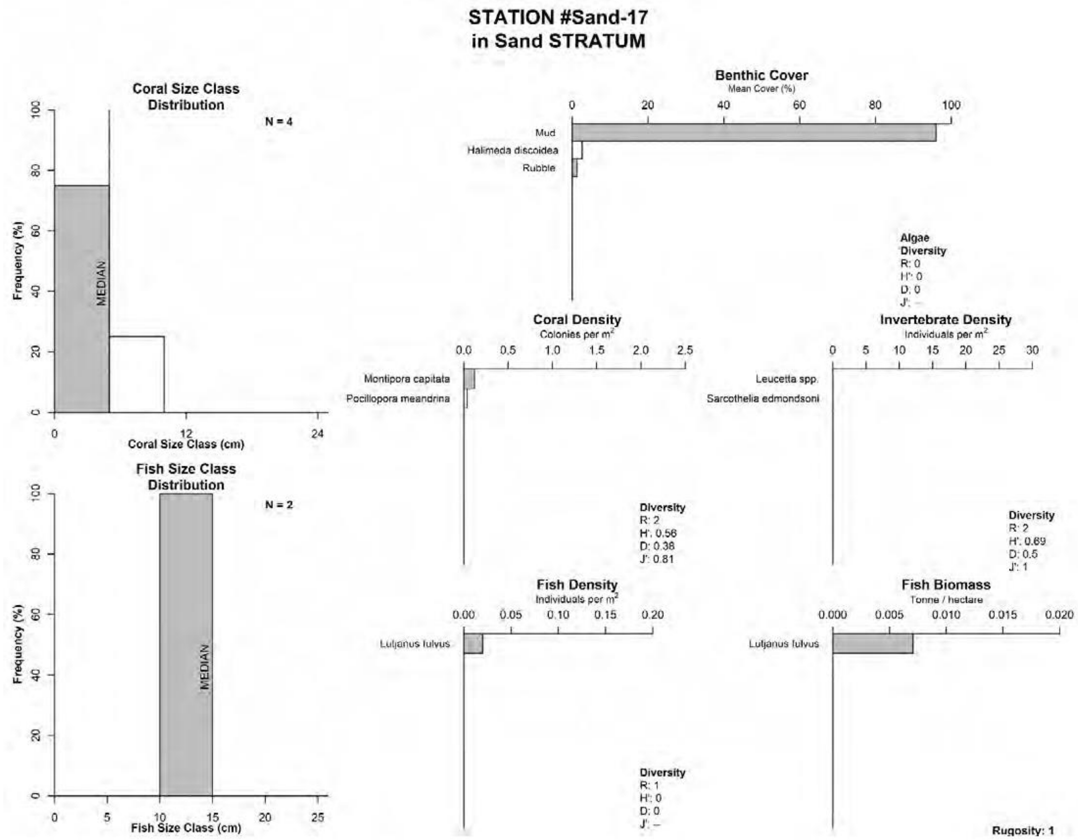

Figure B17: Station Sand-17. Biological characterization for station Sand-17 in the Sand Stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

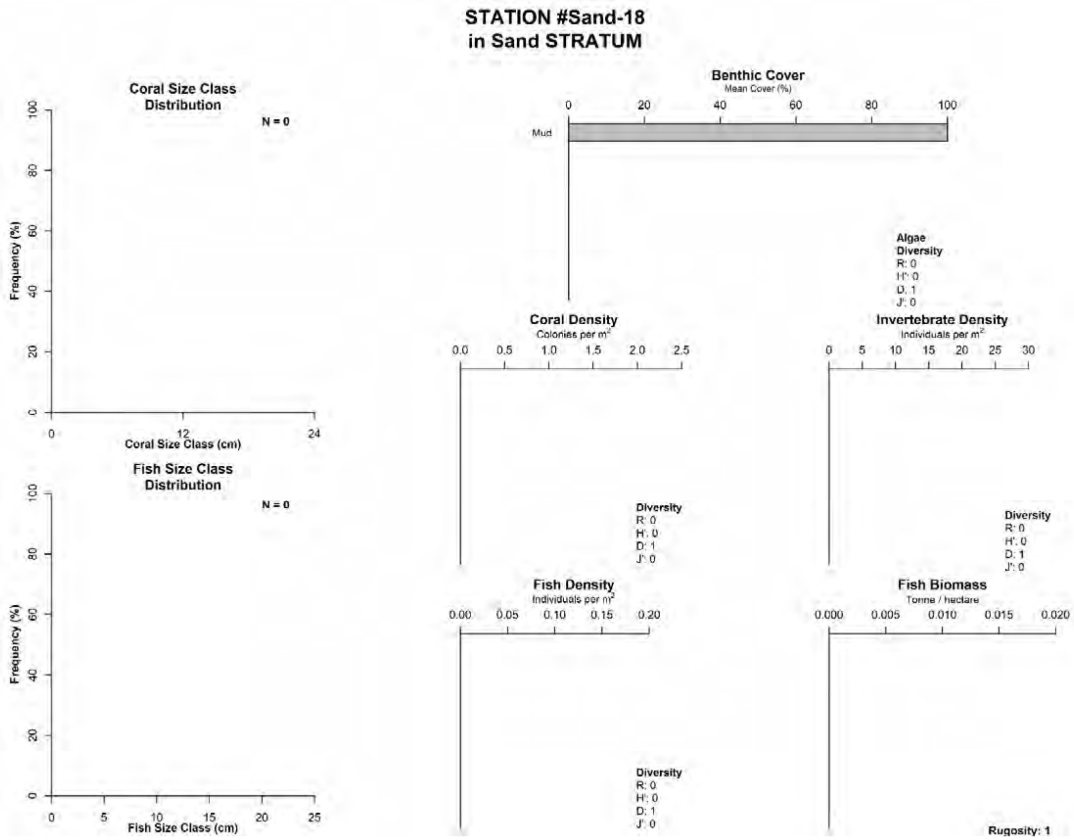

Figure B18: Station Sand-18. Biological characterization for station Sand-18 in the Sand Stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

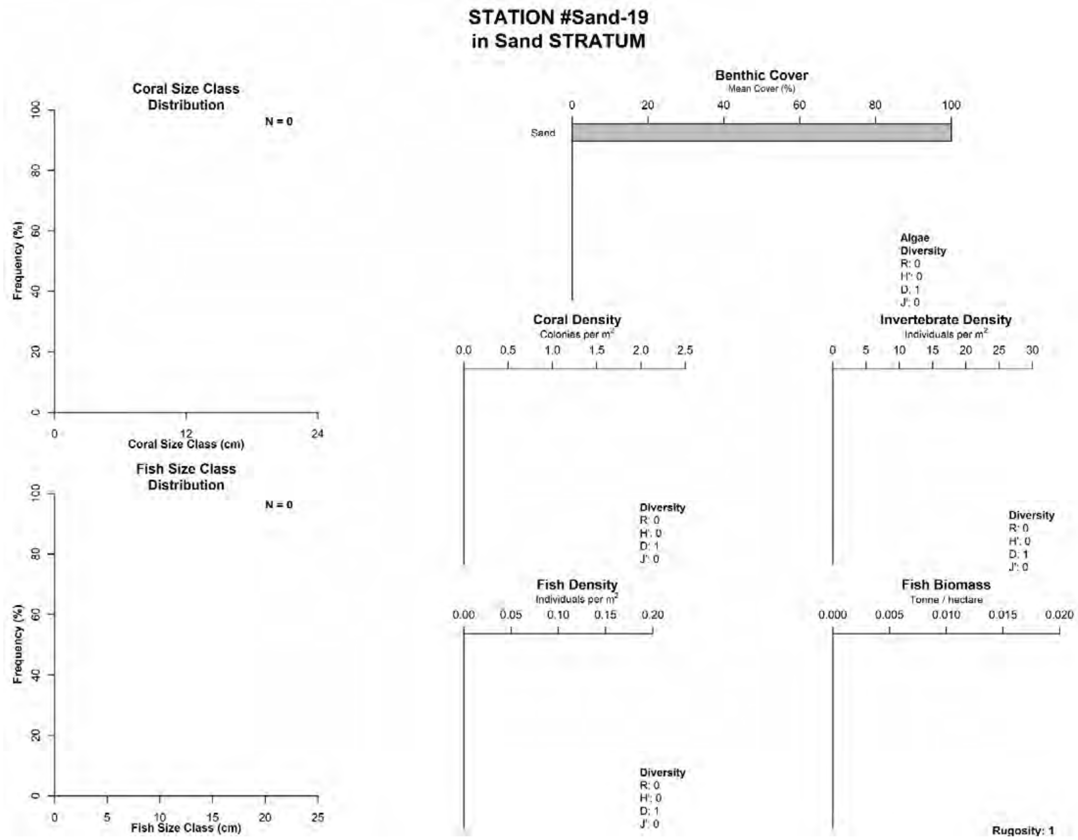

Figure B19: Station Sand-19. Biological characterization for station Sand-19 in the Sand Stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

76

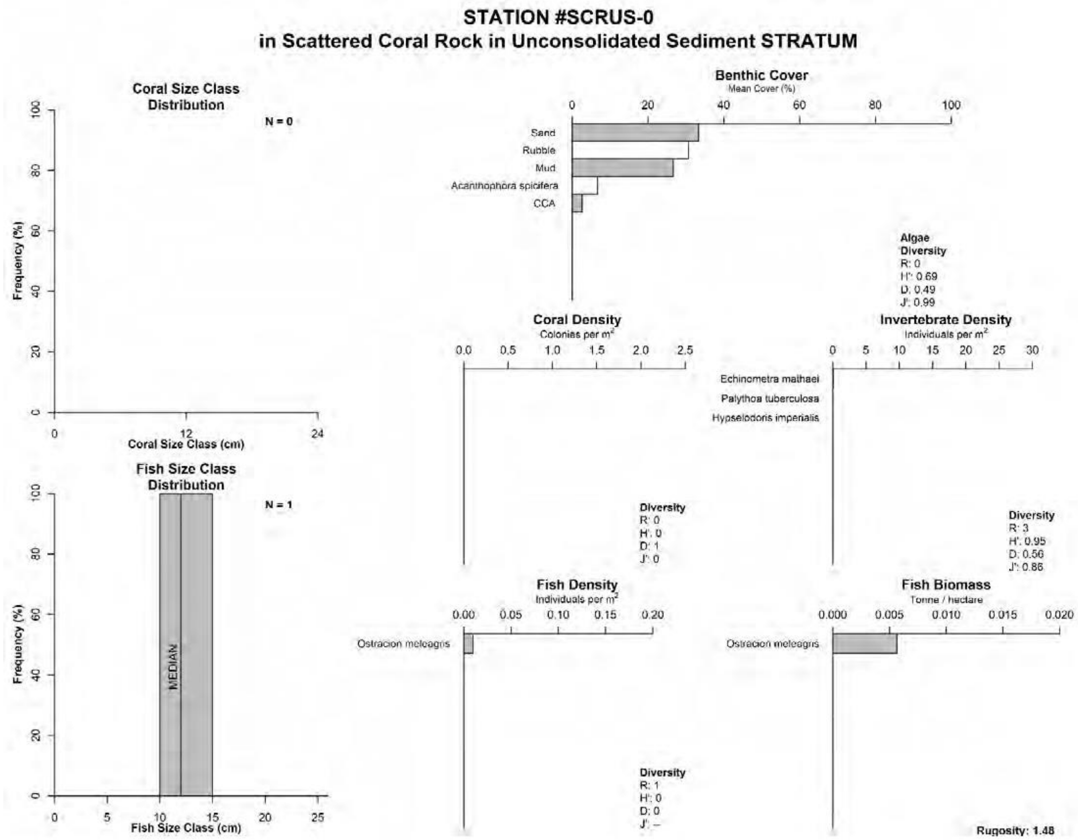

Figure B20: Station SCRUS-0. Biological characterization for station SCRUS-0 in the Scattered Coral/Rock in Unconsolidated Sediment Stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

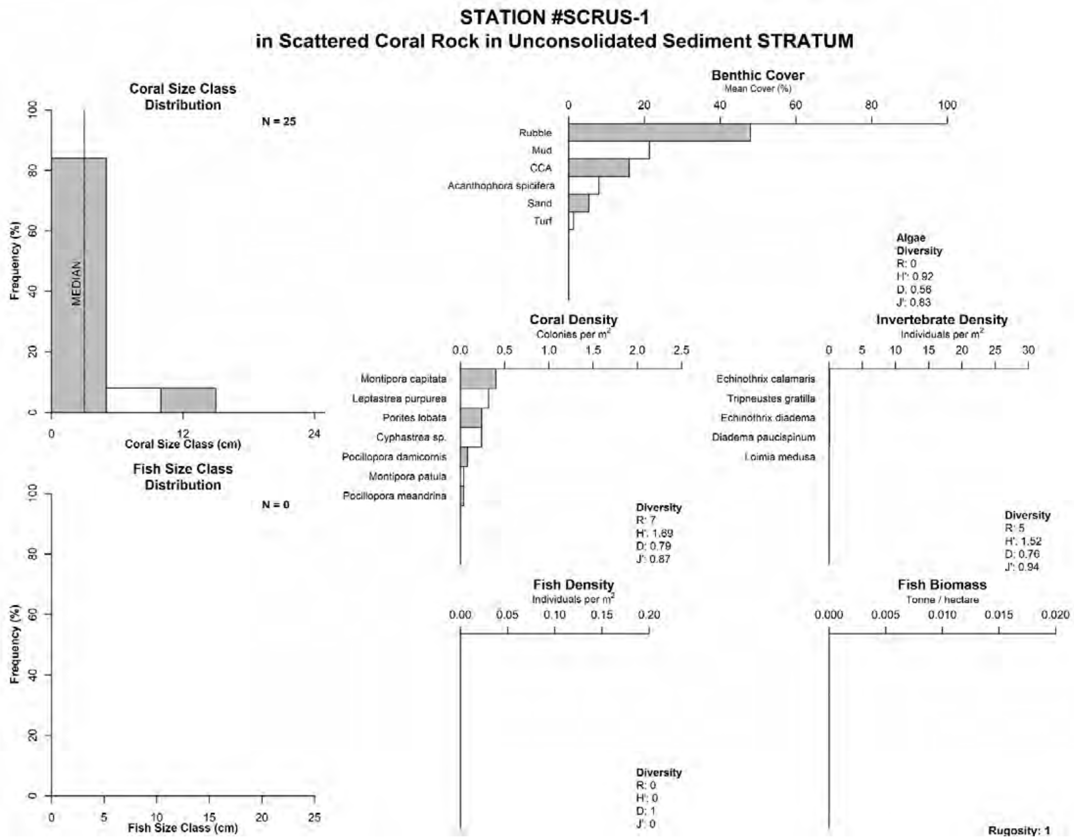

Figure B21: Station SCRUS-1. Biological characterization for station SCRUS-1 in the Scattered Coral/Rock in Unconsolidated Sediment Stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

78

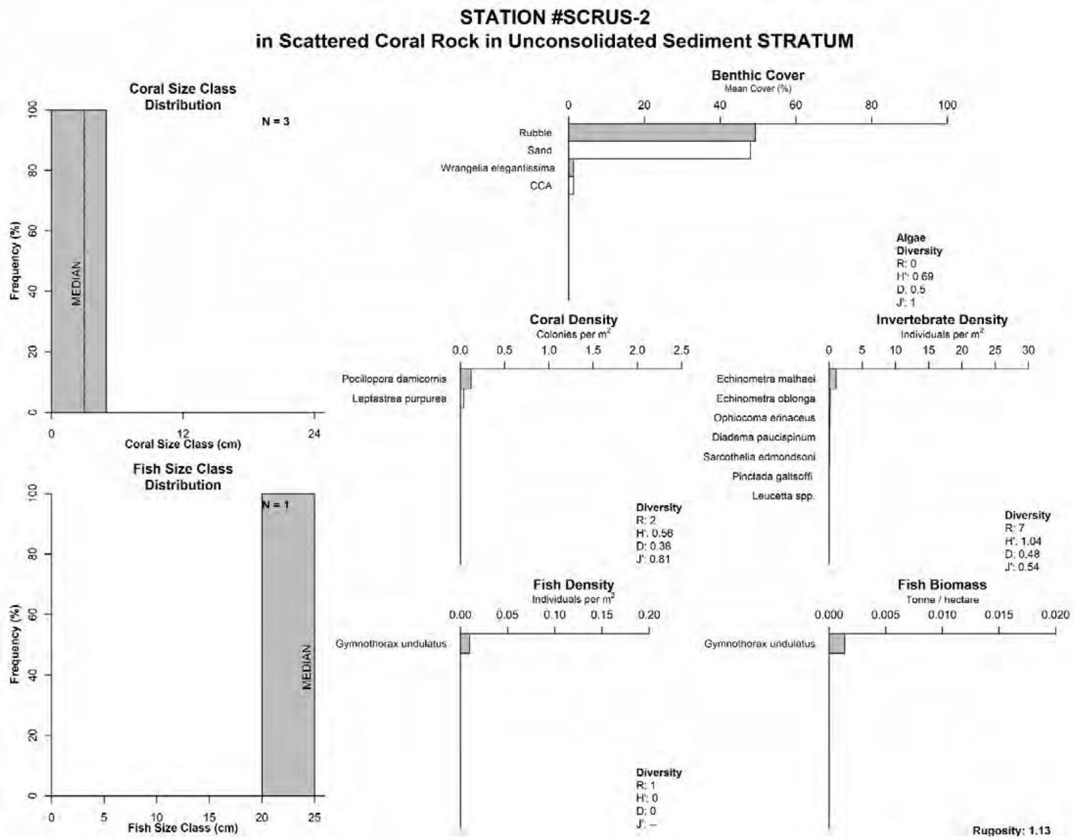

Figure B22: Station SCRUS-2. Biological characterization for station SCRUS-2 in the Scattered Coral/Rock in Unconsolidated Sediment Stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

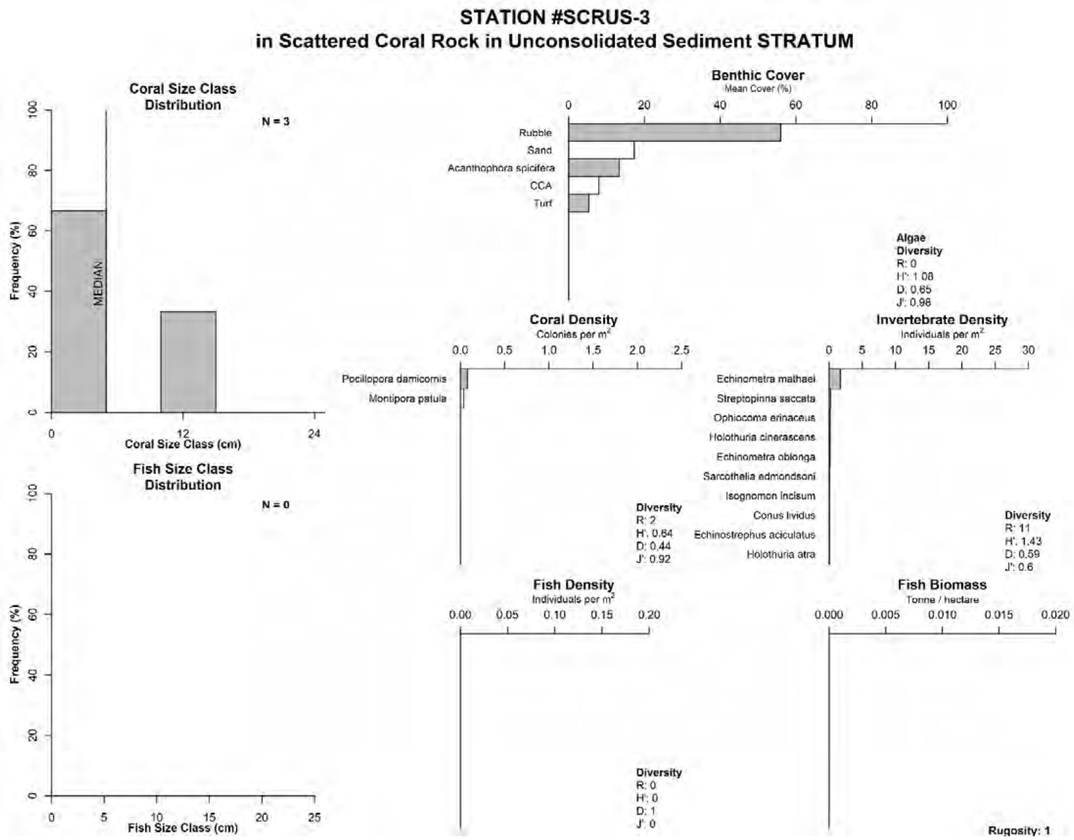

Figure B23: Station SCRUS-3. Biological characterization for station SCRUS-3 in the Scattered Coral/Rock in Unconsolidated Sediment Stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

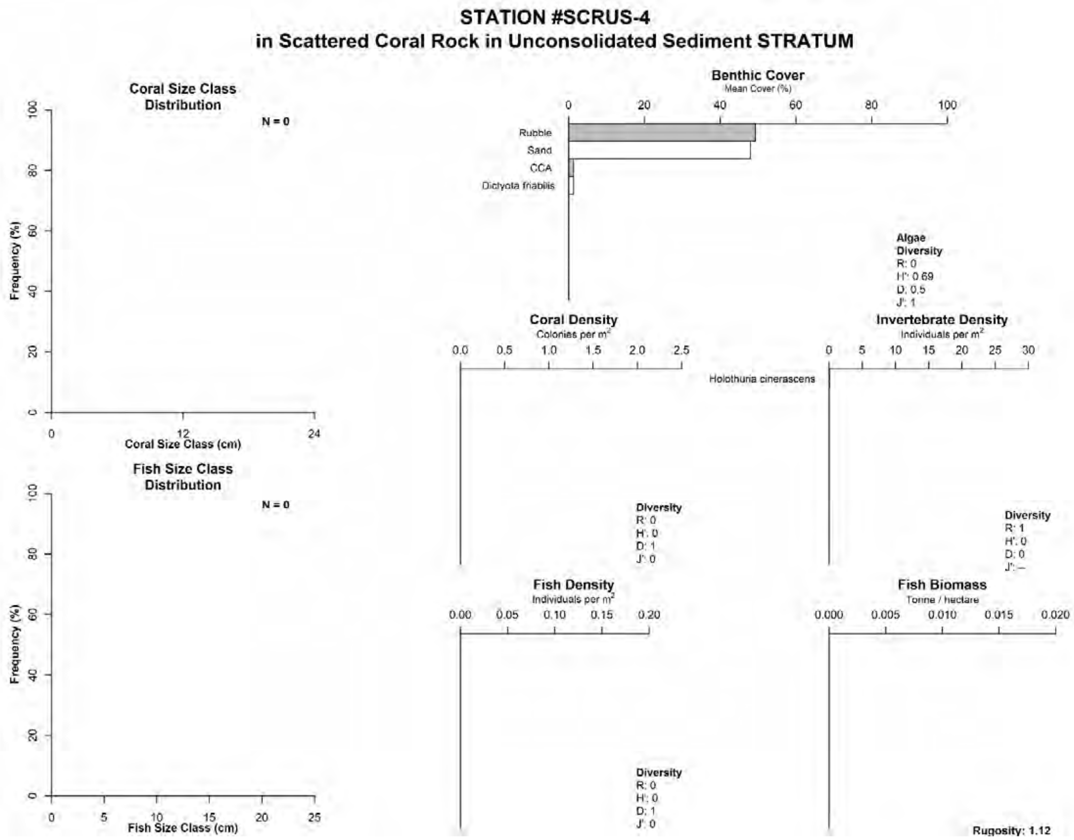

Figure B24: Station SCRUS-4. Biological characterization for station SCRUS-4 in the Scattered Coral/Rock in Unconsolidated Sediment Stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

81

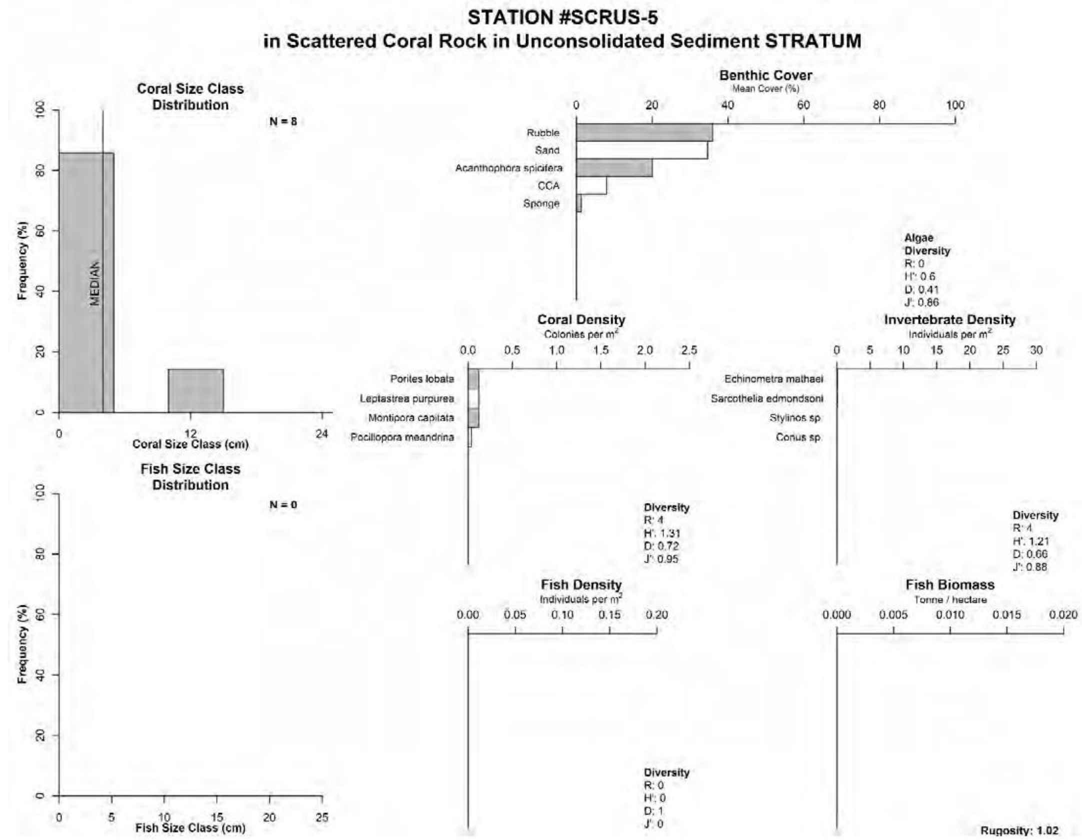

Figure B25: Station SCRUS-5. Biological characterization for station SCRUS-5 in the Scattered Coral/Rock in Unconsolidated Sediment Stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

82

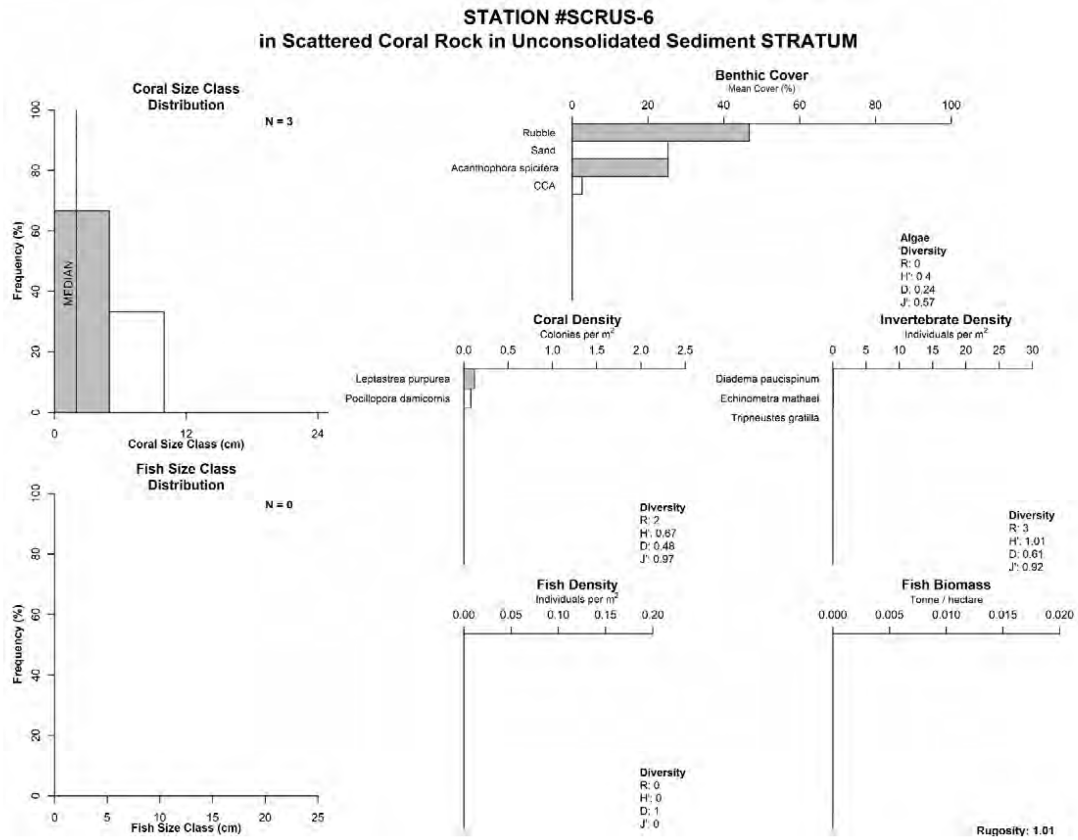

Figure B26: Station SCRUS-6. Biological characterization for station SCRUS-6 in the Scattered Coral/Rock in Unconsolidated Sediment Stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

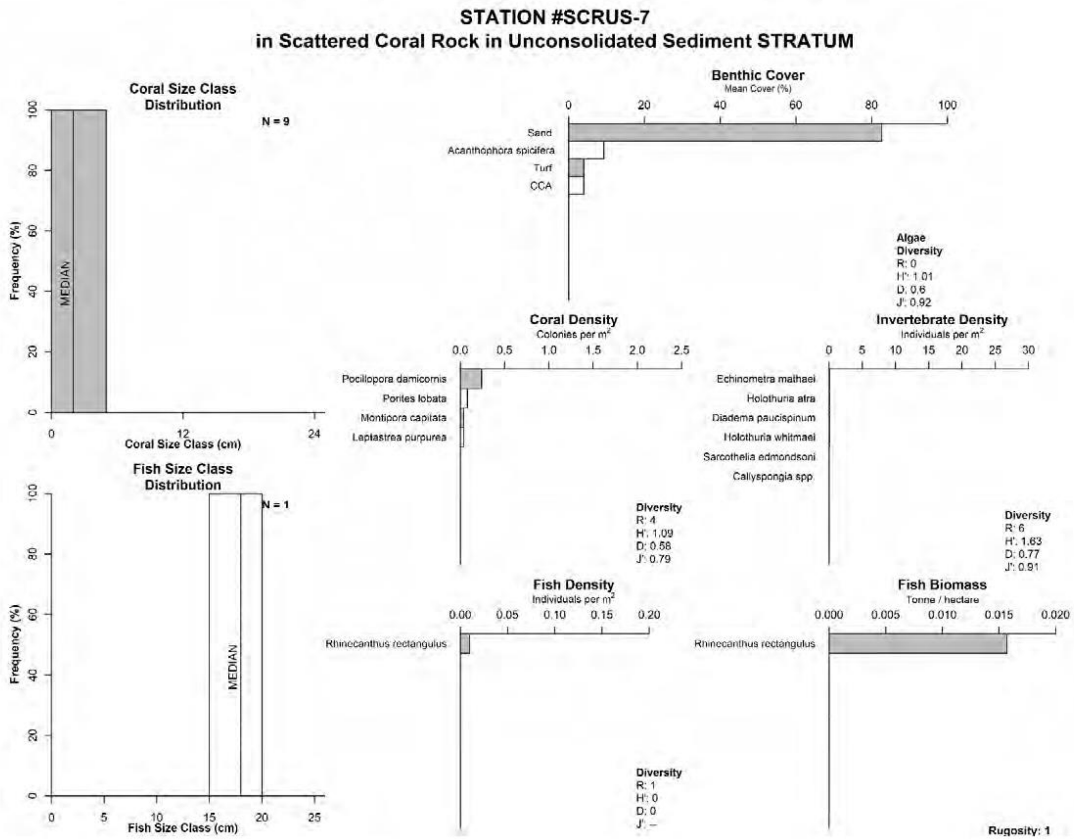

Figure B27: Station SCRUS-7. Biological characterization for station SCRUS-7 in the Scattered Coral/Rock in Unconsolidated Sediment Stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

84

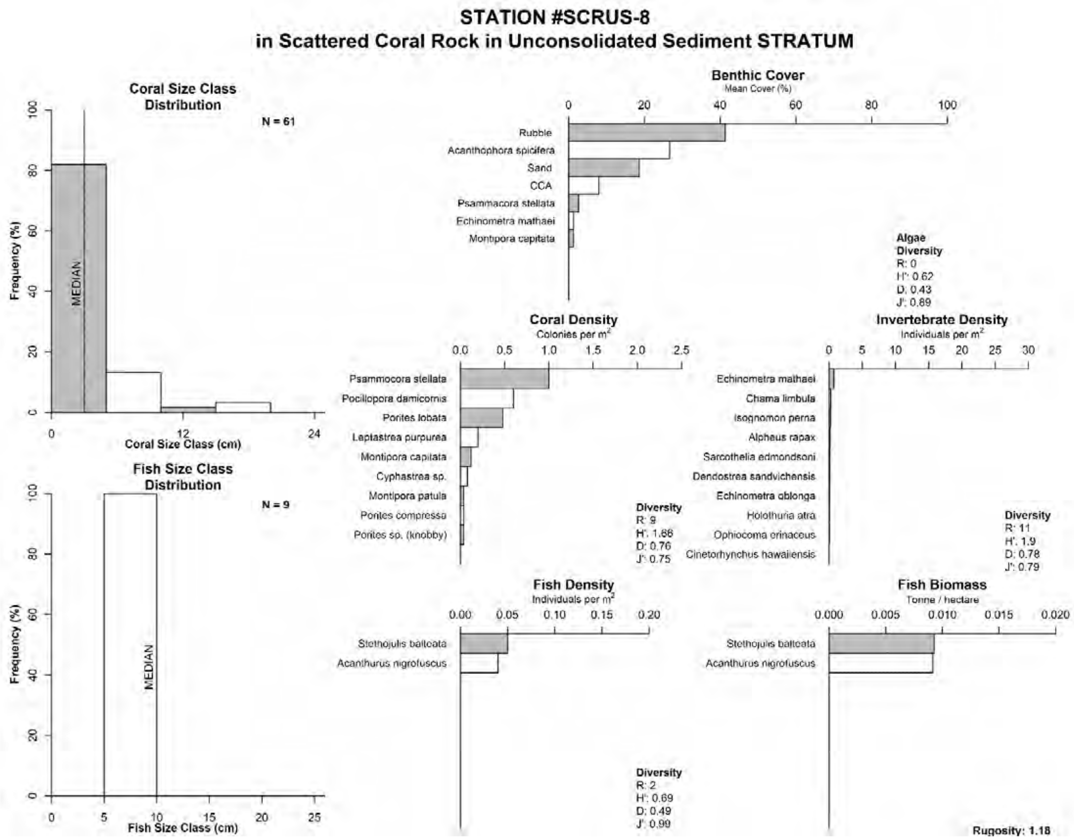

Figure B28: Station SCRUS-8. Biological characterization for station SCRUS-8 in the Scattered Coral/Rock in Unconsolidated Sediment Stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

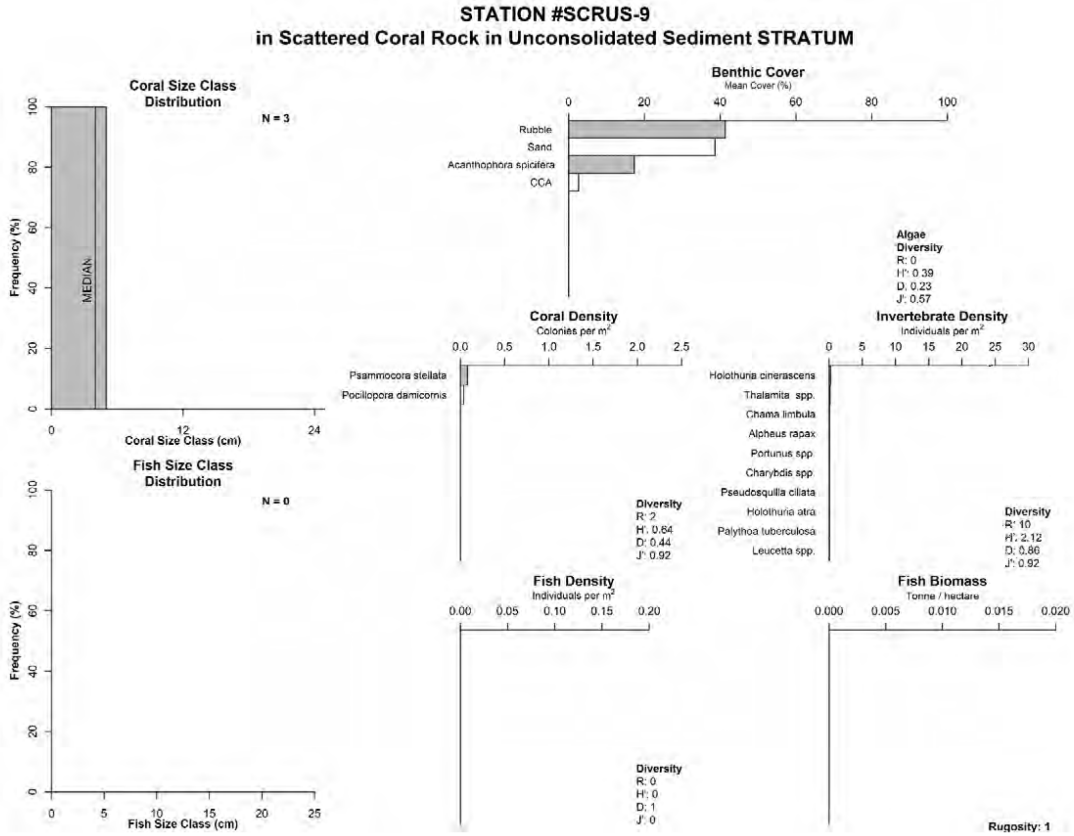

Figure B29: Station SCRUS-9. Biological characterization for station SCRUS-9 in the Scattered Coral/Rock in Unconsolidated Sediment Stratum. Note: NO DATA means that this data component was not collected while blank graphs represent no observations.

APPENDIX C: Images of the Haleiwa Beach Area

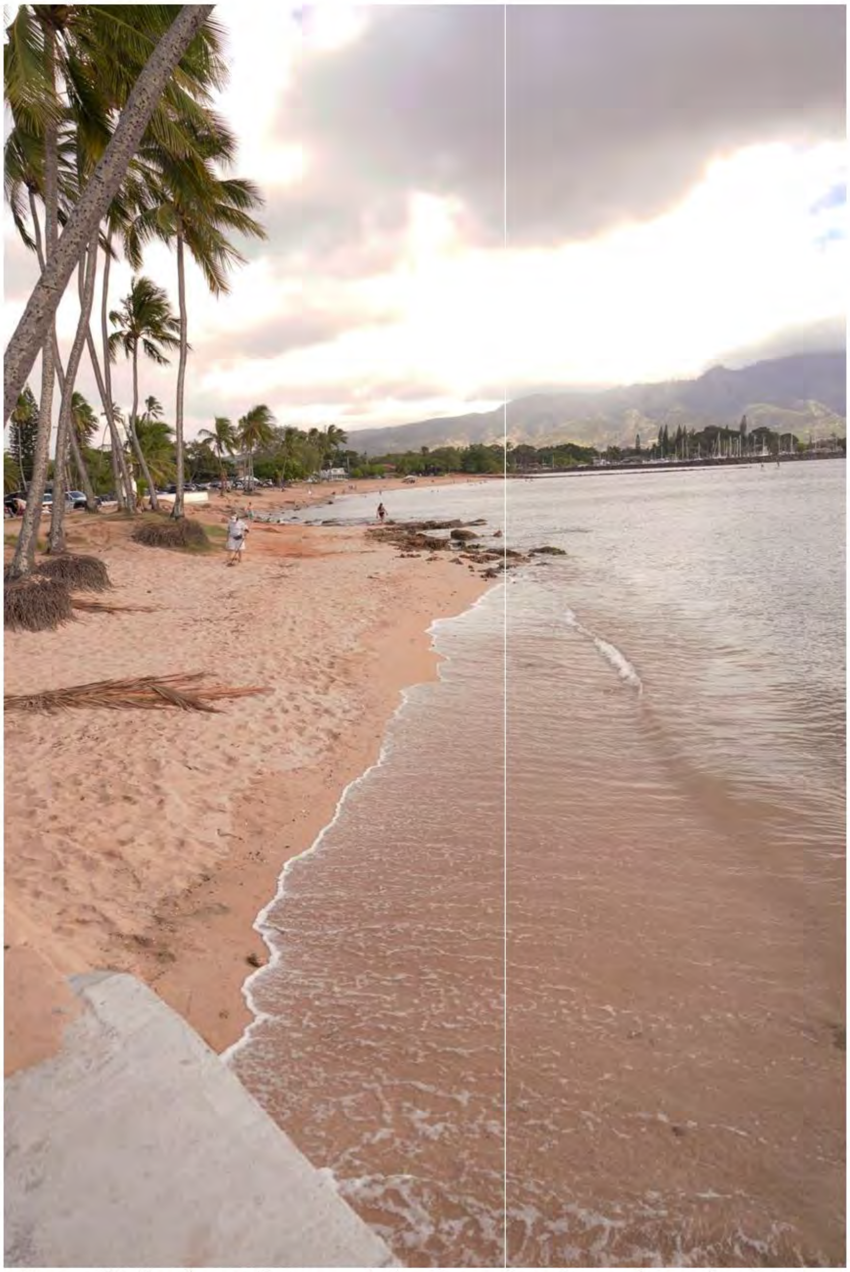

Figure C1: Beach area facing south. Beach area from the comfort station facing south.

Figure C2: Beach area facing north. Beach area from the comfort station facing north.

Figure C3: Beach area facing north and seaward. Beach area from the comfort station facing north and seaward showing the offshore jetty past the rocky shoreline intertidal area.

Figure C4: Coral Examples. Examples of coral species within the project area. Upper left: *Pocillopora meandrina*; Upper right: *Montipora capitata*; Lower left: *Psammocora stellata*; Lower right: *Pocillopora damicornis*.

Figure C5: Scattered Coral/Rock in Unconsolidated Sediment Stratum Example. A typical example of the Scattered Coral/Rock in Unconsolidated Sediment habitat structure.

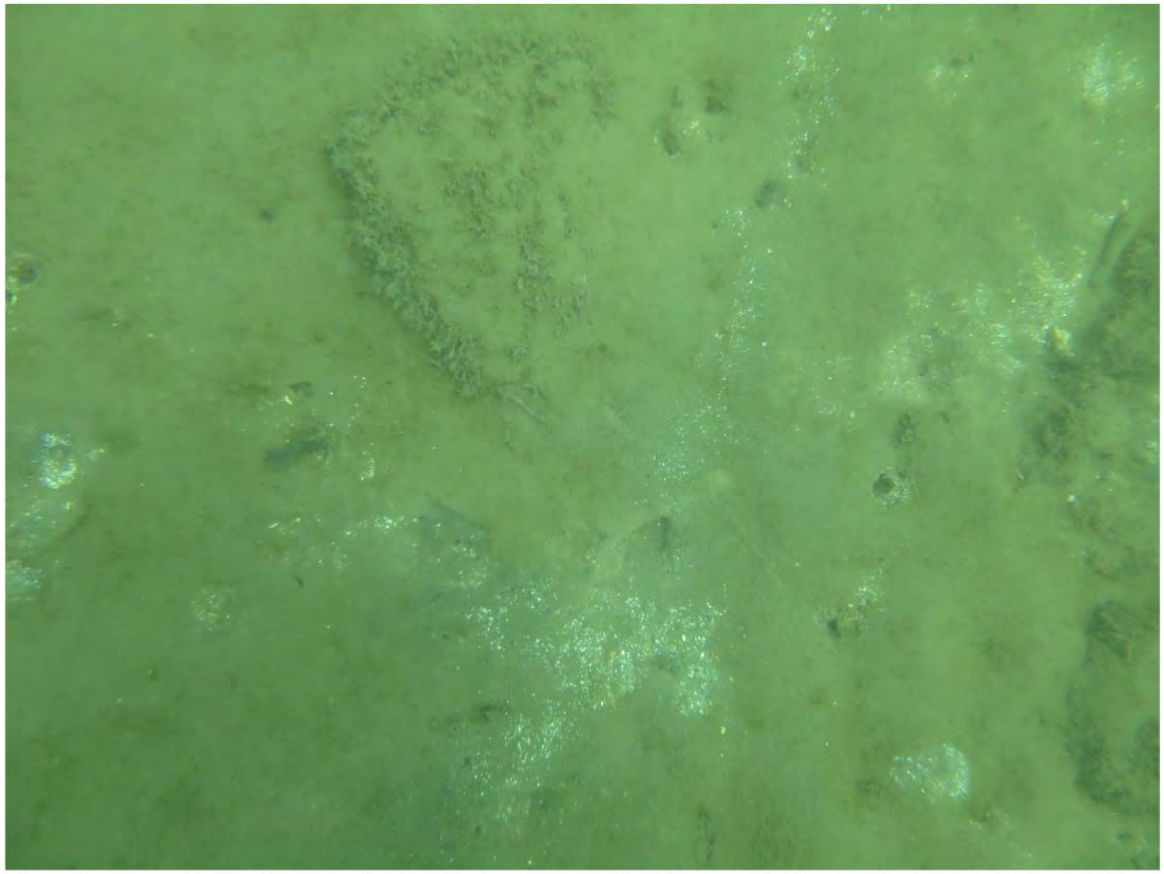

Figure C6: Sand Stratum Example. Example of the substrate composition of the Sand stratum indicating a mixture of mud and sand.

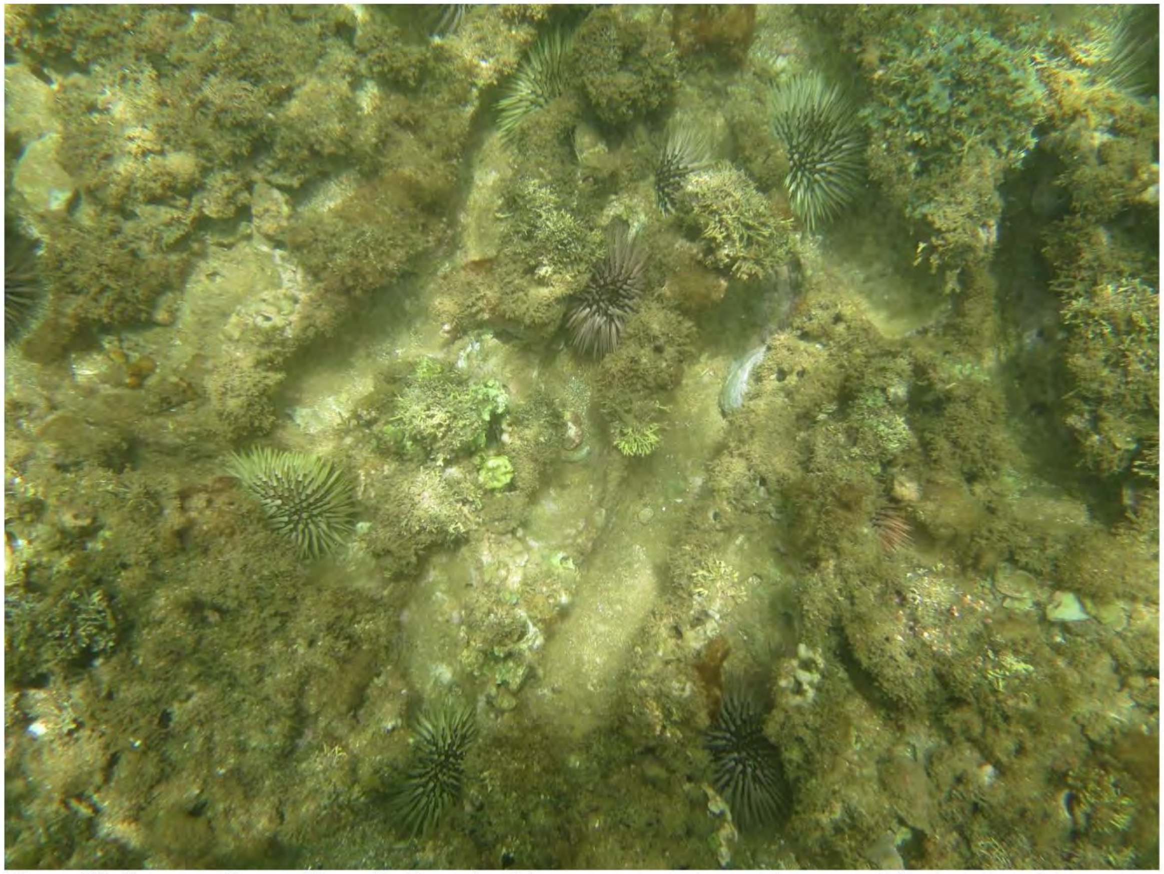
Figure C7: Pavement Stratum Example. Example of the pavement stratum with many rock-boring sea urchins, *Echinometra mathaei*.

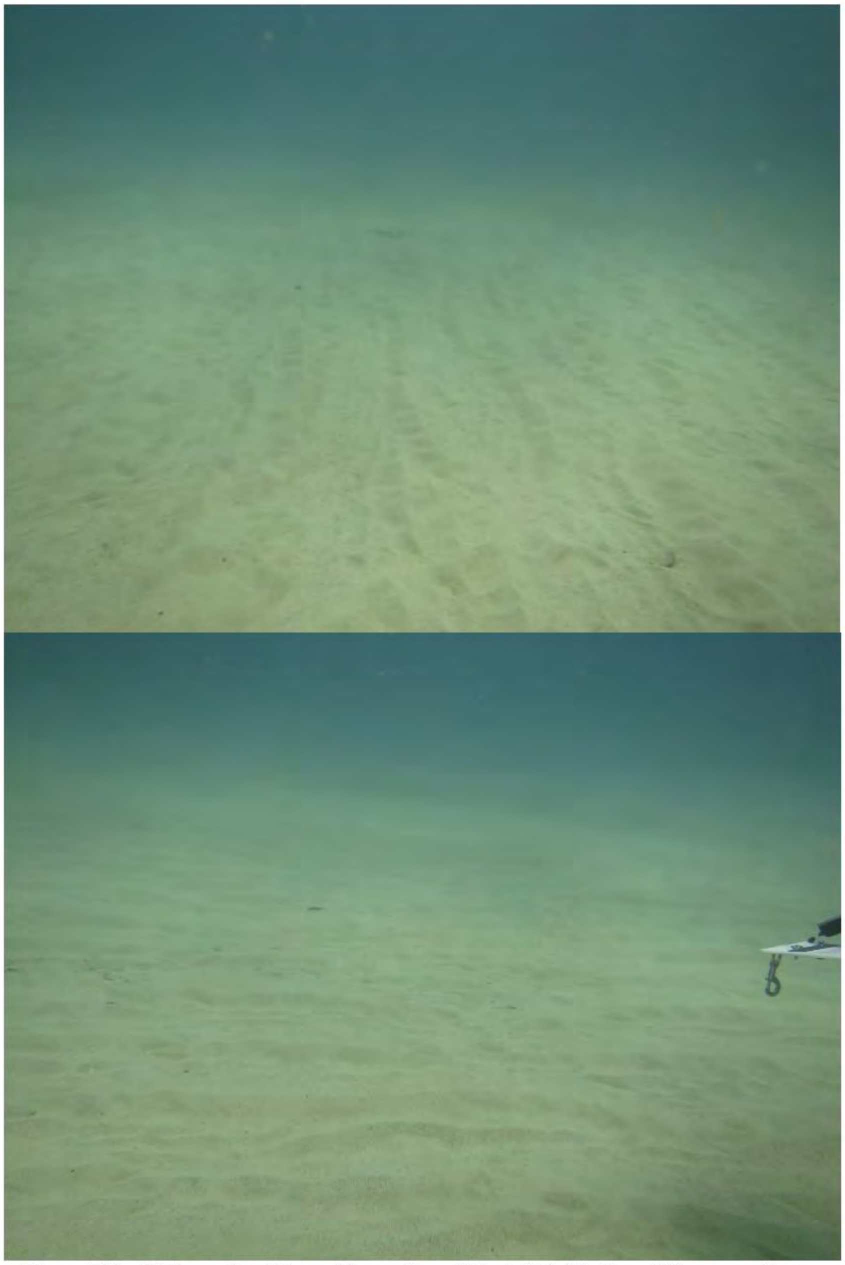

Figure C8: Offshore Sand Area. Examples of the habitat in the offshore sand area.

Figure C9: Barge Offload Area. Examples of the habitat in the barge offload area.

APPENDIX D: Maps of Haleiwa Beach Re-nourishment Project Offshore Sand Area

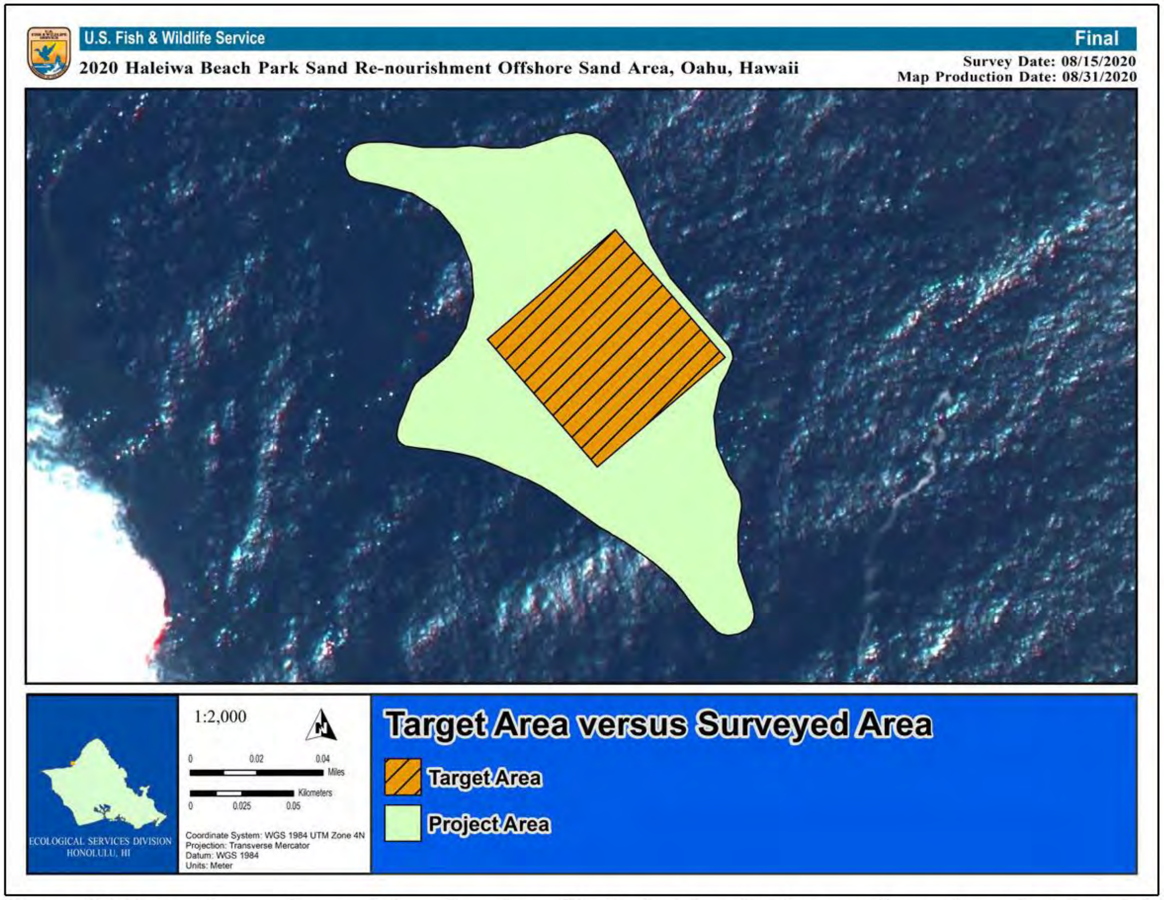

Figure D1: Target Area vs. Surveyed Area. Overview of the Project Area (total surveyed area plus project footprint) versus the Target Area (project footprint).

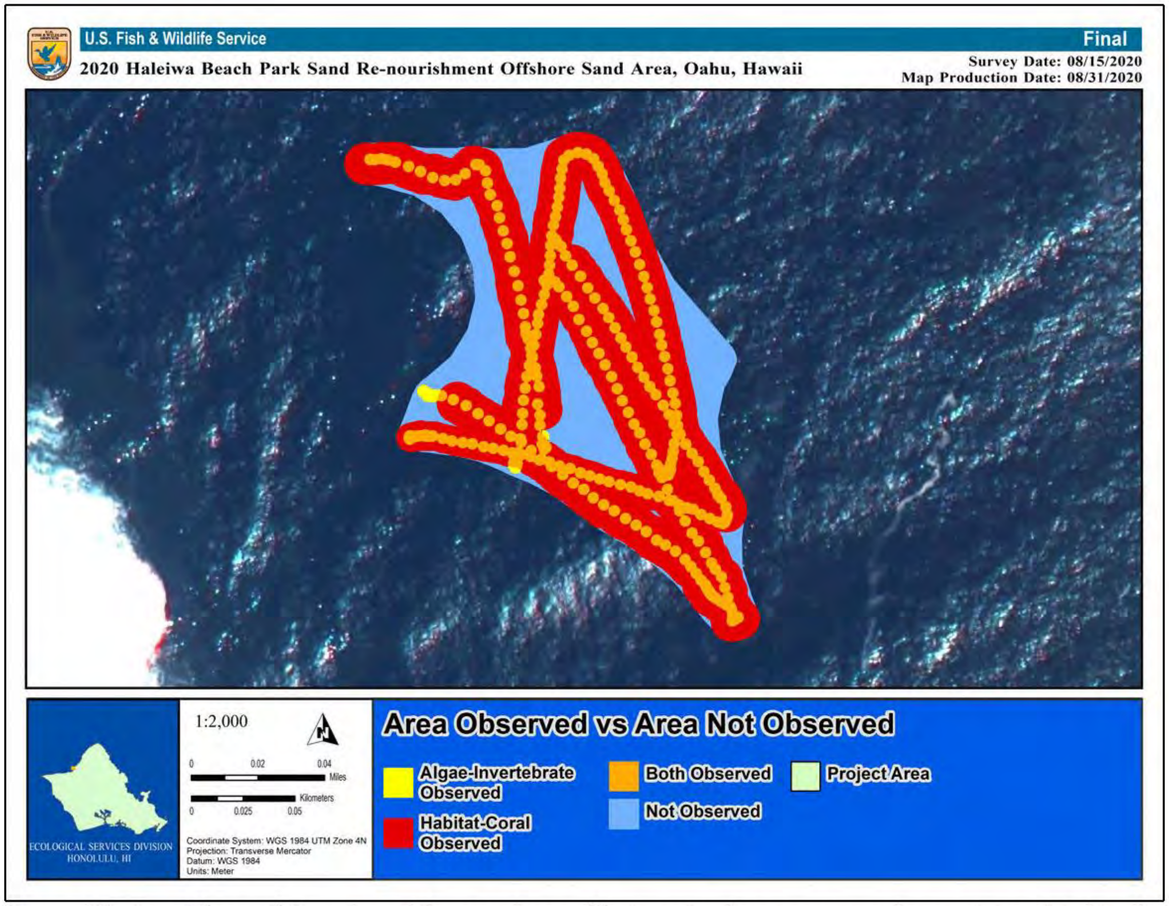

Figure D2: Area Observed. Overview of the area observed by in-water observers versus the area interpolated in all maps.

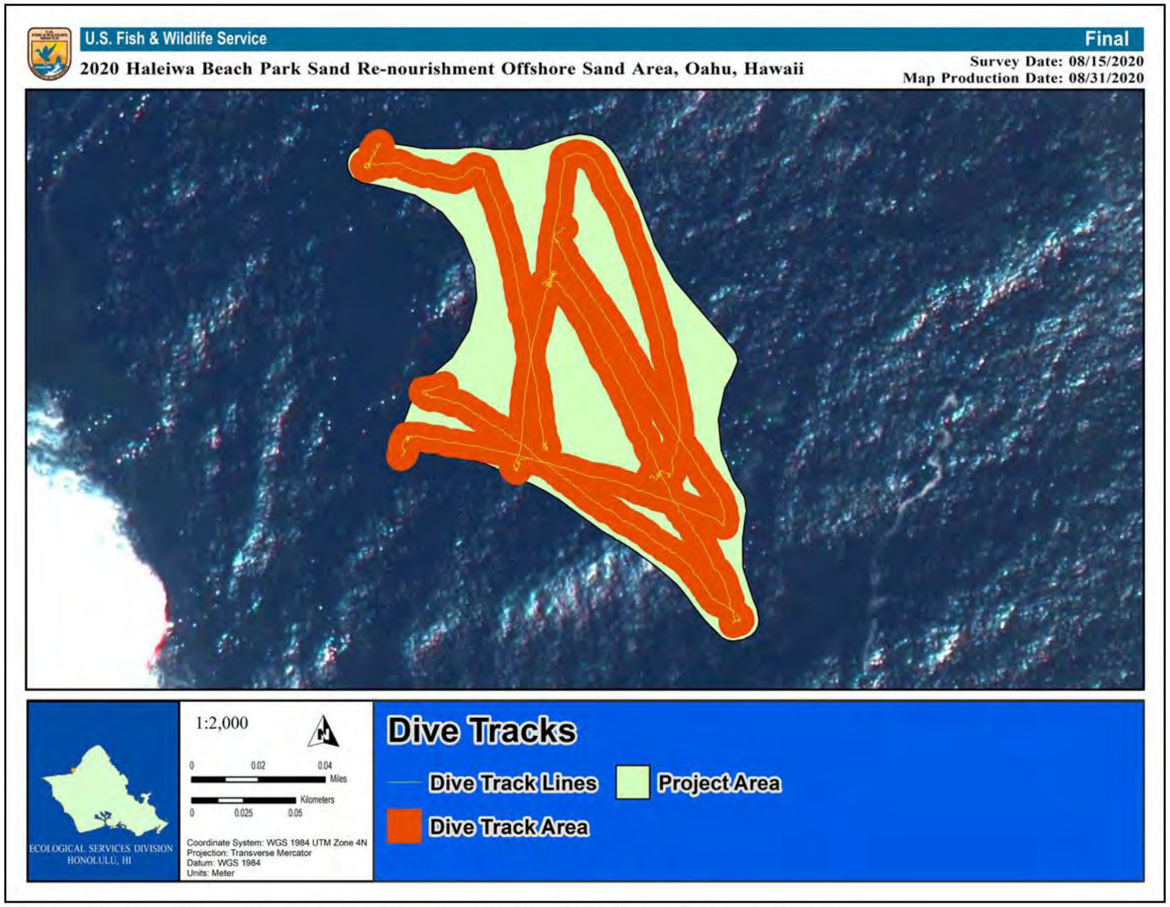

Figure D3: Dive Tracks. Overview of the dive tracks within the project area contains.

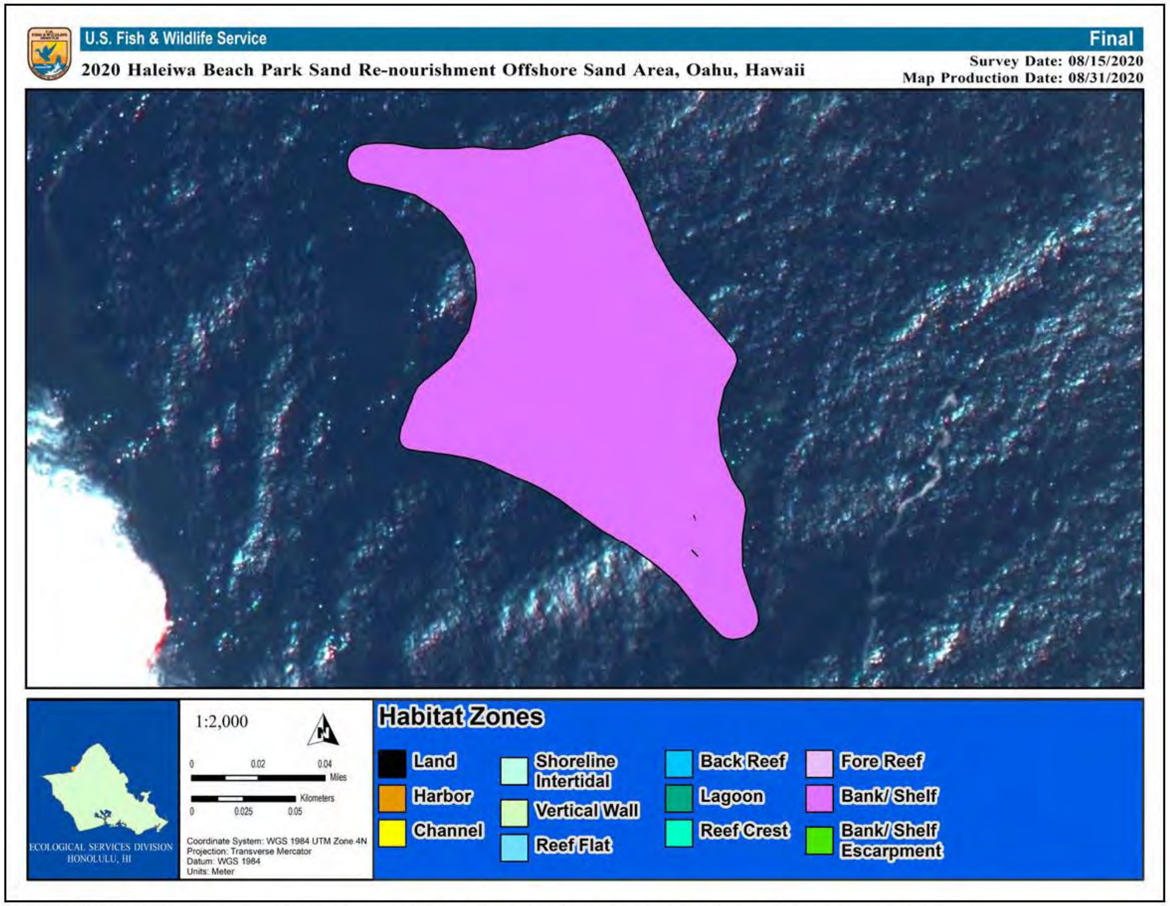

Figure D4: Habitat Zones. Overview of the various habitat zones that the project area contains.

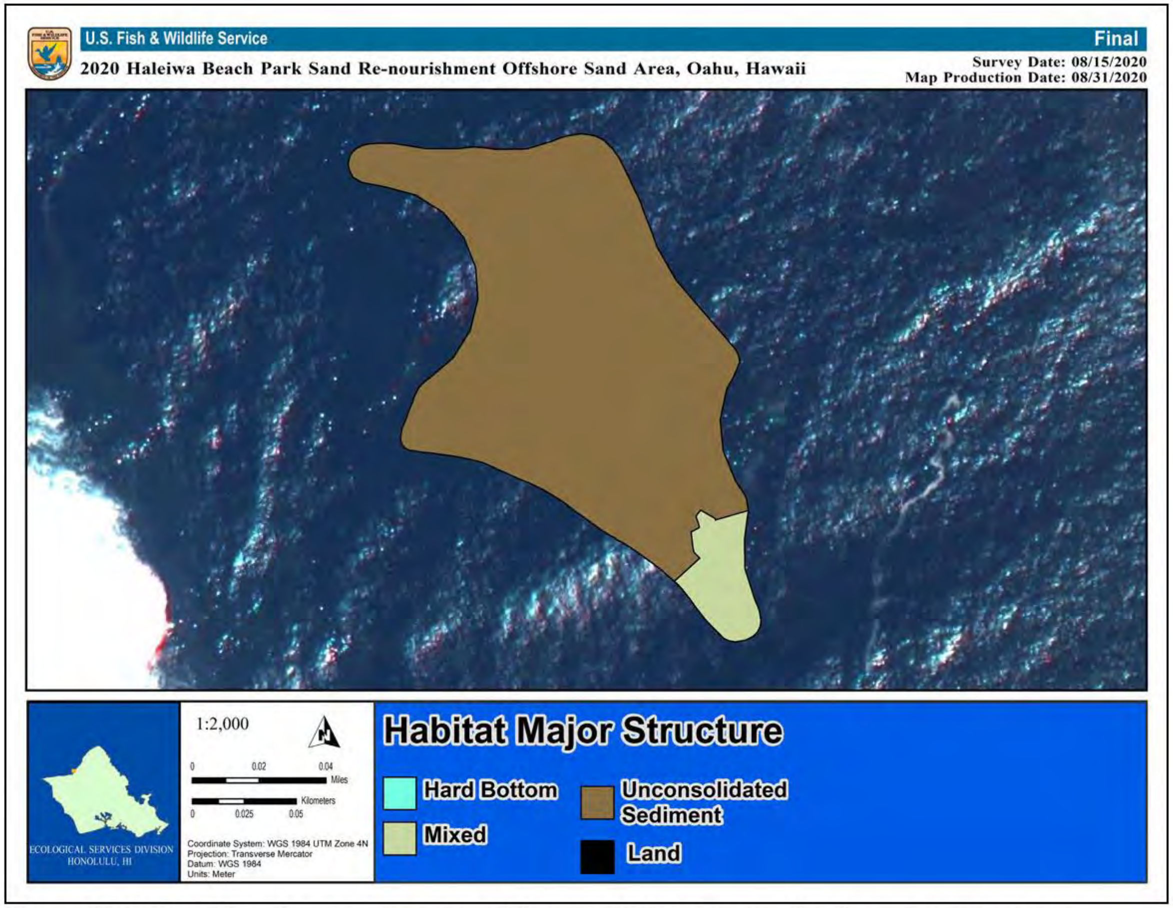

Figure D5: Habitat Major Structure. Overview of the major habitat structures that the project area contains.

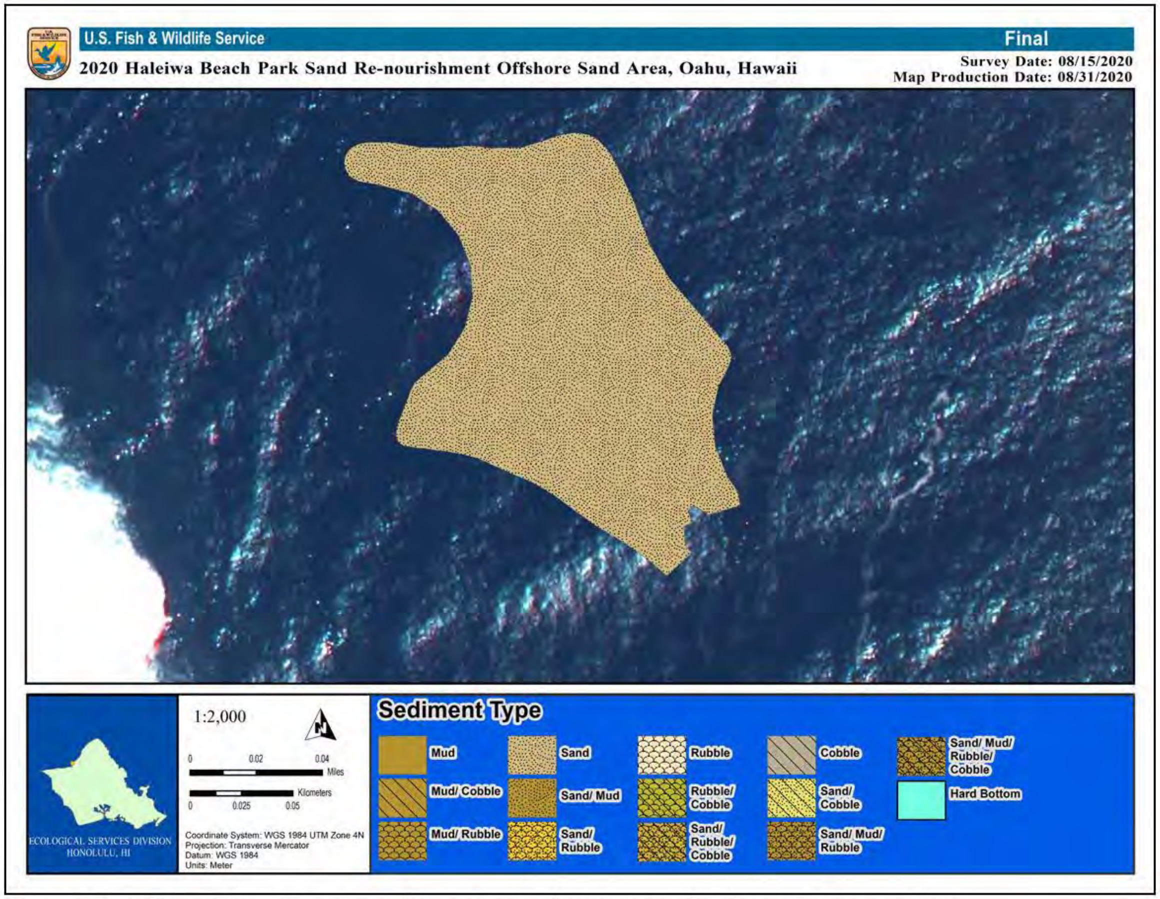

Figure D6: Sediment Type. Overview of the various sediment types that the project area contains.

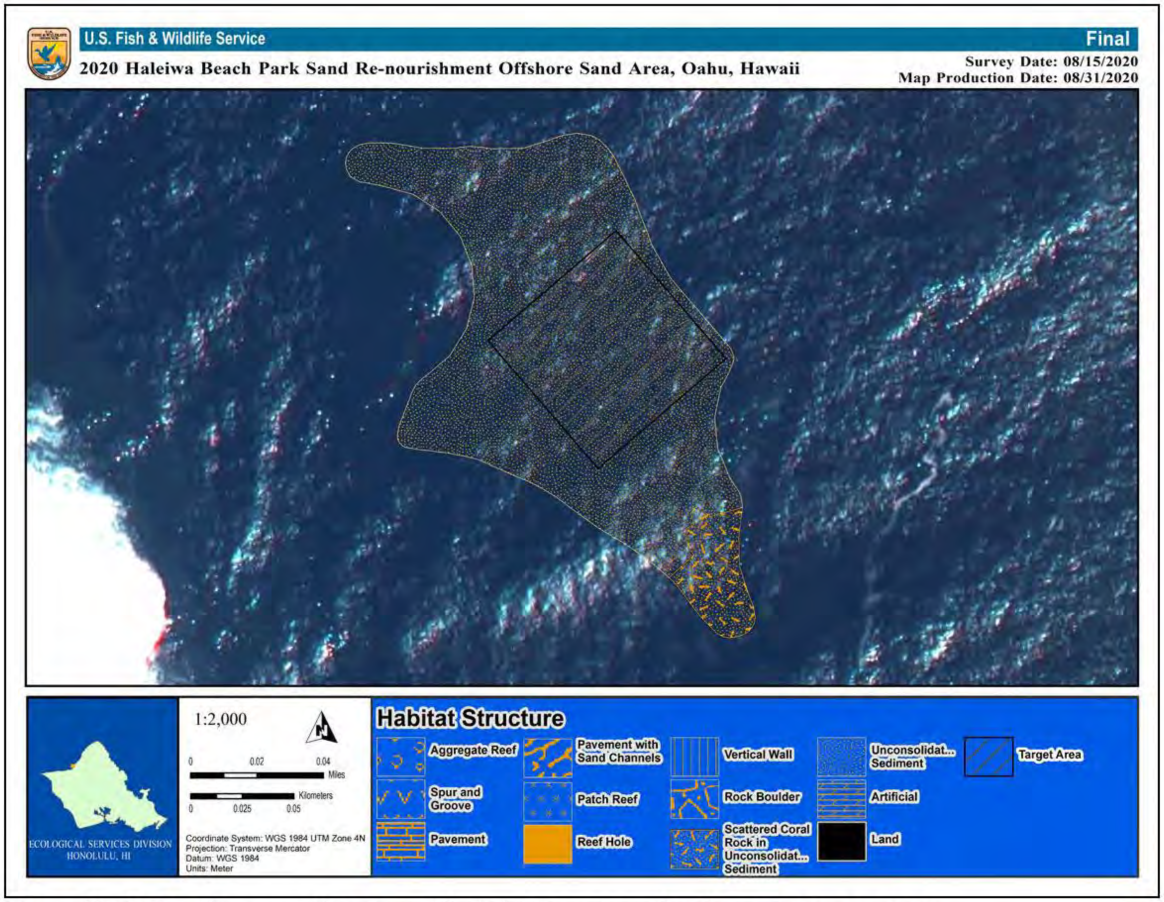

Figure D7: Habitat Structure. Overview of the habitat structures that the project area contains.

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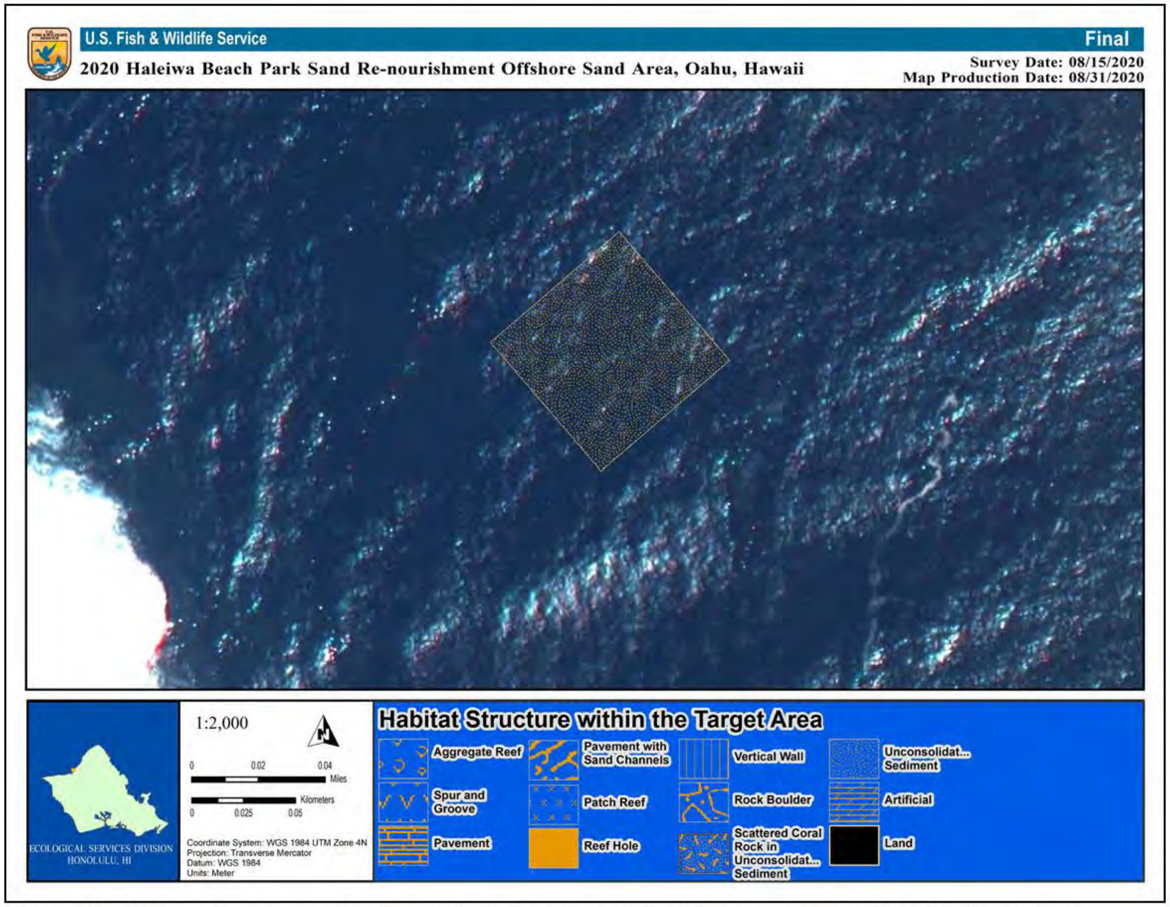

Figure D8: Habitat Structure within Target Area. Overview of the habitat structures within the Target Area.

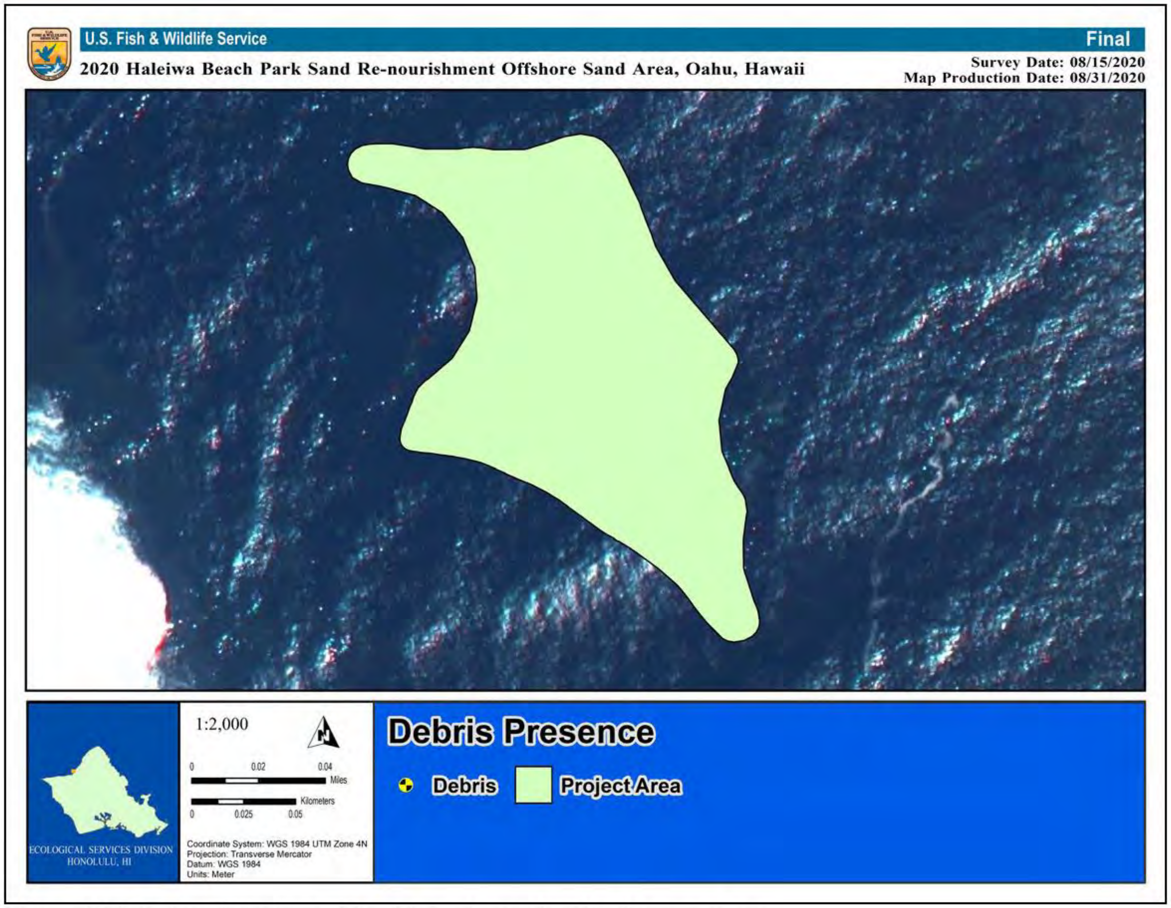

Figure D10: Debris. Overview of the debris observed within the project area.

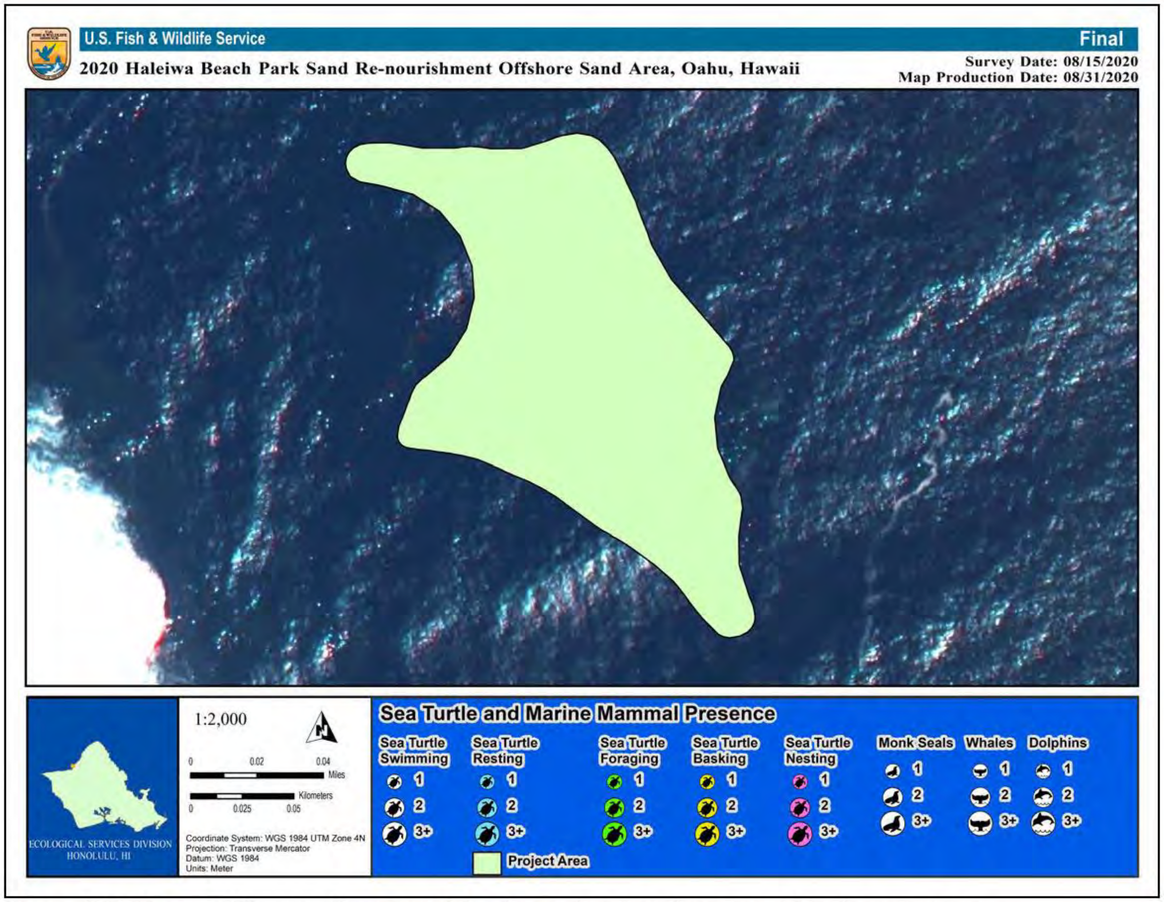

Figure D11: Protected Species. Overview of the observed protected species within the project area.

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APPENDIX E: Maps of Haleiwa Beach Re-nourishment Project Sand Barge Offload Area

Figure E1: Target Area vs. Surveyed Area. Overview of the Project Area (total surveyed area plus project footprint) versus the Target Area (project footprint).

Figure E2: Area Observed. Overview of the area observed by in-water observers versus the area interpolated in all maps.

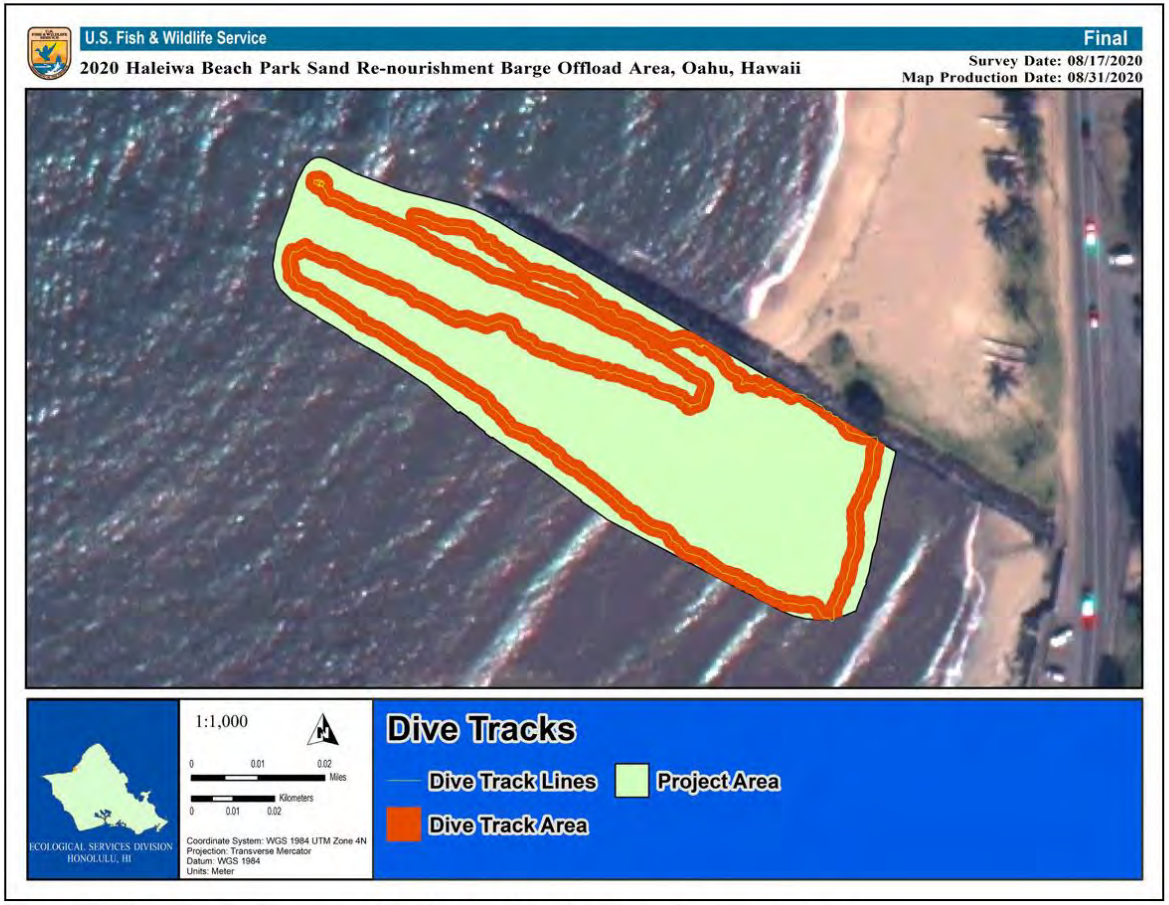

Figure E3: Dive Tracks. Overview of the dive tracks within the project area contains.

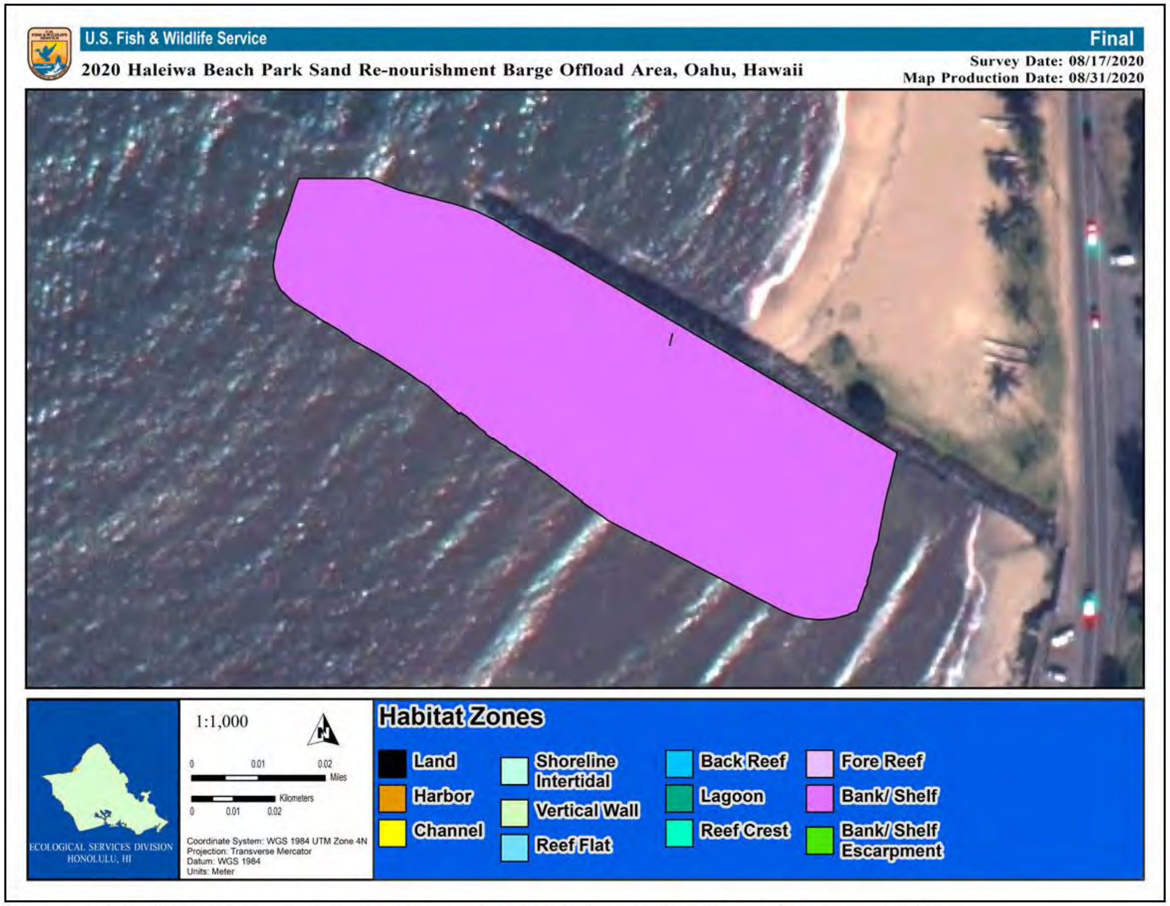

Figure E4: Habitat Zones. Overview of the various habitat zones that the project area contains.

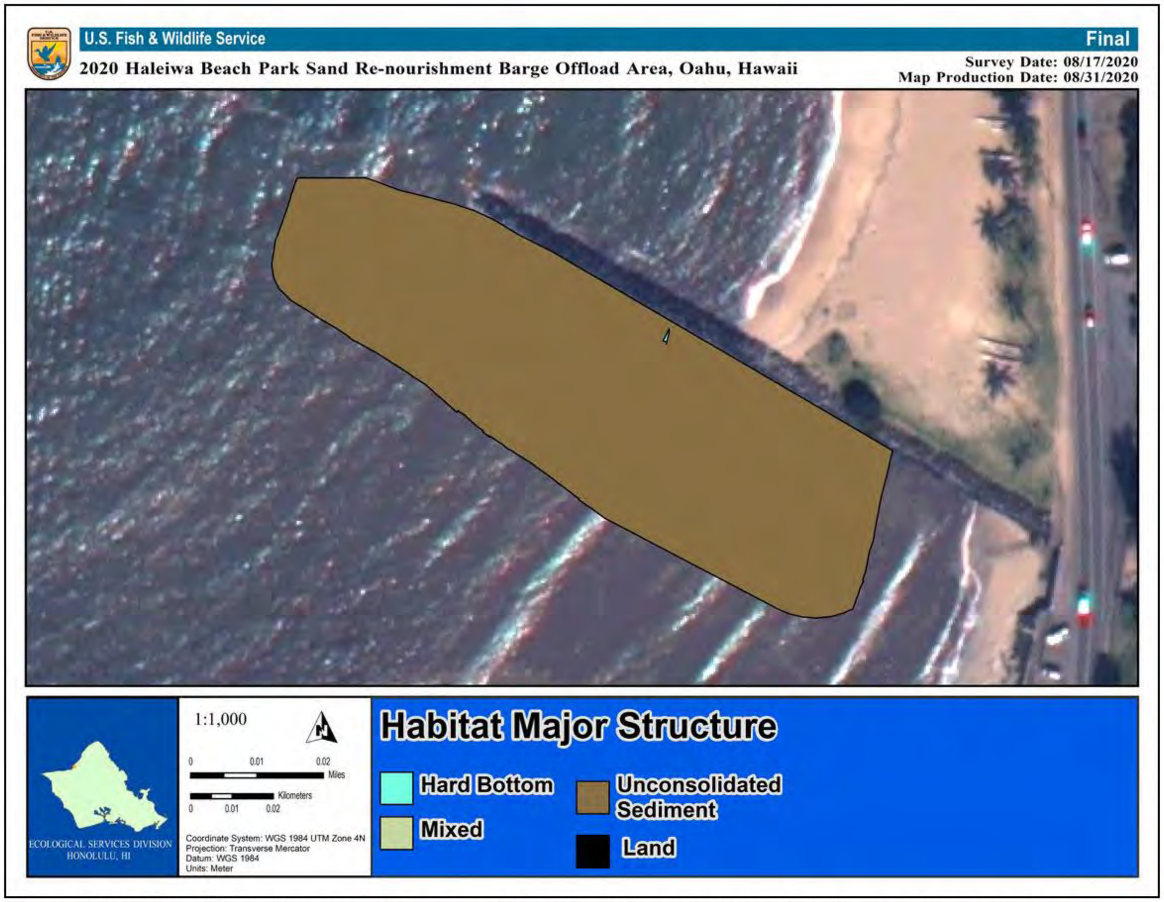

Figure E5: Habitat Major Structure. Overview of the major habitat structures that the project area contains.

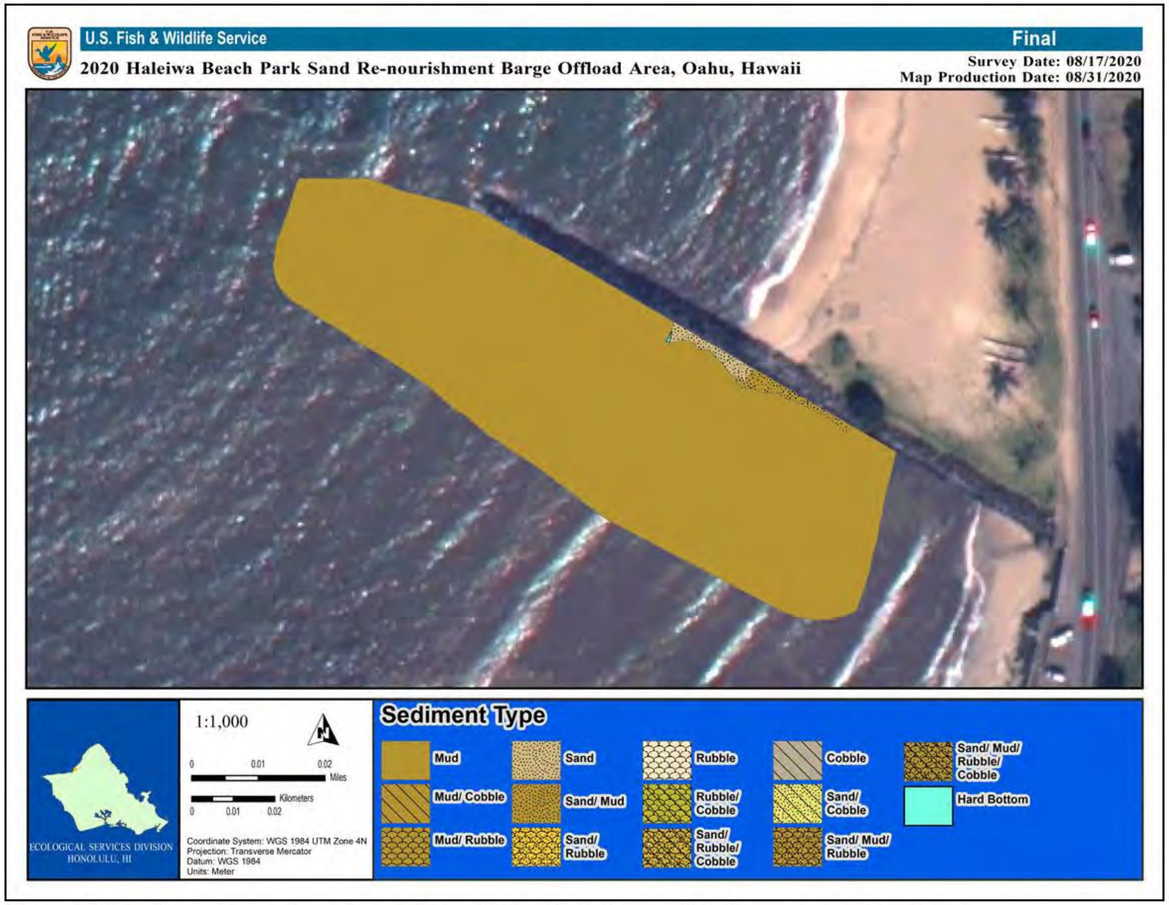

Figure E6: Sediment Type. Overview of the various sediment types that the project area contains.

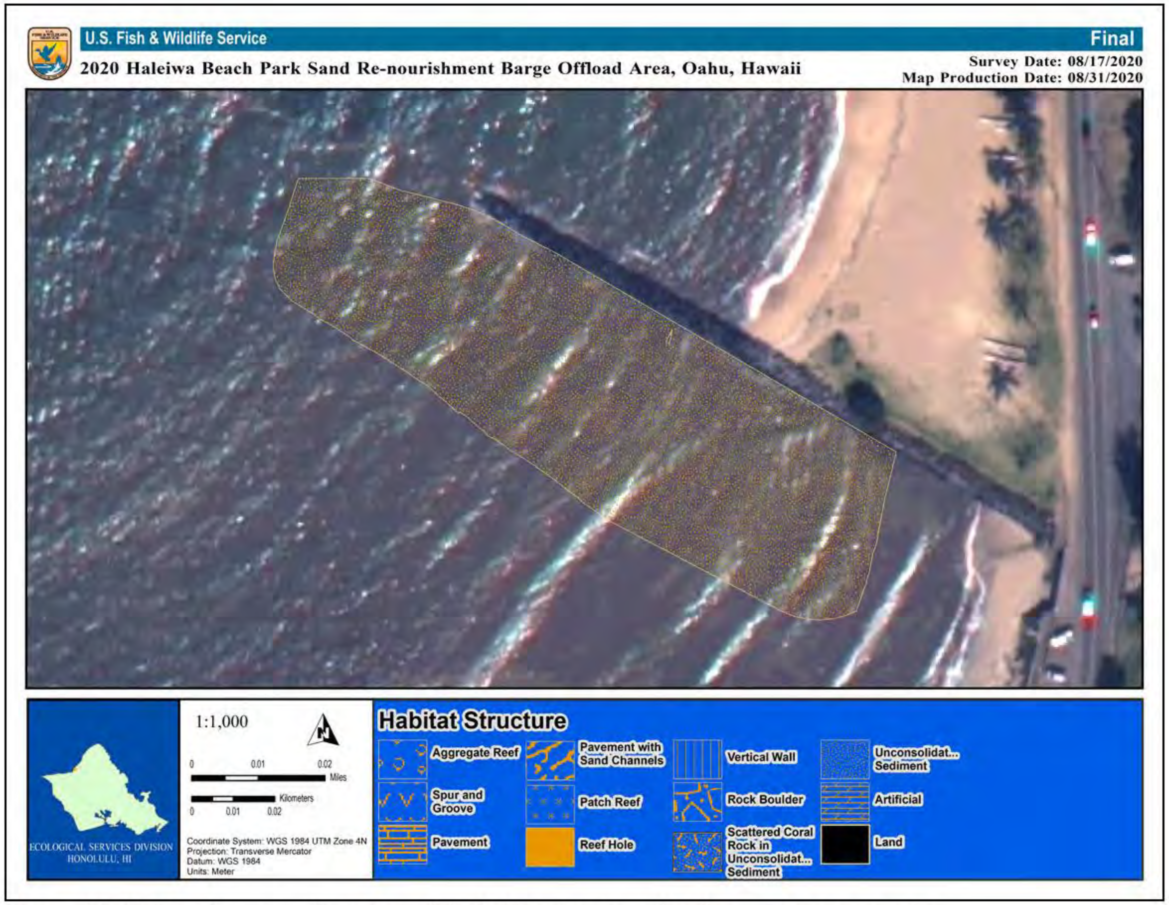

Figure E7: Habitat Structure. Overview of the habitat structures that the project area contains.

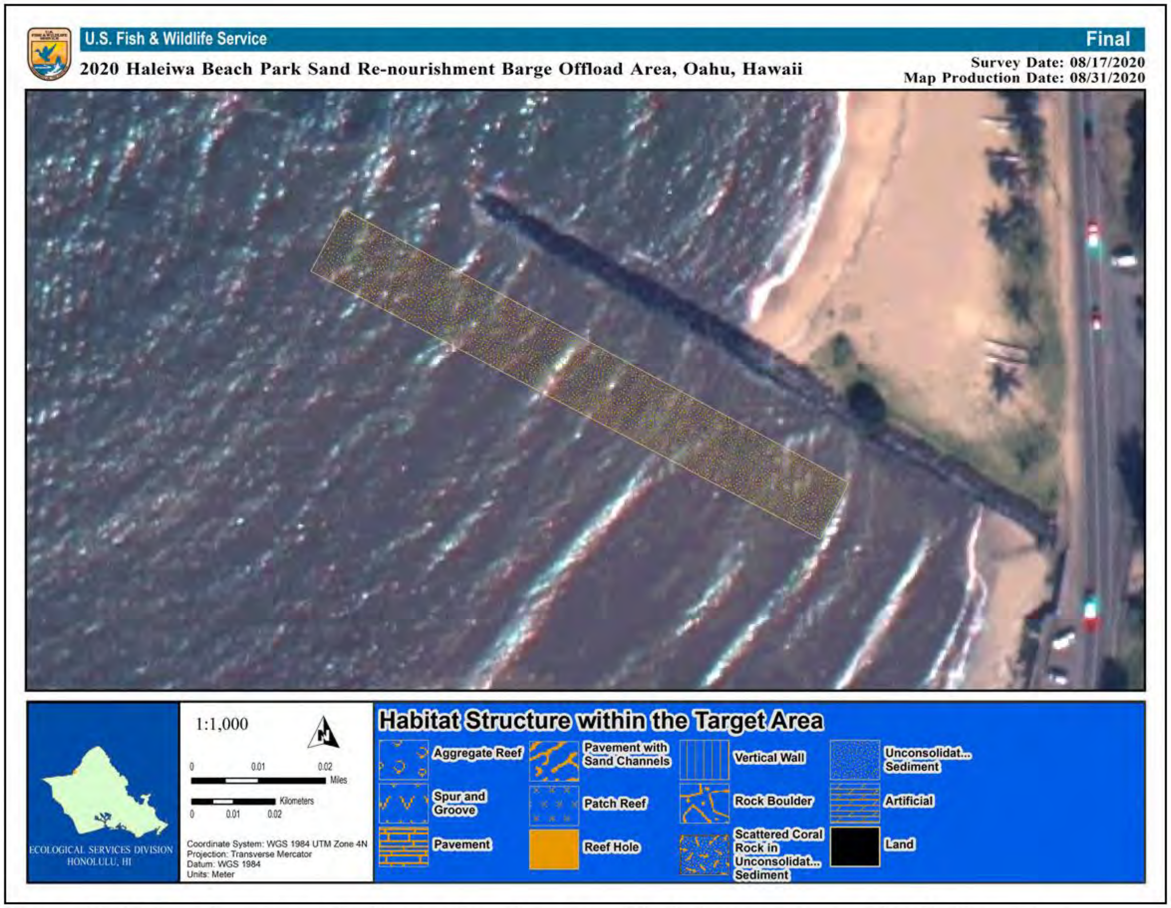

Figure E8: Habitat Structure within Target Area. Overview of the habitat structures within the Target Area.

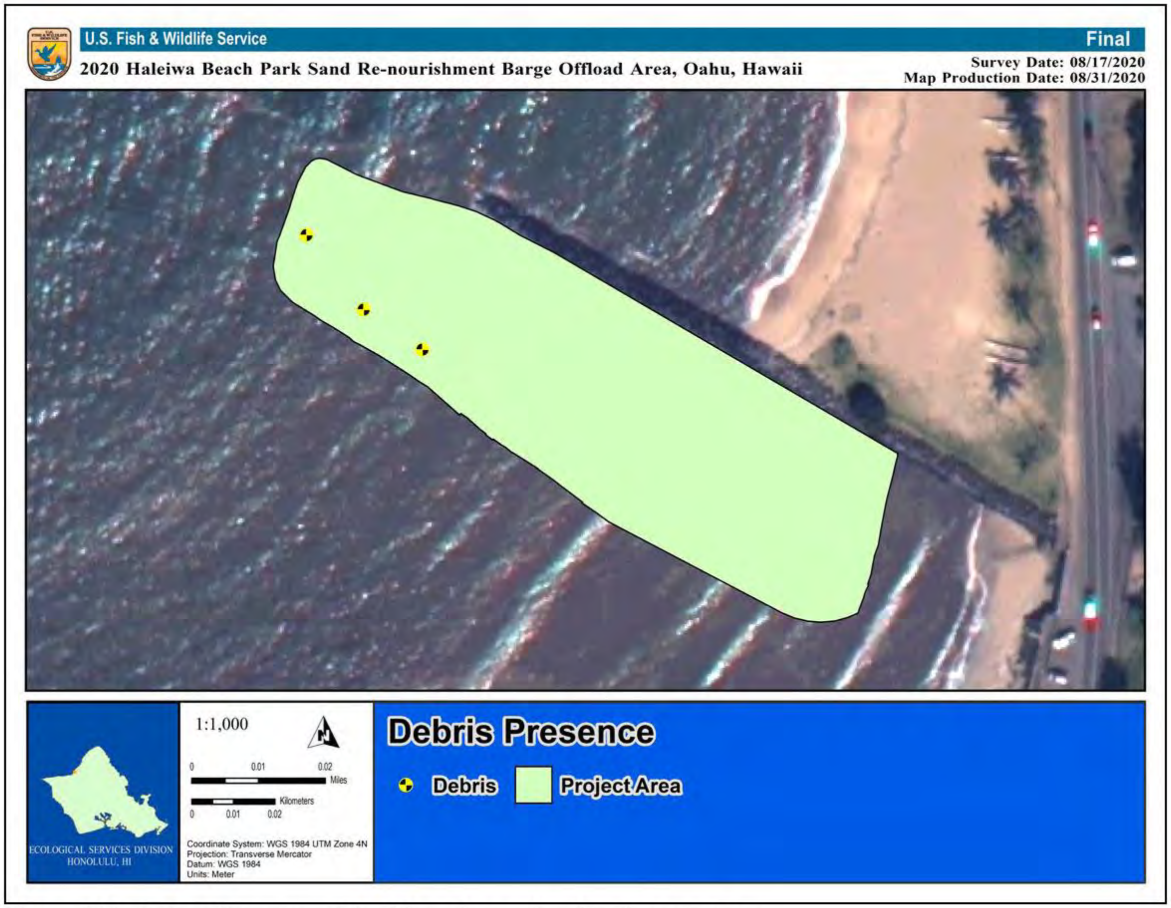

Figure E10: Debris. Overview of the debris observed within the project area.

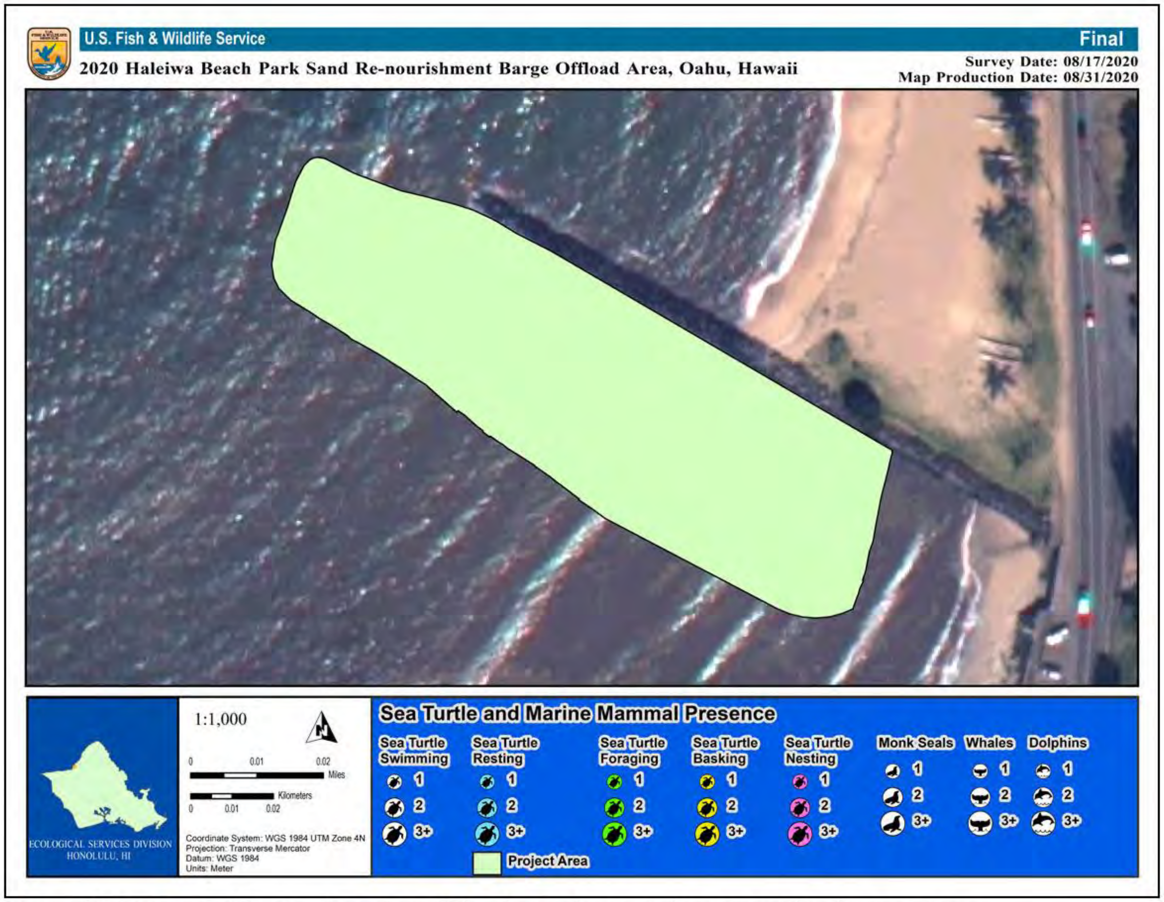

Figure E11: Protected Species. Overview of the observed protected species within the project area.

APPENDIX F: Maps of Haleiwa Beach Re-nourishment Project Small Boat Harbor Channel Area

Figure F1: Target Area vs. Surveyed Area. Overview of the Project Area (total surveyed area plus project footprint) versus the Target Area (project footprint).

Figure F2: Area Observed. Overview of the area observed by in-water observers versus the area interpolated in all maps.

Figure F3: Dive Tracks. Overview of the dive tracks within the project area contains.

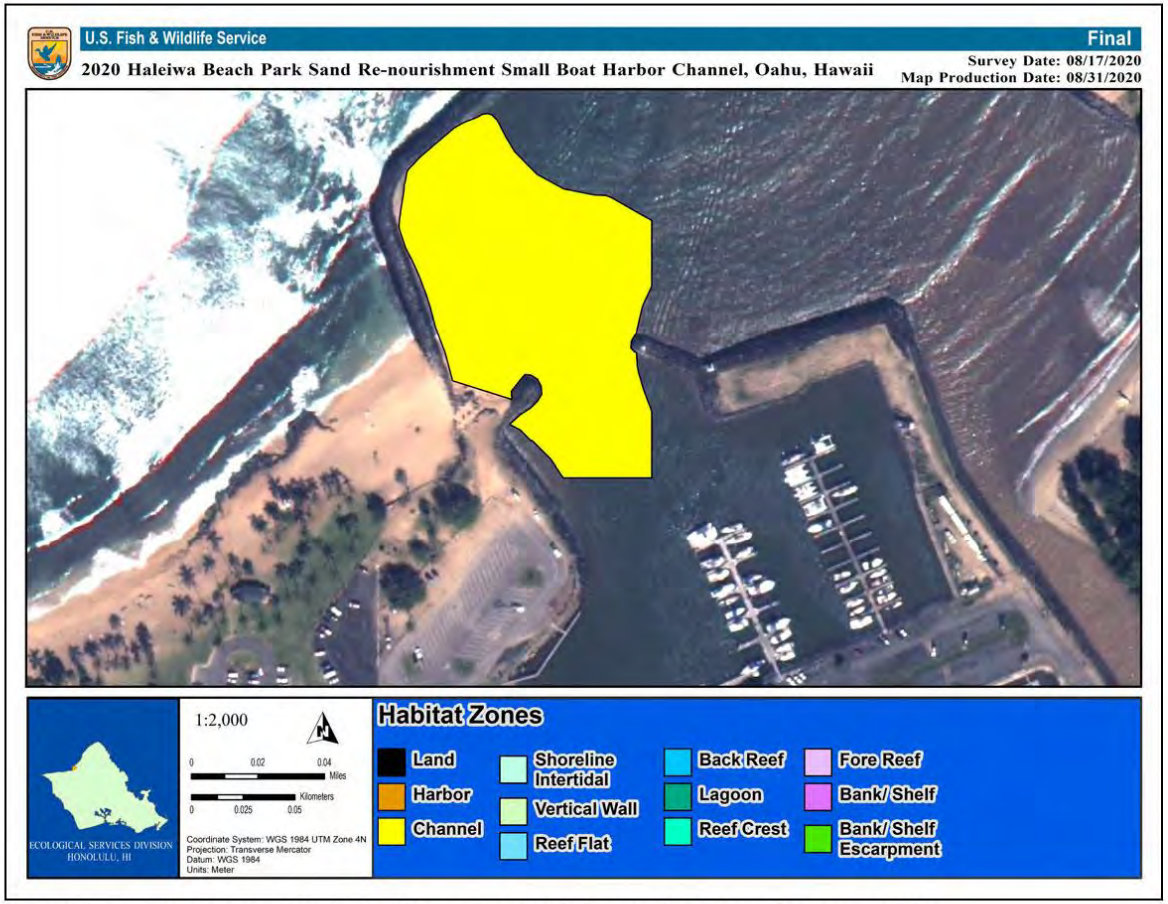

Figure F4: Habitat Zones. Overview of the various habitat zones that the project area contains.

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Figure F5: Habitat Major Structure. Overview of the major habitat structures that the project area contains.

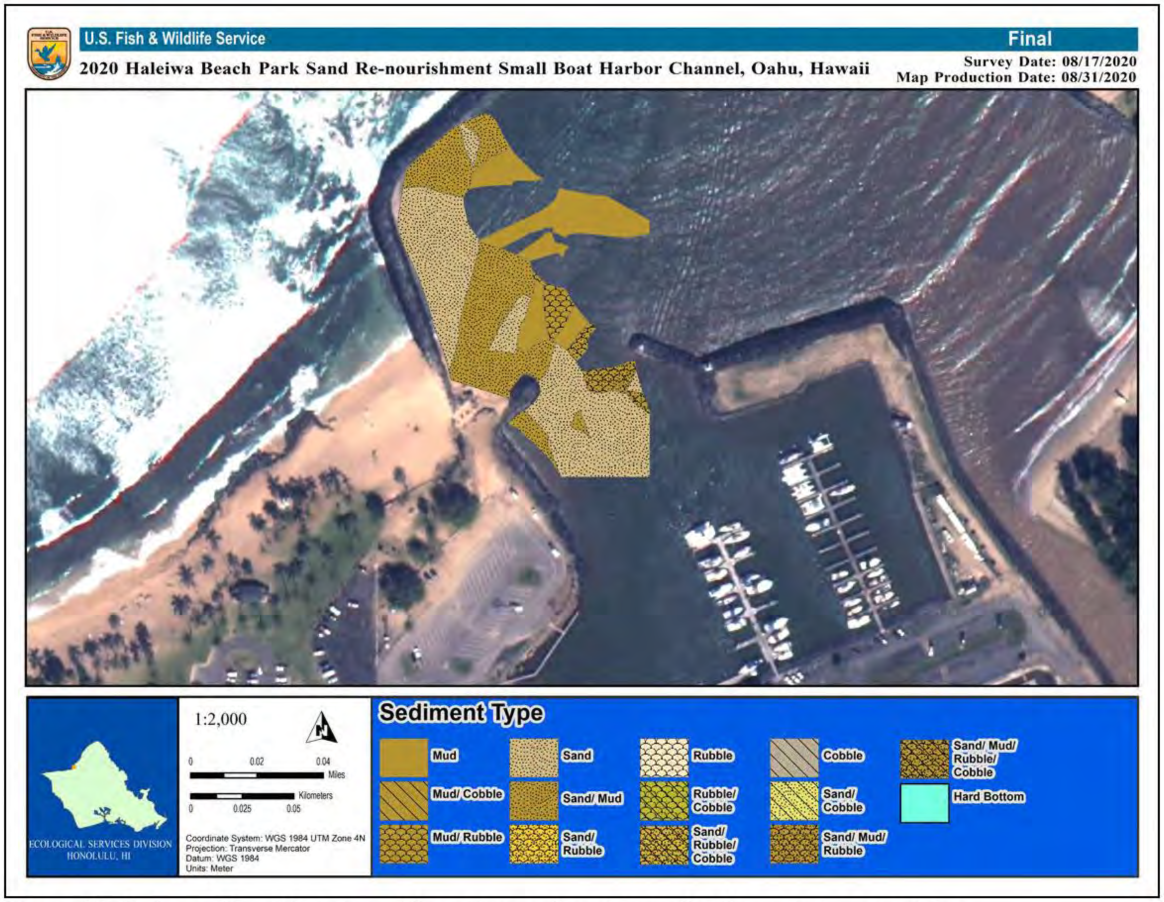

Figure F6: Sediment Type. Overview of the various sediment types that the project area contains.

Figure F7: Habitat Structure. Overview of the habitat structures that the project area contains.

Figure F8: Habitat Structure within Target Area. Overview of the habitat structures within the Target Area.

Figure F10: Debris. Overview of the debris observed within the project area.

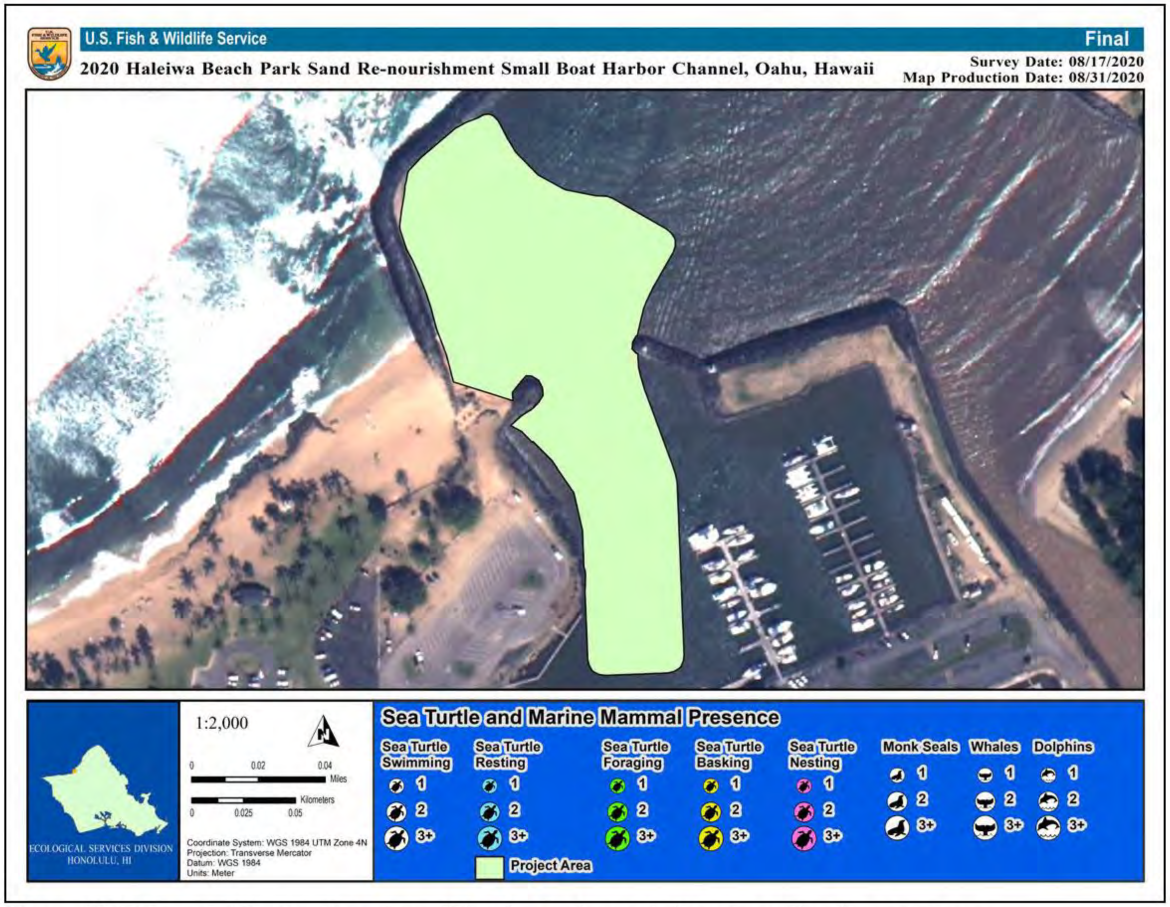

Figure F11: Protected Species. Overview of the observed protected species within the project area.

Figure F13: Coral Presence and Morphology. Overview of the observed coral presence and morphologies within the Project Area.

APPENDIX G: Comments Received on Draft Report

DAVID Y. IGE
GOVERNOR OF
HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
FIRST DEPUTY

M. KALEO MANUEL
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF AQUATIC RESOURCES
1151 PUNCHBOWL STREET, ROOM 330
HONOLULU, HAWAII 96813

Date: 9/22/2020
DAR # AR0013

MEMORANDUM

TO: Brian J. Neilson
DAR Administrator

FROM: Catherine Gewecke, Aquatic Biologist

SUBJECT: Request for Comments - Phase I and II Marine Habitat Characterization
Haleiwa Beach Park Beach Re-Nourishment

Request Submitted by: U.S. Fish and Wildlife Service (Pacific Islands Fish & Wildlife Office)

Location of Project: Haleiwa Beach Park Beach, Oahu

Brief Description of Project:

The U.S. Army Corps of Engineers (USACE) Civil Works Branch is proposing to place sand at Haleiwa Beach Park, Oahu, Hawaii, as part of a beneficial reuse of dredged material from the Haleiwa Small Boat Harbor and nearby offshore sand sources. The proposed project will incorporate the placement of sand along the beach at Haleiwa Beach Park, Oahu; the sand sources include the federal channel of the Haleiwa Small Boat Harbor, a sand deposition area to the west of the federal channel (~2,000 cubic yards), and an offshore sand location. The U.S. Fish and Wildlife Service(Pacific Islands Fish and Wildlife Office -PIFWO), conducted this resource investigation to document the resources within the project area and analyze the potential impacts to marine resources.

Comments:

☐ No Comments ☒ Comments Attached

Thank you for providing DAR the opportunity to review and comment on the proposed project. Should there be any changes to the project plan, DAR requests the opportunity to review and comment on those changes.

Comments Approved: ____________________ Date: Sep 22, 2020
Brian J. Neilson
DAR Administrator

DAR# AR0013

Brief Description of Project

The proposed project will incorporate the placement of sand along the beach at Haleiwa Beach Park, Oahu. The sand sources include the federal channel of the Haleiwa Small Boat Harbor, a sand deposition area to the west of the federal channel (~2,000 cubic yards), and an offshore sand location as shown in Figure 4. The impact assessment of these areas will be provided in a supplement to this report.

The location and placement of sand along Haleiwa Beach will be determined by the amount of sand available from the above-mentioned sand sources. In order to assess the potential impacts of sand placement, the USACE has determined five potential alternatives. These alternatives are approximate and meant for scaling purposes and not definitive sand placement. The five alternatives show a greater area of sand placement on the beach with Alternative 1 being a No Action alternative, and alternatives 2 through 5 being the placement of sand from a small portion of the beach (Alternative 2) to the entire length of the beach (Alternative 5; for the size and location of the alternatives, please see Figures 5–8 in the). The area of the alternatives (Table 2) include: 4,660 m2 for Alternative 2, 6,356 m2 for Alternative 3, 8,685 m2 for Alternative 4, and 18,003 m2 for Alternative 5.

Resource Concerns:

The primary concerns associated with the proposed project include the direct impacts associated with the placement of sand on existing marine habitat, particularly the Shoreline Intertidal community. The proposed Alternative 5 would cover a significant amount of Shoreline Intertidal area as well as some portions of the Pavement and Scattered Coral/Rock in Unconsolidated Sediment habitats, although the latter is a much smaller portion of the total area. The specific planning objective of this draft resource investigation is to provide technical assistance and recommendations to USACE to allow equal weight project benefits and natural resources in decision-making. To achieve this goal, the USFWS provide the following: 1) biological and habitat data for the Haleiwa Beach Park area; 2) analysis of potential impacts of the proposed project to fish and wildlife resources and their habitats; and 3) recommendations for minimization and avoidance measures.

All maps and figures can be referenced in the Draft Fish and Wildlife Coordination Act Report for Phase I and II Marine Habitat Characterization Haleiwa Beach Park Beach Re-Nourishment.

DAR# AR0013

Comments

DAR supports USFWS recommendations but with additional requirements and recommendations as stated below.

USFWS RECOMMENDATIONS
Based on the description of resources within the project area, the Service provides the following recommendations.

1) The Service recommends that measures be taken to minimize water from discharging back into the coastal area that could create a sediment plume. It is possible that placement of sand may occur directly from the water to the beach area. Minimization measures such as sand berms should be used to slow and pool water on the beach. In addition, silt curtains should be used to minimize sediment generated from the dewatering of dredged sediment.

2) The Service recommends avoiding placing sand in the Shoreline Intertidal – Rocky stratum given the unique intertidal community documented. Sand placement should avoid the northern section of the project area based on the amount of Shoreline Intertidal community impacted, and specifically a higher density of corals in the northern Pavement stratum. While the number of corals is generally low, more sand placement in this section may have increased impacts to the limited coral community. (See additional requirements from DAR below regarding avoiding impacts to stony corals and live rock).

3) The Service recommends that the amount of sand placed in the northern section and in the Shoreline Intertidal – Rocky stratum should be limited, or only nourished to the extent that is needed to protect the shore-side structures. Alternatives to sand should also be explored to protect the structures, but also maintain the integrity of the intertidal community. (See additional requirements from DAR below regarding avoiding impacts to stony corals and live rock).

4) The Service also recommends that annual quantitative surveys be conducted for a minimum of five years post sand placement in order to document the changes to the marine communities. This effort can also show any effects of movement of sand across the area and help determine if future re-nourishment initiatives will have continuing impacts.

As stated by USFWS, the direct impacts are straightforward, as the sand placement will cover portions of the project area. Of particular concern to DAR is impact to regulated resources, including stony coral and live rock.

DAR# AR0013

Comments

DAR Comments: Review of USFWS marine resource maps in the Draft Fish and Wildlife Coordination Act Report indicate that certain areas within the entire proposed project area are populated with regulated stony corals and live rock. The area was divided into the following five distinct strata for the purposes of the developing a quantitative sampling design: Shoreline Intertidal – Sandy, Shoreline Intertidal -Rocky, Scattered Coral/Rock in Unconsolidated Sediment, Pavement and Sand. These five strata consisted of the following aquatic resources (see Draft FWCA Report for more detail):

1. Shoreline Intertidal – Sandy: characterized as predominantly sand (86%) and rubble (11%) with a small amount of hard bottom (4%). The biological diversity within this stratum was very low with no corals observed (they were not enumerated in the methods), no algae species, no fish species, and nine invertebrate species.

2. Shoreline Intertidal -Rocky: characterized by the fact that it was predominantly hard bottom (66%) along the intertidal section of the coastline which exposes the habitat to air during low tide periods. The biological diversity of this stratum was similar to the Pavement stratum with 2 species of algae, 22 species of invertebrates, and 3 species of fishes. No coral or fish size data was collected in this stratum, and no coral colonies were observed during the invertebrate counts.

3. Scattered Coral/Rock in Unconsolidated Sediment: characterized by a slightly higher rugosity than the Pavement stratum, but still had a relatively low value of 1.09. This area was the most dominant habitat type through the project area (58%). Most of the area consisted of small rocks (larger than rubble) and scattered hard bottom pavement mixed with sand (35%) and rubble (40%; Figure 11). The biological diversity of this stratum was slightly higher than the Pavement stratum, with 5 species of algae, 10 species of coral, 32 species of invertebrates, and 5 species of fishes. The dominant alga present was the non-native alga, Acanthophora spicifera at 13%. The top five coral species were Pocillopora damicornis (0.12 colonies/m2), Psammocora stellata (0.11 colonies/m2), Porites lobata (0.09 colonies/m2), Leptastrea purpurea (0.08 colonies/m2), and Montipora capitata (0.07 colonies/m2).

4. Pavement: characterized by a low rugosity (1.03) hard bottom area. This area was mostly located in the northern section of the project area with some adjacent to the middle section. Quantitative analysis of bottom cover consisted of 32% uncolonized hard bottom, 29% sand, and 6% rubble. Sand was periodically scattered across the Pavement stratum, but did not constitute the underlying structure of the habitat. The biological diversity of this area was generally low compared to most coral reef areas. This area had 4 species of algae, 6 species of stony coral, 6 species of fishes, and 27 species of invertebrates. Of the coral species, the dominant coral

Comments

species was Psammocora stellata (0.44 colonies/m2), which is a small branching coral usually not attached and most were small colonies of less than five centimeters (cm).

5. Sand: characterized as sand and a sand/rubble mixture. However, quantitative evaluation on the bottom cover of this area shows 65% cover was mud and 33% was sand. The discrepancy is most likely a result of the low visibility during the mapping surveys and the location of the three transects used to characterize the habitat. This area was entirely in the southern portion of the project area next to the southern groin bounding the beach park. The high percentage of mud is likely due to the proximity to the mouth of the Anahulu River. This area was fairly depauperate except for a few organisms observed on one transect. This transect was a result of the last few meters crossing into the Scattered Coral/Rock in Unconsolidated Sediment stratum.

Note: It is important to note that these surveys did not investigate the infaunal community, so the true diversity of the community is not considered at all biological community scales.

Under section § 13-95-70 Stony corals and § 13-95-71 Live Rock (Hawaii Administrative Rules) it is unlawful for any person to take, break, or damage any stony coral or live rock except for inadvertent breakage, damage, or displacement of an aggregate area of less than one half square meter of coral or less than one square meter of live rock, and it is unlawful for any person to damage any stony coral by any intentional or negligent activity causing the introduction of sediment, biological contaminants, or pollution into state waters.

"Stony coral" means any invertebrate species belonging to the Order Scleractinia, characterized by having a hard, calcareous skeleton, that are native to the Hawaiian islands.

"Live rock" means any natural hard substrate to which marine life is visibly attached or affixed.

In order to avoid impact to regulated stony coral and live rock DAR requests that the sand be placed in areas which are absent of stony corals and live rock. Based on the USFWS marine biological surveys in the Draft FWCA Report, the two areas that are relatively void of stony coral and live rock or have the least amount of these resources are the strata defined as "Shoreline Intertidal – Sandy" and "Sand".

Comments

Within these areas with zero to sparse coverage of stony coral and live rock, DAR would additionally request that any corals or live rock that are present be transplanted from the site to a nearby environmentally similar site (e.g. similar types of corals and live rock currently exist in the proposed transplant site, site has similar habitat parameters such as depth, light, water motion and the proposed site is not anticipated to be developed in the future and will not be affected by the current project). Any type of transplantation effort would require multi-year monitoring under some type of agreement or permit.

As noted by USFWS in their biological surveys, under the currently proposed alternatives and their associated footprints of sand deposition (see figures/maps in the Draft FWCA Report), the Shoreline Intertidal – Rocky stratum (of the five of the strata assessed) will be impacted most significantly. Of the estimated 2,907 m2 of Shoreline Intertidal – Rocky area, the direct impacts to this area will be 1,506 m2, 1,556 m2, 2,088 m2, and 2,799 m2 for Alternatives 2, 3, 4,and 5, respectively. This represents impacts to 51%, 53%, 72%, and 96% of this area respectively. Alternative 5 would remove the vast majority of this habitat from the rocky shoreline intertidal area. No corals were documented during surveys within this area, but the area was predominantly (66%) hard bottom (i.e. live rock).

If it is not feasible or practical to target the areas with zero to sparse coverage of stony coral and live rock (i.e. depositing sand only in the "Shoreline Intertidal – Sandy" and "Sand" areas) and the other three remaining areas are proposed for nourishment instead (Shoreline Intertidal -Rocky, Scattered Coral/Rock in Unconsolidated Sediment, Pavement), the Department (DLNR) may determine that this activity qualifies as one which may receive an exemption from coral and live rock administrative rules (after review of the full proposal from the USACE), under the Hawaii Revised Statute for Special Activity Permits (§187A-6, HRS).

Under §187A-6, HRS, Special Activity Permits, there are provisions that exist for the take of regulated resources for specific purposes: Under the department may issue permits, not longer than one year in duration, to any person to take aquatic life, possess or use fishing gear, or engage in any feeding, watching, or other such non-consumptive activity related to aquatic resources, otherwise prohibited by law, in any part of the State, for scientific, educational, management, or propagation purposes, subject to chapter 195D and subject to those restrictions the department deems desirable.

Comments

If the Department makes this determination, it may be possible to categorize this beach nourishment activity under a "management" purpose, and issue a Special Activity Permit for the take of limited amounts of stony coral and live rock if the take has been minimized to the extent practicable (i.e. this would mean targeting areas that have the least amount of coral and live rock, implementing transplantation efforts or supporting offset measure/projects to restore coral or live rock in another area).

If it is determined possible to issue a Special Activity Permit for this activity then DAR would request (as conditions of the permit) that any corals or live rock that are present be transplanted from the site to a nearby environmentally similar site (e.g. similar types of corals and live rock currently exist in the proposed transplant site, site has similar habitat parameters such as depth, light, water motion and the proposed site is not anticipated to be developed in the future and will not be affected by the current project). That would be the initial recommendation of DAR: transplantation with multi-year monitoring under some type of agreement or permit.

If there are any corals or live rock that cannot be realistically* transplanted (e.g. large volumes of natural rubble or hard consolidated substrate/reef flat which presumably cannot be moved) from the area that will affected by the project, then DAR would require an offset measure/project (as conditions of permit or an agreement) to restore coral or live rock in another area (e.g. providing support to a coral restoration project to restore or grow coral or an herbivore/grazer project to restore live rock). If tis was a viable option, the USACE would need to quantify the number and sizes of coral colonies to be impacted and square area of live rock to be impacted.

Note: The transplant site needs to be an environmentally similar site (e.g. similar types of corals and live rock currently exist in the proposed transplant site, site has similar habitat parameters such as depth, light, water motion and the proposed site is not anticipated to be developed in the future and will not be affected by the current project), where the corals will realistically* survive transplantation and the amount of rubble to be transplanted should not negatively affect the new site – *i.e. the volume of loose rubble should not impact existing coral colonies or other aquatic resources at site by smothering or abrasion etc.

If the Department cannot make the determination that sand nourishment can qualify under the management purpose under §187A-6, then avoidance measures would need to be implemented.

DAR# AR0013

Comments

CWA 404(b)(1) guidelines consider vegetated shallows to be Special Aquatic Sites. Within the Pacific Islands, the USFWS considers Halimeda meadows and seagrass communities to be vegetated shallows. DAR additionally recommends avoiding nourishing of sand in areas with other important aquatic resources such as these vegetated shallows, as they may provide foraging grounds for regulated fish species and protected turtle species.

The Office of Conservation and Coastal Lands (OCCL) is another office within DLNR that may need to be consulted for this activity, if the lands that are being dredged or nourished are considered to fall under their jurisdiction as submerged lands or conservation district lands.

DAR would request more information on turbidity cause by the nourishment (e.g. potential duration for turbidity in the water column to be increased during nourishment activities, estimated area to be affected by turbidity, potential drift of sediment to areas other than target nourishment areas).

Based on potential concern from fishermen that may use this area, it would be recommended that the project managers initiate a public outreach and education effort to effectively document and attempt to mitigate any on-going concerns brought forward from the community.

DAR would request the USACE to specify/confirm the delineations and footprints of the areas under each alternative in order to identify which areas with which resources will impacted.

DAR requests BMPs which minimize sedimentation/turbidity during nourishment activities to be implemented (e.g. sediment fences/booms/socks), and would like the chance to review and comment on any BMPs to reduce sedimentation or turbidity.

Thank you for providing DAR the opportunity to review and comment on the Request for Comments - Phase I and II Marine Habitat Characterization Haleiwa Beach Park Beach Re-Nourishment Draft Report - U.S. Fish and Wildlife Service (Pacific Islands Fish & Wildlife Office). DAR requests the opportunity to review and additionally comment on the official proposal for this activity from the USACE. Should there be any changes, amendments or modifications to the current plans, DAR requests the opportunity to review and comment on those changes.

Attachment 2
404(b)(1) Water Quality Certification

August 2020

EVALUATION OF SECTION 404(b)(1) GUIDELINES (SHORT FORM)

PROPOSED PROJECT: Haleiwa Section 1122 Feasibility Study

	Yes	No*
1. Review of Compliance (230.10(a)-(d))		
A review of the proposed project indicates that:		
a. The placement represents the least environmentally damaging practicable alternative and, if in a special aquatic site, the activity associated with the placement must have direct access or proximity to, or be located in the aquatic ecosystem, to fulfill its basic purpose (if no, see section 2 and information gathered for EA alternative).	X	
b. The activity does not appear to:		
1) Violate applicable state water quality standards or effluent standards prohibited under Section 307 of the Clean Water Act;	X	
2) Jeopardize the existence of Federally-listed endangered or threatened species or their habitat; and	X	
3) Violate requirements of any Federally-designated marine sanctuary (if no, see section 2b and check responses from resource and water quality certifying agencies).	X	
c. The activity will not cause or contribute to significant degradation of waters of the U.S. including adverse effects on human health, life stages of organisms dependent on the aquatic ecosystem, ecosystem diversity, productivity and stability, and recreational, aesthetic, an economic values (if no, see values, Section 2)	X	
d. Appropriate and practicable steps have been taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem (if no, see Section 5)	X	

Documentation of 230.10(a-d) is provided in the Haleiwa Section 1122 Environmental Appendix of the DIFR/EA

	Not Applicable	Not Significant	Significant*
2. Technical Evaluation Factors (Subparts C-F) (where a 'Significant' category is checked, add explanation below.)			
a. Physical and Chemical Characteristics of the Aquatic Ecosystem (Subpart C)			
1) Substrate impacts		X	
2) Suspended particulates/turbidity impacts		X	
3) Water column impacts		X	
4) Alteration of current patterns and water circulation		X	
5) Alteration of normal water fluctuation/hydroperiod		X	
6) Alteration of salinity gradients		X	
b. Biological Characteristics of the Aquatic Ecosystem (Subpart D)			
1) Effect on threatened/endangered species and their habitat		X	
2) Effect on the aquatic food web		X	
3) Effect on other wildlife (mammals, birds, reptiles and amphibians)		X	
	Not Applicable	**Not Significant**	**Significant***
2. Technical Evaluation Factors (Subparts C-F) (where a 'Significant' category is checked, add explanation below.)			
c. Special Aquatic Sites (Subpart E)			
1) Sanctuaries and refuges	X		
2) Wetlands		X	
3) Mud flats	X		
4) Vegetated shallows	X		
5) Coral reefs		X	
6) Riffle and pool complexes	X		
d. Human Use Characteristics (Subpart F)			
1) Effects on municipal and private water supplies		X	
2) Recreational and Commercial fisheries impacts		X	
3) Effects on water-related recreation		X	
4) Aesthetic impacts		X	
5) Effects on parks, national and historical monuments, national seashores, wilderness areas, research sites, and similar preserves		X	

Documentation of Subparts C-F is provided in the Haleiwa Section 1122 Environmental Appendix of the D IFR/EA

	Yes
3. Evaluation of Dredged or Fill Material (Subpart G)	
a. The following information has been considered in evaluating the biological availability of possible contaminants in dredged or fill material (check only those appropriate)	
1) Physical characteristics	X
2) Hydrography in relation to known or anticipated sources of contaminants	X
3) Results from previous testing of the material or similar material in the vicinity of the project	X
4) Known, significant sources of persistent pesticides from land runoff or percolation	X
5) Spill records for petroleum products or designated (Section 311 of Clean Water Act) hazardous substances	X
6) Other public records of significant introduction of contaminants from industries, municipalities or other sources	X
7) Known existence of substantial material deposits of substances which could be released in harmful quantities to the aquatic environment by man-induced discharge activities	X

As documented in the Haleiwa Section 1122 DIFR/EA there have no HTRW concerns with the dredged material in the past. The material will be tested prior to dredging to confirm this.

	Yes	No
b. An evaluation of the appropriate information in 3a above indicates that there is reason to believe the proposed dredged or fill material is not a carrier of contaminants, or that levels of contaminants are substantively similar at extraction and placement sites and not likely to degrade the placement sites, or the material meets the testing exclusion criteria.	X	

As documented in the Haleiwa Section 1122 DIFR/EA there have no HTRW concerns with the dredged material in the past. The material will be tested prior to dredging to confirm this.

	Yes
4. Placement Site Delineation (230.11(f))	
a. The following factors as appropriate, have been considered in evaluating the placement site:	
1) Depth of water at placement site	**X**
2) Current velocity, direction, and variability at placement site	**X**
3) Degree of turbulence	**X**
4) Water column stratification	**X**
5) Discharge vessel speed and direction	**X**
6) Rate of discharge	**X**
7) Fill material characteristics (constituents, amount, and type of material, settling velocities)	**X**
8) Number of discharges per unit of time	**X**
9) Other factors affecting rates and patterns of mixing (specify)	**X**

As documented in the Haleiwa Section 1122 DIFR/EA there have no concerns with the suitability of the dredged material in the past. The material will be tested for suitability of placement prior to dredging to confirm this.

	Yes	No
b. An evaluation of the appropriate factors in 4a above indicates that the placement site and/or size of mixing zone are acceptable.	**X**	

As documented in the Haleiwa Section 1122 DIFR/EA there have no concerns with the suitability of the dredged material in the past. The material will be tested for suitability of placement prior to dredging to confirm this.

	Yes	No
5. Actions to Minimize Adverse Effects (Subpart H)		
All appropriate and practicable steps have been taken, through application of recommendations of 230.70-230.77 to ensure minimal adverse effects of the proposed discharge.	**X**	

As documented in the Haleiwa Section 1122 DIFR/EA there have no concerns with the suitability of the dredged material in the past. The material will be tested for suitability of placement prior to dredging to confirm this

	Yes	No*
6. Factual Determination (230.11)		
A review of appropriate information as identified in items 2-5 above indicates that there is minimal potential for short- or long-term environmental effects of the proposed discharge as related to:		
a. Physical substrate at the placement site (review Sections 2a. 3, 4, and 5 above)	X	
b. Water circulation, fluctuation and salinity (review Sections 2a. 3, 4, and 5)	X	
c. Suspended particulates/turbidity (review Sections 2a. 3, 4, and 5)	X	
d. Contaminant availability (review Sections 2a. 3, and 4)	X	
e. Aquatic ecosystem structure and function (review Sections 2b and c, 3, and 5)	X	
f. Placement site (review Sections 2, 4, and 5)	X	
g. Cumulative impacts on the aquatic ecosystem	X	
h. Secondary impacts on the aquatic ecosystem	X	

Documentation of 230.11(a-h) is provided in the Haleiwa Section 1122 Environmental Appendix of the DIFR/EA

7. Evaluation Responsibility
a. This evaluation was prepared by: Harmon Brown, PhD Position: Biologist, CESWF-PEE-C

8. Findings	Yes
a. The proposed placement site for discharge of or fill material complies with the Section 404(b)(1) Guidelines.	X
b. The proposed placement site for discharge of dredged or fill material complies with the Section 404(b)(1) Guidelines with the inclusion of the following conditions:	X

List of conditions:

c. The proposed placement site for discharge of dredged or fill material does not comply with the Section 404(b)(1) Guidelines for the following reason(s):	n/a
1) There is a less damaging practicable alternative	n/a
2) The proposed discharge will result in significant degradation of the aquatic ecosystem	n/a
3) The proposed discharge does not include all practicable and appropriate measures to minimize potential harm to the aquatic ecosystem	n/a

______________________ Date	______________________________________ Jennifer Moore, PMP

NOTES:

* A negative, significant, or unknown response indicates that the permit application may not be in compliance with the Section 404(b)(1) Guidelines.

Negative responses to three or more of the compliance criteria at the preliminary stage indicate that the proposed projects may not be evaluated using this "short form" procedure. Care should be used in assessing pertinent portions of the technical information of items 2a-e before completing the final review of compliance.

Negative response to one of the compliance criteria at the final stage indicates that the proposed project does not comply with the Guidelines. If the economics of navigation and anchorage of Section 404(b)(2) are to be evaluated in the decision-making process, the "short form" evaluation process is inappropriate.

Attachment 3
Ecosystem Modeling

August 2020

1.0 Introduction

The U.S. Army Corps of Engineers (USACE), in partnership with the City and County of Honolulu, is assessing the beneficial use of dredged material on Haleiwa Beach, Island of Oahu, Hawai'i. The project is located on the northeastern shore of Oahu, approximately 30 miles north of Honolulu, Hawai'i. The study area encompasses the federally authorized Haleiwa Small Boat Harbor and the Haleiwa Beach Park (Figure 1). The study area also includes a 0.3 acre settling basin (Settling Basin) located immediately to the east of the state breakwater on Ali'i Beach, and a 1.7-acre offshore sand deposit. A total of five alternatives were assessed, including the no-action alternative, also known as the Future without Project (FWOP) condition. A discussion of the alternatives can be found in Section 3 of the EA.

As part of the alternative comparison process an ecological model was used to determine the most beneficial plan for selection of the Tentatively Selected Plan (TSP). This model was chosen in consultation with the state and federal resource agencies and meets the requirements for model use in USACE Section 1122 studies.

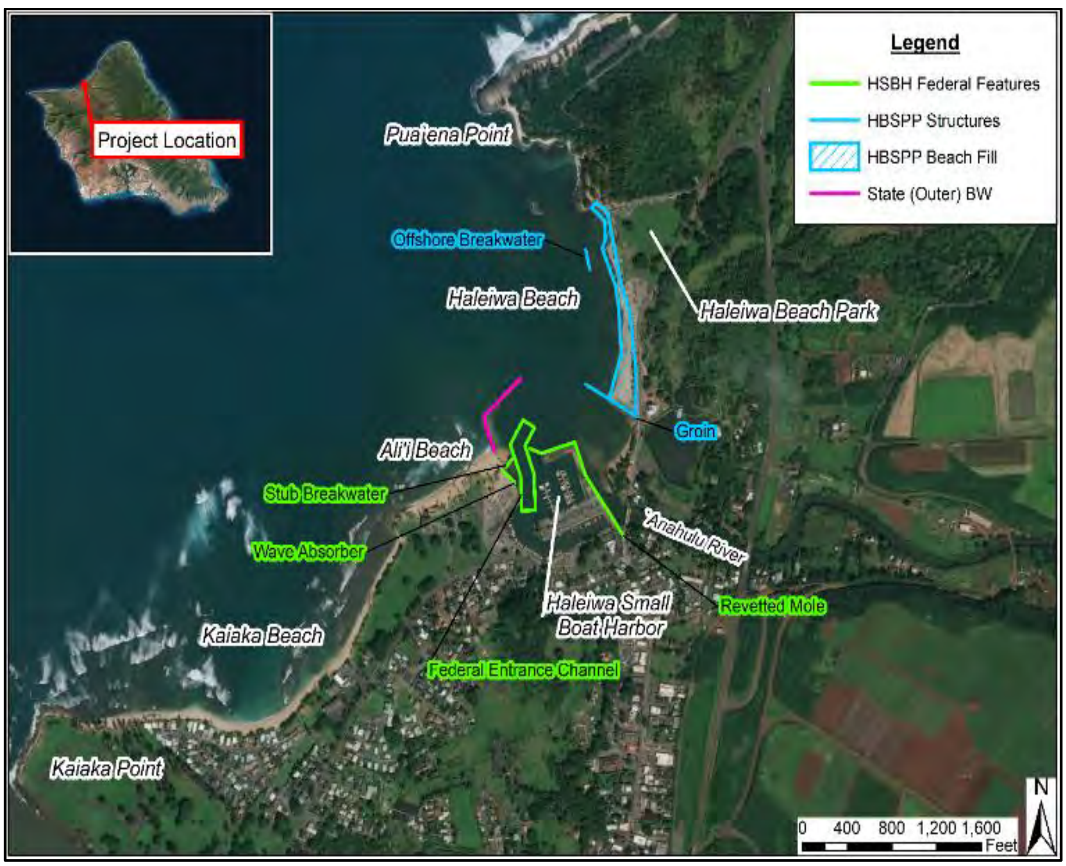

Figure 1. Project Location and Study Area

2.0 Model Selection

The model chosen for the study is taken from Comer (2002) and looks at the suitability of beaches for green sea turtles. The model utilizes a Habitat Suitability Index (HSI) to assess the quality and of beaches for nesting turtles and takes in to account the quantity of beach created.

3.0 Resource Agency Coordination

The project was presented to representatives of state and federal agencies on June 19, 2019. The agencies included the Hawaii State Department of Health (HSDOH), National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS), and USACE. During this day-long meeting the potential physical and environmental effects and benefits of the project were discussed, and a conceptual model was mapped out (Figure 2). Several potential models were discussed, but the Comer (2002) green sea turtle was the consensus for the model with the most potential to effectively compare the alternatives.

4.0 Model Description

The Comer (2002) green sea turtle model uses a composite index of five variables to create the HSI and arrive at an Average Annualized Habitat Unit (AAHU) for each alternative. The AAHUs were evaluated over a 50-year period. The model variables are the percentage of man-made obstacles within the habitat, the illuminance (measured in lux), compaction of the soil (measured in inches), the percentage of sand contained within the material, and the amount of debris within the material.

Variable 1 in the model assesses the percentage of man-made obstacles in the habitat with the lowest percentage (<=4%) resulting in the highest (1.0) suitability index. All other levels receive a zero score for Variable 1. The second variable assesses the amount of artificial light delivered to the habitat. Again the lowest levels (<=3 lux) result in the highest suitability index and all other values receive a zero value. Variable 3 is a measure of the compaction (in inches) of the sand on the beach. The empirical measurements used to develop the model found that compaction of 2 – 4 inches and 8 – 11 inches were both of the highest quality so would receive a 1.0 suitability index, while compaction of 0 - 1 inch would get 0.5 suitability index, and 5 – 7 inches would receive a zero score. Variables 4 and 5 deal with the quality of the sand. Variable 4 measures the percent of sand within the mixture and Variable 5 measures the percent of debris within the mixture. For Variable 4 a percent of 1 – 13 percent receives a suitability index of 0.9, 14 – 25 percent receives a 1.0, 26 – 40 receives a 0.2 and all other percentages get a zero score. For Variable 5 zero percent receives a score of 0.2, 1 – 38 percent gets a suitability index of 0.5, 39 – 50 percent gets the highest (1.0) score, and 51 – 100 gets a 0.9 score.The models were run on 10-year periods over a 50-year life cycle. This allows for changes to be measured over the life of the project. The acreages of each alternative were used to determine the overall AAHU for the individual alternatives.

5.0 Project Benefits

Under the FWOP conditions no dredging would take place and the beach would continue to erode causing continued loss of habitat. Under the remaining alternatives dredging would occur from a combination of sources and suitable material would be placed on Haleiwa Beach, increasing the size of the beach and increasing the amount of habitat available.

The first three variables were assumed to be held constant after discussions with the resource agencies. Therefore, only the final two variables changed within the model over time, along with the acreage due to erosion under the FWOP conditions. The numbers for these variables were derived from previous dredged material sample testing results.

The results of the model runs can be found in Table 1. As expected, the number of AAHUs increased with the increase in acreage of beach created. Under the FWOP conditions there would be no change in AAHUs as no habitat would be created. The TSP (Alternative 4) created the largest number of net AAHUs at 1.77.

The spreadsheet calculations can be seen in Section 7.0.

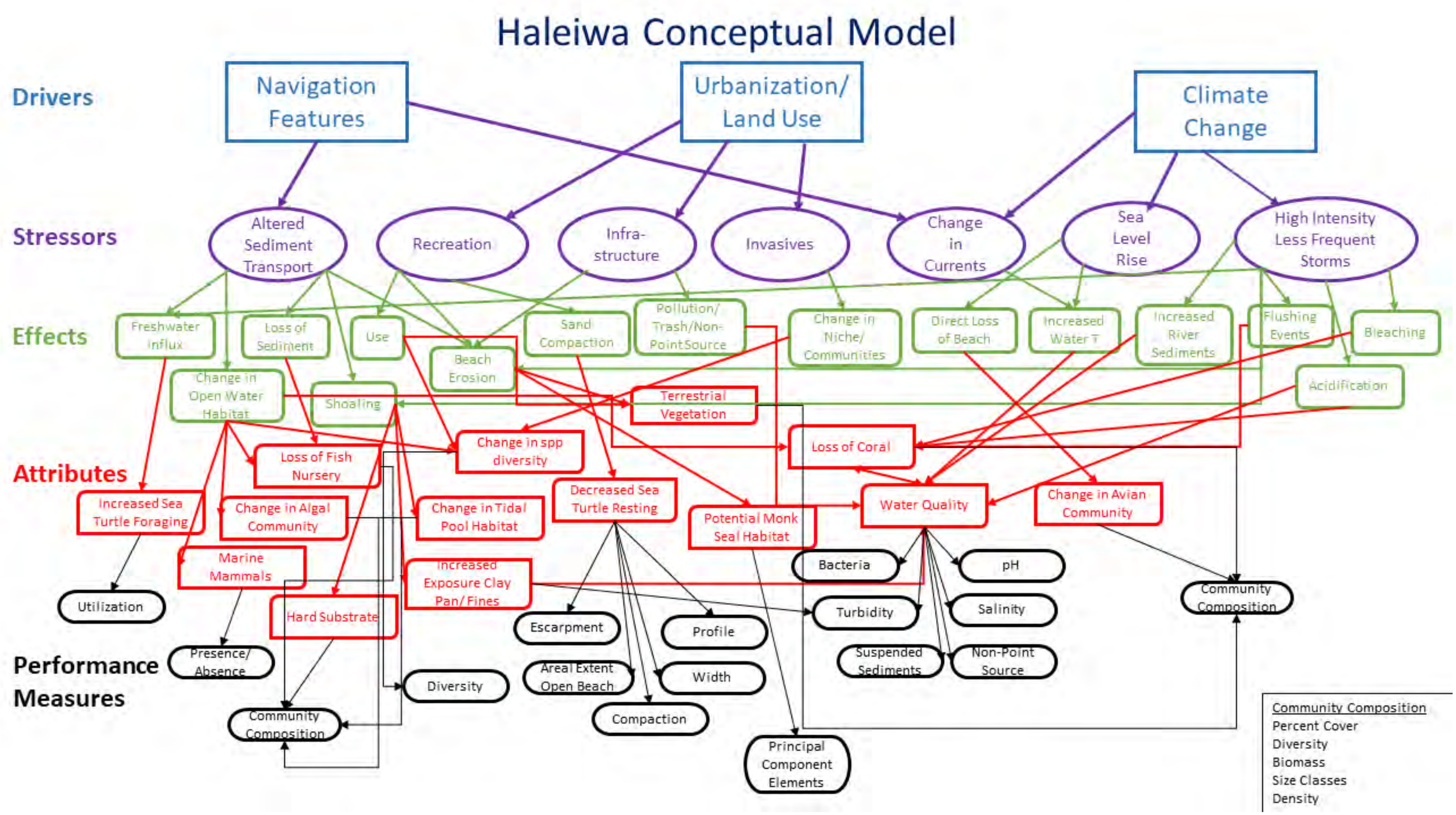

Figure 2. Conceptual Model for the Haleiwa Section 1122 Feasibility Study.

Table 1. Net AAHUs for the Haleiwa Section 1122 Alternative Plans

Alternative	Net AAHUs
FWOP	0.0
Federal Navigation Channel (12' MLLW)	0.30
Federal Navigation Channel (13' MLLW)	0.64
Federal Navigation Channel and Settling Basin	0.84
Federal Navigation Channel, Settling Basin, and Offshore Sand Deposit	1.77

6.0 References

Comer, KE (2002) Habitat Suitability Index models for nesting sea turtles at the U.S. Naval Station Guantanamo Bay, Cuba. M.A. Thesis. San Diego State University. San Diego, CA. 104 pp.

7.0 Model Spreadsheets

7.1 FWOP Conditions

Project:	Haleiwa 1122 - Alternative1 - No BU						
Acres	2.1						
Condition: Future Without Project		**TY**	0	**TY**	1	**TY**	11
Variable			**SI**		**SI**		**SI**
V1	% man-made (0-47)	1	1.00	1	1.00	1	1.00
V2	Illuminance (0-144)	3	1.00	3	1.00	3	1.00
V3	Compaction (0-11)	3	1.00	3	1.00	3	1.00
V4	% sand (0-75)	40	0.20	40	0.20	40	0.20
V5	% debris (0-100)	40	1.00	40	1.00	30	0.50
		HSI=	**0.84**	HSI=	**0.84**	HSI=	**0.71**
Condition: Future Without Project		**TY**	21	**TY**	31	**TY**	41
Variable			**SI**		**SI**		**SI**
V1	% man-made	1	1.00	1	1.00	1	1.00
V2	Illuminance	3	1.00	3	1.00	3	1.00
V3	Compaction	3	1.00	3	1.00	3	1.00
V4	% sand	40	0.20	40	0.20	40	0.20
V5	% debris	30	0.50	20	0.50	20	0.50
		HSI=	**0.71**	HSI=	**0.71**	HSI=	**0.71**
Condition: Future Without Project		**TY**	51	**TY**		**TY**	
Variable			**SI**		**SI**		**SI**
V1	% man-made	1	1.00				
V2	Illuminance	3	1.00				
V3	Compaction	3	1.00				
V4	% sand	40	0.20				
V5	% debris	0	0.20				
		HSI=	**0.63**	HSI=		HSI=	

Green Sea Turtle HSI Model Spreadsheet							
Acres	2.1						
	Condition: Future With Project	**TY**	0	**TY**	1	**TY**	11
Variable			**SI**		**SI**		**SI**
V1	% man-made	1	1.00	1	1.00	1	1.00
V2	Illuminance	3	1.00	3	1.00	3	1.00
V3	Compaction	3	1.00	3	1.00	3	1.00
V4	% sand	40	0.20	40	0.20	40	0.20
V5	% debris	40	1.00	40	1.00	30	0.50
		HSI=	**0.84**	HSI=	**0.84**	HSI=	**0.71**
	Condition: Future With Project	**TY**	21	**TY**	31	**TY**	41
Variable			**SI**		**SI**		**SI**
V1	% man-made	1	1.00	1	1.00	1	1.00
V2	Illuminance	3	1.00	3	1.00	3	1.00
V3	Compaction	3	1.00	3	1.00	3	1.00
V4	% sand	40	0.20	40	0.20	40	0.20
V5	% debris	30	0.50	20	0.50	20	0.50
		HSI=	**0.71**	HSI=	**0.71**	HSI=	**0.71**
	Condition: Future With Project	**TY**	51	**TY**		**TY**	
Variable			**SI**		**SI**		**SI**
V1	% man-made	1	1.00				
V2	Illuminance	3	1.00				
V3	Compaction	3	1.00				
V4	% sand	40	0.20				
V5	% debris	0	0.20				
		HSI=	**0.63**	HSI=		HSI=	

Condition: Future Without Project

TY	Acres	HSI	Total HUs	Cumulative HUs
0	2	0.84	1.77	
1	2	0.84	1.77	1.77
11	2	0.71	1.28	15.17
21	2	0.71	1.06	11.70
31	1	0.71	0.78	9.22
41	1	0.71	0.57	6.73
51	0	0.63	0.19	3.71
Max TY=	51		AAHUs=	0.95

Net Change in AAHUs due to Project

Future With Project AAHUs	0.95
Future Without Project AAHUs	0.95
Net Change	0.00

Condition: Future With Project

TY	Acres	HSI	Total HUs	Cumulative HUs
0	2	0.84	1.77	
1	2	0.84	1.77	1.77
11	2	0.71	1.28	15.17
21	2	0.71	1.06	11.70
31	1	0.71	0.78	9.22
41	1	0.71	0.57	6.73
51	0	0.63	0.19	3.71
Max TY=	51		AAHUs=	0.95

7.2 Federal Navigation Channel (Alternative 2)

Project: Haleiwa 1122 - Alternative 2

Acres: 1.2

Condition: Future Without Project		TY	0	TY	1	TY	11
Variable			SI		SI		SI
V1	% man-made (0-47)	1	1.00	1	1.00	1	1.00
V2	Illuminance (0-144)	3	1.00	3	1.00	3	1.00
V3	Compaction (0-11)	3	1.00	3	1.00	3	1.00
V4	% sand (0-75)	40	0.20	40	0.20	40	0.20
V5	% debris (0-100)	40	1.00	40	1.00	30	0.50
		HSI=	0.84	HSI=	0.84	HSI=	0.71

Condition: Future Without Project		TY	21	TY	31	TY	41
Variable			SI		SI		SI
V1	% man-made	1	1.00	1	1.00	1	1.00
V2	Illuminance	3	1.00	3	1.00	3	1.00
V3	Compaction	3	1.00	3	1.00	3	1.00
V4	% sand	40	0.20	40	0.20	40	0.20
V5	% debris	30	0.50	20	0.50	20	0.50
		HSI=	0.71	HSI=	0.71	HSI=	0.71

Condition: Future Without Project		TY	51	TY		TY	
Variable			SI		SI		SI
V1	% man-made	1	1.00				
V2	Illuminance	3	1.00				
V3	Compaction	3	1.00				
V4	% sand	40	0.20				
V5	% debris	0	0.20				
		HSI=	0.63	HSI=		HSI=	

Green Sea Turtle HSI Model Spreadsheet

Acres: 1.2

Condition: Future With Project		TY	0	TY	1	TY	11
Variable			SI		SI		SI
V1	% man-made	1	1.00	1	1.00	1	1.00
V2	Illuminance	3	1.00	3	1.00	3	1.00
V3	Compaction	3	1.00	3	1.00	3	1.00
V4	% sand	40	0.20	40	0.20	40	0.20
V5	% debris	40	1.00	30	0.50	30	0.50
		HSI=	0.84	HSI=	0.71	HSI=	0.71

Condition: Future With Project		TY	21	TY	31	TY	41
Variable			SI		SI		SI
V1	% man-made	1	1.00	1	1.00	1	1.00
V2	Illuminance	3	1.00	3	1.00	3	1.00
V3	Compaction	3	1.00	3	1.00	3	1.00
V4	% sand	40	0.20	40	0.20	40	0.20
V5	% debris	30	0.50	30	0.50	30	0.50
		HSI=	0.71	HSI=	0.71	HSI=	0.71

Condition: Future With Project		TY	51	TY		TY	
Variable			SI		SI		SI
V1	% man-made	1	1.00				
V2	Illuminance	3	1.00				
V3	Compaction	3	1.00				
V4	% sand	40	0.20				
V5	% debris	30	0.50				
		HSI=	0.71	HSI=		HSI=	

Green Sea Turtle HSI Model Spreadsheet

Condition: Future Without Project

TY	Acres	HSI	Total HUs	Cumulative HUs
0	1	0.84	1.01	
1	1.2	0.84	1.01	1.01
11	1	0.71	0.71	8.56
21	0.88	0.71	0.62	6.66
31	0.67	0.71	0.47	5.49
41	0.5	0.71	0.35	4.15
51	0.2	0.63	0.13	2.36
Max TY=	51		AAHUs=	0.55

Condition: Future With Project

TY	Acres	HSI	Total HUs	Cumulative HUs
0	1	0.84	1.01	
1	1	0.71	0.85	0.93
11	1	0.71	0.85	8.51
21	1	0.71	0.85	8.51
31	1	0.71	0.85	8.51
41	1	0.71	0.85	8.51
51	1	0.71	0.85	8.51
Max TY=	51		AAHUs=	0.85

Net Change in AAHUs due to Project

Future With Project AAHUs	0.85
Future Without Project AAHUs	0.55
Net Change	0.30

7.3 Federal Navigation Channel (Alternative 2a)

Project: Haleiwa 1122 - Alternative 2a

Acres 1.6

Condition: Future Without Project

Variable		TY 0	SI	TY 1	SI	TY 11	SI
V1	% man-made (0-47)	1	1.00	1	1.00	1	1.00
V2	Illuminance (0-144)	3	1.00	3	1.00	3	1.00
V3	Compaction (0-11)	3	1.00	3	1.00	3	1.00
V4	% sand (0-75)	40	0.20	40	0.20	40	0.20
V5	% debris (0-100)	40	1.00	40	1.00	30	0.50
		HSI=	0.84	HSI=	0.84	HSI=	0.71

Condition: Future Without Project

Variable		TY 21	SI	TY 31	SI	TY 41	SI
V1	% man-made	1	1.00	1	1.00	1	1.00
V2	Illuminance	3	1.00	3	1.00	3	1.00
V3	Compaction	3	1.00	3	1.00	3	1.00
V4	% sand	40	0.20	40	0.20	40	0.20
V5	% debris	30	0.50	20	0.50	20	0.50
		HSI=	0.71	HSI=	0.71	HSI=	0.71

Condition: Future Without Project

Variable		TY 51	SI	TY	SI	TY	SI
V1	% man-made	1	1.00				
V2	Illuminance	3	1.00				
V3	Compaction	3	1.00				
V4	% sand	40	0.20				
V5	% debris	0	0.20				
		HSI=	0.63	HSI=		HSI=	

Green Sea Turtle HSI Model Spreadsheet

Acres 1.6

Condition: Future With Project

Variable		TY 0	SI	TY 1	SI	TY 11	SI
V1	% man-made	1	1.00	1	1.00	1	1.00
V2	Illuminance	3	1.00	3	1.00	3	1.00
V3	Compaction	3	1.00	3	1.00	3	1.00
V4	% sand	40	0.20	25	1.00	25	1.00
V5	% debris	40	1.00	30	0.50	30	0.50
		HSI=	0.84	HSI=	0.86	HSI=	0.86

Condition: Future With Project

Variable		TY 21	SI	TY 31	SI	TY 41	SI
V1	% man-made	1	1.00	1	1.00	1	1.00
V2	Illuminance	3	1.00	3	1.00	3	1.00
V3	Compaction	3	1.00	3	1.00	3	1.00
V4	% sand	25	1.00	25	1.00	25	1.00
V5	% debris	30	0.50	30	0.50	30	0.50
		HSI=	0.86	HSI=	0.86	HSI=	0.86

Condition: Future With Project

Variable		TY 51	SI	TY	SI	TY	SI
V1	% man-made	1	1.00				
V2	Illuminance	3	1.00				
V3	Compaction	3	1.00				
V4	% sand	25	1.00				
V5	% debris	30	0.50				
		HSI=	0.86	HSI=		HSI=	

Green Sea Turtle HSI Model Spreadsheet

Condition: Future Without Project

TY	Acres	HSI	Total HUs	Cumulative HUs
0	2	0.84	1.30	
1	2	0.84	1.35	1.32
11	1	0.71	0.96	11.52
21	1	0.71	0.82	8.93
31	1	0.71	0.62	7.23
41	1	0.71	0.48	5.53
51	0	0.63	0.16	3.17
Max TY=	51		AAHUs=	0.74

Condition: Future With Project

TY	Acres	HSI	Total HUs	Cumulative HUs
0	2	0.84	1.35	
1	2	0.86	1.38	1.36
11	2	0.86	1.38	13.78
21	2	0.86	1.38	13.78
31	2	0.86	1.38	13.78
41	2	0.86	1.38	13.78
51	2	0.86	1.38	13.78
Max TY=	51		AAHUs=	1.38

Net Change in AAHUs due to Project

Future With Project AAHUs	1.38
Future Without Project AAHUs	0.74
Net Change	0.64

7.4 Federal Navigation Channel and Settling Basin (Alternative 3)

Project: Haleiwa 1122 - Alternative 3

Acres: 2.1

Condition: Future Without Project

Variable		TY 0	SI	TY 1	SI	TY 11	SI
V1	% man-made (0-47)	1	1.00	1	1.00	1	1.00
V2	Illuminance (0-144)	3	1.00	3	1.00	3	1.00
V3	Compaction (0-11)	3	1.00	3	1.00	3	1.00
V4	% sand (0-75)	40	0.20	40	0.20	40	0.20
V5	% debris (0-100)	40	1.00	40	1.00	30	0.50
		HSI=	0.84	HSI=	0.84	HSI=	0.71

Condition: Future Without Project

Variable		TY 21	SI	TY 31	SI	TY 41	SI
V1	% man-made	1	1.00	1	1.00	1	1.00
V2	Illuminance	3	1.00	3	1.00	3	1.00
V3	Compaction	3	1.00	3	1.00	3	1.00
V4	% sand	40	0.20	40	0.20	40	0.20
V5	% debris	30	0.50	20	0.50	20	0.50
		HSI=	0.71	HSI=	0.71	HSI=	0.71

Condition: Future Without Project

Variable		TY 51	SI	TY	SI	TY	SI
V1	% man-made	1	1.00				
V2	Illuminance	3	1.00				
V3	Compaction	3	1.00				
V4	% sand	40	0.20				
V5	% debris	0	0.20				
		HSI=	0.63	HSI=		HSI=	

Green Sea Turtle HSI Model Spreadsheet

Acres: 2.1

Condition: Future With Project

Variable		TY 0	SI	TY 1	SI	TY 11	SI
V1	% man-made	1	1.00	1	1.00	1	1.00
V2	Illuminance	3	1.00	3	1.00	3	1.00
V3	Compaction	3	1.00	3	1.00	3	1.00
V4	% sand	40	0.20	25	1.00	25	1.00
V5	% debris	40	1.00	30	0.50	30	0.50
		HSI=	0.84	HSI=	0.86	HSI=	0.86

Condition: Future With Project

Variable		TY 21	SI	TY 31	SI	TY 41	SI
V1	% man-made	1	1.00	1	1.00	1	1.00
V2	Illuminance	3	1.00	3	1.00	3	1.00
V3	Compaction	3	1.00	3	1.00	3	1.00
V4	% sand	25	1.00	25	1.00	25	1.00
V5	% debris	30	0.50	30	0.50	30	0.50
		HSI=	0.86	HSI=	0.86	HSI=	0.86

Condition: Future With Project

Variable		TY 51	SI	TY	SI	TY	SI
V1	% man-made	1	1.00				
V2	Illuminance	3	1.00				
V3	Compaction	3	1.00				
V4	% sand	25	1.00				
V5	% debris	30	0.50				
		HSI=	0.86	HSI=		HSI=	

Green Sea Turtle HSI Model Spreadsheet

Condition: Future Without Project

TY	Acres	HSI	Total HUs	Cumulative HUs
0	2	0.84	1.94	
1	2	0.84	1.77	1.86
11	2	0.71	1.27	15.13
21	2	0.71	1.08	11.77
31	1	0.71	0.81	9.46
41	1	0.71	0.62	7.16
51	0	0.63	0.21	4.11
Max TY=	51		AAHUs=	0.97

Condition: Future With Project

TY	Acres	HSI	Total HUs	Cumulative HUs
0	2	0.84	1.77	
1	2	0.86	1.81	1.79
11	2	0.86	1.81	18.09
21	2	0.86	1.81	18.09
31	2	0.86	1.81	18.09
41	2	0.86	1.81	18.09
51	2	0.86	1.81	18.09
Max TY=	51		AAHUs=	1.81

Net Change in AAHUs due to Project

Future With Project AAHUs	1.81
Future Without Project AAHUs	0.97
Net Change	0.84

7.5 Federal Navigation Channel, Settling Basin, and Offshore Sand Deposit (TSP/Alternative 4)

Green Sea Turtle HSI Model Spreadsheet

Project: Haleiwa 1122 - Alternative 5

Condition: Future Without Project (Acres 4.4)

Variable		TY 0	SI	TY 1	SI	TY 11	SI
V1	% man-made (0-47)	1	1.00	1	1.00	1	1.00
V2	Illuminance (0-144)	3	1.00	3	1.00	3	1.00
V3	Compaction (0-11)	3	1.00	3	1.00	3	1.00
V4	% sand (0-75)	40	0.20	40	0.20	40	0.20
V5	% debris (0-100)	40	1.00	40	1.00	30	0.50
		HSI=	0.84	HSI=	0.84	HSI=	0.71

Condition: Future With Project (Acres 4.4)

Variable		TY 0	SI	TY 1	SI	TY 11	SI
V1	% man-made	1	1.00	1	1.00	1	1.00
V2	Illuminance	3	1.00	3	1.00	3	1.00
V3	Compaction	3	1.00	3	1.00	3	1.00
V4	% sand	40	0.20	25	1.00	25	1.00
V5	% debris	40	1.00	30	0.50	30	0.50
		HSI=	0.84	HSI=	0.86	HSI=	0.86

Condition: Future Without Project

Variable		TY 21	SI	TY 31	SI	TY 41	SI
V1	% man-made	1	1.00	1	1.00	1	1.00
V2	Illuminance	3	1.00	3	1.00	3	1.00
V3	Compaction	3	1.00	3	1.00	3	1.00
V4	% sand	40	0.20	40	0.20	40	0.20
V5	% debris	30	0.50	20	0.50	20	0.50
		HSI=	0.71	HSI=	0.71	HSI=	0.71

Condition: Future With Project

Variable		TY 21	SI	TY 31	SI	TY 41	SI
V1	% man-made	1	1.00	1	1.00	1	1.00
V2	Illuminance	3	1.00	3	1.00	3	1.00
V3	Compaction	3	1.00	3	1.00	3	1.00
V4	% sand	25	1.00	25	1.00	25	1.00
V5	% debris	30	0.50	30	0.50	30	0.50
		HSI=	0.86	HSI=	0.86	HSI=	0.86

Condition: Future Without Project

Variable		TY 51	SI	TY	SI	TY	SI
V1	% man-made	1	1.00				
V2	Illuminance	3	1.00				
V3	Compaction	3	1.00				
V4	% sand	40	0.20				
V5	% debris	0	0.20				
		HSI=	0.63	HSI=		HSI=	

Condition: Future With Project

Variable		TY 51	SI	TY	SI	TY	SI
V1	% man-made	1	1.00				
V2	Illuminance	3	1.00				
V3	Compaction	3	1.00				
V4	% sand	25	1.00				
V5	% debris	30	0.50				
		HSI=	0.86	HSI=		HSI=	

Green Sea Turtle HSI Model Spreadsheet

Condition: Future Without Project

TY	Acres	HSI	Total HUs	Cumulative HUs
0	4	0.84	3.71	
1	4	0.84	3.71	3.71
11	4	0.71	2.64	31.63
21	3	0.71	2.25	24.49
31	2	0.71	1.69	19.71
41	2	0.71	1.28	14.82
51	1	0.63	0.45	8.46
Max TY=	51		AAHUs=	2.02

Condition: Future With Project

TY	Acres	HSI	Total HUs	Cumulative HUs
0	4	0.84	3.71	
1	4	0.86	3.79	3.75
11	4	0.86	3.79	37.90
21	4	0.86	3.79	37.90
31	4	0.86	3.79	37.90
41	4	0.86	3.79	37.90
51	4	0.86	3.79	37.90
Max TY=	51		AAHUs=	3.79

Net Change in AAHUs due to Project

Future With Project AAHUs	3.79
Future Without Project AAHUs	2.02
Net Change	1.77

Attachment 4
Monitoring and Adaptive Management Plan

August 2020

1.0 Introduction

In accordance with Section 2039(a) of the Water Resources Development Act of 2007 a monitoring and adaptive management plan must be developed for ecosystem restoration projects. The monitoring and adaptive management plan is intended to detail how the success of ecosystem restoration measures will be measured.

The Haleiwa 1122 Tentatively Selected Plan includes restoration of the Haleiwa Beach on the Island of Oahu, Hawaii. This monitoring and adaptive management plan will address these beach restoration measures.

2.0 Beach Restoration

2.1 Post-construction survey

As-built drawings of the completed project are to be included in the specifications of the construction contract. These drawings can be utilized in lieu of a post-construction survey.

2.2 Performance criteria

Reasonable assurance of the long-term success of the beach restoration can be provided by meeting short-term and long-term milestones. The performance criteria for the restoration plan will be based around the design of the project. Meeting these criteria will also ensure that the restoration performs in a manner that provides increased benefits for sea turtles and water birds by increasing habitat availability and improving habitat suitability for the species.

The restoration of a beach is performed through the addition of material from a suitable source that meets a criteria of a matching proportion of sand and other material (such as clay and fines). The material is placed in a manner so that the beach profile is wider (the area from mean low tide to the dunes) and higher (the percentage of the beach above the mean high tide line). The area of beach restoration will be no less than 0.74 acres.

Compliance with the design-based performance criteria shall be documented during each monitoring event that will occur approximately 1, 3, 5, and 10 years after construction has been completed.

2.3 Contingencies

Successful establishment of an effective beach restoration depends on a number of physical factors that cannot be controlled. Severe flooding and tropical storms can remove material from the beach in unanticipated manners, thus decreasing the success of the beach restoration.

2.4 Performance Monitoring

Beach monitoring will be conducted at scheduled intervals following construction. The schedule and objectives of post-construction monitoring events are shown in **Table 1** below. A written report following each monitoring event will be submitted to the USACE for review.

2.5 Corrective Actions

If corrective actions are required approval will be obtained from the USACE prior to their performance. These actions may include:

a. Mobilization of heavy equipment to rework the existing beach material in order to improve the beach profile.
b. Augmentation of the material to address settlement or subsidence below target elevations.
c. Augmentation of the material to address erosion due to storms or heavy flooding.

Construction of a new beach is not considered a corrective action. These corrective actions may be triggered by the following:

a. Subsidence or settling of the beach below target elevations (as confirmed by surveys).
b. Excessive erosion in any scheduled post-construction monitoring event.

Table 1. Post-Construction Restoration Monitoring Events

Monitoring Schedule	Characteristics to Evaluate	Methods
Approximately 1 year following certification of completion of construction	Beach profile	Emery (1961) or similar
Approximately 3 years following certification of completion of construction	Beach profile	Emery (1961) or similar
Approximately 5 years following certification of completion of construction	Beach profile	Emery (1961) or similar
Approximately 10 years following certification of completion of construction	Beach profile	Emery (1961) or similar

3.0 Labor

Collection of beach profile data for performance criteria monitoring would require two technicians for one day each scheduled monitoring event. The annual labor cost would be $7,500, with a total cost of $30,000.

4.0 References

Emery, K.O. (1961) A simple method of measuring beach profiles. Limnology and Oceanography. 6:90-93.

Attachment 5

Endangered Species Act Consultation

August 2020

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, HONOLULU DISTRICT
FORT SHAFTER, HAWAII 96858-5440

Civil and Public Works Branch
Programs and Project Management Division

Mr. Michael Tosatto
Regional Administrator
National Marine Fisheries Service, Pacific Islands Regional Office
1845 Wasp Boulevard
Building 176
Honolulu, Hawaii 96818

Dear Mr. Tosatto:

The Honolulu District, U.S. Army Corps of Engineers (Corps) seeks technical assistance from your agency in accordance with Section 7 of the Endangered Species Act (ESA) of 1973, as amended, (16 U.S.C. 1531 *et. seq.*) for the proposed project, as described below. The Corps would also like to request a list of endangered species that may occur within the study area for the Haleiwa Harbor Beneficial Use of Dredged Materials feasibility study.

The Corps is conducting a feasibility study to determine potential beneficial uses of material dredged from Haleiwa Harbor, located in northern Oahu, Hawaii. Pursuant to Section 102 of the National Environmental Policy Act (NEPA) as implemented by the regulations promulgated by the Council on Environmental Quality (40 CFR Parts 1500-1508 and Corps Engineering Regulation 200-2-2), an Environmental Assessment (EA) will be included in an integrated Feasibility Report (FR) for this study. The NEPA and Hawaiʻi Environmental Policy Act (HEPA) compliant Integrated FR/EA is being prepared for the proposed action under the authority of Section 1122 of the Water Resources Development Act of 2016, as amended (33 U.S.C. 2326). The Project is necessary to address ongoing maintenance of the Federal navigation channel at Haleiwa Harbor while seeking opportunities to utilize the dredged material in a beneficial manner.

The FR/EA is considering various sources of suitable material both inside and outside of the limits of the Haleiwa Harbor Federal entrance channel for the purpose of beneficial disposal along the shoreline at the adjacent Haleiwa Beach Park. The study area is presented in Enclosure 1.

If you have any questions or require additional information, please contact Mr. Michael Wyatt, Civil Works Branch, at (808) 835-4031 or e-mail michael.d.wyatt@usace.army.mil.

Sincerely,

CAYETANO.STEPHEN.N.1179660098

Stephen N. Cayetano, P.E.
Deputy District Engineer for
Programs and Project Management

Enclosure

cc:
Ian Lundgren, NOAA
Steve Kolinsky, NOAA

Enclosure 1: Haleiwa Study Area

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, HONOLULU DISTRICT
FORT SHAFTER, HAWAII 96858-5440

Civil and Public Works Branch
Programs and Project Management Division

Dr. Mary M. Abrams
Field Supervisor
U.S. Fish and Wildlife Service (USFWS)
Pacific Islands Fish and Wildlife Office
300 Ala Moana Blvd., Room 3-122
Box 50088
Honolulu, Hawaii 96850

Dear Dr. Abrams:

The Honolulu District, U.S. Army Corps of Engineers (Corps) seeks technical assistance from your agency in accordance with Section 7 of the Endangered Species Act (ESA) of 1973, as amended, (16 U.S.C. 1531 *et. seq.*) for the proposed project, as described below. The Corps would also like to request a list of endangered species that may occur within the study area for the Haleiwa Harbor Beneficial Use of Dredged Materials feasibility study.

The Corps is conducting a feasibility study to determine potential beneficial uses of material dredged from Haleiwa Harbor, located in northern Oahu, Hawaii. Pursuant to Section 102 of the National Environmental Policy Act (NEPA) as implemented by the regulations promulgated by the Council on Environmental Quality (40 CFR Parts 1500-1508 and Corps Engineering Regulation 200-2-2), an Environmental Assessment (EA) will be included in an Integrated Feasibility Report (FR) for this study. The NEPA and Hawai'i Environmental Policy Act (HEPA) compliant Integrated FR/EA is being prepared for the proposed action under the authority of Section 1122 of the Water Resources Development Act of 2016, as amended (33 U.S.C. 2326). The Project is necessary to address ongoing maintenance of the Federal navigation channel at Haleiwa Harbor while seeking opportunities to utilize the dredged material in a beneficial manner.

The FR/EA is considering various sources of suitable material both inside and outside of the limits of the Haleiwa Harbor Federal entrance channel for the purpose of beneficial disposal along the shoreline at the adjacent Haleiwa Beach Park. The study area is presented in Enclosure 1.

If you have any questions or require additional information, please contact Mr. Michael Wyatt, Civil Works Branch, at (808) 835-4031 or e-mail michael.d.wyatt@usace.army.mil.

Sincerely,

CAYETANO.ST
EPHEN.N.1179
660098

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Date: 2019.04.04
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Stephen N. Cayetano, P.E.
Deputy District Engineer for
Programs and Project Management

Enclosure

Enclosure 1: Haleiwa Study Area

BIOLOGICAL ASSESSMENT FOR IMPACTS TO ENDANGERED AND THREATENED SPECIES RELATIVE TO THE HALEIWA SECTION 1122, HALEIWA, ISLAND OF OAHU, HAWAII PROJECT

Prepared by:
U.S. Army Corps of Engineers
Galveston District
2000 Fort Point Road
Galveston, Texas 77550

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1.0 Introduction

1.1 Purpose of the Biological Assessment

This Biological Assessment (BA) is being prepared to fulfill the U.S. Army Corps of Engineers' (USACE) requirements as outlined under Section 7(c) of the Endangered Species Act (ESA) of 1973, as amended. The proposed Federal action (project) requiring the assessment is the beneficial use of dredged material for the restoration of the Haleiwa Beach on the Island of Oahu in Honolulu County, Hawaii. Details of the proposed project are provided in Section 1.2; specific details are available in the Draft Environmental Assessment (EA; USACE, 2020). This BA evaluates the potential impacts the project may have on federally listed endangered and threatened species and is being prepared to assist U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) personnel in fulfilling their obligations under the ESA. Table 1 presents a list of federally listed threatened and endangered species that are addressed in this BA, as provided by USFWS and NMFS.

Table 1. Threatened and Endangered Wildlife Species of possible occurrence in Honolulu County, Hawaii

Common Name	Scientific Name	Status
Birds		
Hawaiian Coot	*Fulica alai*	Endangered
Hawaiian Gallinule	*Gallinula chloropus sandvicencis*	Endangered
Hawaiian Stilt	*Himantopus mexiancus knudseni*	Endangered
Reptiles		
Green Sea Turtle	*Chelonia mydas*	Threatened
Hawksbill Sea Turtle	*Eretmochelys imbricata*	Endangered
Mammal		
Hawaiian Monk Seal*	*Monachus schauinslandi*	Endangered

* This species also has critical habitat delineated in the project area.

For the purposes of the BA, we define the "project area" as those areas that will be directly affected by construction and maintenance of the proposed project. This includes the proposed dredging footprint and proposed placement area (Figure 1).

1.2 Alternatives Considered

This section discusses alternatives considered during the preparation of the Environmental Assessment. The objective of this study is to identify measures to beneficially use dredged material from the routine maintenance dredging of the Haleiwa Small Boat Harbor (HSBH). A total of five alternatives were assessed, including the no-action alternative, also known as the Future without Project (FWOP) condition.

1.2.1 Federal Standard

Alternative 1, also known as the Federal Standard, entails continuing placement operations as they have been in the past. The dredged material from the HSBH federal navigation channel would be placed in the Oahu Offshore Dredge Material Disposal Site (ODMDS). Under this alternative the dredged material would not be utilized in a beneficial use scenario.

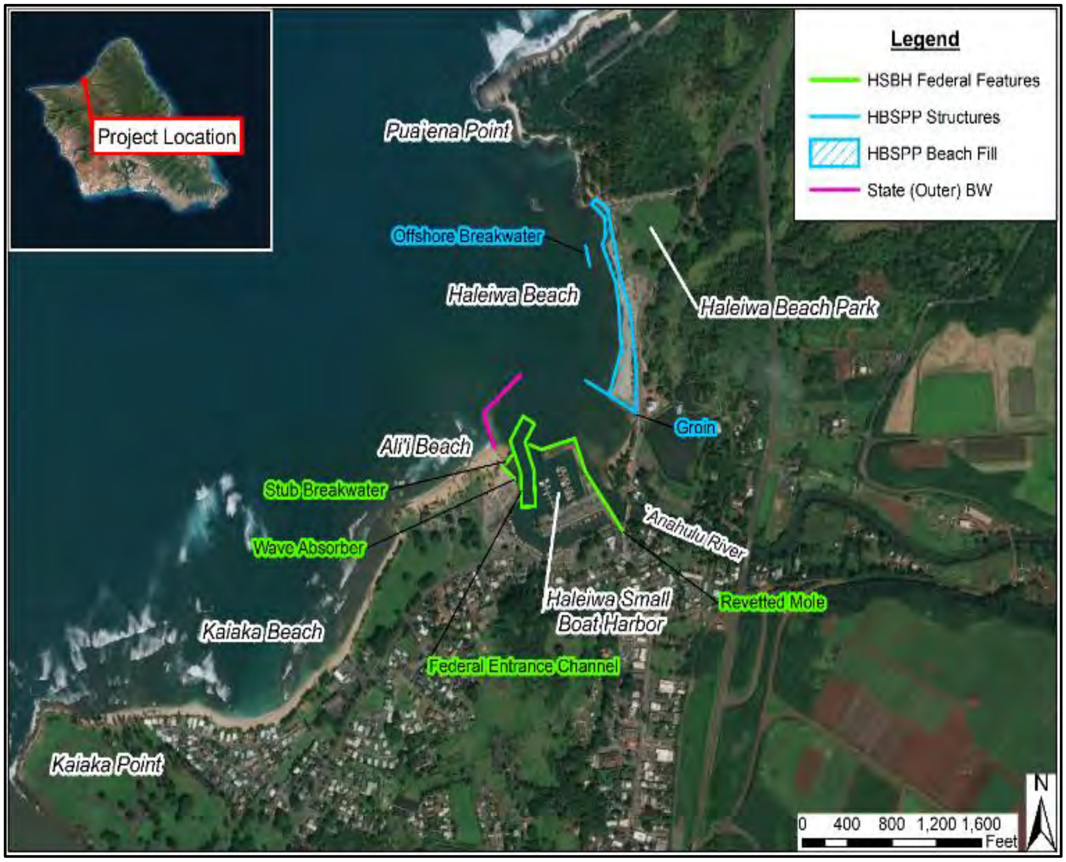

Figure 1. Project Location and Study Area

1.2.2 Federal Navigation Channel

1.2.2.1 Alternative 2

Alternative 2 would utilize approximately 7,166 cubic yards (cy) of dredged material by dredging the HSBH federal navigation channel to 12' depth Mean Lower Low Water (MLLW) and place that material on Haleiwa Beach over an area of approximately 1.20 acres.

1.2.2.2 Alternative 2a

Alternative 2a would utilize approximately 8,871 cy of dredged material by dredging the HSBH federal navigation channel to 13' depth MLLW and place that material on Haleiwa Beach over an area of approximately 1.50 acres.

1.2.3 Federal Navigation Channel and Settling Basin

Alternative 3 builds off Alternative 2a by adding in material from advanced maintenance dredging of the settling basin to the west of the offshore breakwater. This alternative adds approximately 5,529 additional cy of material for a total of 14,400 cy that can be used beneficially on Haleiwa Beach. The additional material increases the placement area to 2.10 acres.

1.2.4 Federal Navigation Channel, Settling Basin, and Offshore Sand Deposit (TSP)

Alternative 4 utilizes an offshore sand deposit with beach quality sand that would provide an additional 11,671 cy of material for beneficial use on Haleiwa Beach. This would increase the total amount of material to be placed on the beach to 26,071 cy and increase the placement area to 4.40 acres.

1.3 Project Area Habitat Description

The project is located on the northeastern shore of Oahu, approximately 30 miles north of Honolulu, Hawai'i. Haleiwa Beach sits on Waialua Bay and is exposed to wave action throughout the year, with larger more intense waves occurring in the winter. Along the Haleiwa Beach are sandy reaches of shoreline and hard-pack tidal zones. Coral reefs can be found in the areas just outside the beach and within the bay, though the density of corals is relatively low.

2.0 STATUS OF THE LISTED SPECIES

To assess the potential impacts of the proposed project on endangered and threatened species, a literature review was performed and other scientific data was researched to determine species distributions, habitat needs, and other biological requirements. Significant literature sources consulted for this report include the USFWS series on endangered species of the seacoast of the U.S., Federal status reports and recovery plans, peer-reviewed journals, and other standard references.

2.1 Hawaiian Coot

2.1.1 Reason for Status

The Hawaiian coot (*Fulica alai*) was listed as an endangered species under the Endangered Species Act on October 13, 1970 (35 Federal Register [FR] 13519). The Hawaiian coot decline was caused by predatory pressure from multiple species, including dogs, cats, mongooses, rats, fish, cattle egrets (*Bubulcus ibis*), and the black-crowned night heron (*Nycticorax nycticorax*) (USFWS, 2011).

2.1.2 Habitat

The ‘Alae ke‘oke‘o, or Hawaiian coot is an endemic waterbird in Hawai‘i (Mitchell et al., 2005). The Hawaiian Coot is a generalist with a diet ranging from seeds and leaves, snails, crustaceans, insects, tadpoles, and small fish. The coots typically forage in water less than 12-inches deep. The coots create floating nests in open water, constructed of aquatic vegetation, and anchored to emergent vegetation. Open water nests are typically composed of water hyssop (*Bacopa monnier*) and Hilo grass (*Paspalum conjugatum*) while platform nests in emergent vegetation are comprised from buoyant stems of bulrushes (*Scirpus* spp.). The coot inhabits lowland wetland habitats with suitable emergent plant growth interspersed with open water. These habitats include freshwater wetlands, taro fields, freshwater reservoirs, canefield reservoirs, sewage treatment ponds, brackish wetlands, and rarely saltwater habitats.

2.1.3 Range

On Oahu the Hawaiian coot can be found in coastal brackish and fresh-water ponds, streams and marshes (USFWS, 2011).

2.1.4 Distribution in Study Area

The Hawaiian coot prefers open water habitats, such as ponds, which are not present in the study area. Therefore, the species is not likely to occur to be seen directly in the study area, though may be seen in the wetlands north of Haleiwa Beach Park.

2.2 Hawaiian Gallinule

2.2.1 Reason for Status

The Hawaiian gallinule (*Gallinula chloropus sandvicencis*) was listed as an endangered species under the Endangered Species Act on October 13, 1970 (35 FR 13519). The Hawaiian gallinule was common on all the Hawaiian Islands until the 1940's. The decline of taro farming and rice cultivation may have contributed to the decline of the species. Further agricultural development, along with residential development, modified the channels that the species utilized and led to additional declines in the species numbers.

2.2.2 Habitat

The 'Alae 'ula or Hawaiian gallinule is an endemic waterbird in Hawaii. The Hawaiian gallinule is believed to be an opportunistic feeder with a diet consisting of algae, mollusks, aquatic insects, grasses and other plant material. The Hawaiian gallinule is a secretive bird that forages in dense emergent vegetation. Their habitat consists of freshwater marshes, wet pastures, reservoirs, streams, and lotus fields. They are less often found in brackish or saline waters. The optimum overall ratio of vegetation to open water is a 50:50 mix (Weller and Frederickson, 1973).

2.2.3 Range

Approximately half of all Hawaiian gallinules can be found on the Island of Oahu with the predominance being found in the north and east coasts of the island, particularly between Haleiwa and Waimanalo (USFWS, 2011).

2.2.4 Distribution in Study Area

While the Hawaiian gallinule is prevalent in the north and east coast of Oahu the species is not present in the study area due to the recreational nature of the site and the secretive nature of the species.

2.3 Hawaiian Stilt

2.3.1 Reason for Status

The Hawaiian stilt (*Himantopus mexiancus knudseni*) was listed as an endangered species under the Endangered Species Act on October 13, 1970 (35 FR 13519). The loss of wetland habitat has contributed to the decline in the population of the Hawaiian stilt. The species was also a popular bird for hunters until the practice was outlawed in 1939 (USFWS, 2011).

2.3.2 Habitat

The Ae'o or Hawaiian stilt is an endemic waterbird in Hawaii. The Hawaiian stilt is an opportunistic feeder eating a variety of invertebrates and aquatic organisms, particularly water boatmen (family *Corixidae*), beetles (order *Coleoptera*), brine fly larvae (*Ephydra riparia*), small fish (Mozambique tilapia [*Oreochromis mossambica*] and mosquito fish [*Gambusia affinis*]), and tadpoles (*Bufo* spp.). They typically feed in shallow wetlands. Nesting occurs on freshly exposed mudflats with sparse vegetation, typically from mid-February through August (USFWS, 2011).

2.3.3 Range

Oahu is home to the largest population of Hawaiian stilts within the Hawaiian Islands. They can be found at the James Campbell National Wildlife Refuge, the Pearl Harbor National Wildlife Refuge and scattered throughout fish ponds in beach parks as well as along the northern and eastern coasts (USFWS, 2011).

2.3.4 Distribution in Study Area

The Hawaiian stilt is primarily a wetland or mudflat species and is not expected to be seen in the study area.

2.4 Green Sea Turtle

2.4.1 Reason for Status

The green sea turtle (*Chelonia mydas*) was listed on 28 July 1978 as threatened except for Florida and the Pacific Coast of Mexico (including the Gulf of California) where it was listed as endangered (43 FR 32808). The greatest cause of decline in green turtle populations is commercial harvest for eggs and food. Other turtle parts are used for leather and jewelry, and small turtles are sometimes stuffed for curios. Incidental catch during commercial shrimp trawling is a continued source of mortality that adversely affects recovery. It is estimated that before the implementation of Turtle Exclusion Devices (TED) requirements, the offshore commercial shrimp fleet captured about 925 green turtles a year, of which approximately 225 would die. Most turtles killed are juveniles and subadults. Various other fishing operations also negatively affect this species (NMFS, 2006). Epidemic outbreaks of fibropapilloma or "tumor" infections recently have occurred on green sea turtles, especially in Hawaii and Florida, posing a severe threat. The cause of these outbreaks is largely unknown, but it could be caused by a viral infection (Barrett, 1996). This species is also subject to various negative impacts shared by sea turtles in general.

2.4.2 Habitat

The green sea turtle primarily utilizes shallow habitats such as lagoons, bays, inlets, shoals, estuaries, and other areas with an abundance of marine algae and seagrasses. Individuals observed in the open ocean are believed to be migrants en route to feeding grounds or nesting beaches (Meylan, 1982). Hatchlings often float in masses of sea plants (e.g., rafts of sargassum) in convergence zones. Coral reefs and rocky outcrops near feeding pastures often are used as resting areas. The adults are primarily herbivorous, while the juveniles consume more invertebrates. Foods consumed include seagrasses, macroalgae, and other marine plants, mollusks, sponges, crustaceans, and jellyfish (Mortimer, 1982).

Terrestrial habitat is typically limited to nesting activities, although in some areas, such as Hawaii and the Galápagos Islands, they will bask on beaches (Balazs, 1980). They prefer high-energy beaches with deep sand, which may be coarse to fine, with little organic content. At least in some regions, they generally nest consistently at the same beach, which is apparently their natal beach (Allard et al., 1994; Meylan et al., 1990), although an individual might switch to a different nesting beach within a single nesting season.

2.4.3 Range

The green sea turtle is a circumglobal species in tropical and subtropical waters. The green sea turtles of the Hawaiian archipelago are a discrete population based on their range, movement, and genetics (Seminoff et al., 2015).

2.4.4 Distribution in Study Area

The green sea turtle is known to be a common inhabitant of Waialua Bay. No nesting activity is known to occur on Haleiwa Beach.

2.5 Hawksbill Sea Turtle

2.5.1 Reason for Status

The hawksbill sea turtle (*Eretmochelys imbricata*) was federally listed as endangered on 2 June 1970 (35 FR 8495) with critical habitat designated in Puerto Rico on 24 May 1978 (43 FR 22224). The greatest threat to this species is harvest to supply the market for tortoiseshell and stuffed turtle curios (Meylan and Donnelly, 1999). Hawksbill shell (bekko) commands high prices. Japanese imports of raw bekko between 1970 and 1989 totaled 1,573,770 pounds (713,850 kilograms), representing more than 670,000 turtles.

The hawksbill is also used in the manufacture of leather, oil, perfume, and cosmetics (NMFS, 2006).

Other threats include destruction of breeding locations by beach development, incidental take in lobster and Caribbean reef fish fisheries, pollution by petroleum products (especially oil tanker discharges), entanglement in persistent marine debris (Meylan, 1992), and predation on eggs and hatchlings. See USFWS (1998) for detailed information on certain threats, including beach erosion, beach armoring, beach nourishment, sand mining, artificial lighting, beach cleaning, increased human presence, recreational beach equipment, predation, and poaching.

In 1998, NMFS designated critical habitat near Mona Island and Isla Monito, Puerto Rico, seaward to 3.5 miles (63 FR 46693–46701).

2.5.2 Habitat

Hawksbills generally inhabit coastal reefs, bays, rocky areas, passes, estuaries, and lagoons, where they occur at depths of less than 70 feet (21.5 m). Like some other sea turtle species, hatchlings are sometimes found floating in masses of marine plants (e.g., sargassum rafts) in the open ocean (NFWL, 1980). Hawksbills reenter coastal waters when they reach a carapace length of approximately 7.9 to 9.8 inches (20 to 25 centimeters). Coral reefs are widely recognized as the resident foraging habitat of juveniles, subadults, and adults. This habitat association is undoubtedly related to their diet of sponges, which need solid substrate for attachment. Hawksbills also occur around rocky outcrops and high-energy shoals, which are also optimum sites for sponge growth. In Texas, juvenile hawksbills are associated with stone jetties (NMFS, 2006).

While this species is omnivorous, it prefers invertebrates, especially encrusting organisms, such as sponges, tunicates, bryozoans, mollusks, corals, barnacles, and sea urchins. Pelagic species consumed include jellyfish and fish, and plant material such as algae, sea grasses and mangroves have been reported as food items for this turtle (Carr, 1952; Mortimer, 1982; Musick, 1979; Pritchard, 1977; Rebel, 1974). The young are reported to be somewhat more herbivorous than adults (Ernst and Barbour, 1972).

Terrestrial habitat is typically limited to nesting activities. The hawksbill, which is typically a solitary nester, nests on undisturbed, deep-sand beaches, from high-energy ocean beaches to tiny pocket beaches several meters wide bounded by crevices of cliff walls. Typically, the sand beaches are low energy, with woody vegetation, such as sea grape (*Coccoloba uvifera*), near the waterline (NRC, 1990).

2.5.3 Range

The hawksbill is circumtropical, occurring in tropical and subtropical seas of the Atlantic, Pacific, and Indian oceans (Witzell, 1983). This species is probably the most tropical of all marine turtles, although it does occur in many temperate regions. Hawkbills nest primarily along the east coast of the island of Hawaii. The number of nesting females in the Hawaiian Islands seems to be stable at about 20 per year (NMFS and USFWS, 2013).

2.5.4 Distribution in Study Area

Hawksbills are uncommon in Waialua Bay and are not expected to be seen in the study area.

2.6 Hawaiian Monk Seal

2.6.1 Reason for Status

The Hawaiian Monk Seal (*Monachus schauinslandi*) was listed as an endangered species under the Endangered Species Act on December 23, 1976 (41 FR 51611). The decline of the Hawaiian monk seal is due multiple threats, including limitation of food for juveniles, predation by Galapagos sharks, habitat loss, disease, entanglements in derelict fishing gear, and intentional killings (NOAA, 2020).

Critical habitat for the Hawaiian monk seal was designated on April 30,1986. The critical habitat was expanded on May 26, 1988 to include additional islands and extend the marine portion out to 20 fathoms (53 FR 18988). The critical habitat was revised on August 21, 2015 (80 FR 50925). The current critical habitat for the species contains two terrestrial and one marine essential feature. They are as follows:

1. Terrestrial areas and adjacent shallow, sheltered aquatic areas with characteristics preferred by monk seals for pupping and nursing.
2. Marine areas from 0 to 200 m in depth that support adequate prey quality and quantity for juvenile and adult seal foraging.
3. Significant areas for monk seals for hauling out, resting, or molting.

2.6.2 Habitat

Hawaiian monk seals spend the majority of their life in the water, as much as two-thirds of their time. They are benthic foragers and can dive to depths exceeding 500 m in search of food on coral reefs and terraces of atolls. They are generalist feeders that will eat a variety of prey, including fish, cephalopods, and crustaceans. When hauling out on to dry land to rest or to pup the Hawaiian monk seal prefers sandy beaches, but will utilize most any substrate, including emergent reefs and shipwrecks (NMFS, 2007).

2.6.3 Range

The Hawaiian monk seal can be found throughout the Hawaiian archipelago, though most of the population are found in the Northwest Hawaiian Islands. An increase in numbers and births have been occurring in the Main Hawaiian Islands since the early 2000's.

The area around the Haleiwa Beach Park is included in the Marine Critical Habitat designation, but not the terrestrial designation (NMFS, 2007).

2.6.4 Distribution in Study Area

As the area around the Haleiwa Beach Park is included in the designated critical habitat for the Hawaiian Monk Seal it is likely that the species will occur within the study area.

They are not likely to be found on the terrestrial portion of the project but can be found in Waialua Bay.

3.0 Effects Analysis and Avoidance, Minimization, and Conservation Measures

In this document, the USACE presents their determinations about each species potentially occurring within the affected area of the MSC Improvement Project, using language recommended by USFWS:

- *No effect* – USACE determines that its proposed action will not affect a federally listed species or critical habitat;
- *May affect, but not likely to adversely affect* – USACE determines that the project may affect listed species and/or critical habitat; however, the effects are expected to be discountable, insignificant, or completely beneficial; or
- *Likely to adversely affect* – USACE determines adverse effects to listed species and/or critical habitat may occur as a direct result of the proposed action or its interrelated or interdependent actions, and the effect is not discountable, insignificant, or completely beneficial. Under this determination, an additional determination is made whether the action is likely to jeopardize the continued survival and eventual recovery of the species.

Following USACE effect determinations for the project on federally listed species, USFWS and NMFS will review the information and complete the Section 7 consultation process under the ESA.

The following sections provide the USACE's findings and species-specific avoidance, minimization, and conservation measures that support the effect determinations.

3.1 Hawaiian Coot

The coot is not expected at present to occur in the project area. Therefore, no impacts and no effects are anticipated as a result of the proposed project.

3.2 Hawaiian Gallinule

The gallinule is not expected at present to occur in the project area. Therefore, no impacts and no effects are anticipated as a result of the proposed project.

3.3 Hawaiian Stilt

The stilt is not expected at present to occur in the project area. Therefore, no impacts and no effects are anticipated as a result of the proposed project.

3.4 Green Sea Turtle

The sedimentation resulting from dredging activities may affect food sources for green sea turtles, and the turbidity could affect primary productivity. However, this would be short term. The increased possibility of chemical or oil spills could pose a threat to turtles both directly and indirectly through their food source. While adult sea turtles may be mobile enough to avoid areas of high oil or chemical concentrations, juveniles in the area would be more susceptible.

The sedimentation resulting from placement of dredged material may affect food sources for turtles, and turbidity could affect primary productivity. They could also be exposed to trash and debris; however, turtles should be easily able to overcome a descending plume, and available food sources should not be seriously reduced. Project activities may affect, but not likely adversely affect green sea turtles.

Sedimentation curtains can be used as Best Management Practice (BMP) during placement of materials to minimize turbidity and to maintain materials in the placement area to the greatest extent.

3.5 Hawksbill Sea Turtle

The sedimentation resulting from dredging activities may affect food sources for hawksbill sea turtles, and the turbidity could affect primary productivity. However, this would be short term. The increased possibility of chemical or oil spills could pose a threat to turtles both directly and indirectly through their food source. While adult sea turtles may be mobile enough to avoid areas of high oil or chemical concentrations, juveniles in the area would be more susceptible.

The sedimentation resulting from placement of dredged material may affect food sources for turtles, and turbidity could affect primary productivity. They could also be exposed to trash and debris; however, turtles should be easily able to overcome a descending plume, and available food sources should not be seriously reduced. Project activities may affect, but not likely adversely affect hawksbill sea turtles.

Sedimentation curtains can be used as a Best Management Practice (BMP) during placement of materials to minimize turbidity and to maintain materials in the placement area to the greatest extent.

3.6 Hawaiian Monk Seal

The sedimentation resulting from dredging activities may affect food sources for Hawaiian monk seals, and the turbidity could affect primary productivity. However, this would be short term. The increased possibility of chemical or oil spills could pose a threat to seals both directly and indirectly through their food source.

The sedimentation resulting from placement of dredged material may affect food sources for seals, and turbidity could affect primary productivity. They could also be exposed to trash and debris; however, seals should be easily able to overcome a descending plume, and available food sources should not be seriously reduced. Project activities may affect, but not likely adversely affect Hawaiian monk seals.

Sedimentation curtains can be used as a BMP during placement of materials to minimize turbidity and to maintain materials in the placement area to the greatest extent.

The project is not expected to adversely modify the critical habitat of the Hawaiian monk seal.

4.0 Summary

The proposed project may affect a few federally listed endangered or threatened species. The Hawaiian coot, Hawaiian gallinule, and Hawaiian stilt are unlikely to occur in the project area. The project may affect, but is not likely to adversely affect the green sea turtle, hawksbill sea turtle and Hawaiian monk seal. The project is unlikely to jeopardize/destroy or adversely modify critical habitat for any listed species. Species effect determinations are summarized in Table 2.

Table 2. Effects Determinations for Threatened and Endangered Wildlife Species of possible occurrence in Honolulu County, Hawaii

Common Name	Determination
Birds	
Hawaiian Coot	No Effect
Hawaiian Gallinule	No Effect
Hawaiian Stilt	No Effect
Reptiles	
Green Sea Turtle	May affect, not likely to adversely affect
Hawksbill Sea Turtle	May affect, not likely to adversely affect
Mammal	
Hawaiian Monk Seal	May affect, not likely to adversely affect

5.0 References

Allard, MW, MM Miyamoto, KA Bjorndal, AB Bolton, and BW Bowen. (1994) Support for natal homing in green turtles from mitochondrial DNA sequences. Copeia 1994:34–41.

Balazs, G. 1980. Synopsis of biological data on the green turtle in the Hawaiian Islands. NOAA Technical Memorandum. NMFS-SWFC-7.

Barrett, S. (1996) Disease threatens green sea turtles. Endangered Species Bulletin 21(2):8–9. Bartlett, R.D., and P.P. Bartlett. 1999. A field guide to Texas reptiles and amphibians. Gulf Publishing Company. Houston.

Carr, AF. (1952) Handbook of turtles: the turtles of the United States, Canada and Baja California. Comstock Publ. Assoc., Cornell Univ. Press, Ithaca, New York.

Ernst, C.H., and R.W. Barbour. 1972. Turtles of the United States. University of Kentucky Press, Lexington.

Meylan, A. (1982) Sea turtle migration – evidence from tag returns. In: K. Bjorndal (editor), Biology and Conservation of Sea Turtles. Pp. 91–100. Smithsonian Institution Press, Washington, D.C. 583 pp.

Meylan, A. (1992) Hawksbill turtle *Eretmochelys imbricata* (Linnaeus). In Rare and endangered biota of Florida. Vol. III. Amphibians and reptiles (P.E. Moler, editor). University Press of Florida, Gainesville.

Meylan, AB, and M Donnelly. (1999) Status justification for listing the hawksbill turtle (*Eretmochelys imbricata*) as critically endangered on the 1996 IUCN red list of threatened animals. Chelonian Conservation and Biology 3(2):200–224.

Meylan, AB, BW Bowen, and JC Avise. (1990) A genetic test of the natal homing versus social facilitation models for green turtle migration. Science 248:724–727.
Mitchell et al., 2005

Mortimer, JA. (1982) Feeding ecology of sea turtles. In: Biology and conservation of sea Turtles (K. Bjorndal, editor), 103–109. Smithsonian Institution Press, Washington, D.C.

Musick, J. (1979) The marine turtles of Virginia with notes on identification and natural history. Educational Series No. 24. Sea Grant Program, Virginia Institute of Marine Science, Gloucester Point.

National Fish and Wildlife Laboratory (NFWL). 1980. Selected vertebrate endangered species of the seacoast of the United States. U.S. Fish and Wildlife Service, Biological Services Program, Washington, D.C. FWS/OBS-80/01.

National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration. 2006. Information on sea turtles. http://www.nmfs.noaa.gov/pr/species/turtles.html.

NMFS. (2007) Recovery plan for the Hawaiian Monk Seal (*Monachus schauinslandi*). Second revision. National Marine Fisheries Service, Silver Spring, MD. 165 pp.

NMFS and USFWS. (2013) Hawksbill sea turtle (*Eretmochelys imbricata*) 5-year review: Summary and evaluation. National Marine Fisheries Service, Silver Spring, MD and U.S. Fish and Wildlife Service, Jacksonville, FL. 92 pp.

NOAA. (2020). Species Directory: Hawaiian Monk Seal. https://www.fisheries.noaa.gov/species/hawaiian-monk-seal. Accessed August 28, 2020.

National Research Council (NRC). (1990) Decline of the sea turtles: causes and prevention. National Academy Press, Washington, D.C.

Pritchard, PCH. (1977) Marine turtles of Micronesia. Chelonia Press, San Francisco, California.

Rebel, TP. (1974) Sea turtles and the turtle industry of the West Indies, Florida, and the Gulf of Mexico. Rev. Ed. University of Miami Press, Coral Gables, Florida.

Seminoff, JA, CD Allen, GH Balazs, PH Dutton, T Eguchi, HL Haas, SA Hargrove, M Jensen, DL Klemm, AM Lauritsen, SL MacPherson, P Opay, EE Possardt, S Pultz, E Seney, KS Van Houton, and RS Waples. (2015) Status Review of the Green turtle (*Chelonia mydas*) under the Endangered Species Act. NOAA Technical Memorandum. NOAA-TM-NMFS-SWFSC-539. 571 pp.

USFWS. (1998) Multi-species recovery plan for the threatened and endangered species of South Florida. Technical/Agency draft, U.S. Fish and Wildlife Service, Atlanta, Georgia.

USFWS. (2011) Recovery Plan for Hawaiian Waterbirds: Second Revision. U.S. Fish and Wildlife Service. Portland, Oregon. 233 pp.

Weller, MW and LH Frederickson. (1973) Avian ecology of a managed glacial marsh. Living Bird. 12: 269-291.

Witzell, WN. (1983) Synopsis of biological data on the hawksbill turtle *Eretmochelys imbricate* (Linnaeus, 1766). FAO Fisheries Synopsis No. 137. FIR/S137, SAST – Hawksbill Turtle – 5.31 (07) 017.01. Food and Agriculture Organization (FAO) of the United Nations, Rome, Italy.

Appendix C: Economic Analysis

SECTION 1122

BENEFICIAL USE OF DREDGED MATERIAL (BUDM)

HALE'IWA SMALL BOAT HARBOR

August 2020

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Contents

1.0 Introduction

The Hale'iwa Section 1122 Beneficial Use of Dredged Materials (BUDM) Feasibility Study documents the analyses completed to investigate uses of dredged material that can provide benefits to the navigation, coastal storm risk management, recreation, and environmental missions. Despite general perceptions of Hawaii, sand is relatively scarce, and the study area is the most visited beach outside of Waikiki and therefore a high-value opportunity for receipt of beach grade sand harvested in accordance with authority granted under Section 1122 of WRDA 2016.

This Economic Appendix describes the methods and results of the economic analyses completed in support of the Hale'iwa Section 1122 Feasibility Study. All economic evaluations were completed in accordance with U.S. Army Corps of Engineers (USACE) policies and evaluation procedures as defined by the *Economic and Environmental Principles & Guidelines for Water and Related Land Resources Implementation Studies* (P&G). The P&G establishes four accounts to facilitate evaluation and display of the effects of alternative plans. These accounts are: national economic development (NED), environmental quality (EQ), regional economic development (RED), and other social effects (OSE).

This appendix addresses the NED account. The **national economic development (NED) account** displays changes in the economic value of the national output of goods and services. The NED benefits of the Hale'iwa Section 1122 include navigation, coastal storm risk management, and recreation.

1.1 NED Benefits and Costs

This appendix presents an NED evaluation of the Base Plan as well as four alternatives that utilize dredged materials for beach nourishment and were determined to be the most cost-effective. These alternatives entail dredging different quantities of sediment in combination from the federal channel, advanced maintenance area, and offshore sand deposit. Alternative 1 is the "No Action" Alternative which entails continuing to dredge the federal channel and dispose of the materials at the ocean dredged material disposal site (ODMDS). Alternative 2 would increase the dredged amount by deepening the federal channel to 12' and disposing of the dredged material through a combination of beach placement and the ODMDS. Alternative 3 would increase the dredged amount by deepening the federal channel to 13' and disposing of the dredged material through a combination of beach placement and the ODMDS. Alternative 4 would increase the dredged amount by combining alternative 3 with dredging the deposition basin and disposing of the dredged material through a combination of beach placement and the ODMDS. Alternative 5 would increase the dredged amount by combining alternative 4 with dredging an offshore sand deposit and disposing of the dredged material through a combination of beach placement and the ODMDS.

NED benefits for each alternative were calculated as the sum of the benefits in the following three categories: navigation, coastal storm reduction measures (CSRM), and recreation. Each benefit category was calculated separately and the methods used to calculate them are described in detail in section 2.0 below.

NED costs for each alternative include mechanical dredging contract costs, mob/demob costs, and contingency but do not include the preconstruction engineering and design (PED) costs and supervision and administration (S&A) costs. NED costs are briefly described in section 3.0 below and in greater detail in Appendix D – Costs.

1.2 Net Benefits and BCR for Alternative Plans

Net NED benefits are calculated as average annual benefits (AAB) less average annual costs (AAC), while the benefit to cost ratio (BCR) is the ratio of AAB to AAC. A BCR greater than 1 indicates a project is economically justified. For this project, there is an additional constraint that the BCR must be greater than 0.51 with the exclusion of recreation benefits.

NED benefits and costs were developed for a 50-year period of analysis, the first project year (PY1) being Fiscal Year 2024 (FY24). The project benefit and cost time streams were converted to average annual values using the 50-year period of analysis, FY20 price levels, and the FY20 federal discount rate (FDR) of 2.750 percent (per Economic Guidance Memorandum, 20-01, Federal Interest Rates for Corps of Engineers Projects for Fiscal Year 2020). The annuity factor is determined using the FY20 FDR. It is used to derive the estimated average annual benefits (AAB) and average annual costs (AAC).

All monetary values in this economic appendix are presented in FY20 prices.

Table C-1: Period of Analysis, Price Level and Federal Discount Rate for Economic Evaluation

Period of Analysis	50 Years
Base Year: Project Year 1 (PY1)	FY24
Project Year 50 (PY50)	FY73
Price Level	FY20
FY20 Federal Discount Rate	2.75%
Annuity Factor	0.037

2.0 NED Benefits of Alternatives

2.1 Navigation Benefits

The navigation benefits associated with Hale'iwa Harbor are derived from the channel deepening, which deepens the federal channel to a depth of 12' in alternative 2 or a depth of 13' in the other alternative plans. This dredging allows vessels to move through the federal channel unimpeded by sediment until sediment builds up again at which point additional dredging would be required. The key benefit to navigation is the offset of operations and maintenance (O&M) dredging until a later date at which point it would be necessary to deepen the channel to an appropriate depth for safe navigation. The period of offset O&M dredging was determined based on the amount of sediment dredged and the rate of shoaling, creating navigation benefits for differing lengths of time depending on the alternative. Alternatives 3 and 4 have a greater period of offset O&M dredging resulting from a reduction of the rate of shoaling caused by the settling basin. Table C-2 shows the navigation benefits determined for each alternative.

Table C-2: Hale'iwa Harbor: Navigation Benefits [1/]

Alternative	Base Plan	Alt 2	Alt 2a	Alt 3	Alt 4
Years of Offset O&M Dredging	10	10	17	26	26
Nav Benefits	$1,174,000	$1,174,000	$1,996,000	$3,052,000	$3,052,000
Present Value Nav Benefits	$1,042,000	$1,042,000	$1,621,000	$2,220,000	$2,220,000

1/ Navigation benefits were calculated for 10 years since online date based on delayed O&M dredging costs.

2.2 Coastal Storm Reduction Measures (CSRM) Benefits

The Coastal Storm Damage Reduction (CSRM) benefits associated with Hale'iwa Harbor relate to the reinforcement of a 550 foot tall wall at Hale'iwa Beach Park that offers protection to the beach and its facilities but has experienced erosion and the formation of sinkholes due to undermining. Placing dredged material on the beach would help stabilize and protect the wall allowing for a longer period of protection than the current condition. This longer period of protection was estimated based on the amount of sand in cubic yards (cy) placed on the beach under each alternative and current erosion rates for the beach. The wall is then expected to fail between one and five years after the additional sand has eroded away, after which CSRM benefits would no longer be present. Table C-3 shows the CSRM benefits determined for each alternative.

Table C-3: Hale'iwa Harbor: CSRM Benefits

Alternative	Base Plan	Alt 2	Alt 2a	Alt 3	Alt 4
CSRM Benefits	$276,000	$1,111,000	$1,298,000	$1,440,000	$2,362,000
Present Value CSRM Benefits	$262,000	$949,000	$1,081,000	$1,169,000	$1,600,000

1/ CSRM benefits were calculated for a number of years dependent upon the amount of placed sediment on the beach and the current rate of erosion.

2.3 Recreation Benefits

The recreation benefits associated with Hale'iwa Harbor were calculated based on current visitation to Hale'iwa Beach Park and how the additional sand placed on the beach would affect this visitation. Calculations were made based on available data for the beach and IWR Report 86-R-4, which gives guidance on how to determine NED benefits derived from recreation. The capacity method, as outlined in appendix E of the report, was used to estimate the design day load (total number of people using the recreation site in a day) of the beach and using that value to calculate the annual use of the site. The design day load is the product of multiplying number of units (parking spaces at Hale'iwa Beach Park), capacity per unit (people per car occupying a parking space), and daily turnover rate (number of uses of a unit per day). Table C-4 shows the calculation for design day load at Hale'iwa Beach Park.

Table C-4: Design Day Use – Hale'iwa Beach Park

Number of units	94
Capacity per Unit	3.4
Daily Turnover Rate	2
Design Day Use	**639.2**

1/ Capacity per unit and daily turnover rate were acquired from IWR Report 74-R1.

Annual use of Hale'iwa Beach Park was calculated by multiplying the design day load, the average number of weekend days in peak season, the proportion of annual use expected during peak season, and the proportion of peak season use on the weekend. Table C-5 shows the calculation for annual use of Hale'iwa Beach Park.

Table C-5: Annual Use – Hale'iwa Beach Park

Design Day Use	639.2
Ave Number of Weekend Days in Peak Season	24
Proportion of Annual Use Expected in Peak Season	60%
Proportion of Peak Season Use Expected on Weekends	50%
Annual Use	**4,602**

1/ Number of weekend days in peak season was determined based on travel by air to O'ahu island, which occurs in June, July, and September based on 2017 Hawaii Tourism Board data.
2/ Proportions of annual use expected in peak season and peak season use expected on weekends were acquired from IWR Report 74-R1.

Average annual recreation benefits at Hale'iwa Harbor were estimated based on the annual use of Hale'iwa Beach Park and the Unit Day Value (UDV) of recreational activities offered at the beach. The primary recreational activities include surfing, paddle boarding, and turtle watching, thus the specialized recreation UDVs were used to calculate the recreational benefits of the beach. Under the base plan this UDV is $22.38 while under the other alternatives it is $27.91 as the additionally placed sand improves the sea turtle habitat (see the Appendix B – Environmental for additional details) which increases the recreational value of turtle watching. UDV estimates were pulled from EGM20-03. Table C-6 shows the recreation benefits determined for each alternative.

Table C-6: Hale'iwa Harbor: Recreation Benefits

Alternative	Base Plan	Alt 2	Alt 2a	Alt 3	Alt 4
Rec Benefits	$0	$3,746,000	$4,682,000	$5,619,000	$12,643,000
Present Value Rec Benefits	$0	$3,552,000	$4,363,000	$5,147,000	$10,225,000

1/ Recreational benefits were calculated for a number of years dependent upon the amount of placed sediment on the beach and the current rate of erosion.

2.4 Total NED Benefits

The total benefits for Hale'iwa Harbor were calculated as the sum of the three benefit categories: navigation, CSRM, and recreation. Table C-7 shows the total benefits determined for each alternative.

Table C-7: Hale'iwa Harbor: Recreation Benefits

Alternative	Base Plan	Alt 2	Alt 2a	Alt 3	Alt 4
Total Benefits	$1,450,000	$6,031,000	$7,976,000	$10,111,000	$18,525,000
Present Value Total Benefits	$1,304,000	$5,543,000	$7,065,000	$8,535,000	$14,339,000

1/ Total benefits are the sum of all benefits within the 50-year period of analysis.

3.0 NED Costs and Evaluation of Alternative Plans

The total project cost (present value) and the associated AAC were developed for the Base Plan (Alternative 1) as well as four additional alternatives: Alternative 2, Alternative 2a, Alternative 3, and Alternative 4. The project cost time stream was converted to an average annual value using a 50-year period of analysis, the FY20 FDR of 2.75 percent, FY20 prices, and a base year of FY24. An annuity factor of 3.7% was used to derive annual costs (AAC). A summary of each alternative and the associated costs is presented below. All dollar values are presented in FY20 prices.

3.1 Base Plan

The **Base Plan (Alternative 1)** includes dredging of the federal channel and hauling sediment to the Ocean Dredged Material Disposal Site (ODMDS). No structural modifications would be implemented at Hale'iwa Harbor. Costs associated with the Base Plan are those associated with dredging operations and approximately 4,000 cy of material would be dredged from the channel. These dredging costs include the mechanical dredging contract and mobilization and demobilization (Mob/Demob) but do not include preconstruction engineering and design (PED) and supervision and administration (S&A) costs. These costs are presented in **Error! Reference source not found.**.

Table C-8: Base Plan Dredging Costs (FY20 Prices) 1/

Cost Category	Total Direct Cost ($)	Contingency ($)	Total Project Cost ($)	Total Present Value Cost ($)
Mechanical Dredge	$233,000	$70,000	$303,000	$311,000
Mob/Demob	$670,000	$201,000	$871,000	$895,000
Total Construction Cost	$903,000	$271,000	$1,174,000	$1,206,000
Interest During Construction	$12,000	$4,000	$16,000	$16,000
Total Costs	$915,000	$275,000	$1,190,000	$1,223,000

1/ Values rounded to nearest thousand. Costs reflect a dredging volume of 4,000 cy.

Refer to the Appendix D – Costs for further details.

3.2 Alternatives 2 and 2a

Alternative 2 includes dredging of the federal channel then hauling sediment to the Ocean Dredged Material Disposal Site (ODMDS) as well as placing sediment at the Hale'iwa Beach Park. No structural modifications would be implemented at Hale'iwa Harbor. Costs associated with the Base Plan are those associated with dredging the channel to a depth of 12', placing approximately 2,000 cy of material at the ODMDS, and placing the remaining 2,433 cy of material at Hale'iwa Beach Park. These dredging costs include the mechanical dredging contract and mobilization and demobilization (Mob/Demob) but do not include preconstruction engineering and design (PED) and supervision and administration (S&A) costs.

Alternative 2a is nearly identical to Alternative 2 except that this alternative calls for the channel to be dredged to a depth of 13' with the additional 1,705 cy of material placed at Hale'iwa Beach Park for a total of 4,138 material placed there.

These costs associated with Alternatives 2 and 2a are presented in **Error! Reference source not found.** and Table C-10.

Table C-9: Alternative 2 Dredging Costs (FY20 Prices) 1/

Cost Category	Total Direct Cost ($)	Contingency ($)	Total Project Cost ($)	Total Present Value Cost ($)
Mechanical Dredge	$801,000	$240,000	$1,041,000	$1,070,000
Mob/Demob	$680,000	$204,000	$884,000	$908,000
Total Construction Cost	$1,481,000	$444,000	$1,925,000	$1,979,000
Interest During Construction	$20,000	$6,000	$26,000	$27,000
Total Costs	$1,501,000	$450,000	$1,951,000	$2,006,000

1/ Values rounded to nearest thousand. Costs reflect a dredging volume of 4,433 cy.

Table C-10: Alternative 2a Dredging Costs (FY20 Prices) 1/

Cost Category	Total Direct Cost ($)	Contingency ($)	Total Project Cost ($)	Total Present Value Cost ($)
Mechanical Dredge	$886,000	$265,000	$1,151,000	$1,183,000
Mob/Demob	$693,000	$208,000	$901,000	$908,000
Total Construction Cost	$1,566,000	$469,000	$2,052,000	$2,091,000
Interest During Construction	$22,000	$6,000	$28,000	$29,000
Total Costs	$1,588,000	$475,000	$2,080,000	$2,120,000

1/ Values rounded to nearest thousand. Costs reflect a dredging volume of 6,138 cy.

Refer to the Appendix D – Costs for further details.

3.3 Alternative 3

Alternative 3 includes dredging of the federal channel as well as the settling basin then hauling sediment to the Ocean Dredged Material Disposal Site (ODMDS) as well as placing sediment at the Hale'iwa Beach Park. No structural modifications would be implemented at Hale'iwa Harbor. Costs associated with Alternative 3 are those associated with dredging the channel to a depth of 13', dredging the settling basin, placing approximately 2,000 cy of material at the ODMDS, and placing the remaining 6,338 cy of material at Hale'iwa Beach Park. These dredging costs include the mechanical dredging contract and mobilization and demobilization (Mob/Demob) but do not include preconstruction engineering and design (PED) and supervision and administration (S&A) costs. These costs are presented in **Error! Reference source not found.**.

Table C-11: Alternative 3 Dredging Costs (FY20 Prices) 1/

Cost Category	Total Direct Cost ($)	Contingency ($)	Total Project Cost ($)	Total Present Value Cost ($)
Mechanical Dredge	$1,198,000	$359,000	$1,557,000	$1,600,000
Mob/Demob	$694,000	$208,000	$902,000	$926,000
Total Construction Cost	$1,891,000	$567,000	$2,459,000	$2,526,000
Interest During Construction	$26,000	$8,000	$34,000	$35,000
Total Costs	$1,917,000	$575,000	$2,493,000	$2,561,000

1/ Values rounded to nearest thousand. Costs reflect a dredging volume of 4,000 cy.

Refer to the Appendix D – Costs for further details.

3.4 Alternative 4

Alternative 4 includes dredging of the federal channel as well as the settling basin and an offshore sand deposit then hauling sediment to the Ocean Dredged Material Disposal Site (ODMDS) as well as placing sediment at the Hale'iwa Beach Park. No structural modifications would be implemented at Hale'iwa Harbor. Costs associated with Alternative 4 are those associated with dredging the channel to a depth of 13', dredging the settling basin, dredging the offshore sand deposit, placing approximately 2,000 cy of material at the ODMDS, and placing the remaining 21,338 cy of material at Hale'iwa Beach Park. These dredging costs include the mechanical dredging contract and mobilization and demobilization (Mob/Demob) but do not include preconstruction engineering and design (PED) and supervision and administration (S&A) costs. These costs are presented in **Error! Reference source not found.**.

Table C-12: Alternative 4 Dredging Costs (FY20 Prices) 1/

Cost Category	Total Direct Cost ($)	Contingency ($)	Total Project Cost ($)	Total Present Value Cost ($)
Mechanical Dredge	$2,060,000	$618,000	$2,678,000	$2,752,000
Mob/Demob	$694,000	$208,000	$902,000	$927,000
Total Construction Cost	$2,754,000	$826,000	$3,580,000	$3,679,000
Interest During Construction	$38,000	$11,000	$49,000	$50,000
Total Costs	$2,792,000	$837,000	$3,629,000	$3,729,000

1/ Values rounded to nearest thousand. Costs reflect a dredging volume of 4,000 cy.

Refer to the Appendix D – Costs for further details.

3.5 Expected Net Benefits and BCR

Net NED benefits are calculated as average annual benefits (AAB) less average annual costs (AAC), while the benefit to cost ratio (BCR) is the ratio of AAB to AAC. A BCR greater than 1 indicates a project is economically justified.

The expected (most likely) AAB and AAC for each alternative are presented in **Error! Reference source not found.**. Since each alternative produces a BCR greater than 1.0, all alternatives are economically justified. The Tentatively Selected Plan (TSP) is Alternative 4 as it provides the greatest net benefits.

Table C-13: Expected AAB, AAC, Incremental AAC, Net Benefits, & BCR for All Alternatives (FY20 Price Level)

	Alt 1 (base)	Alt 2	Alt 2a	Alt 3	Alt 4
Total AAB	$48,000	$205,000	$262,000	$316,000	$531,000
Total AAC	$45,000	$74,000	$79,000	$95,000	$138,000
Incremental AAC	$0	$29,000	$33,000	$50,000	$93,000
Net Benefits	$3,000	$131,000	$183,000	$221,000	$393,000
BCR	1.07	2.77	3.32	3.33	3.85

1/ AAB and AAC were estimated using base year of 2024 (FY24), the FY20 FDR of 2.75%, and 50-year period of analysis.

Due to the high value of recreation benefits associated with these alternatives additional BCRs were calculated for each alternative with recreation benefits removed from the calculation as shown in Table C-14. According to Section 3.7 b (7) of the Planning Guidance Notebook, budget Policy generally precludes using Civil Works resources to implement recreation oriented projects in the Civil Works program. An exception is where a project is formulated for other primary purposes and average annual recreation benefits are less than 50 percent of the average annual benefits required for justification (i.e., the recreation benefits that are required for justification are less than an amount equal to 50 percent of project costs). Since each alternative produces a BCR greater than 0.51 without recreational benefits, all alternatives are compliant with budgeting policy and Alternative 4 remains the TSP.

Table C-14: Expected AAB, AAC, Incremental AAC, Net Benefits, & BCR for All Alternatives Less Recreation Benefits (FY20 Price Level)

	Alt 1 (base)	Alt 2	Alt 2a	Alt 3	Alt 4
Total AAB (less Rec Benefits)	$48,000	$74,000	$100,000	$126,000	$141,000
Total AAC	$45,000	$74,000	$79,000	$95,000	$138,000
Incremental AAC	$0	$29,000	$33,000	$50,000	$93,000
Net Benefits	$3,000	$0	$21,000	$31,000	$3,000
BCR	1.07	1.00	1.27	1.33	1.02

1/ AAB and AAC were estimated using base year of 2024 (FY24), the FY20 FDR of 2.75%, and 50-year period of analysis.

4.0 Acronyms

AAB	average annual benefits
AAC	average annual cost
BCR	benefit-cost ratio
FDR	federal discount rate
FWOP	future without-project
FWP	future with-project
FY	fiscal year
NED	national economic development
P&G	Economic and Environmental Principles & Guidelines for Water and Related Land Resources Implementation Studies
PED	preconstruction engineering and design
PY	project year
S&A	supervision and administration
TSP	Tentatively Selected Plan
USACE	U.S. Army Corps of Engineers

Honolulu District

Pacific Ocean Division

SECTION 1122: BENEFICIAL USE OF DREDGED MATERIAL

HALEIWA SMALL BOAT HARBOR MAINTENANCE DREDGING AND BEACH RESTORATION, ISLAND OF OAHU, HAWAII.

Appendix D

Cost Engineering Appendix

Draft Feasibility Report

Date 9/28/2020

ATTACHMENTS

1. Project Description

Haleiwa Beach Park is adjacent to the Harbor, and is part of the federally authorized Haleiwa Beach Restoration Project, constructed in 1965. The northern portion of this beach experienced significant erosion and its area is significantly reduced from its initial extent. Additionally, public infrastructure that is part of Haleiwa Beach Park, including a sea wall and comfort station experienced storm damage without the beach to protect it. A World War II Monument is also at risk of storm damage as a result of the reduced beach extent.

2. Alternatives

Four major Alternatives were considered for this study (not including NO ACTION).

Alternative 1: No-Action

Alternative 2: Beneficial Use From Federal Navigation Channel to 12' Depth

Alternative 2a: Beneficial Use From Federal Navigation Channel to 13' Depths

Alternative 3: Beneficial Use From Federal Navigation Channel to 13' Depth, Settling Basin, and Non-Federal Navigation Settling Basin

Alternative 4: Beneficial Use of Dredged Material from Federal Channel to 13', Settling Basin, and Non-Federal Offshore Sand Borrow Area

National Economic Development Plan (NED) / Tentatively Selected Plan

Alternative 4: Beneficial Use of Dredged Material from Federal Channel to 13', Settling Basin, and Non- Offshore Sand Borrow Area.

Components:

Federal Navigation Channel

~2,400 cy – beach suitable sands

~2,000 cy – finer sediments taken to South Oahu ODMDS

1' additional material ~ 1,700 cy – beach suitable sand

Non-Federal Navigation Settling Basin ~ 2,200 cy beach suitable sand

Non-Federal Offshore Borrow Pit~ 15,000 cy beach suitable sand

Barge Access Zone ~ 4,700 cy beach suitable sand

3. Cost Summary

The following table includes cost summary of the various alternatives. The NED selected alternatives is shown in YELLOW below as alternative 4 with access channel. Note: Below cost represents construction cost, no design or S&A cost included.

Alternative Comparison Estimates (1,000's)				Alternative Estimates (Hauling from Harbor)				Alternative Estimates (with Access Channel to Groin)			
Alt.	Measure	Dredging Location	Disposal Method	Quantity (cy)	Total Direct Cost	Contingency	Total Project Cost	Quantity (cy)	Total Direct Cost	Contingency	Total Project Cost
						33%				30%	
Alt 1	Base Plan/Fed Standard Dredge Channel Haul to Ocean Dredged Material Disposal Site (ODMDS)			4,000	$ 894	$ 295	$ 1,189	4,000	$ 894	$ 268	$ 1,162
	Mob and Demob			-	662	219	$ 881	-	662	199	$ 861
	Mechanical Dredge (Marine)	Federal Channel	South Oahu offshore disposal site (ODMDS) (50+ mi each way)	4,000	231	76	$ 308	4,000	231	69	$ 301
Alt 2	Beneficial Use from Federal Navigation Channel to 12' Depth			4,433	$ 1,569	$ 518	$ 2,087	4,433	$ 1,485	$ 446	$ 1,931
	Mob and Demob			-	707	233	$ 940	-	683	205	$ 888
	Mechanical Dredge (Marine)	Federal Channel	ODMDS Disposal	2,000	144	47	$ 191	2,000	144	43	$ 187
	Mechanical Dredge (Marine)	Federal Channel	Haleiwa Beach Park	2,433	719	237	$ 956	2,433	658	197	$ 856
Alt 2A	Beneficial Use from Federal Navigation Channel with Additional Deepening to 13' Depth			6,138	$ 1,735	$ 572	$ 2,307	10,871	$ 1,568	$ 470	$ 2,039
	Mob and Demob			-	707	233	$ 940	-	677	203	$ 881
	Mechanical Dredge (Marine)	Federal Channel	ODMDS Disposal	2,000	144	47	$ 191	2,000	144	43	$ 187
	Mechanical Dredge (Marine)	Federal Channel	Haleiwa Beach Park	2,433	719	237	$ 956	7,166	658	197	$ 856
	Mechanical Dredge (Marine)	Federal Channel	Haleiwa Beach Park	1,705	166	55	$ 220	1,705	89	27	$ 116
Alt 3	Beneficial Use From Federal Navigation Channel with Additional Deepening and Settling Basin			8,338	$ 1,985	$ 655	$ 2,640	13,071	$ 1,906	$ 572	$ 2,478
	Mob and Demob			-	707	233	$ 940	-	705	212	$ 917
	Mechanical Dredge (Marine)	Federal Channel	ODMDS Disposal	2,000	144	47	$ 191	2,000	144	43	$ 187
	Mechanical Dredge (Marine)	Federal Channel	Haleiwa Beach Park	2,433	729	241	$ 970	7,166	658	197	$ 856
	Mechanical Dredge (Marine)	Federal Channel	Haleiwa Beach Park	1,705	160	53	$ 213	1,705	89	27	$ 116
	Mechanical Dredge (Marine)	Deposition Basin	Haleiwa Beach Park	2,200	245	81	$ 326	2,200	310	93	$ 403
Alt 4	Beneficial Use From Federal Navigation Channel with Additional Deepening, Settling Basin, and Offshore Sand Deposit			23,338	$ 3,591	$ 1,185	$ 4,775	28,071	$ 2,807	$ 842	$ 3,650
	Mob and Demob			-	707	233	$ 940	-	707	212	$ 919
	Mechanical Dredge (Marine)	Federal Channel	ODMDS Disposal	2,000	144	47	$ 191	2,000	144	43	$ 187
	Mechanical Dredge (Marine)	Federal Channel	Haleiwa Beach Park	2,433	729	241	$ 970	7,166	658	197	$ 856
	Mechanical Dredge (Marine)	Federal Channel	Haleiwa Beach Park	1,705	160	53	$ 213	1,705	89	27	$ 116
	Mechanical Dredge (Marine)	Deposition Basin	Haleiwa Beach Park	2,200	245	81	$ 326	2,200	310	93	$ 403
	Mechanical Dredge (Marine)	Offshore site	Haleiwa Beach Park	15,000	1,606	530	$ 2,136	15,000	900	270	$ 1,170

Does not include 30 and 31 Account for PED and S&A.

4. Basis of Design

The design details are described in the Haleiwa Small Boat Harbor Maintenance Dredging and Beach Restoration Maintenance Dredging Plans and Specifications. The plan set provides the beach locations, site access, and work limits for beach area placement. The plans show the proposed approach harbor dredging area as well as dredge material placement area next to the harbor for comparison and beach areas.

Basis of Quantities

Quantities were provided by the technical team.

Offshore Sand Borrow Area

~15,000 cy – beach suitable sands taken to Haleiwa Beach Park. Outside of Federal channel – (100% non-Federal cost).

NED - 26,000 cy of sandy material placed at Haleiwa Beach Park, fills littoral cell to capacity

5. Construction Estimate

Marine work was predominantly estimated utilizing CEDEP spreadsheets with specified input factors. Mechanical CEDEP was used for the Baseline dredging, as conducted historically comparing the Alternate 1 placement area barging distance with typical maintenance contract littoral placement. The Pipeline Hydrauilic Dredge CEDEP was used for Alternative 2 comparing the difference in transporting and placement costs less the cost of dredging and Alternative 3 considering a small hydraulic dredge or similar hydraulic pumping for offloading dredge material. Developed cost was verified with Historical Data from reference project's Bid Abstracts and RMS documentation for reasonableness.

Major Construction Features for the recommended plan (Alt 4) were estimated as follows.

Mobilization & Demobilization

Marine Mobilization/Demobilization was developed in CEDEP (Mob Input tab). It was assumed that it would take 5 day with a crew of 10 men (8hrs/day) to prep the dredge for transfer to the jobsite and another 2 days using the same crew to prep the equipment for work once it arrived at the jobsite. A 200 mile mob distance was used. The cost to relocate supervisory personnel to the jobsite is also included in CEDEP calcs. Land Mobilization were based on Cost Book items and includes land based MOB/DEMOB.

Beach Placement of Dredging Material

Based on previous maintenance dredging contracts in RMS, a reduced crew size of 15 was used to account for the hydraulic offloading with an effective working time of 50% as specified in CEDEP. A production rate of 150 CY/HR is assumed for offloading as well as beach placement. The land based beach placement crew consists of 1 operator and 1 laborer with articulated loader and trailer mounted light set for extending offloading time consistent with the assumed dredging operations.

General Conditions, Overhead, and Profit

The estimate assumes that the prime contractor will self-perform all marine work. It also assumes that the prime contractor will add 10% for home office overhead (HOOH), 15% for job office overhead, and 10% for profit as a running percentage of direct cost.

Miscellaneous TPCS Markups, Assumptions, & General Notes

Escalation on construction features assumes mid-point of first year construction approx. 3Q2022 with Ready to Advertise (RTA) tentatively scheduled for 4Q2021. Per EM 110-2-1304 (31-MAR-2020 INDICES)

Costs for the 30 & 31 accounts (PED and CM respectively) were provided by the POH Cost Engineering Chief at 12.3% and 4.1% respectively of the contract total.

A 14.29% Overtime rate was applied in CEDEP and MII and assumes 2 shifts, 10 HR work days 6 days per week with 1.5 pay for Saturdays and anytime over a typical 40 hour work.

Marine Labor Rates per General Decision Number Davis Bacon Wages.

MII Equipment rates per EP 1110-1-8, Volume 10, 2018.

MCACES Markups

Prime - Oahu

Markup	Own Work	Sub Work
JOOH [Running %]	15.00%	15.00%
HOOH [Running %]	10.00%	10.00%
Profit [Running %]	10.00%	10.00%
Bond [Running %]	1.00%	1.00%
Excise Tax [Direct Pct]	4.17%	4.17%

Sub Work - Oahu

Markup	Own Work	Sub Work
Sub OH [Running %]	15.00%	15.00%
Sub Profit [Running %]	10.00%	10.00%

Engineering & Surveying

Markup	Own Work	Sub Work
Sub OH [Running %]	15.00%	15.00%
Sub Profit [Running %]	10.00%	10.00%

No Real Estate action is needed.

"The Agreement between the United States of America and the State of Hawaii for local cooperation in connection with emergency repairs to Shore Protection Structures under Public Law 99, Haleiwa Beach, Oahu, Hawaii, dated 8th August 1977, allows for all lands, easements, and rights-of-way necessary for the authorized emergency work. The State further gave the Government the right to enter upon lands which the State owns or controls, for the purpose of operating, repairing, and maintaining the Project."

6. Construction Schedule

The construction schedule for this project is based Dredging contract for FY23 and durations estimated based on the project features contained in the CEDEP spreadsheets and the MII estimate. The anticipated dredging Base year is 2023. The current estimated duration for offloading and placement of dredged material within 1 dredging season.

7. Acquisition Plan

The current acquisition strategy is assumed fully open and competitive though an actual contracting plan has yet to be established.

8. Risk Assessment

An abbreviated risk analysis (ARA) was performed to develop a weighted contingency for the construction cost estimate. The current weighted construction contingency for the NED alternative 4 is approximately 30%. The overall Project weighted contingency ranged from 30% to 35% (Excluding Real Estate). The contingency accounts for dredge contractor competition and availability cost uncertainties. The concerns outlined in the ARA could have an overall impact on the project. Project costs have the potential to increase due to economic conditions and the level of apparent competition during the solicitation process. Due to the level of technical information available, current plan set provided by the PDT, and Moderate Risk level overall the estimate is considered Class 4 (per ER 1110-2-1302). Considering POH has completed similar dredging projects in close proximity and good historical data is available referencing scope of work (SOW) and pricing, the current contingency may reflect a typical Class 4 Cost Estimate Classification.

9. References

U.S. Army Corps of Engineers, 1993, Engineering and Design Cost Engineering Policy and General Requirements, Engineering Regulation 1110-1-1300, Department of the Army, Washington D.C., 26 March 1993.

U.S. Army Corps of Engineers, 1999, Engineering and Design for Civil Works Projects,

Engineering Regulation 1110-2-1150, Department of the Army, Washington D.C., 31 August 1999.

U.S. Army Corps of Engineers, 2016, Civil Works Cost Engineering, Engineering Regulation 1110-2-1302, Department of the Army, Washington D.C., 30 June 2016.

U.S. Army Corps of Engineers, 2019, Civil Works Construction Cost Index System (CWCCIS), Engineering Manual 1110-2-1304, Department of the Army, Washington D.C., 31 March 2020.

Unified Facilities Criteria, 2011, Handbook: Construction Cost Estimating, Unified Facilities Criteria (UFC) 3-740-05, Department of Defense, 1 June 2011.

TSP Total Project Cost

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: **Haleiwa Harbor**
DISTRICT: **POH**
PREPARED: **9/29/2020**
PROJECT NO: **Alternative 4 - Beneficial Use From Federal Navigation Channel with Additional Deepening, Settling Basin, and Offshore Sand**
LOCATION: **Oahu**
POC: **CHIEF, COST ENGINEERING**

This Estimate reflects the scope and schedule in report; Report Name and date

Civil Works Work Breakdown Structure		**ESTIMATED COST**				**PROJECT FIRST COST (Constant Dollar Basis)**						**TOTAL PROJECT COST (FULLY FUNDED)**			
								Program Year (Budget EC):		2021					
								Effective Price Level Date:		1-Oct- 20					
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	REMAINING COST ($K)	Spent Thru: **1-Oct-19** ($K)	**TOTAL FIRST COST** ($K)	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
02	RELOCATIONS	$2,807	$842	30%	$3,649		$2,807	$842	$3,649		$3,649	6.6%	$2,993	$898	$3,890
06	FISH & WILDLIFE FACILITIES		-			-						-			
			-			-						-			
			-			-						-			
	CONSTRUCTION ESTIMATE TOTALS:	$2,807	$842		$3,649		$2,807	$842	$3,649		$3,649	6.6%	$2,993	$898	$3,890
01	LANDS AND DAMAGES		-			-						-			
30	PLANNING, ENGINEERING & DESIGN	$77	$23	30%	$100		$77	$23	$100	$443	$543	1.1%	$78	$23	$544
31	CONSTRUCTION MANAGEMENT	$231	$69	30%	$300		$231	$69	$300		$300	8.8%	$251	$75	$327
	PROJECT COST TOTALS:	$3,115	$935	30%	$4,050		$3,115	$935	$4,050	$443	**$4,493**	6.6%	$3,322	$997	$4,761

_______________ CHIEF, COST ENGINEERING

_______________ PROJECT MANAGER, XXX

_______________ CHIEF, REAL ESTATE, XXX

_______________ CHIEF, PLANNING, XXX

_______________ CHIEF, ENGINEERING, XXX

_______________ CHIEF, OPERATIONS, XXX

_______________ CHIEF, CONSTRUCTION, XXX

_______________ CHIEF, CONTRACTING, XXX

_______________ CHIEF, PM-PB, xxxx

_______________ CHIEF, DPM, XXX

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Haleiwa Harbor
LOCATION: Oahu
This Estimate reflects the scope and schedule in report; Report Name and date

DISTRICT: POH
POC: CHIEF, COST ENGINEERING

PREPARED: 9/29/2020

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 9/29/20 Estimate Price Level: 1-Oct-20				Program Year (Budget EC): 2021 Effective Price Level Date: 1 -Oct-20								
WBS NUMBER *A*	Civil Works Feature & Sub-Feature Description *B*	COST ($K) *C*	CNTG ($K) *D*	RISK BASED CNTG (%) *E*	TOTAL ($K) *F*	ESC (%) *G*	COST ($K) *H*	CNTG ($K) *I*	TOTAL ($K) *J*	Mid-Point Date *P*	ESC (%) *L*	COST ($K) *M*	CNTG ($K) *N*	FULL ($K) *O*
	Alternative #5													
12	NAVIGATION PORTS & HARBORS	$2,807	$842	30.0%	$3,649		$2,807	$842	$3,649	2023Q2	6.6%	$2,993	$898	$3,890
06	FISH & WILDLIFE FACILITIES													
	CONSTRUCTION ESTIMATE TOTALS:	$2,807	$842	30.0%	$3,649		$2,807	$842	$3,649			$2,993	$898	$3,890
01	LANDS AND DAMAGES													
30	PLANNING, ENGINEERING & DESIGN													
	Project Management			30.0%										
	Planning & Environmental Compliance			30.0%										
	Engineering & Design	$77	$23	30.0%	$100		$77	$23	$100	2021Q2	1.1%	$78	$23	$101
	Reviews, ATRs, IEPRs, VE			30.0%										
	Life Cycle Updates (cost, schedule, risks)			30.0%										
	Contracting & Reprographics			30.0%										
12.2%	Engineering During Construction			30.0%										
	Planning During Construction			30.0%										
	Adaptive Management & Monitoring			30.0%										
	Project Operations			30.0%										
31	CONSTRUCTION MANAGEMENT													
4.1%	Construction Management	$231	$69	30.0%	$300		$231	$69	$300	2023Q2	8.8%	$251	$75	$327
	Project Operation:			30.0%										
	Project Management			30.0%										
	CONTRACT COST TOTALS:	$3,115	$935		$4,050		$3,115	$935	**$4,050**			$3,322	$997	**$4,318**

Total Project Cost Summaries

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: **Haleiwa Harbor** DISTRICT: **POH** PREPARED: **9/29/2020**
PROJECT NO: **Alternative 1 - Base Plan/Fed Standard Dredge Channel Haul to Ocean Dredged Material Disposal Site (ODMDS)**
LOCATION: **Oahu** POC: **CHIEF, COST ENGINEERING**

This Estimate reflects the scope and schedule in report; Report Name and date

Civil Works Work Breakdown Structure		**ESTIMATED COST**				**PROJECT FIRST COST (Constant Dollar Basis)**						**TOTAL PROJECT COST (FULLY FUNDED)**			
								Program Year (Budget EC):		2021					
								Effective Price Level Date:		1-Oct- 20					
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	REMAINING COST ($K)	Spent Thru: 1-Oct-19 ($K)	**TOTAL FIRST COST ($K)**	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
02	RELOCATIONS	$894	$268	30%	$1,162		$894	$268	$1,162		$1,162	6.6%	$953	$286	$1,239
06	FISH & WILDLIFE FACILITIES			-		-						-			
				-		-						-			
				-		-						-			
	CONSTRUCTION ESTIMATE TOTALS:	$894	$268		$1,162		$894	$268	$1,162		$1,162	6.6%	$953	$286	$1,239
01	LANDS AND DAMAGES			-		-						-			
30	PLANNING, ENGINEERING & DESIGN	$77	$23	30%	$100		$77	$23	$100		$100	1.1%	$78	$23	$101
31	CONSTRUCTION MANAGEMENT	$231	$69	30%	$300		$231	$69	$300		$300	8.8%	$251	$75	$327
	PROJECT COST TOTALS:	$1,202	$361	30%	$1,563		$1,202	$361	$1,563		**$1,563**	6.7%	$1,282	$385	$1,667

____________________ CHIEF, COST ENGINEERING

____________________ PROJECT MANAGER, XXX

____________________ CHIEF, REAL ESTATE, XXX

____________________ CHIEF, PLANNING, XXX

____________________ CHIEF, ENGINEERING, XXX

____________________ CHIEF, OPERATIONS, XXX

____________________ CHIEF, CONSTRUCTION, XXX

____________________ CHIEF, CONTRACTING, XXX

____________________ CHIEF, PM-PB, xxxx

____________________ CHIEF, DPM, XXX

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Haleiwa Harbor
LOCATION: Oahu
This Estimate reflects the scope and schedule in report; Report Name and date

DISTRICT: POH
POC: CHIEF, COST ENGINEERING

PREPARED: 9/29/2020

WBS Structure		**ESTIMATED COST**				**PROJECT FIRST COST (Constant Dollar Basis)**				**TOTAL PROJECT COST (FULLY FUNDED)**				
		Estimate Prepared: 9/29/20				Program Year (Budget EC): 2021								
		Estimate Price Level: 1-Oct-20				Effective Price Level Date: 1 -Oct-20								
				RISK BASED										
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	***B***	***C***	***D***	***E***	***F***	***G***	***H***	***I***	***J***	***P***	***L***	***M***	***N***	***O***
	Alternative #1													
12	NAVIGATION PORTS & HARBORS	$894	$268	30.0%	$1,162		$894	$268	$1,162	2023Q2	6.6%	$953	$286	$1,239
06	FISH & WILDLIFE FACILITIES													
	CONSTRUCTION ESTIMATE TOTALS:	$894	$268	30.0%	$1,162		$894	$268	$1,162			$953	$286	$1,239
01	LANDS AND DAMAGES													
30	PLANNING, ENGINEERING & DESIGN													
	Project Management			30.0%										
	Planning & Environmental Compliance			30.0%										
	Engineering & Design	$77	$23	30.0%	$100		$77	$23	$100	2021Q2	1.1%	$78	$23	$101
	Reviews, ATRs, IEPRs, VE			30.0%										
	Life Cycle Updates (cost, schedule, risks)			30.0%										
	Contracting & Reprographics			30.0%										
12.2%	Engineering During Construction			30.0%										
	Planning During Construction			30.0%										
	Adaptive Management & Monitoring			30.0%										
	Project Operations			30.0%										
31	CONSTRUCTION MANAGEMENT													
4.1%	Construction Management	$231	$69	30.0%	$300		$231	$69	$300	2023Q2	8.8%	$251	$75	$327
	Project Operation:			30.0%										
	Project Management			30.0%										
	CONTRACT COST TOTALS:	$1,202	$361		$1,563		$1,202	$361	**$1,563**			$1,282	$385	**$1,667**

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: **Haleiwa Harbor**
PROJECT NO: **Alternative 2 - Beneficial Use from Federal Navigation Channel to 12' Depth**
LOCATION: **Oahu**

DISTRICT: **POH**
PREPARED: **9/29/2020**
POC: **CHIEF, COST ENGINEERING**

This Estimate reflects the scope and schedule in report; Report Name and date

Civil Works Work Breakdown Structure		**ESTIMATED COST**				**PROJECT FIRST COST (Constant Dollar Basis)**						**TOTAL PROJECT COST (FULLY FUNDED)**			
						Program Year (Budget EC): 2021									
						Effective Price Level Date: 1-Oct- 20									
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	REMAINING COST ($K)	Spent Thru: 1-Oct-19 ($K)	TOTAL FIRST COST ($K)	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
02	RELOCATIONS	$1,485	$446	30%	$1,931		$1,485	$446	$1,931		$1,931	6.6%	$1,583	$475	$2,058
06	FISH & WILDLIFE FACILITIES		-			-						-			
			-			-						-			
			-			-						-			
	CONSTRUCTION ESTIMATE TOTALS:	$1,485	$446		$1,931		$1,485	$446	$1,931		$1,931	6.6%	$1,583	$475	$2,058
01	LANDS AND DAMAGES		-			-						-			
30	PLANNING, ENGINEERING & DESIGN	$77	$23	30%	$100		$77	$23	$100	$443	$543	1.1%	$78	$23	$544
31	CONSTRUCTION MANAGEMENT	$231	$69	30%	$300		$231	$69	$300		$300	8.8%	$251	$75	$327
	PROJECT COST TOTALS:	$1,793	$538	30%	$2,331		$1,793	$538	$2,331	$443	**$2,774**	6.7%	$1,912	$574	$2,929

______________________ CHIEF, COST ENGINEERING

______________________ PROJECT MANAGER, XXX

______________________ CHIEF, REAL ESTATE, XXX

______________________ CHIEF, PLANNING, XXX

______________________ CHIEF, ENGINEERING, XXX

______________________ CHIEF, OPERATIONS, XXX

______________________ CHIEF, CONSTRUCTION, XXX

______________________ CHIEF, CONTRACTING, XXX

______________________ CHIEF, PM-PB, xxxx

______________________ CHIEF, DPM, XXX

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Haleiwa Harbor
LOCATION: Oahu
This Estimate reflects the scope and schedule in report; Report Name and date

DISTRICT: POH
POC: CHIEF, COST ENGINEERING

PREPARED: 9/29/2020

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 9/29/20 Estimate Price Level: 1-Oct-20				Program Year (Budget EC): 2021 Effective Price Level Date: 1 -Oct-20								
WBS NUMBER *A*	Civil Works Feature & Sub-Feature Description *B*	COST ($K) *C*	CNTG ($K) *D*	RISK BASED CNTG (%) *E*	TOTAL ($K) *F*	ESC (%) *G*	COST ($K) *H*	CNTG ($K) *I*	TOTAL ($K) *J*	Mid-Point Date *P*	ESC (%) *L*	COST ($K) *M*	CNTG ($K) *N*	FULL ($K) *O*
	Alternative #2													
12	NAVIGATION PORTS & HARBORS	$1,485	$446	30.0%	$1,931		$1,485	$446	$1,931	2023Q2	6.6%	$1,583	$475	$2,058
06	FISH & WILDLIFE FACILITIES													
	CONSTRUCTION ESTIMATE TOTALS:	$1,485	$446	30.0%	$1,931		$1,485	$446	$1,931			$1,583	$475	$2,058
01	LANDS AND DAMAGES													
30	PLANNING, ENGINEERING & DESIGN													
	Project Management			30.0%										
	Planning & Environmental Compliance			30.0%										
	Engineering & Design	$77	$23	30.0%	$100		$77	$23	$100	2021Q2	1.1%	$78	$23	$101
	Reviews, ATRs, IEPRs, VE			30.0%										
	Life Cycle Updates (cost, schedule, risks)			30.0%										
	Contracting & Reprographics			30.0%										
12.2%	Engineering During Construction			30.0%										
	Planning During Construction			30.0%										
	Adaptive Management & Monitoring			30.0%										
	Project Operations			30.0%										
31	CONSTRUCTION MANAGEMENT													
4.1%	Construction Management	$231	$69	30.0%	$300		$231	$69	$300	2023Q2	8.8%	$251	$75	$327
	Project Operation:			30.0%										
	Project Management			30.0%										
	CONTRACT COST TOTALS:	$1,793	$538		$2,331		$1,793	$538	**$2,331**			$1,912	$574	**$2,486**

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: **Haleiwa Harbor** DISTRICT: **POH** PREPARED: **9/29/2020**
PROJECT NO: **Alternative 2A - Beneficial Use from Federal Navigation Channel with Additional Deepening to 13' Depth**
LOCATION: **Oahu** POC: **CHIEF, COST ENGINEERING**

This Estimate reflects the scope and schedule in report; Report Name and date

Civil Works Work Breakdown Structure		**ESTIMATED COST**				**PROJECT FIRST COST (Constant Dollar Basis)**						**TOTAL PROJECT COST (FULLY FUNDED)**			
							Program Year (Budget EC):			2021					
							Effective Price Level Date:			1-Oct- 20					
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	REMAINING COST ($K)	Spent Thru: **1-Oct-19** ($K)	**TOTAL FIRST COST** ($K)	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
02	RELOCATIONS	$1,568	$470	30%	$2,039		$1,568	$470	$2,039		$2,039	6.6%	$1,672	$502	$2,173
06	FISH & WILDLIFE FACILITIES		-			-						-			
			-			-						-			
			-			-						-			
	CONSTRUCTION ESTIMATE TOTALS:	$1,568	$470		$2,039		$1,568	$470	$2,039		$2,039	6.6%	$1,672	$502	$2,173
01	LANDS AND DAMAGES		-			-						-			
30	PLANNING, ENGINEERING & DESIGN	$77	$23	30%	$100		$77	$23	$100	$443	$543	1.1%	$78	$23	$544
31	CONSTRUCTION MANAGEMENT	$231	$69	30%	$300		$231	$69	$300		$300	8.8%	$251	$75	$327
	PROJECT COST TOTALS:	$1,876	$563	30%	$2,439		$1,876	$563	$2,439	$443	**$2,882**	6.7%	$2,001	$600	$3,044

______________________ CHIEF, COST ENGINEERING

______________________ PROJECT MANAGER, XXX

______________________ CHIEF, REAL ESTATE, XXX

______________________ CHIEF, PLANNING, XXX

______________________ CHIEF, ENGINEERING, XXX

______________________ CHIEF, OPERATIONS, XXX

______________________ CHIEF, CONSTRUCTION, XXX

______________________ CHIEF, CONTRACTING, XXX

______________________ CHIEF, PM-PB, xxxx

______________________ CHIEF, DPM, XXX

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Haleiwa Harbor
LOCATION: Oahu
This Estimate reflects the scope and schedule in report; Report Name and date

DISTRICT: POH
POC: CHIEF, COST ENGINEERING

PREPARED: 9/29/2020

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 9/29/20 Estimate Price Level: 1-Oct-20				Program Year (Budget EC): 2021 Effective Price Level Date: 1 -Oct-20								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	RISK BASED CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	Alternative #3													
12	NAVIGATION PORTS & HARBORS	$1,568	$470	30.0%	$2,039		$1,568	$470	$2,039	2023Q2	6.6%	$1,672	$502	$2,173
06	FISH & WILDLIFE FACILITIES													
	CONSTRUCTION ESTIMATE TOTALS:	$1,568	$470	30.0%	$2,039		$1,568	$470	$2,039			$1,672	$502	$2,173
01	LANDS AND DAMAGES													
30	PLANNING, ENGINEERING & DESIGN													
	Project Management			30.0%										
	Planning & Environmental Compliance			30.0%										
	Engineering & Design	$77	$23	30.0%	$100		$77	$23	$100	2021Q2	1.1%	$78	$23	$101
	Reviews, ATRs, IEPRs, VE			30.0%										
	Life Cycle Updates (cost, schedule, risks)			30.0%										
	Contracting & Reprographics			30.0%										
12.2%	Engineering During Construction			30.0%										
	Planning During Construction			30.0%										
	Adaptive Management & Monitoring			30.0%										
	Project Operations			30.0%										
31	CONSTRUCTION MANAGEMENT													
4.1%	Construction Management	$231	$69	30.0%	$300		$231	$69	$300	2023Q2	8.8%	$251	$75	$327
	Project Operation:			30.0%										
	Project Management			30.0%										
	CONTRACT COST TOTALS:	$1,876	$563		$2,439		$1,876	$563	**$2,439**			$2,001	$600	**$2,601**

****** TOTAL PROJECT COST SUMMARY ******

PROJECT: **Haleiwa Harbor** DISTRICT: **POH** PREPARED: **9/29/2020**
PROJECT NO: **Alternative 3 - Beneficial Use From Federal Navigation Channel with Additional Deepening and Settling Basin**
LOCATION: **Oahu** POC: **CHIEF, COST ENGINEERING**

This Estimate reflects the scope and schedule in report; Report Name and date

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
						Program Year (Budget EC): 2021									
						Effective Price Level Date: 1-Oct- 20									
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	REMAINING COST ($K)	Spent Thru: 1-Oct-19 ($K)	TOTAL FIRST COST ($K)	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
02	RELOCATIONS	$1,906	$572	30%	$2,478		$1,906	$572	$2,478		$2,478	6.6%	$2,032	$610	$2,642
06	FISH & WILDLIFE FACILITIES		-			-						-			
			-			-						-			
			-			-						-			
	CONSTRUCTION ESTIMATE TOTALS:	$1,906	$572		$2,478		$1,906	$572	$2,478		$2,478	6.6%	$2,032	$610	$2,642
01	LANDS AND DAMAGES		-			-						-			
30	PLANNING, ENGINEERING & DESIGN	$77	$23	30%	$100		$77	$23	$100	$443	$543	1.1%	$78	$23	$544
31	CONSTRUCTION MANAGEMENT	$231	$69	30%	$300		$231	$69	$300		$300	8.8%	$251	$75	$327
	PROJECT COST TOTALS:	$2,214	$664	30%	$2,878		$2,214	$664	$2,878	$443	**$3,321**	6.7%	$2,361	$708	$3,513

________________ CHIEF, COST ENGINEERING

________________ PROJECT MANAGER, XXX

________________ CHIEF, REAL ESTATE, XXX

________________ CHIEF, PLANNING, XXX

________________ CHIEF, ENGINEERING, XXX

________________ CHIEF, OPERATIONS, XXX

________________ CHIEF, CONSTRUCTION, XXX

________________ CHIEF, CONTRACTING, XXX

________________ CHIEF, PM-PB, xxxx

________________ CHIEF, DPM, XXX

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Haleiwa Harbor
LOCATION: Oahu
This Estimate reflects the scope and schedule in report; Report Name and date

DISTRICT: POH
POC: CHIEF, COST ENGINEERING

PREPARED: 9/29/2020

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 9/29/20 Estimate Price Level: 1-Oct-20				Program Year (Budget EC): 2021 Effective Price Level Date: 1 -Oct-20								
WBS NUMBER *A*	Civil Works Feature & Sub-Feature Description *B*	COST ($K) *C*	CNTG ($K) *D*	RISK BASED CNTG (%) *E*	TOTAL ($K) *F*	ESC (%) *G*	COST ($K) *H*	CNTG ($K) *I*	TOTAL ($K) *J*	Mid-Point Date *P*	ESC (%) *L*	COST ($K) *M*	CNTG ($K) *N*	FULL ($K) *O*
	Alternative #4													
12	NAVIGATION PORTS & HARBORS	$1,906	$572	30.0%	$2,478		$1,906	$572	$2,478	2023Q2	6.6%	$2,032	$610	$2,642
06	FISH & WILDLIFE FACILITIES													
	CONSTRUCTION ESTIMATE TOTALS:	$1,906	$572	30.0%	$2,478		$1,906	$572	$2,478			$2,032	$610	$2,642
01	LANDS AND DAMAGES													
30	PLANNING, ENGINEERING & DESIGN													
	Project Management			30.0%										
	Planning & Environmental Compliance			30.0%										
	Engineering & Design	$77	$23	30.0%	$100		$77	$23	$100	2021Q2	1.1%	$78	$23	$101
	Reviews, ATRs, IEPRs, VE			30.0%										
	Life Cycle Updates (cost, schedule, risks)			30.0%										
	Contracting & Reprographics			30.0%										
12.2%	Engineering During Construction			30.0%										
	Planning During Construction			30.0%										
	Adaptive Management & Monitoring			30.0%										
	Project Operations			30.0%										
31	CONSTRUCTION MANAGEMENT													
4.1%	Construction Management	$231	$69	30.0%	$300		$231	$69	$300	2023Q2	8.8%	$251	$75	$327
	Project Operation:			30.0%										
	Project Management			30.0%										
	CONTRACT COST TOTALS:	$2,214	$664		$2,878		$2,214	$664	**$2,878**			$2,361	$708	**$3,070**

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: **Haleiwa Harbor**
PROJECT NO: **Alternative 4 - Beneficial Use From Federal Navigation Channel with Additional Deepening, Settling Basin, and Offshore Sand**
LOCATION: **Oahu**

DISTRICT: **POH**
PREPARED: **9/29/2020**
POC: **CHIEF, COST ENGINEERING**

This Estimate reflects the scope and schedule in report; Report Name and date

Civil Works Work Breakdown Structure		**ESTIMATED COST**				**PROJECT FIRST COST (Constant Dollar Basis)**						**TOTAL PROJECT COST (FULLY FUNDED)**			
						Program Year (Budget EC): 2021									
						Effective Price Level Date: 1-Oct- 20									
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	REMAINING COST ($K)	Spent Thru: **1-Oct-19** ($K)	**TOTAL FIRST COST** ($K)	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
02	RELOCATIONS	$2,807	$842	30%	$3,649		$2,807	$842	$3,649		$3,649	6.6%	$2,993	$898	$3,890
06	FISH & WILDLIFE FACILITIES		-			-						-			
			-			-						-			
			-			-						-			
	CONSTRUCTION ESTIMATE TOTALS:	$2,807	$842		$3,649		$2,807	$842	$3,649		$3,649	6.6%	$2,993	$898	$3,890
01	LANDS AND DAMAGES		-			-						-			
30	PLANNING, ENGINEERING & DESIGN	$77	$23	30%	$100		$77	$23	$100	$443	$543	1.1%	$78	$23	$544
31	CONSTRUCTION MANAGEMENT	$231	$69	30%	$300		$231	$69	$300		$300	8.8%	$251	$75	$327
	PROJECT COST TOTALS:	$3,115	$935	30%	$4,050		$3,115	$935	$4,050	$443	**$4,493**	6.6%	$3,322	$997	$4,761

________________ CHIEF, COST ENGINEERING

________________ PROJECT MANAGER, XXX

________________ CHIEF, REAL ESTATE, XXX

________________ CHIEF, PLANNING, XXX

________________ CHIEF, ENGINEERING, XXX

________________ CHIEF, OPERATIONS, XXX

________________ CHIEF, CONSTRUCTION, XXX

________________ CHIEF, CONTRACTING, XXX

________________ CHIEF, PM-PB, xxxx

________________ CHIEF, DPM, XXX

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: Haleiwa Harbor | DISTRICT: POH | PREPARED: 9/29/2020
LOCATION: Oahu | POC: CHIEF, COST ENGINEERING
This Estimate reflects the scope and schedule in report; Report Name and date

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 9/29/20 Estimate Price Level: 1-Oct-20				Program Year (Budget EC): 2021 Effective Price Level Date: 1 -Oct-20								
WBS NUMBER *A*	Civil Works Feature & Sub-Feature Description *B*	COST ($K) *C*	CNTG ($K) *D*	RISK BASED CNTG (%) *E*	TOTAL ($K) *F*	ESC (%) *G*	COST ($K) *H*	CNTG ($K) *I*	TOTAL ($K) *J*	Mid-Point Date *P*	ESC (%) *L*	COST ($K) *M*	CNTG ($K) *N*	FULL ($K) *O*
	Alternative #5													
12	NAVIGATION PORTS & HARBORS	$2,807	$842	30.0%	$3,649		$2,807	$842	$3,649	2023Q2	6.6%	$2,993	$898	$3,890
06	FISH & WILDLIFE FACILITIES													
	CONSTRUCTION ESTIMATE TOTALS:	$2,807	$842	30.0%	$3,649		$2,807	$842	$3,649			$2,993	$898	$3,890
01	LANDS AND DAMAGES													
30	PLANNING, ENGINEERING & DESIGN													
	Project Management			30.0%										
	Planning & Environmental Compliance			30.0%										
	Engineering & Design	$77	$23	30.0%	$100		$77	$23	$100	2021Q2	1.1%	$78	$23	$101
	Reviews, ATRs, IEPRs, VE			30.0%										
	Life Cycle Updates (cost, schedule, risks)			30.0%										
	Contracting & Reprographics			30.0%										
12.2%	Engineering During Construction			30.0%										
	Planning During Construction			30.0%										
	Adaptive Management & Monitoring			30.0%										
	Project Operations			30.0%										
31	CONSTRUCTION MANAGEMENT													
4.1%	Construction Management	$231	$69	30.0%	$300		$231	$69	$300	2023Q2	8.8%	$251	$75	$327
	Project Operation:			30.0%										
	Project Management			30.0%										
	CONTRACT COST TOTALS:	$3,115	$935		$4,050		$3,115	$935	**$4,050**			$3,322	$997	**$4,318**

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: **Haleiwa Harbor** DISTRICT: **POH** PREPARED: **9/29/2020**
PROJECT NO: **Alternative 1 - Base Plan/Fed Standard Dredge Channel Haul to Ocean Dredged Material Disposal Site (ODMDS)**
LOCATION: **Oahu** POC: **CHIEF, COST ENGINEERING**

This Estimate reflects the scope and schedule in report; Report Name and date

Civil Works Work Breakdown Structure		**ESTIMATED COST**				**PROJECT FIRST COST (Constant Dollar Basis)**						**TOTAL PROJECT COST (FULLY FUNDED)**			
							Program Year (Budget EC):			2021					
							Effective Price Level Date:			1-Oct- 20					
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	REMAINING COST ($K)	Spent Thru: **1-Oct-19** ($K)	**TOTAL FIRST COST** ($K)	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
02	RELOCATIONS	$894	$295	33%	$1,189		$894	$295	$1,189		$1,189	6.6%	$953	$314	$1,267
06	FISH & WILDLIFE FACILITIES		-			-						-			
			-			-						-			
			-			-						-			
	CONSTRUCTION ESTIMATE TOTALS:	$894	$295		$1,189		$894	$295	$1,189		$1,189	6.6%	$953	$314	$1,267
01	LANDS AND DAMAGES		-			-						-			
30	PLANNING, ENGINEERING & DESIGN	$77	$25	33%	$102		$77	$25	$102	$443	$545	1.1%	$78	$26	$547
31	CONSTRUCTION MANAGEMENT	$231	$76	33%	$307		$231	$76	$307		$307	8.8%	$251	$83	$334
	PROJECT COST TOTALS:	$1,202	$397	33%	$1,598		$1,202	$397	$1,598	$443	**$2,041**	6.7%	$1,282	$423	$2,148

________________ CHIEF, COST ENGINEERING

________________ PROJECT MANAGER, XXX

________________ CHIEF, REAL ESTATE, XXX

________________ CHIEF, PLANNING, XXX

________________ CHIEF, ENGINEERING, XXX

________________ CHIEF, OPERATIONS, XXX

________________ CHIEF, CONSTRUCTION, XXX

________________ CHIEF, CONTRACTING, XXX

________________ CHIEF, PM-PB, xxxx

________________ CHIEF, DPM, XXX

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Haleiwa Harbor
LOCATION: Oahu
This Estimate reflects the scope and schedule in report; Report Name and date

DISTRICT: POH
POC: CHIEF, COST ENGINEERING

PREPARED: 9/29/2020

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 9/29/20 Estimate Price Level: 1-Oct-20				Program Year (Budget EC): 2021 Effective Price Level Date: 1 -Oct-20								
WBS NUMBER *A*	Civil Works Feature & Sub-Feature Description *B*	COST ($K) *C*	CNTG ($K) *D*	RISK BASED CNTG (%) *E*	TOTAL ($K) *F*	ESC (%) *G*	COST ($K) *H*	CNTG ($K) *I*	TOTAL ($K) *J*	Mid-Point Date *P*	ESC (%) *L*	COST ($K) *M*	CNTG ($K) *N*	FULL ($K) *O*
	Alternative #1													
12	NAVIGATION PORTS & HARBORS	$894	$295	33.0%	$1,189		$894	$295	$1,189	2023Q2	6.6%	$953	$314	$1,267
06	FISH & WILDLIFE FACILITIES													
	CONSTRUCTION ESTIMATE TOTALS:	$894	$295	33.0%	$1,189		$894	$295	$1,189			$953	$314	$1,267
01	LANDS AND DAMAGES													
30	PLANNING, ENGINEERING & DESIGN													
	Project Management			33.0%										
	Planning & Environmental Compliance			33.0%										
	Engineering & Design	$77	$25	33.0%	$102		$77	$25	$102	2021Q2	1.1%	$78	$26	$104
	Reviews, ATRs, IEPRs, VE			33.0%										
	Life Cycle Updates (cost, schedule, risks)			33.0%										
	Contracting & Reprographics			33.0%										
12.2%	Engineering During Construction			33.0%										
	Planning During Construction			33.0%										
	Adaptive Management & Monitoring			33.0%										
	Project Operations			33.0%										
31	CONSTRUCTION MANAGEMENT													
4.1%	Construction Management	$231	$76	33.0%	$307		$231	$76	$307	2023Q2	8.8%	$251	$83	$334
	Project Operation:			33.0%										
	Project Management			33.0%										
	CONTRACT COST TOTALS:	$1,202	$397		$1,598		$1,202	$397	**$1,598**			$1,282	$423	**$1,705**

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: **Haleiwa Harbor** DISTRICT: **POH** PREPARED: **9/29/2020**
PROJECT NO: **Alternative 2 - Beneficial Use from Federal Navigation Channel to 12' Depth**
LOCATION: **Oahu** POC: **CHIEF, COST ENGINEERING**

This Estimate reflects the scope and schedule in report; Report Name and date

Civil Works Work Breakdown Structure		**ESTIMATED COST**				**PROJECT FIRST COST (Constant Dollar Basis)**						**TOTAL PROJECT COST (FULLY FUNDED)**			
						Program Year (Budget EC):				2021					
						Effective Price Level Date:				1-Oct- 20					
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	REMAINING COST ($K)	Spent Thru: **1-Oct-19** ($K)	**TOTAL FIRST COST** ($K)	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
02	RELOCATIONS	$1,569	$518	33%	$2,087		$1,569	$518	$2,087		$2,087	6.6%	$1,673	$552	$2,225
06	FISH & WILDLIFE FACILITIES		-			-						-			
			-			-						-			
			-			-						-			
	CONSTRUCTION ESTIMATE TOTALS:	$1,569	$518		$2,087		$1,569	$518	$2,087		$2,087	6.6%	$1,673	$552	$2,225
01	LANDS AND DAMAGES		-			-						-			
30	PLANNING, ENGINEERING & DESIGN	$77	$25	33%	$102		$77	$25	$102	$443	$545	8.8%	$84	$28	$554
31	CONSTRUCTION MANAGEMENT	$231	$76	33%	$307		$231	$76	$307		$307	8.8%	$251	$83	$334
	PROJECT COST TOTALS:	$1,877	$619	33%	$2,496		$1,877	$619	$2,496	$443	**$2,939**	7.0%	$2,008	$663	$3,113

_______________ CHIEF, COST ENGINEERING

_______________ PROJECT MANAGER, XXX

_______________ CHIEF, REAL ESTATE, XXX

_______________ CHIEF, PLANNING, XXX

_______________ CHIEF, ENGINEERING, XXX

_______________ CHIEF, OPERATIONS, XXX

_______________ CHIEF, CONSTRUCTION, XXX

_______________ CHIEF, CONTRACTING, XXX

_______________ CHIEF, PM-PB, xxxx

_______________ CHIEF, DPM, XXX

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Haleiwa Harbor | DISTRICT: POH | PREPARED: 9/29/2020
LOCATION: Oahu | POC: CHIEF, COST ENGINEERING
This Estimate reflects the scope and schedule in report; Report Name and date

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared:			9/29/20	Program Year (Budget EC):			2021					
		Estimate Price Level:			1-Oct-20	Effective Price Level Date:			1 -Oct-20					
				RISK BASED										
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	Alternative #2													
12	NAVIGATION PORTS & HARBORS	$1,569	$518	33.0%	$2,087		$1,569	$518	$2,087	2023Q2	6.6%	$1,673	$552	$2,225
06	FISH & WILDLIFE FACILITIES													
	CONSTRUCTION ESTIMATE TOTALS:	$1,569	$518	33.0%	$2,087		$1,569	$518	$2,087			$1,673	$552	$2,225
01	LANDS AND DAMAGES													
30	PLANNING, ENGINEERING & DESIGN													
	Project Management			33.0%										
	Planning & Environmental Compliance			33.0%										
	Engineering & Design			33.0%										
	Reviews, ATRs, IEPRs, VE			33.0%										
	Life Cycle Updates (cost, schedule, risks)			33.0%										
	Contracting & Reprographics			33.0%										
12.2%	Engineering During Construction	$77	$25	33.0%	$102		$77	$25	$102	2023Q2	8.8%	$84	$28	$111
	Planning During Construction			33.0%										
	Adaptive Management & Monitoring			33.0%										
	Project Operations			33.0%										
31	CONSTRUCTION MANAGEMENT													
4.1%	Construction Management	$231	$76	33.0%	$307		$231	$76	$307	2023Q2	8.8%	$251	$83	$334
	Project Operation:			33.0%										
	Project Management			33.0%										
	CONTRACT COST TOTALS:	$1,877	$619		$2,496		$1,877	$619	**$2,496**			$2,008	$663	**$2,670**

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: **Haleiwa Harbor** DISTRICT: **POH** PREPARED: **9/29/2020**
PROJECT NO: **Alternative 2A - Beneficial Use from Federal Navigation Channel with Additional Deepening to 13' Depth**
LOCATION: **Oahu** POC: **CHIEF, COST ENGINEERING**

This Estimate reflects the scope and schedule in report; Report Name and date

Civil Works Work Breakdown Structure		**ESTIMATED COST**				**PROJECT FIRST COST (Constant Dollar Basis)**						**TOTAL PROJECT COST (FULLY FUNDED)**			
								Program Year (Budget EC):		2021					
								Effective Price Level Date:		1-Oct- 20					
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	REMAINING COST ($K)	Spent Thru: **1-Oct-19** ($K)	**TOTAL FIRST COST** ($K)	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
02	RELOCATIONS	$1,735	$572	33%	$2,307		$1,735	$572	$2,307		$2,307	6.6%	$1,849	$610	$2,459
06	FISH & WILDLIFE FACILITIES			-		-						-			
				-		-						-			
				-		-						-			
	CONSTRUCTION ESTIMATE TOTALS:	$1,735	$572		$2,307		$1,735	$572	$2,307		$2,307	6.6%	$1,849	$610	$2,459
01	LANDS AND DAMAGES			-		-						-			
30	PLANNING, ENGINEERING & DESIGN	$77	$25	33%	$102		$77	$25	$102	$443	$545	1.1%	$78	$26	$547
31	CONSTRUCTION MANAGEMENT	$231	$76	33%	$307		$231	$76	$307		$307	8.8%	$251	$83	$334
	PROJECT COST TOTALS:	$2,043	$674	33%	$2,717		$2,043	$674	$2,717	$443	**$3,160**	6.7%	$2,178	$719	$3,340

____________________ CHIEF, COST ENGINEERING

____________________ PROJECT MANAGER, XXX

____________________ CHIEF, REAL ESTATE, XXX

____________________ CHIEF, PLANNING, XXX

____________________ CHIEF, ENGINEERING, XXX

____________________ CHIEF, OPERATIONS, XXX

____________________ CHIEF, CONSTRUCTION, XXX

____________________ CHIEF, CONTRACTING, XXX

____________________ CHIEF, PM-PB, xxxx

____________________ CHIEF, DPM, XXX

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Haleiwa Harbor
LOCATION: Oahu
This Estimate reflects the scope and schedule in report; Report Name and date

DISTRICT: POH
POC: CHIEF, COST ENGINEERING
PREPARED: 9/29/2020

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 9/29/20 Estimate Price Level: 1-Oct-20				Program Year (Budget EC): 2021 Effective Price Level Date: 1 -Oct-20								
				RISK BASED										
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	Alternative #3													
12	NAVIGATION PORTS & HARBORS	$1,735	$572	33.0%	$2,307		$1,735	$572	$2,307	2023Q2	6.6%	$1,849	$610	$2,459
06	FISH & WILDLIFE FACILITIES													
	CONSTRUCTION ESTIMATE TOTALS:	$1,735	$572	33.0%	$2,307		$1,735	$572	$2,307			$1,849	$610	$2,459
01	LANDS AND DAMAGES													
30	PLANNING, ENGINEERING & DESIGN													
	Project Management			33.0%										
	Planning & Environmental Compliance			33.0%										
	Engineering & Design	$77	$25	33.0%	$102		$77	$25	$102	2021Q2	1.1%	$78	$26	$104
	Reviews, ATRs, IEPRs, VE			33.0%										
	Life Cycle Updates (cost, schedule, risks)			33.0%										
	Contracting & Reprographics			33.0%										
12.2%	Engineering During Construction			33.0%										
	Planning During Construction			33.0%										
	Adaptive Management & Monitoring			33.0%										
	Project Operations			33.0%										
31	CONSTRUCTION MANAGEMENT													
4.1%	Construction Management	$231	$76	33.0%	$307		$231	$76	$307	2023Q2	8.8%	$251	$83	$334
	Project Operation:			33.0%										
	Project Management			33.0%										
	CONTRACT COST TOTALS:	$2,043	$674		$2,717		$2,043	$674	**$2,717**			$2,178	$719	**$2,897**

Filename: Haleiwa Project TPCS hauling alt2a 20 Oct 2020.xlsx
TPCS

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: **Haleiwa Harbor** DISTRICT: **POH** PREPARED: **9/29/2020**
PROJECT NO: **Alternative 3 - Beneficial Use From Federal Navigation Channel with Additional Deepening and Settling Basin**
LOCATION: **Oahu** POC: **CHIEF, COST ENGINEERING**

This Estimate reflects the scope and schedule in report; Report Name and date

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
								Program Year (Budget EC):		2021					
								Effective Price Level Date:		1-Oct- 20					
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	REMAINING COST ($K)	Spent Thru: 1-Oct-19 ($K)	TOTAL FIRST COST ($K)	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
02	RELOCATIONS	$1,985	$655	33%	$2,640		$1,985	$655	$2,640		$2,640	6.6%	$2,116	$698	$2,814
06	FISH & WILDLIFE FACILITIES			-		-						-			
				-		-						-			
				-		-						-			
	CONSTRUCTION ESTIMATE TOTALS:	$1,985	$655		$2,640		$1,985	$655	$2,640		$2,640	6.6%	$2,116	$698	$2,814
01	LANDS AND DAMAGES			-		-						-			
30	PLANNING, ENGINEERING & DESIGN	$77	$25	33%	$102		$77	$25	$102	$443	$545	1.1%	$78	$26	$547
31	CONSTRUCTION MANAGEMENT	$231	$76	33%	$307		$231	$76	$307		$307	8.8%	$251	$83	$334
	PROJECT COST TOTALS:	$2,293	$757	33%	$3,049		$2,293	$757	$3,049	$443	**$3,492**	6.6%	$2,445	$807	$3,695

____________________ CHIEF, COST ENGINEERING

____________________ PROJECT MANAGER, XXX

____________________ CHIEF, REAL ESTATE, XXX

____________________ CHIEF, PLANNING, XXX

____________________ CHIEF, ENGINEERING, XXX

____________________ CHIEF, OPERATIONS, XXX

____________________ CHIEF, CONSTRUCTION, XXX

____________________ CHIEF, CONTRACTING, XXX

____________________ CHIEF, PM-PB, xxxx

____________________ CHIEF, DPM, XXX

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Haleiwa Harbor
LOCATION: Oahu
This Estimate reflects the scope and schedule in report; Report Name and date

DISTRICT: POH
POC: CHIEF, COST ENGINEERING

PREPARED: 9/29/2020

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 9/29/20 Estimate Price Level: 1-Oct-20				Program Year (Budget EC): 2021 Effective Price Level Date: 1 -Oct-20								
WBS NUMBER *A*	Civil Works Feature & Sub-Feature Description *B*	COST ($K) *C*	CNTG ($K) *D*	RISK BASED CNTG (%) *E*	TOTAL ($K) *F*	ESC (%) *G*	COST ($K) *H*	CNTG ($K) *I*	TOTAL ($K) *J*	Mid-Point Date *P*	ESC (%) *L*	COST ($K) *M*	CNTG ($K) *N*	FULL ($K) *O*
	Alternative #4													
12	NAVIGATION PORTS & HARBORS	$1,985	$655	33.0%	$2,640		$1,985	$655	$2,640	2023Q2	6.6%	$2,116	$698	$2,814
06	FISH & WILDLIFE FACILITIES													
	CONSTRUCTION ESTIMATE TOTALS:	$1,985	$655	33.0%	$2,640		$1,985	$655	$2,640			$2,116	$698	$2,814
01	LANDS AND DAMAGES													
30	PLANNING, ENGINEERING & DESIGN													
	Project Management			33.0%										
	Planning & Environmental Compliance			33.0%										
	Engineering & Design	$77	$25	33.0%	$102		$77	$25	$102	2021Q2	1.1%	$78	$26	$104
	Reviews, ATRs, IEPRs, VE			33.0%										
	Life Cycle Updates (cost, schedule, risks)			33.0%										
	Contracting & Reprographics			33.0%										
12.2%	Engineering During Construction			33.0%										
	Planning During Construction			33.0%										
	Adaptive Management & Monitoring			33.0%										
	Project Operations			33.0%										
31	CONSTRUCTION MANAGEMENT													
4.1%	Construction Management	$231	$76	33.0%	$307		$231	$76	$307	2023Q2	8.8%	$251	$83	$334
	Project Operation:			33.0%										
	Project Management			33.0%										
	CONTRACT COST TOTALS:	$2,293	$757		$3,049		$2,293	$757	**$3,049**			$2,445	$807	**$3,252**

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: **Haleiwa Harbor**
PROJECT NO: **Alternative 4 - Beneficial Use From Federal Navigation Channel with Additional Deepening, Settling Basin, and Offshore Sand**
LOCATION: **Oahu**

DISTRICT: **POH**
PREPARED: **9/29/2020**
POC: **CHIEF, COST ENGINEERING**

This Estimate reflects the scope and schedule in report; Report Name and date

Civil Works Work Breakdown Structure		**ESTIMATED COST**				**PROJECT FIRST COST (Constant Dollar Basis)**						**TOTAL PROJECT COST (FULLY FUNDED)**			
								Program Year (Budget EC):		2021					
								Effective Price Level Date:		1-Oct- 20					
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	REMAINING COST ($K)	Spent Thru: **1-Oct-19** ($K)	**TOTAL FIRST COST** ($K)	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
02	RELOCATIONS	$3,591	$1,185	33%	$4,775		$3,591	$1,185	$4,775		$4,775	6.6%	$3,828	$1,263	$5,091
06	FISH & WILDLIFE FACILITIES		-			-						-			
			-			-						-			
			-			-						-			
	CONSTRUCTION ESTIMATE TOTALS:	$3,591	$1,185		$4,775		$3,591	$1,185	$4,775		$4,775	6.6%	$3,828	$1,263	$5,091
01	LANDS AND DAMAGES		-			-						-			
30	PLANNING, ENGINEERING & DESIGN	$77	$25	33%	$102		$77	$25	$102	$443	$545	1.1%	$78	$26	$547
31	CONSTRUCTION MANAGEMENT	$231	$76	33%	$307		$231	$76	$307		$307	8.8%	$251	$83	$334
	PROJECT COST TOTALS:	$3,899	$1,287	33%	$5,185		$3,899	$1,287	$5,185	$443	**$5,628**	6.6%	$4,157	$1,372	$5,972

__________________ CHIEF, COST ENGINEERING

__________________ PROJECT MANAGER, XXX

__________________ CHIEF, REAL ESTATE, XXX

__________________ CHIEF, PLANNING, XXX

__________________ CHIEF, ENGINEERING, XXX

__________________ CHIEF, OPERATIONS, XXX

__________________ CHIEF, CONSTRUCTION, XXX

__________________ CHIEF, CONTRACTING, XXX

__________________ CHIEF, PM-PB, xxxx

__________________ CHIEF, DPM, XXX

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Haleiwa Harbor
LOCATION: Oahu
This Estimate reflects the scope and schedule in report; Report Name and date

DISTRICT: POH
POC: CHIEF, COST ENGINEERING

PREPARED: 9/29/2020

WBS Structure		**ESTIMATED COST**				**PROJECT FIRST COST (Constant Dollar Basis)**				**TOTAL PROJECT COST (FULLY FUNDED)**				
		Estimate Prepared: 9/29/20 Estimate Price Level: 1-Oct-20				Program Year (Budget EC): 2021 Effective Price Level Date: 1 -Oct-20								
WBS NUMBER *A*	Civil Works Feature & Sub-Feature Description *B*	COST ($K) *C*	CNTG ($K) *D*	RISK BASED CNTG (%) *E*	TOTAL ($K) *F*	ESC (%) *G*	COST ($K) *H*	CNTG ($K) *I*	TOTAL ($K) *J*	Mid-Point Date *P*	ESC (%) *L*	COST ($K) *M*	CNTG ($K) *N*	FULL ($K) *O*
	Alternative #5													
12	NAVIGATION PORTS & HARBORS	$3,591	$1,185	33.0%	$4,775		$3,591	$1,185	$4,775	2023Q2	6.6%	$3,828	$1,263	$5,091
06	FISH & WILDLIFE FACILITIES													
	CONSTRUCTION ESTIMATE TOTALS:	$3,591	$1,185	33.0%	$4,775		$3,591	$1,185	$4,775			$3,828	$1,263	$5,091
01	LANDS AND DAMAGES													
30	PLANNING, ENGINEERING & DESIGN													
	Project Management			33.0%										
	Planning & Environmental Compliance			33.0%										
	Engineering & Design	$77	$25	33.0%	$102		$77	$25	$102	2021Q2	1.1%	$78	$26	$104
	Reviews, ATRs, IEPRs, VE			33.0%										
	Life Cycle Updates (cost, schedule, risks)			33.0%										
	Contracting & Reprographics			33.0%										
12.2%	Engineering During Construction			33.0%										
	Planning During Construction			33.0%										
	Adaptive Management & Monitoring			33.0%										
	Project Operations			33.0%										
31	CONSTRUCTION MANAGEMENT													
4.1%	Construction Management	$231	$76	33.0%	$307		$231	$76	$307	2023Q2	8.8%	$251	$83	$334
	Project Operation:			33.0%										
	Project Management			33.0%										
	CONTRACT COST TOTALS:	$3,899	$1,287		$5,185		$3,899	$1,287	**$5,185**			$4,157	$1,372	**$5,529**

MCACES Detailed Estimates
Hauling Option

Hauling Option

Higher risk due to offload at Marina Area. Vessel traffic, working around docks, drying of material etc. Use 33%

Estimated by EC-S

Designed by

Prepared by Kim Callan

Preparation Date 5/22/2020

Effective Date of Pricing 5/22/2020

Estimated Construction Time Days

Description	Quantity	UOM	ContractCost
Alt 1 Base Plan/Fed Standard Dredge Channel Haul to Ocean Dredged Material Disposal Site (ODMDS)	1	EA	893.8
M&D Mob, Demob & Preparatory Work	1	JOB	662.5
ODMDS ODMDS Disposal	4,000	CY	231.4
Alt 2 Beneficial Use from Federal Navigation Channel to 12’ Depth	1	EA	1,568.9
M&D Mobilization and Demobilization	1	EA	706.7
ODMDS ODMDS Disposal	2,000	CY	143.6
BEACH Dispose at Haleiwa Beach Park	2,433	CY	718.6
Alt 2a Beneficial Use from Federal Navigation Channel with Additional Deepening to 13’ Depth	1	EA	1,734.6
M&D Mobilization and Demobilization	1	EA	706.7
ODMDS ODMDS Disposal	2,000	CY	143.6
BEACH Dispose at Haleiwa Beach Park	2,433	CY	718.6
BEACH BEACH Dispose at Haleiwa Beach Park with Addtional Deepening to 13' Depth	1,705	CY	165.6
Alt 3 Beneficial Use From Federal Navigation Channel with Additional Deepening and Settling Basin	1	EA	1,984.6
M&D Mobilization and Demobilization	1	EA	706.7
ODMDS ODMDS Disposal	2,000	CY	143.6
BEACH Dispose at Haleiwa Beach Park	2,433	CY	729.0
BEACH BEACH Dispose at Haleiwa Beach Park with Addtional Deepening to 13' Depth	1,705	CY	160.2
BASIN Remove Sand from Settling Basin Long Reach Excavator (max reach 50ft)	2,200	CY	245.1
Alt 4 Beneficial Use From Federal Navigation Channel with Additional Deepening, Settling Basin, and Offshore Sand Deposit	1	EA	3,590.5
M&D Mobilization and Demobilization	1	EA	706.7
ODMDS ODMDS Disposal	2,000	CY	143.6
BEACH Dispose at Haleiwa Beach Park	2,433	CY	729.0
BEACH BEACH Dispose at Haleiwa Beach Park with Addtional Deepening to 13' Depth	1,705	CY	160.2
BASIN Remove Sand from Settling Basin Long Reach Excavator (max reach 50ft)	2,200	CY	245.1
OFF Offshore Material to Beach	15,000	CY	1,605.9

Description	Quantity	UOM	ContractCost
Details			
Alt 1 Base Plan/Fed Standard Dredge Channel Haul to Ocean Dredged Material Disposal Site (ODMDS)			
M&D Mob, Demob & Preparatory Work			
Mob/Demob (Marine)			
USR Mob/Demob (CEDEP)	1	LS	662,466
ODMDS ODMDS Disposal			
090115 Mechanical Dredging			
09011502 Site Work			
Dredging			
USR Dredging (CEDEP)	4,000	CY	192,990
090199 Associated General Items			
As-Builts			
USR SURV-CADD Survey (CADD)	40	HR	4,819
USR CIV-STR-CADD Civil / Struct Design Team CADD	120	HR	33,564
Alt 2 Beneficial Use from Federal Navigation Channel to 12' Depth			
M&D Mobilization and Demobilization			
M&D Mob, Demob & Preparatory Work			
Mob/Demob (Marine)			
USR Mob/Demob (CEDEP)	1	LS	662,466
LAND Mob/Demob (Land)			
GEN T15Z6570 TRACTOR, CRAWLER (DOZER), 300-340 HP (224-254 KW), POWERSHIFT, W/UNIVERSAL BLADE	16	HR	7,443
PTC R50Z5600 ROLLER, VIBRATORY, SELF-PROPELLED, SINGLE DRUM, SMOOTH, 4.6 TON (4.2 MT), 48" (1.2 M) WIDE, SOIL COMPACTOR	16	HR	1,461
PTC T15Z6440 TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	16	HR	1,461
PTC T50Z7580 TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	16	HR	1,982
MAP T40RS002 TRUCK OPTIONS, WATER TANK, 3,000 GAL (ADD 40,000 GVW TRUCK)	16	HR	298
MIL B-TRKDVRHV Truck Drivers, Heavy	16	HR	3,110
USR Trucking w/ Low Boy, Mob/Demob	16	HR	6,151
USR DRE-OFFL Off-Loading w/ Cat 945B from Barge to shore	16	HR	19,636
EP H25KC020 HYDRAULIC EXCAVATOR, CRAWLER, 53,400 LBS, 2.5 CY BUCKET, 39' MAX DIGGING DEPTH, LONG REACH BOOM	16	HR	2,441
GEN S25Z6010 SCRAPER, TOWED, 9-12 CY (7-9 M3), 16 TON (14.5 MT) (ADD 225 HP (168 KW) TRACTOR)	16	HR	219
GEN T50Z7700 DUMP TRUCK, HIGHWAY, 10 - 13 CY (7.6 - 9.9 M3) DUMP BODY, 35,000 LBS (15,900 KG) GVW, 2 AXLE, 4X2	16	HR	0
GEN T50Z7700 DUMP TRUCK, HIGHWAY, 10 - 13 CY (7.6 - 9.9 M3) DUMP BODY, 35,000 LBS (15,900 KG) GVW, 2 AXLE, 4X2	16	HR	0
ODMDS ODMDS Disposal			
090115 Mechanical Dredging			
09011502 Site Work			
Dredging			
USR Dredging (CEDEP)	2,000	CY	105,265
090199 Associated General Items			
As-Builts			

Description	Quantity	UOM	ContractCost
USR SURV-CADD Survey (CADD)	40	HR	4,819
USR CIV-STR-CADD Civil / Struct Design Team CADD	120	HR	33,564
BEACH Dispose at Haleiwa Beach Park			
Dredging			
Dredging			
USR Dredging (CEDEP)	2,433	CY	52,285
Hauling Beach Material			
Unload Scow and Dewater			
USR DRE-OFFL Off-Loading w/ Cat 945B from Barge to shore	47	HR	57,420
USR XEQOP-GP12 Outside Equip Operator, Gp 12 (9-07)	47	HR	9,226
GEN T15Z6570 TRACTOR, CRAWLER (DOZER), 300-340 HP (224-254 KW), POWERSHIFT, W/UNIVERSAL BLADE	55	HR	25,486
MAP T10CA013 TRACTOR ATTACHMENTS, BLADE, UNIVERSAL, HYDRAULIC, FOR D7, 10.09 CY (ADD D7 TRACTOR)	55	HR	1,069
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	55	HR	10,631
Load Trucks			
HNC 312316440220 Excavate and load, bank measure, light material, 1-1/2 C.Y. bucket, wheeled loader	2,000	BCY	7,909
Haul including road flaggers			
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1 (8/31/15)	60	HR	8,849
RSM 312323200018 Cycle hauling(wait, load, travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 10 min wait/load/unload, 8 C.Y. truck, cycle 2 miles, 15MPH, excludes loading equipment	2,500	LCY	18,689
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1 (8/31/15)	60	HR	8,849
RSM 312323170020 Fill, dumped material, spread, by dozer, excludes compaction	2,500	LCY	10,299
Site Work			
Land Survey & Layout			
USR Survey Crew	1	DAY	5,238
BMPs			
USR Geotextile (for Construction Entrance)	200	SY	421
USR Temp Construction Safety Fence	4,000	SY	8,421
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1	80	HR	11,799
USR Surge Mateiral	130	EA	14,279
Dike Construction & Dewater			
Silt Fence			
RSM 312513101120 Erosion control, silt fence, polypropylene, 3' high, includes 7.5' posts	1,060	LF	14,424
Construct Berms			
De-watering / Settling Basin			
USR True Dam Sediment Filter	24	EA	8,787
USR Sandbags	520	EA	476
RSM 331113350300 Public Water Utility Distribution Piping, piping HDPE, butt fusion joints, 40' lengths, 8" diameter, SDR 21	50	LF	2,244
De-Watering Berm			
RSM 015613600400 Tarpaulins, reinforced polyethylene, clear, 5.5 mils thick	14,000	SF	4,613
RSM 312316462000 Excavating, bulk, dozer, open site, bank measure, sand and gravel, 80 H.P. dozer, 50' haul	3,733	BCY	23,261
HNC 312213100210 Shape enbankment, slope greater than 1 in 4, by machine	1,556	SY	4,869

Description	Quantity	UOM	ContractCost
Sediment Drying Area			
USR DRE-LND Land Crew	480	HR	296,876
Final Cleanup of COSA Areas			
MIL X-LABORER Outside Laborers, (Semi-Skilled)	16	HR	2,360
MIL B-EQOPRLT Equip. Operators, Light	16	HR	3,091
EP B15EC003 STREET SWEEPER, 12' BROOM PATH, 4.5 CY HOPPER, 350 GAL WATER TANK, SELF PROPELLED	16	HR	3,363
Road Repair			
RSM 320130106260 Site maintenance, road & walk maintenance, sidewalk, brick pavers, steam cleaning	9,600	SF	14,331
RSM 321216190300 Cold-mix asphalt paving, well graded granular aggregate, 0.5 gallons asphalt/S.Y. per inch of depth, 4" course, rotary plant mixed in place, compacted	535	SY	50,669
As-Builts			
USR SURV-CADD Survey (CADD)	40	HR	4,819
USR CIV-STR-CADD Civil / Struct Design Team CADD	120	HR	33,564
Alt 2a Beneficial Use from Federal Navigation Channel with Additional Deepening to 13’ Depth			
M&D Mobilization and Demobilization			
M&D Mob, Demob & Preparatory Work			
Mob/Demob (Marine)			
USR Mob/Demob (CEDEP)	1	LS	662,466
LAND Mob/Demob (Land)			
GEN T15Z6570 TRACTOR, CRAWLER (DOZER), 300-340 HP (224-254 KW), POWERSHIFT, W/UNIVERSAL BLADE	16	HR	7,443
PTC R50Z5600 ROLLER, VIBRATORY, SELF-PROPELLED, SINGLE DRUM, SMOOTH, 4.6 TON (4.2 MT), 48" (1.2 M) WIDE, SOIL COMPACTOR	16	HR	1,461
PTC T15Z6440 TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	16	HR	1,461
PTC T50Z7580 TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	16	HR	1,982
MAP T40RS002 TRUCK OPTIONS, WATER TANK, 3,000 GAL (ADD 40,000 GVW TRUCK)	16	HR	298
MIL B-TRKDVRHV Truck Drivers, Heavy	16	HR	3,110
USR Trucking w/ Low Boy, Mob/Demob	16	HR	6,151
USR DRE-OFFL Off-Loading w/ Cat 945B from Barge to shore	16	HR	19,636
EP H25KC020 HYDRAULIC EXCAVATOR, CRAWLER, 53,400 LBS, 2.5 CY BUCKET, 39' MAX DIGGING DEPTH, LONG REACH BOOM	16	HR	2,441
GEN S25Z6010 SCRAPER, TOWED, 9-12 CY (7-9 M3), 16 TON (14.5 MT) (ADD 225 HP (168 KW) TRACTOR)	16	HR	219
GEN T50Z7700 DUMP TRUCK, HIGHWAY, 10 - 13 CY (7.6 - 9.9 M3) DUMP BODY, 35,000 LBS (15,900 KG) GVW, 2 AXLE, 4X2	16	HR	0
GEN T50Z7700 DUMP TRUCK, HIGHWAY, 10 - 13 CY (7.6 - 9.9 M3) DUMP BODY, 35,000 LBS (15,900 KG) GVW, 2 AXLE, 4X2	16	HR	0
ODMDS ODMDS Disposal			
090115 Mechanical Dredging			
09011502 Site Work			
Dredging			
USR Dredging (CEDEP)	2,000	CY	105,265
090199 Associated General Items			
As-Builts			
USR SURV-CADD Survey (CADD)	40	HR	4,819
USR CIV-STR-CADD Civil / Struct Design Team CADD	120	HR	33,564
BEACH Dispose at Haleiwa Beach Park			

Description	Quantity	UOM	ContractCost
Dredging			
Dredging			
USR Dredging (CEDEP)	2,433	CY	52,285
Hauling Beach Material			
Unload Scow and Dewater			
USR DRE-OFFL Off-Loading w/ Cat 945B from Barge to shore	47	HR	57,420
USR XEQOP-GP12 Outside Equip Operator, Gp 12 (9-07)	47	HR	9,226
GEN T15Z6570 TRACTOR, CRAWLER (DOZER), 300-340 HP (224-254 KW), POWERSHIFT, W/UNIVERSAL BLADE	55	HR	25,486
MAP T10CA013 TRACTOR ATTACHMENTS, BLADE, UNIVERSAL, HYDRAULIC, FOR D7, 10.09 CY (ADD D7 TRACTOR)	55	HR	1,069
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	55	HR	10,631
Load Trucks			
HNC 312316440220 Excavate and load, bank measure, light material, 1-1/2 C.Y. bucket, wheeled loader	2,000	BCY	7,909
Haul including road flaggers			
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1 (8/31/15)	60	HR	8,849
RSM 312323200018 Cycle hauling(wait, load, travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 10 min wait/load/unload, 8 C.Y. truck, cycle 2 miles, 15MPH, excludes loading equipment	2,500	LCY	18,689
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1 (8/31/15)	60	HR	8,849
RSM 312323170020 Fill, dumped material, spread, by dozer, excludes compaction	2,500	LCY	10,299
Site Work			
Land Survey & Layout			
USR Survey Crew	1	DAY	5,238
BMPs			
USR Geotextile (for Construction Entrance)	200	SY	421
USR Temp Construction Safety Fence	4,000	SY	8,421
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1	80	HR	11,799
USR Surge Mateiral	130	EA	14,279
Dike Construction & Dewater			
Silt Fence			
RSM 312513101120 Erosion control, silt fence, polypropylene, 3' high, includes 7.5' posts	1,060	LF	14,424
Construct Berms			
De-watering / Settling Basin			
USR True Dam Sediment Filter	24	EA	8,787
USR Sandbags	520	EA	476
RSM 331113350300 Public Water Utility Distribution Piping, piping HDPE, butt fusion joints, 40' lengths, 8" diameter, SDR 21	50	LF	2,244
De-Watering Berm			
RSM 015613600400 Tarpaulins, reinforced polyethylene, clear, 5.5 mils thick	14,000	SF	4,613
RSM 312316462000 Excavating, bulk, dozer, open site, bank measure, sand and gravel, 80 H.P. dozer, 50' haul	3,733	BCY	23,261
HNC 312213100210 Shape enbankment, slope greater than 1 in 4, by machine	1,556	SY	4,869
Sediment Drying Area			
USR DRE-LND Land Crew	480	HR	296,876
Final Cleanup of COSA Areas			

Description	Quantity	UOM	ContractCost
MIL X-LABORER Outside Laborers, (Semi-Skilled)	16	HR	2,360
MIL B-EQOPRLT Equip. Operators, Light	16	HR	3,091
EP B15EC003 STREET SWEEPER, 12' BROOM PATH, 4.5 CY HOPPER, 350 GAL WATER TANK, SELF PROPELLED	16	HR	3,363
Road Repair			
RSM 320130106260 Site maintenance, road & walk maintenance, sidewalk, brick pavers, steam cleaning	9,600	SF	14,331
RSM 321216190300 Cold-mix asphalt paving, well graded granular aggregate, 0.5 gallons asphalt/S.Y. per inch of depth, 4" course, rotary plant mixed in place, compacted	535	SY	50,669
As-Builts			
USR SURV-CADD Survey (CADD)	40	HR	4,819
USR CIV-STR-CADD Civil / Struct Design Team CADD	120	HR	33,564
BEACH BEACH Dispose at Haleiwa Beach Park with Addtional Deepening to 13' Depth			
Dredging			
Dredging			
USR Dredging (CEDEP)	1,705	CY	36,640
Hauling Beach Material			
Unload Scow and Dewater			
USR DRE-OFFL Off-Loading w/ Cat 945B from Barge to shore	33	HR	40,239
USR XEQOP-GP12 Outside Equip Operator, Gp 12 (9-07)	33	HR	6,465
GEN T15Z6570 TRACTOR, CRAWLER (DOZER), 300-340 HP (224-254 KW), POWERSHIFT, W/UNIVERSAL BLADE	41	HR	18,974
MAP T10CA013 TRACTOR ATTACHMENTS, BLADE, UNIVERSAL, HYDRAULIC, FOR D7, 10.09 CY (ADD D7 TRACTOR)	41	HR	796
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	41	HR	7,915
Load Trucks			
HNC 312316440220 Excavate and load, bank measure, light material, 1-1/2 C.Y. bucket, wheeled loader	2,000	BCY	7,909
Haul including road flaggers			
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1 (8/31/15)	60	HR	8,849
RSM 312323200018 Cycle hauling(wait, load, travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 10 min wait/load/unload, 8 C.Y. truck, cycle 2 miles, 15MPH, excludes loading equipment	2,500	LCY	18,689
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1 (8/31/15)	60	HR	8,849
RSM 312323170020 Fill, dumped material, spread, by dozer, excludes compaction	2,500	LCY	10,299
Alt 3 Beneficial Use From Federal Navigation Channel with Additional Deepening and Settling Basin			
M&D Mobilization and Demobilization			
M&D Mob, Demob & Preparatory Work			
MAR Mob/Demob (Marine)			
USR Mob/Demob (CEDEP)	1	LS	662,466
LAND Mob/Demob (Land)			
GEN T15Z6570 TRACTOR, CRAWLER (DOZER), 300-340 HP (224-254 KW), POWERSHIFT, W/UNIVERSAL BLADE	16	HR	7,443
PTC R50Z5600 ROLLER, VIBRATORY, SELF-PROPELLED, SINGLE DRUM, SMOOTH, 4.6 TON (4.2 MT), 48" (1.2 M) WIDE, SOIL COMPACTOR	16	HR	1,461
PTC T15Z6440 TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	16	HR	1,461
PTC T50Z7580 TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	16	HR	1,982
MAP T40RS002 TRUCK OPTIONS, WATER TANK, 3,000 GAL (ADD 40,000 GVW TRUCK)	16	HR	298
MIL B-TRKDVRHV Truck Drivers, Heavy	16	HR	3,110
USR Trucking w/ Low Boy, Mob/Demob	16	HR	6,151

Description	Quantity	UOM	ContractCost
USR DRE-OFFL Off-Loading w/ Cat 945B from Barge to shore	16	HR	19,636
EP H25KC020 HYDRAULIC EXCAVATOR, CRAWLER, 53,400 LBS, 2.5 CY BUCKET, 39' MAX DIGGING DEPTH, LONG REACH BOOM	16	HR	2,441
GEN S25Z6010 SCRAPER, TOWED, 9-12 CY (7-9 M3), 16 TON (14.5 MT) (ADD 225 HP (168 KW) TRACTOR)	16	HR	219
GEN T50Z7700 DUMP TRUCK, HIGHWAY, 10 - 13 CY (7.6 - 9.9 M3) DUMP BODY, 35,000 LBS (15,900 KG) GVW, 2 AXLE, 4X2	16	HR	0
GEN T50Z7700 DUMP TRUCK, HIGHWAY, 10 - 13 CY (7.6 - 9.9 M3) DUMP BODY, 35,000 LBS (15,900 KG) GVW, 2 AXLE, 4X2	16	HR	0
ODMDS ODMDS Disposal			
090115 Mechanical Dredging			
09011502 Site Work			
Dredging			
USR Dredging (CEDEP)	2,000	CY	105,265
090199 Associated General Items			
As-Builts			
USR SURV-CADD Survey (CADD)	40	HR	4,819
USR CIV-STR-CADD Civil / Struct Design Team CADD	120	HR	33,564
BEACH Dispose at Haleiwa Beach Park			
Dredging			
Dredging			
USR Dredging (CEDEP)	2,433	CY	52,285
Hauling Beach Material			
Unload Scow and Dewater			
USR DRE-OFFL Off-Loading w/ Cat 945B from Barge to shore	47	HR	57,420
USR XEQOP-GP12 Outside Equip Operator, Gp 12 (9-07)	47	HR	9,226
GEN T15Z6570 TRACTOR, CRAWLER (DOZER), 300-340 HP (224-254 KW), POWERSHIFT, W/UNIVERSAL BLADE	55	HR	25,486
MAP T10CA013 TRACTOR ATTACHMENTS, BLADE, UNIVERSAL, HYDRAULIC, FOR D7, 10.09 CY (ADD D7 TRACTOR)	55	HR	1,069
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	55	HR	10,631
Load Trucks			
HNC 312316440220 Excavate and load, bank measure, light material, 1-1/2 C.Y. bucket, wheeled loader	3,041	BCY	12,026
Haul including road flaggers			
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1 (8/31/15)	60	HR	8,849
RSM 312323200018 Cycle hauling(wait, load, travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 10 min wait/load/unload, 8 C.Y. truck, cycle 2 miles, 15MPH, excludes loading equipment	3,041	LCY	22,735
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1 (8/31/15)	60	HR	8,849
RSM 312323170020 Fill, dumped material, spread, by dozer, excludes compaction	3,041	LCY	12,529
Site Work			
Land Survey & Layout			
USR Survey Crew	1	DAY	5,238
BMPs			
USR Geotextile (for Construction Entrance)	200	SY	421
USR Temp Construction Safety Fence	4,000	SY	8,421
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1	80	HR	11,799
USR Surge Mateiral	130	EA	14,279

Description	Quantity	UOM	ContractCost
Dike Construction & Dewater			
Silt Fence			
RSM 312513101120 Erosion control, silt fence, polypropylene, 3' high, includes 7.5' posts	1,060	LF	14,424
Construct Berms			
De-watering / Settling Basin			
USR True Dam Sediment Filter	24	EA	8,787
USR Sandbags	520	EA	476
RSM 331113350300 Public Water Utility Distribution Piping, piping HDPE, butt fusion joints, 40' lengths, 8" diameter, SDR 21	50	LF	2,244
De-Watering Berm			
RSM 015613600400 Tarpaulins, reinforced polyethylene, clear, 5.5 mils thick	14,000	SF	4,613
RSM 312316462000 Excavating, bulk, dozer, open site, bank measure, sand and gravel, 80 H.P. dozer, 50' haul	3,733	BCY	23,261
HNC 312213100210 Shape enbankment, slope greater than 1 in 4, by machine	1,556	SY	4,869
Sediment Drying Area			
USR DRE-LND Land Crew	480	HR	296,876
Final Cleanup of COSA Areas			
MIL X-LABORER Outside Laborers, (Semi-Skilled)	16	HR	2,360
MIL B-EQOPRLT Equip. Operators, Light	16	HR	3,091
EP B15EC003 STREET SWEEPER, 12' BROOM PATH, 4.5 CY HOPPER, 350 GAL WATER TANK, SELF PROPELLED	16	HR	3,363
Road Repair			
RSM 321216190300 Cold-mix asphalt paving, well graded granular aggregate, 0.5 gallons asphalt/S.Y. per inch of depth, 4" course, rotary plant mixed in place, compacted	535	SY	50,669
RSM 320130106260 Site maintenance, road & walk maintenance, sidewalk, brick pavers, steam cleaning	9,600	SF	14,331
As-Builts			
USR SURV-CADD Survey (CADD)	40	HR	4,819
USR CIV-STR-CADD Civil / Struct Design Team CADD	120	HR	33,564
BEACH BEACH Dispose at Haleiwa Beach Park with Addtional Deepening to 13' Depth			
Dredging			
Dredging			
USR Dredging (CEDEP)	1,705	CY	36,640
Hauling Beach Material			
Unload Scow and Dewater			
USR DRE-OFFL Off-Loading w/ Cat 945B from Barge to shore	33	HR	40,239
USR XEQOP-GP12 Outside Equip Operator, Gp 12 (9-07)	33	HR	6,465
GEN T15Z6570 TRACTOR, CRAWLER (DOZER), 300-340 HP (224-254 KW), POWERSHIFT, W/UNIVERSAL BLADE	41	HR	18,974
MAP T10CA013 TRACTOR ATTACHMENTS, BLADE, UNIVERSAL, HYDRAULIC, FOR D7, 10.09 CY (ADD D7 TRACTOR)	41	HR	796
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	41	HR	7,915
Load Trucks			
HNC 312316440220 Excavate and load, bank measure, light material, 1-1/2 C.Y. bucket, wheeled loader	1,705	BCY	6,742
Haul including road flaggers			
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1 (8/31/15)	60	HR	8,849
RSM 312323200018 Cycle hauling(wait, load, travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 10 min wait/load/unload, 8	2,131	LCY	15,932

Description	Quantity	UOM	ContractCost
C.Y. truck, cycle 2 miles, 15MPH, excludes loading equipment			
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1 (8/31/15)	60	HR	8,849
RSM 312323170020 Fill, dumped material, spread, by dozer, excludes compaction	2,131	LCY	8,780
BASIN Remove Sand from Settling Basin Long Reach Excavator (max reach 50ft)			
Remove Sand			
Land Survey & Layout			
USR Survey Crew	1	DAY	5,238
BMPs			
USR Temp Construction Safety Fence	4,000	SY	8,421
USR Silt Fence	8,000	LF	25,629
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1 (8/31/15)	24	HR	3,540
Dike Construction & De-water			
Silt Fence			
RSM 312513101120 Erosion control, silt fence, polypropylene, 3' high, includes 7.5' posts	1,060	LF	14,424
Construct Berms			
De-watering / Settling Basin			
USR True Dam Sediment Filter	24	EA	8,787
USR Sandbags	520	EA	476
RSM 331113350300 Public Water Utility Distribution Piping, piping HDPE, butt fusion joints, 40' lengths, 8" diameter, SDR 21	50	LF	2,244
De-Watering Berm			
RSM 015613600400 Tarpaulins, reinforced polyethylene, clear, 5.5 mils thick	14,000	SF	4,613
RSM 312316462000 Excavating, bulk, dozer, open site, bank measure, sand and gravel, 80 H.P. dozer, 50' haul	3,733	BCY	23,261
HNC 312213100210 Shape enbankment, slope greater than 1 in 4, by machine	1,556	SY	4,869
Sediment Drying Area			
USR DRE-LND Land Crew	40	HR	24,740
De-water			
USR DOZ-D6 Dozer D6 Crew	30	HR	14,322
USR LDR-950 Cat 950G Ldr 3 CY, Wh Crew	30	HR	11,702
USR UNIEX1 1 CY Backhoe Cat 318B Ave	30	HR	14,937
Dredging			
EP H25KC020 HYDRAULIC EXCAVATOR, CRAWLER, 53,400 LBS, 2.5 CY BUCKET, 39' MAX DIGGING DEPTH, LONG REACH BOOM	22	HR	3,356
MIL B-LABORERG Laborers, General (Lowest paid) LAB II (9/3/18)	22	HR	3,093
USR Hauling	45	HR	13,973
USR Rubber tires for traction on beach	1	LS	1,831
USR Dredging (CEDEP)	2,200	CY	55,658
Alt 4 Beneficial Use From Federal Navigation Channel with Additional Deepening, Settling Basin, and Offshore Sand Deposit			
M&D Mobilization and Demobilization			
M&D Mob, Demob & Preparatory Work			
MAR Mob/Demob (Marine)			
USR Mob/Demob (CEDEP)	1	LS	662,466
LAND Mob/Demob (Land)			

Description	Quantity	UOM	ContractCost
GEN T15Z6570 TRACTOR, CRAWLER (DOZER), 300-340 HP (224-254 KW), POWERSHIFT, W/UNIVERSAL BLADE	16	HR	7,443
PTC R50Z5600 ROLLER, VIBRATORY, SELF-PROPELLED, SINGLE DRUM, SMOOTH, 4.6 TON (4.2 MT), 48" (1.2 M) WIDE, SOIL COMPACTOR	16	HR	1,461
PTC T15Z6440 TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	16	HR	1,461
PTC T50Z7580 TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	16	HR	1,982
MAP T40RS002 TRUCK OPTIONS, WATER TANK, 3,000 GAL (ADD 40,000 GVW TRUCK)	16	HR	298
MIL B-TRKDVRHV Truck Drivers, Heavy	16	HR	3,110
USR Trucking w/ Low Boy, Mob/Demob	16	HR	6,151
USR DRE-OFFL Off-Loading w/ Cat 945B from Barge to shore	16	HR	19,636
EP H25KC020 HYDRAULIC EXCAVATOR, CRAWLER, 53,400 LBS, 2.5 CY BUCKET, 39' MAX DIGGING DEPTH, LONG REACH BOOM	16	HR	2,441
GEN S25Z6010 SCRAPER, TOWED, 9-12 CY (7-9 M3), 16 TON (14.5 MT) (ADD 225 HP (168 KW) TRACTOR)	16	HR	219
GEN T50Z7700 DUMP TRUCK, HIGHWAY, 10 - 13 CY (7.6 - 9.9 M3) DUMP BODY, 35,000 LBS (15,900 KG) GVW, 2 AXLE, 4X2	16	HR	0
GEN T50Z7700 DUMP TRUCK, HIGHWAY, 10 - 13 CY (7.6 - 9.9 M3) DUMP BODY, 35,000 LBS (15,900 KG) GVW, 2 AXLE, 4X2	16	HR	0
ODMDS ODMDS Disposal			
090115 Mechanical Dredging			
09011502 Site Work			
Dredging			
USR Dredging (CEDEP)	2,000	CY	105,265
090199 Associated General Items			
As-Builts			
USR SURV-CADD Survey (CADD)	40	HR	4,819
USR CIV-STR-CADD Civil / Struct Design Team CADD	120	HR	33,564
BEACH Dispose at Haleiwa Beach Park			
Dredging			
Dredging			
USR Dredging (CEDEP)	2,433	CY	52,285
Hauling Beach Material			
Unload Scow and Dewater			
USR DRE-OFFL Off-Loading w/ Cat 945B from Barge to shore	47	HR	57,420
USR XEQOP-GP12 Outside Equip Operator, Gp 12 (9-07)	47	HR	9,226
GEN T15Z6570 TRACTOR, CRAWLER (DOZER), 300-340 HP (224-254 KW), POWERSHIFT, W/UNIVERSAL BLADE	55	HR	25,486
MAP T10CA013 TRACTOR ATTACHMENTS, BLADE, UNIVERSAL, HYDRAULIC, FOR D7, 10.09 CY (ADD D7 TRACTOR)	55	HR	1,069
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	55	HR	10,631
Load Trucks			
HNC 312316440220 Excavate and load, bank measure, light material, 1-1/2 C.Y. bucket, wheeled loader	3,041	BCY	12,026
Haul including road flaggers			
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1 (8/31/15)	60	HR	8,849
RSM 312323200018 Cycle hauling(wait, load, travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 10 min wait/load/unload, 8 C.Y. truck, cycle 2 miles, 15MPH, excludes loading equipment	3,041	LCY	22,735
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1 (8/31/15)	60	HR	8,849
RSM 312323170020 Fill, dumped material, spread, by dozer, excludes compaction	3,041	LCY	12,529
Site Work			
Land Survey & Layout			

Description	Quantity	UOM	ContractCost
USR Survey Crew	1	DAY	5,238
BMPs			
USR Geotextile (for Construction Entrance)	200	SY	421
USR Temp Construction Safety Fence	4,000	SY	8,421
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1	80	HR	11,799
USR Surge Mateiral	130	EA	14,279
Dike Construction & Dewater			
Silt Fence			
RSM 312513101120 Erosion control, silt fence, polypropylene, 3' high, includes 7.5' posts	1,060	LF	14,424
Construct Berms			
De-watering / Settling Basin			
USR True Dam Sediment Filter	24	EA	8,787
USR Sandbags	520	EA	476
RSM 331113350300 Public Water Utility Distribution Piping, piping HDPE, butt fusion joints, 40' lengths, 8" diameter, SDR 21	50	LF	2,244
De-Watering Berm			
RSM 015613600400 Tarpaulins, reinforced polyethylene, clear, 5.5 mils thick	14,000	SF	4,613
RSM 312316462000 Excavating, bulk, dozer, open site, bank measure, sand and gravel, 80 H.P. dozer, 50' haul	3,733	BCY	23,261
HNC 312213100210 Shape enbankment, slope greater than 1 in 4, by machine	1,556	SY	4,869
Sediment Drying Area			
USR DRE-LND Land Crew	480	HR	296,876
Final Cleanup of COSA Areas			
MIL X-LABORER Outside Laborers, (Semi-Skilled)	16	HR	2,360
MIL B-EQOPRLT Equip. Operators, Light	16	HR	3,091
EP B15EC003 STREET SWEEPER, 12' BROOM PATH, 4.5 CY HOPPER, 350 GAL WATER TANK, SELF PROPELLED	16	HR	3,363
Road Repair			
RSM 321216190300 Cold-mix asphalt paving, well graded granular aggregate, 0.5 gallons asphalt/S.Y. per inch of depth, 4" course, rotary plant mixed in place, compacted	535	SY	50,669
RSM 320130106260 Site maintenance, road & walk maintenance, sidewalk, brick pavers, steam cleaning	9,600	SF	14,331
As-Builts			
USR SURV-CADD Survey (CADD)	40	HR	4,819
USR CIV-STR-CADD Civil / Struct Design Team CADD	120	HR	33,564
BEACH BEACH Dispose at Haleiwa Beach Park with Addtional Deepening to 13' Depth			
Dredging			
Dredging			
USR Dredging (CEDEP)	1,705	CY	36,640
Hauling Beach Material			
Unload Scow and Dewater			
USR DRE-OFFL Off-Loading w/ Cat 945B from Barge to shore	33	HR	40,239
USR XEQOP-GP12 Outside Equip Operator, Gp 12 (9-07)	33	HR	6,465
GEN T15Z6570 TRACTOR, CRAWLER (DOZER), 300-340 HP (224-254 KW), POWERSHIFT, W/UNIVERSAL BLADE	41	HR	18,974
MAP T10CA013 TRACTOR ATTACHMENTS, BLADE, UNIVERSAL, HYDRAULIC, FOR D7, 10.09 CY (ADD D7 TRACTOR)	41	HR	796
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	41	HR	7,915

Description	Quantity	UOM	ContractCost
Load Trucks			
HNC 312316440220 Excavate and load, bank measure, light material, 1-1/2 C.Y. bucket, wheeled loader	1,705	BCY	6,742
Haul including road flaggers			
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1 (8/31/15)	60	HR	8,849
RSM 312323200018 Cycle hauling(wait, load, travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 10 min wait/load/unload, 8 C.Y. truck, cycle 2 miles, 15MPH, excludes loading equipment	2,131	LCY	15,932
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1 (8/31/15)	60	HR	8,849
RSM 312323170020 Fill, dumped material, spread, by dozer, excludes compaction	2,131	LCY	8,780
BASIN Remove Sand from Settling Basin Long Reach Excavator (max reach 50ft)			
Remove Sand			
Land Survey & Layout			
USR Survey Crew	1	DAY	5,238
BMPs			
USR Temp Construction Safety Fence	4,000	SY	8,421
USR Silt Fence	8,000	LF	25,629
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1 (8/31/15)	24	HR	3,540
Dike Construction & De-water			
Silt Fence			
RSM 312513101120 Erosion control, silt fence, polypropylene, 3' high, includes 7.5' posts	1,060	LF	14,424
Construct Berms			
De-watering / Settling Basin			
USR True Dam Sediment Filter	24	EA	8,787
USR Sandbags	520	EA	476
RSM 331113350300 Public Water Utility Distribution Piping, piping HDPE, butt fusion joints, 40' lengths, 8" diameter, SDR 21	50	LF	2,244
De-Watering Berm			
RSM 015613600400 Tarpaulins, reinforced polyethylene, clear, 5.5 mils thick	14,000	SF	4,613
RSM 312316462000 Excavating, bulk, dozer, open site, bank measure, sand and gravel, 80 H.P. dozer, 50' haul	3,733	BCY	23,261
HNC 312213100210 Shape enbankment, slope greater than 1 in 4, by machine	1,556	SY	4,869
Sediment Drying Area			
USR DRE-LND Land Crew	40	HR	24,740
De-water			
USR DOZ-D6 Dozer D6 Crew	30	HR	14,322
USR LDR-950 Cat 950G Ldr 3 CY, Wh Crew	30	HR	11,702
USR UNIEX1 1 CY Backhoe Cat 318B Ave	30	HR	14,937
Dredging			
EP H25KC020 HYDRAULIC EXCAVATOR, CRAWLER, 53,400 LBS, 2.5 CY BUCKET, 39' MAX DIGGING DEPTH, LONG REACH BOOM	22	HR	3,356
MIL B-LABORERG Laborers, General (Lowest paid) LAB II (9/3/18)	22	HR	3,093
USR Hauling	45	HR	13,973
USR Rubber tires for traction on beach	1	LS	1,831
USR Dredging (CEDEP)	2,200	CY	55,658
OFF Offshore Material to Beach			

Description	Quantity	UOM	ContractCost
Dredging			
Dredging			
USR Dredging (CEDEP)	15,000	CY	311,713
Hauling Beach Material			
Unload Scow and Dewater			
USR DRE-OFFL Off-Loading w/ Cat 945B from Barge to shore	144	HR	177,004
USR XEQOP-GP12 Outside Equip Operator, Gp 12 (9-07)	144	HR	28,439
GEN T15Z6570 TRACTOR, CRAWLER (DOZER), 300-340 HP (224-254 KW), POWERSHIFT, W/UNIVERSAL BLADE	152	HR	70,814
MAP T10CA013 TRACTOR ATTACHMENTS, BLADE, UNIVERSAL, HYDRAULIC, FOR D7, 10.09 CY (ADD D7 TRACTOR)	152	HR	2,971
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	152	HR	29,540
Load Trucks			
HNC 312316440220 Excavate and load, bank measure, light material, 1-1/2 C.Y. bucket, wheeled loader	15,000	BCY	59,315
Haul including road flaggers			
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1 (8/31/15)	424	HR	62,535
RSM 312323200018 Cycle hauling(wait, load, travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 10 min wait/load/unload, 8 C.Y. truck, cycle 2 miles, 15MPH, excludes loading equipment	18,750	LCY	140,165
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1 (8/31/15)	424	HR	62,535
RSM 312323170020 Fill, dumped material, spread, by dozer, excludes compaction	18,750	LCY	77,246
Site Work			
Land Survey & Layout			
USR Survey Crew	5	DAY	26,188
BMPs			
USR Geotextile (for Construction Entrance)	200	SY	421
USR Temp Construction Safety Fence	4,000	SY	8,421
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1 (8/31/15)	80	HR	11,799
Dike Construction			
Silt Fence			
RSM 312513101120 Erosion control, silt fence, polypropylene, 3' high, includes 7.5' posts	1,060	LF	14,424
Construct Berms			
De-watering / Settling Basin			
USR True Dam Sediment Filter	24	EA	8,787
USR Sandbags	520	EA	476
RSM 331113350300 Public Water Utility Distribution Piping, piping HDPE, butt fusion joints, 40' lengths, 8" diameter, SDR 21	50	LF	2,244
De-Watering Berm			
RSM 015613600400 Tarpaulins, reinforced polyethylene, clear, 5.5 mils thick	28,000	SF	9,226
RSM 312316462000 Excavating, bulk, dozer, open site, bank measure, sand and gravel, 80 H.P. dozer, 50' haul	3,733	BCY	23,261
HNC 312213100210 Shape enbankment, slope greater than 1 in 4, by machine	3,111	SY	9,737
Sediment Drying Area			
USR DRE-LND Land Crew	480	HR	296,876
De-water			
USR DOZ-D6 Dozer D6 Crew	80	HR	38,191

Description	Quantity	UOM	ContractCost
USR LDR-950 Cat 950G Ldr 3 CY, Wh Crew	80	HR	31,205
USR UNIEX1 1 CY Backhoe Cat 318B Ave	80	HR	39,832
Final Cleanup of COSA Areas			
MIL X-LABORER Outside Laborers, (Semi-Skilled)	120	HR	17,698
MIL B-EQOPRLT Equip. Operators, Light	16	HR	3,091
EP B15EC003 STREET SWEEPER, 12' BROOM PATH, 4.5 CY HOPPER, 350 GAL WATER TANK, SELF PROPELLED	16	HR	3,363
As-Builts			
USR SURV-CADD Survey (CADD)	40	HR	4,819
USR CIV-STR-CADD Civil / Struct Design Team CADD	120	HR	33,564

MCACES Detailed Estimates
Groin Option

Summary Report
With Access Groin

Estimated by EC-S
Designed by
Prepared by Kim Callan
Preparation Date 5/22/2020
Effective Date of Pricing 5/22/2020
Estimated Construction Time Days

Description	Quantity	UOM	ContractCost
Alt 1 No Action Alternative/ Base Plan - Dredge Channel Haul to Ocean Dredged Material Disposal Site (ODMDS)	**1**	**EA**	**893.8**
M&D Mob, Demob & Preparatory Work	**1**	**JOB**	**662.5**
ODMDS ODMDS Disposal	**4,000**	**CY**	**231.4**
Alt 2 Beneficial Use from Federal Navigation Channel to 12' Depth	**1**	**EA**	**1,485.0**
M&D Mobilization and Demobilization	**1**	**EA**	**683.1**
ODMDS ODMDS Disposal	**2,000**	**CY**	**143.6**
BEACH Dispose at Haleiwa Beach Park	**2,433**	**CY**	**658.3**
Alt 2A Beneficial Use from Federal Navigation Channel with Additional Deepening to 13' Depth	**1**	**EA**	**1,568.2**
M&D Mobilization and Demobilization	**1**	**EA**	**677.4**
ODMDS ODMDS Disposal	**2,000**	**CY**	**143.6**
BEACH Dispose at Haleiwa Beach Park	**7,166**	**CY**	**658.3**
BEACH Dispose at Haleiwa Beach Park with Addtional Deepening to 13' Depth	**1,705**	**CY**	**88.9**
Alt 3 Beneficial Use From Federal Navigation Channel with Additional Deepening and Settling Basin	**1**	**EA**	**1,906.0**
M&D Mobilization and Demobilization	**1**	**EA**	**705.2**
ODMDS ODMDS Disposal	**2,000**	**CY**	**143.6**
BEACH Dispose at Haleiwa Beach Park	**7,166**	**CY**	**658.3**
BEACH Dispose at Haleiwa Beach Park with Addtional Deepening to 13' Depth	**1,705**	**CY**	**88.9**
BASIN Remove Sand from Settling Basin Long Reach Excavator (max reach 50ft)	**2,200**	**CY**	**309.9**
Alt 4 Beneficial Use From Federal Navigation Channel with Additional Deepening, Settling Basin, and Offshore Sand Deposit	**1**	**EA**	**2,807.4**
M&D Mobilization and Demobilization	**1**	**EA**	**706.9**
ODMDS ODMDS Disposal	**2,000**	**CY**	**143.6**
BEACH Dispose at Haleiwa Beach Park	**7,166**	**CY**	**658.3**
BEACH Dispose at Haleiwa Beach Park with Addtional Deepening to 13' Depth	**1,705**	**CY**	**88.9**
BASIN Remove Sand from Settling Basin Long Reach Excavator (max reach 50ft)	**2,200**	**CY**	**309.9**

Description	Quantity	UOM	ContractCost
OFF Offshore Material to Beach	**15,000**	**CY**	**899.8**

Description	Quantity	UOM	ContractCost
Details			
Alt 1 No Action Alternative/ Base Plan - Dredge Channel Haul to Ocean Dredged Material Disposal Site (ODMDS)			
M&D Mob, Demob & Preparatory Work			
Mob/Demob (Marine)			
USR Mob/Demob (CEDEP)	1	LS	662,466
ODMDS ODMDS Disposal			
090115 Mechanical Dredging			
Dredging			
USR Dredging (CEDEP)	4,000	CY	192,990
09011502 Site Work			
090199 Associated General Items			
As-Builts			
USR SURV-CADD Survey (CADD)	40	HR	4,819
USR CIV-STR-CADD Civil / Struct Design Team CADD	120	HR	33,564
Alt 2 Beneficial Use from Federal Navigation Channel to 12' Depth			
M&D Mobilization and Demobilization			
M&D Mob, Demob & Preparatory Work			
Mob/Demob (Marine)			
USR Mob/Demob (CEDEP)	1	LS	662,466
Mob/Demob (Land)			
GEN T15Z6570 TRACTOR, CRAWLER (DOZER), 300-340 HP (224-254 KW), POWERSHIFT, W/UNIVERSAL BLADE	16	HR	7,443
PTC R50Z5600 ROLLER, VIBRATORY, SELF-PROPELLED, SINGLE DRUM, SMOOTH, 4.6 TON (4.2 MT), 48" (1.2 M) WIDE, SOIL COMPACTOR	16	HR	1,461
PTC T50Z7580 TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	16	HR	1,982
MAP T40RS002 TRUCK OPTIONS, WATER TANK, 3,000 GAL (ADD 40,000 GVW TRUCK)	16	HR	298
MIL B-TRKDVRHV Truck Drivers, Heavy	16	HR	3,110
USR Trucking w/ Low Boy, Mob/Demob	16	HR	6,151
GEN S25Z6010 SCRAPER, TOWED, 9-12 CY (7-9 M3), 16 TON (14.5 MT) (ADD 225 HP (168 KW) TRACTOR)	16	HR	219
ODMDS ODMDS Disposal			
090115 Mechanical Dredging			
Dredging			
USR Dredging (CEDEP)	2,000	CY	105,265
09011502 Site Work			
090199 Associated General Items			
As-Builts			
USR SURV-CADD Survey (CADD)	40	HR	4,819
USR CIV-STR-CADD Civil / Struct Design Team CADD	120	HR	33,564
BEACH Dispose at Haleiwa Beach Park			
Dredging			

Description	Quantity	UOM	ContractCost
Dredge Access Channel			
Dredging			
USR Dredging (CEDEP)	4,733	CY	79,178
Place Access Channel at Haleiwa Beach Park			
GEN S25Z6010 SCRAPER, TOWED, 9-12 CY (7-9 M3), 16 TON (14.5 MT) (ADD 225 HP (168 KW) TRACTOR)	160	HR	2,192
GEN T15Z6520 TRACTOR, CRAWLER (DOZER), 181-250 HP (135-186 KW), POWERSHIFT, LGP, W/UNIVERSAL BLADE	160	HR	39,682
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	160	HR	31,047
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	160	HR	31,047
USR DRE-OFFL Off-Loading w/ Cat 945B from Barge to shore	160	HR	196,357
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	160	HR	31,047
Dredging			
USR Dredging (CEDEP)	2,433	CY	45,842
Place at Haleiwa Beach Park			
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1 (8/31/15)	76	HR	11,209
GEN S25Z6010 SCRAPER, TOWED, 9-12 CY (7-9 M3), 16 TON (14.5 MT) (ADD 225 HP (168 KW) TRACTOR)	76	HR	1,041
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	76	HR	14,747
GEN T15Z6570 TRACTOR, CRAWLER (DOZER), 300-340 HP (224-254 KW), POWERSHIFT, W/UNIVERSAL BLADE	76	HR	35,353
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	76	HR	14,747
Site Work			
Land Survey & Layout			
USR Survey Crew	1	DAY	5,238
BMPs			
USR Geotextile (for Construction Entrance)	200	SY	421
USR Temp Construction Safety Fence	4,000	SY	8,421
USR Silt Fence	8,000	LF	25,629
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1	80	HR	11,799
USR Surge Mateiral	130	EA	14,279
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1	80	HR	11,799
Final Cleanup of COSA Areas			
MIL X-LABORER Outside Laborers, (Semi-Skilled)	16	HR	2,360
MIL B-EQOPRLT Equip. Operators, Light	16	HR	3,091
EP B15EC003 STREET SWEEPER, 12' BROOM PATH, 4.5 CY HOPPER, 350 GAL WATER TANK, SELF PROPELLED	16	HR	3,363
As-Builts			
USR SURV-CADD Survey (CADD)	40	HR	4,819
USR CIV-STR-CADD Civil / Struct Design Team CADD	120	HR	33,564
Alt 2A Beneficial Use from Federal Navigation Channel with Additional Deepening to 13’ Depth			
M&D Mobilization and Demobilization			
M&D Mob, Demob & Preparatory Work			
Mob/Demob (Marine)			
USR Mob/Demob (CEDEP)	1	LS	662,466
Mob/Demob (Land)			
GEN T15Z6570 TRACTOR, CRAWLER (DOZER), 300-340 HP (224-254 KW), POWERSHIFT, W/UNIVERSAL BLADE	16	HR	7,443

Description	Quantity	UOM	ContractCost
PTC R50Z5600 ROLLER, VIBRATORY, SELF-PROPELLED, SINGLE DRUM, SMOOTH, 4.6 TON (4.2 MT), 48" (1.2 M) WIDE, SOIL COMPACTOR	16	HR	1,461
PTC T50Z7580 TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	8	HR	991
MAP T40RS002 TRUCK OPTIONS, WATER TANK, 3,000 GAL (ADD 40,000 GVW TRUCK)	8	HR	149
MIL B-TRKDVRHV Truck Drivers, Heavy	8	HR	1,555
USR Trucking w/ Low Boy, Mob/Demob	8	HR	3,075
GEN S25Z6010 SCRAPER, TOWED, 9-12 CY (7-9 M3), 16 TON (14.5 MT) (ADD 225 HP (168 KW) TRACTOR)	16	HR	219
ODMDS ODMDS Disposal			
090115 Mechanical Dredging			
Dredging			
USR Dredging (CEDEP)	2,000	CY	105,265
09011502 Site Work			
090199 Associated General Items			
As-Builts			
USR SURV-CADD Survey (CADD)	40	HR	4,819
USR CIV-STR-CADD Civil / Struct Design Team CADD	120	HR	33,564
BEACH Dispose at Haleiwa Beach Park			
Dredging			
Dredge Access Channel			
Dredging			
USR Dredging (CEDEP)	4,733	CY	79,178
Place Access Channel at Haleiwa Beach Park			
GEN S25Z6010 SCRAPER, TOWED, 9-12 CY (7-9 M3), 16 TON (14.5 MT) (ADD 225 HP (168 KW) TRACTOR)	160	HR	2,192
GEN T15Z6520 TRACTOR, CRAWLER (DOZER), 181-250 HP (135-186 KW), POWERSHIFT, LGP, W/UNIVERSAL BLADE	160	HR	39,682
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	160	HR	31,047
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	160	HR	31,047
USR DRE-OFFL Off-Loading w/ Cat 945B from Barge to shore	160	HR	196,357
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	160	HR	31,047
Dredging			
USR Dredging (CEDEP)	2,433	CY	45,842
Place at Haleiwa Beach Park			
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1 (8/31/15)	76	HR	11,209
GEN S25Z6010 SCRAPER, TOWED, 9-12 CY (7-9 M3), 16 TON (14.5 MT) (ADD 225 HP (168 KW) TRACTOR)	76	HR	1,041
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	76	HR	14,747
GEN T15Z6570 TRACTOR, CRAWLER (DOZER), 300-340 HP (224-254 KW), POWERSHIFT, W/UNIVERSAL BLADE	76	HR	35,353
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	76	HR	14,747
Site Work			
Land Survey & Layout			
USR Survey Crew	1	DAY	5,238
BMPs			
USR Geotextile (for Construction Entrance)	200	SY	421
USR Temp Construction Safety Fence	4,000	SY	8,421

Description	Quantity	UOM	ContractCost
USR Silt Fence	8,000	LF	25,629
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1	80	HR	11,799
USR Surge Mateiral	130	EA	14,279
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1	80	HR	11,799
Final Cleanup of COSA Areas			
MIL X-LABORER Outside Laborers, (Semi-Skilled)	16	HR	2,360
MIL B-EQOPRLT Equip. Operators, Light	16	HR	3,091
EP B15EC003 STREET SWEEPER, 12' BROOM PATH, 4.5 CY HOPPER, 350 GAL WATER TANK, SELF PROPELLED	16	HR	3,363
As-Builts			
USR SURV-CADD Survey (CADD)	40	HR	4,819
USR CIV-STR-CADD Civil / Struct Design Team CADD	120	HR	33,564
BEACH Dispose at Haleiwa Beach Park with Addtional Deepening to 13' Depth			
Dredging			
Dredging			
USR Dredging (CEDEP)	1,705	CY	32,125
Place at Haleiwa Beach Park			
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1 (8/31/15)	56	HR	8,259
GEN S25Z6010 SCRAPER, TOWED, 9-12 CY (7-9 M3), 16 TON (14.5 MT) (ADD 225 HP (168 KW) TRACTOR)	56	HR	767
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	56	HR	10,867
GEN T15Z6570 TRACTOR, CRAWLER (DOZER), 300-340 HP (224-254 KW), POWERSHIFT, W/UNIVERSAL BLADE	56	HR	26,050
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	56	HR	10,867
Alt 3 Beneficial Use From Federal Navigation Channel with Additional Deepening and Settling Basin			
M&D Mobilization and Demobilization			
M&D Mob, Demob & Preparatory Work			
MAR Mob/Demob (Marine)			
USR Mob/Demob (CEDEP)	1	LS	662,466
LAND Mob/Demob (Land)			
GEN T15Z6570 TRACTOR, CRAWLER (DOZER), 300-340 HP (224-254 KW), POWERSHIFT, W/UNIVERSAL BLADE	16	HR	7,443
PTC R50Z5600 ROLLER, VIBRATORY, SELF-PROPELLED, SINGLE DRUM, SMOOTH, 4.6 TON (4.2 MT), 48" (1.2 M) WIDE, SOIL COMPACTOR	16	HR	1,461
PTC T50Z7580 TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	16	HR	1,982
MAP T40RS002 TRUCK OPTIONS, WATER TANK, 3,000 GAL (ADD 40,000 GVW TRUCK)	16	HR	298
MIL B-TRKDVRHV Truck Drivers, Heavy	16	HR	3,110
USR Trucking w/ Low Boy, Mob/Demob	16	HR	6,151
GEN S25Z6010 SCRAPER, TOWED, 9-12 CY (7-9 M3), 16 TON (14.5 MT) (ADD 225 HP (168 KW) TRACTOR)	16	HR	219
USR DRE-OFFL Off-Loading w/ Cat 945B from Barge to shore	16	HR	19,636
EP H25KC020 HYDRAULIC EXCAVATOR, CRAWLER, 53,400 LBS, 2.5 CY BUCKET, 39' MAX DIGGING DEPTH, LONG REACH BOOM	16	HR	2,441
ODMDS ODMDS Disposal			
090115 Mechanical Dredging			
Dredging			
USR Dredging (CEDEP)	2,000	CY	105,265
09011502 Site Work			

Description	Quantity	UOM	ContractCost
090199 Associated General Items			
As-Builts			
USR SURV-CADD Survey (CADD)	40	HR	4,819
USR CIV-STR-CADD Civil / Struct Design Team CADD	120	HR	33,564
BEACH Dispose at Haleiwa Beach Park			
Dredging			
Dredge Access Channel			
Dredging			
USR Dredging (CEDEP)	4,733	CY	79,178
Place Access Channel at Haleiwa Beach Park			
GEN S25Z6010 SCRAPER, TOWED, 9-12 CY (7-9 M3), 16 TON (14.5 MT) (ADD 225 HP (168 KW) TRACTOR)	160	HR	2,192
GEN T15Z6520 TRACTOR, CRAWLER (DOZER), 181-250 HP (135-186 KW), POWERSHIFT, LGP, W/UNIVERSAL BLADE	160	HR	39,682
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	160	HR	31,047
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	160	HR	31,047
USR DRE-OFFL Off-Loading w/ Cat 945B from Barge to shore	160	HR	196,357
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	160	HR	31,047
Dredging			
USR Dredging (CEDEP)	2,433	CY	45,842
Place at Haleiwa Beach Park			
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1 (8/31/15)	76	HR	11,209
GEN S25Z6010 SCRAPER, TOWED, 9-12 CY (7-9 M3), 16 TON (14.5 MT) (ADD 225 HP (168 KW) TRACTOR)	76	HR	1,041
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	76	HR	14,747
GEN T15Z6570 TRACTOR, CRAWLER (DOZER), 300-340 HP (224-254 KW), POWERSHIFT, W/UNIVERSAL BLADE	76	HR	35,353
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	76	HR	14,747
Site Work			
Land Survey & Layout			
USR Survey Crew	1	DAY	5,238
BMPs			
USR Geotextile (for Construction Entrance)	200	SY	421
USR Temp Construction Safety Fence	4,000	SY	8,421
USR Silt Fence	8,000	LF	25,629
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1	80	HR	11,799
USR Surge Mateiral	130	EA	14,279
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1	80	HR	11,799
Final Cleanup of COSA Areas			
MIL X-LABORER Outside Laborers, (Semi-Skilled)	16	HR	2,360
MIL B-EQOPRLT Equip. Operators, Light	16	HR	3,091
EP B15EC003 STREET SWEEPER, 12' BROOM PATH, 4.5 CY HOPPER, 350 GAL WATER TANK, SELF PROPELLED	16	HR	3,363
As-Builts			
USR SURV-CADD Survey (CADD)	40	HR	4,819
USR CIV-STR-CADD Civil / Struct Design Team CADD	120	HR	33,564
BEACH Dispose at Haleiwa Beach Park with Addtional Deepening to 13' Depth			

Description	Quantity	UOM	ContractCost
Dredging			
Dredging			
USR Dredging (CEDEP)	1,705	CY	32,125
Place at Haleiwa Beach Park			
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1 (8/31/15)	56	HR	8,259
GEN S25Z6010 SCRAPER, TOWED, 9-12 CY (7-9 M3), 16 TON (14.5 MT) (ADD 225 HP (168 KW) TRACTOR)	56	HR	767
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	56	HR	10,867
GEN T15Z6570 TRACTOR, CRAWLER (DOZER), 300-340 HP (224-254 KW), POWERSHIFT, W/UNIVERSAL BLADE	56	HR	26,050
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	56	HR	10,867
BASIN Remove Sand from Settling Basin Long Reach Excavator (max reach 50ft)			
Remove Sand			
Dredging			
USR Dredging (CEDEP)	2,200	CY	54,187
Place at Haleiwa Beach Park			
GEN S25Z6010 SCRAPER, TOWED, 9-12 CY (7-9 M3), 16 TON (14.5 MT) (ADD 225 HP (168 KW) TRACTOR)	80	HR	1,096
GEN T15Z6520 TRACTOR, CRAWLER (DOZER), 181-250 HP (135-186 KW), POWERSHIFT, LGP, W/UNIVERSAL BLADE	80	HR	19,841
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	80	HR	15,524
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	80	HR	15,524
USR DRE-OFFL Off-Loading w/ Cat 945B from Barge to shore	80	HR	98,178
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	80	HR	15,524
Site Work			
Land Survey & Layout			
USR Survey Crew	1	DAY	5,238
BMPs			
USR Temp Construction Safety Fence	4,000	SY	8,421
USR Silt Fence	8,000	LF	25,629
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1 (8/31/15)	24	HR	3,540
Final Cleanup of COSA Areas			
MIL X-LABORER Outside Laborers, (Semi-Skilled)	16	HR	2,360
MIL B-EQOPRLT Equip. Operators, Light	16	HR	3,091
EP B15EC003 STREET SWEEPER, 12' BROOM PATH, 4.5 CY HOPPER, 350 GAL WATER TANK, SELF PROPELLED	16	HR	3,363
As-Builts			
USR SURV-CADD Survey (CADD)	40	HR	4,819
USR CIV-STR-CADD Civil / Struct Design Team CADD	120	HR	33,564
Alt 4 Beneficial Use From Federal Navigation Channel with Additional Deepening, Settling Basin, and Offshore Sand Deposit			
M&D Mobilization and Demobilization			
M&D Mob, Demob & Preparatory Work			
MAR Mob/Demob (Marine)			
USR Mob/Demob (CEDEP)	1	LS	662,466
LAND Mob/Demob (Land)			
GEN T15Z6570 TRACTOR, CRAWLER (DOZER), 300-340 HP (224-254 KW), POWERSHIFT, W/UNIVERSAL BLADE	16	HR	7,443

Description	Quantity	UOM	ContractCost
PTC R50Z5600 ROLLER, VIBRATORY, SELF-PROPELLED, SINGLE DRUM, SMOOTH, 4.6 TON (4.2 MT), 48" (1.2 M) WIDE, SOIL COMPACTOR	16	HR	1,461
PTC T15Z6440 TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	16	HR	1,461
PTC T50Z7580 TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	16	HR	1,982
MAP T40RS002 TRUCK OPTIONS, WATER TANK, 3,000 GAL (ADD 40,000 GVW TRUCK)	16	HR	298
MIL B-TRKDVRHV Truck Drivers, Heavy	16	HR	3,110
USR Trucking w/ Low Boy, Mob/Demob	16	HR	6,151
GEN S25Z6010 SCRAPER, TOWED, 9-12 CY (7-9 M3), 16 TON (14.5 MT) (ADD 225 HP (168 KW) TRACTOR)	16	HR	219
USR DRE-OFFL Off-Loading w/ Cat 945B from Barge to shore	16	HR	19,636
EP H25KC020 HYDRAULIC EXCAVATOR, CRAWLER, 53,400 LBS, 2.5 CY BUCKET, 39' MAX DIGGING DEPTH, LONG REACH BOOM	16	HR	2,441
GEN S25Z6010 SCRAPER, TOWED, 9-12 CY (7-9 M3), 16 TON (14.5 MT) (ADD 225 HP (168 KW) TRACTOR)	16	HR	219
ODMDS ODMDS Disposal			
090115 Mechanical Dredging			
Dredging			
USR Dredging (CEDEP)	2,000	CY	105,265
09011502 Site Work			
090199 Associated General Items			
As-Builts			
USR SURV-CADD Survey (CADD)	40	HR	4,819
USR CIV-STR-CADD Civil / Struct Design Team CADD	120	HR	33,564
BEACH Dispose at Haleiwa Beach Park			
Dredging			
Dredge Access Channel			
Dredging			
USR Dredging (CEDEP)	4,733	CY	79,178
Place Access Channel at Haleiwa Beach Park			
GEN S25Z6010 SCRAPER, TOWED, 9-12 CY (7-9 M3), 16 TON (14.5 MT) (ADD 225 HP (168 KW) TRACTOR)	160	HR	2,192
GEN T15Z6520 TRACTOR, CRAWLER (DOZER), 181-250 HP (135-186 KW), POWERSHIFT, LGP, W/UNIVERSAL BLADE	160	HR	39,682
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	160	HR	31,047
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	160	HR	31,047
USR DRE-OFFL Off-Loading w/ Cat 945B from Barge to shore	160	HR	196,357
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	160	HR	31,047
Dredging			
USR Dredging (CEDEP)	2,433	CY	45,842
Place at Haleiwa Beach Park			
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1 (8/31/15)	76	HR	11,209
GEN S25Z6010 SCRAPER, TOWED, 9-12 CY (7-9 M3), 16 TON (14.5 MT) (ADD 225 HP (168 KW) TRACTOR)	76	HR	1,041
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	76	HR	14,747
GEN T15Z6570 TRACTOR, CRAWLER (DOZER), 300-340 HP (224-254 KW), POWERSHIFT, W/UNIVERSAL BLADE	76	HR	35,353
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	76	HR	14,747
Site Work			
Land Survey & Layout			
USR Survey Crew	1	DAY	5,238

Description	Quantity	UOM	ContractCost
BMPs			
USR Geotextile (for Construction Entrance)	200	SY	421
USR Temp Construction Safety Fence	4,000	SY	8,421
USR Silt Fence	8,000	LF	25,629
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1	80	HR	11,799
USR Surge Mateiral	130	EA	14,279
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1	80	HR	11,799
Final Cleanup of COSA Areas			
MIL X-LABORER Outside Laborers, (Semi-Skilled)	16	HR	2,360
MIL B-EQOPRLT Equip. Operators, Light	16	HR	3,091
EP B15EC003 STREET SWEEPER, 12' BROOM PATH, 4.5 CY HOPPER, 350 GAL WATER TANK, SELF PROPELLED	16	HR	3,363
As-Builts			
USR SURV-CADD Survey (CADD)	40	HR	4,819
USR CIV-STR-CADD Civil / Struct Design Team CADD	120	HR	33,564
BEACH Dispose at Haleiwa Beach Park with Addtional Deepening to 13' Depth			
Dredging			
Dredging			
USR Dredging (CEDEP)	1,705	CY	32,125
Place at Haleiwa Beach Park			
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1 (8/31/15)	56	HR	8,259
GEN S25Z6010 SCRAPER, TOWED, 9-12 CY (7-9 M3), 16 TON (14.5 MT) (ADD 225 HP (168 KW) TRACTOR)	56	HR	767
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	56	HR	10,867
GEN T15Z6570 TRACTOR, CRAWLER (DOZER), 300-340 HP (224-254 KW), POWERSHIFT, W/UNIVERSAL BLADE	56	HR	26,050
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	56	HR	10,867
BASIN Remove Sand from Settling Basin Long Reach Excavator (max reach 50ft)			
Remove Sand			
Dredging			
USR Dredging (CEDEP)	2,200	CY	54,187
Place at Haleiwa Beach Park			
GEN S25Z6010 SCRAPER, TOWED, 9-12 CY (7-9 M3), 16 TON (14.5 MT) (ADD 225 HP (168 KW) TRACTOR)	80	HR	1,096
GEN T15Z6520 TRACTOR, CRAWLER (DOZER), 181-250 HP (135-186 KW), POWERSHIFT, LGP, W/UNIVERSAL BLADE	80	HR	19,841
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	80	HR	15,524
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	80	HR	15,524
USR DRE-OFFL Off-Loading w/ Cat 945B from Barge to shore	80	HR	98,178
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	80	HR	15,524
Site Work			
Land Survey & Layout			
USR Survey Crew	1	DAY	5,238
BMPs			
USR Temp Construction Safety Fence	4,000	SY	8,421
USR Silt Fence	8,000	LF	25,629
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1 (8/31/15)	24	HR	3,540

Description	Quantity	UOM	ContractCost
Final Cleanup of COSA Areas			
MIL X-LABORER Outside Laborers, (Semi-Skilled)	16	HR	2,360
MIL B-EQOPRLT Equip. Operators, Light	16	HR	3,091
EP B15EC003 STREET SWEEPER, 12' BROOM PATH, 4.5 CY HOPPER, 350 GAL WATER TANK, SELF PROPELLED	16	HR	3,363
As-Builts			
USR SURV-CADD Survey (CADD)	40	HR	4,819
USR CIV-STR-CADD Civil / Struct Design Team CADD	120	HR	33,564
OFF Offshore Material to Beach			
Dredging			
Dredging			
USR Dredging (CEDEP)	15,000	CY	304,984
MAP T10CA013 TRACTOR ATTACHMENTS, BLADE, UNIVERSAL, HYDRAULIC, FOR D7, 10.09 CY (ADD D7 TRACTOR)	40	HR	781
USR XEQOP-GP12 Outside Equip Operator, Gp 12 (9-07)	40	HR	7,887
Place at Haleiwa Beach Park			
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1 (8/31/15)	470	HR	69,319
GEN S25Z6010 SCRAPER, TOWED, 9-12 CY (7-9 M3), 16 TON (14.5 MT) (ADD 225 HP (168 KW) TRACTOR)	470	HR	6,439
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	470	HR	91,201
GEN T15Z6570 TRACTOR, CRAWLER (DOZER), 300-340 HP (224-254 KW), POWERSHIFT, W/UNIVERSAL BLADE	470	HR	218,631
USR XEQOP-GP7 Outside Equip Operator, Gp 7 (9-06)	470	HR	91,201
Site Work			
Land Survey & Layout			
USR Survey Crew	5	DAY	26,188
BMPs			
USR Geotextile (for Construction Entrance)	200	SY	421
USR Temp Construction Safety Fence	4,000	SY	8,421
MIL B-LABORER Laborers, (Semi-Skilled), LAB 1 (8/31/15)	80	HR	11,799
Final Cleanup of COSA Areas			
MIL X-LABORER Outside Laborers, (Semi-Skilled)	120	HR	17,698
MIL B-EQOPRLT Equip. Operators, Light	16	HR	3,091
EP B15EC003 STREET SWEEPER, 12' BROOM PATH, 4.5 CY HOPPER, 350 GAL WATER TANK, SELF PROPELLED	16	HR	3,363
As-Builts			
USR SURV-CADD Survey (CADD)	40	HR	4,819
USR CIV-STR-CADD Civil / Struct Design Team CADD	120	HR	33,564

CSRAs (Abbreviated)

Abbreviated Risk Analysis

Project (less than $40M): **Haleiwa - Beneficial Use From Federal Navigation Channel with Additional Deepening, Settling Basin, and Offshore Sand Deposit**

Alternative: **Alt 4**

Project Development Stage/Alternative: **Alternative Formulation**

Risk Category: **Low Risk: Typical Construction, Simple**

Meeting Date: **5/22/2020**

Total Estimated Construction Contract Cost = **$ 3,537,000**

	CWWBS	Feature of Work	Estimated Cost		% Contingency	$ Contingency	Total
	01 LANDS AND DAMAGES	Real Estate	**$ -**		**0%**	$ -	$ -
1	**12 NAVIGATION, PORTS AND HARBORS**	**Mob & Demob**	**$ 694,000**		18%	$ 121,602	$ 815,602
2	**12 NAVIGATION, PORTS AND HARBORS**	**Dredging**	**$ 2,843,000**		37%	$ 1,060,842	$ 3,903,842
12	All Other	**Remaining Construction Items**	**$ -**	*0.0%*	0%	$ -	$ -
13	30 PLANNING, ENGINEERING, AND DESIGN	**Planning, Engineering, & Design**	**$ 77**		0%	$ -	$ 77
14	31 CONSTRUCTION MANAGEMENT	**Construction Management**	**$ 231**		0%	$ -	$ 231
XX	FIXED DOLLAR RISK ADD (EQUALLY DISPERSED TO ALL, MUST INCLUDE JUSTIFICATION SEE BELOW)					**$ -**	

Totals				
Real Estate	$ -	0%	$ -	$ -
Total Construction Estimate	$ 3,537,000	33%	$ 1,182,444	$ 4,719,444
Total Planning, Engineering & Design	$ 77	0%	$ -	$ 77
Total Construction Management	$ 231	0%	$ -	$ 231
Total Excluding Real Estate	**$ 3,537,308**	**33%**	**$ 1,182,444**	**$ 4,719,752**

	Base	50%	80%
Confidence Level Range Estimate ($000's)	$3,537k	$4,247k	$4,720k

* 50% based on base is at 5% CL.

Fixed Dollar Risk Add: (Allows for additional risk to be added to the risk analsyis. Must include justification. Does not allocate to Real Estate.	

Haleiwa - Beneficial Use From Federal Navigation Channel with Additional Deepening, Settling Basin, and Offshore Sand Deposit   Alt 4

Alternative Formulation
Abbreviated Risk Analysis
Meeting Date: 22-May-20

Risk Register

Risk Level

	Negligible	Marginal	Moderate	Significant	Critical
Very Likely	2	3	4	5	5
Likely	1	2	3	4	5
Possible	0	1	2	3	4
Unlikely	0	0	1	2	3

Risk Element	Feature of Work	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Impact	Likelihood	Risk Level
Project Management & Scope Growth					**Maximum Project Growth**	**40%**
PS-1	Mob & Demob	Quantities represent 1 season of dredging.	Therefore little risk of multiple mob and demob occurance	Negligible	Possible	0
PS-2	Dredging	Quantities are based on 2 year old survey, Dredging area is defined.	Marginal risk with project scope growth.	Marginal	Possible	1
Acquisition Strategy					**Maximum Project Growth**	**30%**
AS-1	Mob & Demob	Contract is targeted for full and open competition. Similar projects have been awarded.	Marginal risk with similar projects being awarded.	Marginal	Likely	2
AS-2	Dredging	Contract is targeted for full and open competition. Similar projects have been awarded.	Marginal risk with similar projects being awarded.	Marginal	Likely	2
Construction Elements					**Maximum Project Growth**	**15%**
CON-1	Mob & Demob	Standard Mob and Demob for area	Standard Mob and Demob for area	Negligible	Unlikely	0
CE-2	Dredging	Beach access could cause additional cost	Access to beach dispposal and handling issues	Moderate	Likely	3
Technical Design & Quantities					**Maximum Project Growth**	**20%**
T-1	Mob & Demob	Small quantities therefore 1 mob and demob	none	Marginal	Unlikely	0
T-2	Dredging	Beach quantities may vary	Beach quantities are based on early design levels	Moderate	Likely	3
Cost Estimate Assumptions					**Maximum Project Growth**	**25%**
EST-1	Mob & Demob	Assume local Mob and Demob	Cost could vary dpedning on contractor competition	Moderate	Possible	2
EST-2	Dredging	Dredging cost assumptions for dredgin and beach placement could vary	Much of the dredge production are based on local historic production. However additional requiremnts for beach placement are unknown at this time. Hauling of material adds complexity and risk to cost estimate	Moderate	Likely	3

External Project Risks

					Maximum Project Growth	20%
EX-2	Dredging	Hauling material over local roads	Could cause additional risk from local government on additional requirements.	Marginal	Likely	2

Abbreviated Risk Analysis

cial Use From Federal Navigation Channel with Additional Deepening, Settling Basin, and Offshor

Alternative Formulation

Meeting Date: 5-Jan-15

PDT Members

Note: PDT involvement is commensurate with project size and involvement.

Represents	Name
Project Management:	Reder, Benjamin E CIV USARMY CEPOH (USA) <Benjamin.E.Reder@usace.army.mil>
Engineering & Design:	Podoski, Jessica H CIV USARMY CEPOH (USA) <jessica.h.podoski@usace.army.mil>
Environmental:	Unghire, Joshua M CIV USARMY CELRB (USA) <Joshua.Unghire@usace.army.mil>

Abbreviated Risk Analysis

Project (less than $40M): **Haleiwa - Beneficial Use From Federal Navigation Channel with Additional Deepening, Settling Basin, and Offshore Sand Deposit**

Alternative: **Alt 4**

Project Development Stage/Alternative: **Alternative Formulation**

Risk Category: **Low Risk: Typical Construction, Simple**

Meeting Date: **5/22/2020**

Total Estimated Construction Contract Cost = **$ 2,754,000**

	CWWBS	Feature of Work	Estimated Cost		% Contingency	$ Contingency	Total
	01 LANDS AND DAMAGES	Real Estate	$ -		0%	$ -	$ -
1	12 NAVIGATION, PORTS AND HARBORS	**Mob & Demob**	**$ 694,000**		18%	$ 121,602	$ 815,602
2	12 NAVIGATION, PORTS AND HARBORS	**Dredging**	**$ 2,060,000**		34%	$ 700,394	$ 2,760,394
12	All Other	**Remaining Construction Items**	**$ -**	*0.0%*	0%	$ -	$ -
13	30 PLANNING, ENGINEERING, AND DESIGN	**Planning, Engineering, & Design**	**$ -**		0%	$ -	$ -
14	31 CONSTRUCTION MANAGEMENT	**Construction Management**	**$ -**		0%	$ -	$ -
XX	FIXED DOLLAR RISK ADD (EQUALLY DISPERSED TO ALL, MUST INCLUDE JUSTIFICATION SEE BELOW)					$ -	

Totals				
Real Estate	$ -	0%	$ -	$ -
Total Construction Estimate	$ 2,754,000	30%	$ 821,997	$ 3,575,997
Total Planning, Engineering & Design	$ -	0%	$ -	$ -
Total Construction Management	$ -	0%	$ -	$ -
Total Excluding Real Estate	**$ 2,754,000**	**30%**	**$ 821,997**	**$ 3,575,997**

	Base	**50%**	**80%**
Confidence Level Range Estimate ($000's)	$2,754k	$3,247k	$3,576k

* 50% based on base is at 5% CL.

Fixed Dollar Risk Add: (Allows for additional risk to be added to the risk analsyis. Must include justification. Does not allocate to Real Estate.	

Haleiwa - Beneficial Use From Federal Navigation Channel with Additional Deepening, Settling Basin, and Offshore Sand Deposit Alt 4

Risk Register

Alternative Formulation
Abbreviated Risk Analysis
Meeting Date: 22-May-20

Risk Level

	Negligible	Marginal	Moderate	Significant	Critical
Very Likely	2	3	4	5	5
Likely	1	2	3	4	5
Possible	0	1	2	3	4
Unlikely	0	0	1	2	3

Risk Element	Feature of Work	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Impact	Likelihood	Risk Level
Project Management & Scope Growth				**Maximum Project Growth**		**40%**
PS-1	Mob & Demob	Quantities represent 1 season of dredging.	Therefore little risk of multiple mob and demob occurance	Negligible	Possible	0
PS-2	Dredging	Quantities are based on 2 year old survey, Dredging area is defined.	Marginal risk with project scope growth.	Marginal	Possible	1
Acquisition Strategy				**Maximum Project Growth**		**30%**
AS-1	Mob & Demob	Contract is targeted for full and open competition. Similar projects have been awarded.	Marginal risk with similar projects being awarded.	Marginal	Likely	2
AS-2	Dredging	Contract is targeted for full and open competition. Similar projects have been awarded.	Marginal risk with similar projects being awarded.	Marginal	Likely	2
Construction Elements				**Maximum Project Growth**		**15%**
CON-1	Mob & Demob	Standard Mob and Demob for area	Standard Mob and Demob for area	Negligible	Unlikely	0
CE-2	Dredging	Beach access could cause additional cost	Access to beach dispposal and handling issues	Moderate	Likely	3
Technical Design & Quantities				**Maximum Project Growth**		**20%**
T-1	Mob & Demob	Small quantities therefore 1 mob and demob	none	Marginal	Unlikely	0
T-2	Dredging	Beach quantities may vary	Beach quantities are based on early design levels	Moderate	Likely	3
Cost Estimate Assumptions				**Maximum Project Growth**		**25%**
EST-1	Mob & Demob	Assume local Mob and Demob	Cost could vary dpedning on contractor competition	Moderate	Possible	2
EST-2	Dredging	Dredging cost assumptions for dredgin and beach placement could vary	Much of the dredge production are based on local historic production. However additional requiremnts for beach placement are unknown at this time.	Significant	Possible	3

Abbreviated Risk Analysis

cial Use From Federal Navigation Channel with Additional Deepening, Settling Basin, and Offshor

Alternative Formulation

Meeting Date: 5-Jan-15

PDT Members
Note: PDT involvement is commensurate with project size and involvement.

Represents	Name
Project Management:	Reder, Benjamin E CIV USARMY CEPOH (USA) <Benjamin.E.Reder@usace.army.mil>
Engineering & Design:	Podoski, Jessica H CIV USARMY CEPOH (USA) <jessica.h.podoski@usace.army.mil>
Environmental:	Unghire, Joshua M CIV USARMY CELRB (USA) <Joshua.Unghire@usace.army.mil>

Haleiwa Harbor, Oahu, Hawaii
Dredged Material Management Plan
Preliminary Assessment
September 2018

Project Name

Haleiwa Small Boat Harbor, Oahu, Hawaii

Project CWIS

073356

Project Authorization

Haleiwa Small Boat Harbor (SBH) is located on the north coast of Oahu at the head of Waialua Bay. The project was authorized on 26 March 1964 and 25 October 1974 under Section 107 of the River and Harbor Act of 1960, as amended. The project, which was initially constructed in 1966, was the first joint Federal-State harbor constructed on Oahu. The total project cost was $1,177,642 (Federal: $683,177; non-Federal: $494,465). The general navigation features of Haleiwa Harbor (Figure 1) consist of an entrance channel 740 feet long, 100 to 120 feet wide, and 12 feet deep; a revetted mole that is 1,310 feet long; a stub breakwater that is 80 feet long; and a wave absorber that is 140 feet long. The non-federal sponsor for the harbor is the State of Hawaii, Department of Land and Natural Resources, Division of Boating and Ocean Recreation (DOBOR).

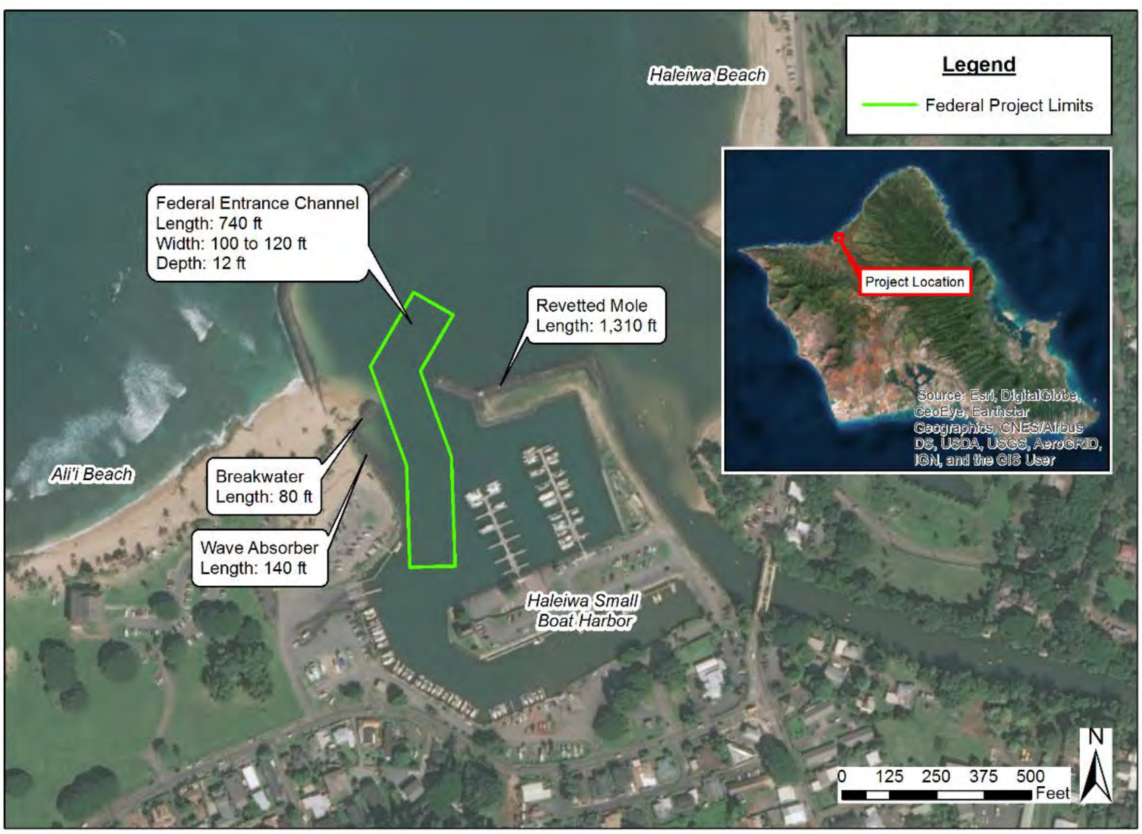

Figure 1. Map of Haleiwa Harbor federal navigation features.

Introduction
Haleiwa SBH is the center for recreational boating activities on the north shore of Oahu. Non-Federal project features include 64 berths, 26 moorings, 2 loading docks, and 3 ramps. Shore side facilities include a harbor office, vessel wash down area, dry land storage, and a fish hoist. Several commercial operations operate out of the harbor, including fishing charters, shark encounters, diving charters, whale watching tours, snorkeling tours, sailing cruises, and other boat tours. The beaches surrounding the harbor are frequented by swimmers, surfers, stand-up paddle boarders, and other recreational ocean users. In the winter, several surf contests are held in this area due to the large surf.

Historically, there has been relatively small quantities and infrequent dredging at the POH navigation harbors. The POH navigation Operations and Maintenance (O&M) project delivery team (PDT) is working to develop the means and methods to better sustain these federal projects and develop plans to better manage the dredged sediment resources on a regional scale. Haleiwa SBH has been dredged twice within the past twenty years, and is expected twice again in the next 20 years.

The State of Hawaii Department of Health (HDOH) maintains a zero allowance for return water from upland disposal and dewatering areas. This Dredged Material Maintenance Plan (DMMP) Preliminary Assessment (PA) lays the ground work for developing upland placement methods acceptable to the HDOH, which will allow for greater opportunities to beneficially use dredged sediments for shoreline protection and other purposes. Management of this scarce sediment resource through streamlined transportation of the materials could potentially lower dredging costs on the main Hawaiian Islands (Tetra Tech 2015).

Site History
Before Haleiwa Harbor was constructed, the mouth of `Anahulu River emptied into the Pacific Ocean at the southwest corner of the current harbor. Part of the harbor authorization in 1964 relocated the river mouth to its present location. The outer breakwater, approximately 840-ft-long, was built by the State of Hawaii in 1955. Section 107 of the River and Harbor Act of 1960 first authorized the construction of Haleiwa SBH, including the entrance channel and revetted mole. The harbor underwent several repair projects in 1970, 1975, and 1978, after sustaining damages during storms. After a storm damaged the harbor in January 1974, emergency repairs and new work were authorized. The new work consisted of a stub breakwater, a wave absorber, and lengthening of both the entrance channel and revetted mole. Construction was completed in November 1975.

Site dredging history
The U.S. Army Corps of Engineers (USACE) has a non-discretionary duty to maintain federally authorized general navigation features. Within the past 20 years, Haleiwa Harbor has been dredged twice, in 1999 and 2009, with a total of about 13,700 cubic yards (cy) of dredged sediment (Table 1).

In 1999, North Pacific Construction, Inc. dredged Haleiwa SBH for a cost of $208,100. They used a clamshell on a floating barge to dredge 7,214 cy of material. Shoaled areas were as shallow as 1ft below MLLW. All the dredged material was stockpiled and disposed of upland.

In December 2009, Trade West Construction, Inc. dredged 6,500 cy of sediment from Haleiwa SBH using a mechanical bucket dredge (Figure 2). Shoaled areas ranged from 4 to 15 feet below mean lower low water (MLLW). During dredging, two high spots composed of hard material were found that apparently hadn't been dredged during the original construction project. All dredged sediments were stockpiled and dewatered at the harbor, then disposed of upland (Figure 3). The dredging was completed at a cost of $1,150,000 that utilized $700,000 of American Recovery and Reinvestment Act funding.

Based on historical dredging and shoaling data, POH anticipates needing to dredge Haleiwa Harbor twice within the next 20 years.

Table 1. USACE dredging history of Haleiwa Harbor.

YEAR	DREDGE OWNER	TYPE OF WORK	TYPE OF DISPOSAL	VOLUME (CY)	TOTAL COST	UNIT COST
1999	CONTRACT	MAINTENANCE	UPLAND	7,214	$208,100	$28.85
2009	CONTRACT	MAINTENANCE	UPLAND	6,500	$1,150,000	$176.92

Figure 2. Photo of dredge operation during 2009 maintenance dredging.

Figure 3. Location of stockpile area at Haleiwa Harbor during the 2009 maintenance dredging.

Shoaling and Maintenance

By evaluating past dredging events and survey data, shoaling rates can be calculated and future dredging requirements can be projected. See Table 2 for a summary of past dredging events and surveys from the past 30 years. The volume is the amount of material that shoaled above the authorized depth of 12 feet, or the amount that was dredged during maintenance dredging. The shoaling rate is calculated in two ways. First, as the volume divided by the number of years since the last dredging. This smooths the data and looks at the longer term trends. Second, as the difference in volume from the previous survey/dredge, divided by the number of years since that event. This method take a look at the shorter-term changes.

Based on the survey data only, the harbor shoals at an average rate of about 100 cy/yr. In fact, prior to the 1999 dredging, the harbor seemed to shoal at a much slower rate. The 1987, 1991, and 1995 volumes were all about 2,000 cy (the small differences may be due to surveying errors). The 1997 survey showed a large increase in shoaled volume, triggering the 1999 dredging. Ten years later, the harbor had to be dredged again. Shoaling rates since the last dredging in 2009 have been low again. This data suggests that the harbor may fill in episodically, such as during storm events, rather than steadily over many years. The average shoaling rates show that over the long term, the harbor shoals at a rate of about 100-200 cy/yr. However, considering the shorter-term episodic events, the harbor shoaling can be estimated at 500 cy/yr.

To predict future dredging needs, a conservative approach will be used. Based on the difference between the two most recent dredging events (i.e. 6,500 cy of material shoaled between 1999 and 2009), we estimate that 650 cy of material shoals each year and that the harbor will need to be dredged about every 10 years. Figure 4, which displays the results of the most recent survey in 2014, depicts the typical shoaling pattern in the harbor.

Table 2. Shoaling Rate based on dredging and hydrosurvey history.

Year	Type of Work	Volume (cy)	Shoaling Rate since last dredging (cy/yr)	Shoaling Rate from previous event (cy/yr)
1966	New Construction	---	---	---
1987	Hydrosurvey	2,053	98	---
1991	Hydrosurvey	2,211	88	40
1995	Hydrosurvey	1,981	68	-58
1997	Hydrosurvey	4,500*	145	1260
1999	Maintenance Dredging	7,214	219	1357
2009	Maintenance Dredging	6,500	650	650
2011	Hydrosurvey	311	156	156
2014	Hydrosurvey	620	124	103
AVERAGE OF HYDROSURVEYS			**113**	**---**
AVERAGE OF ALL			**193**	**523**

*Estimate based on maintenance dredging plans.

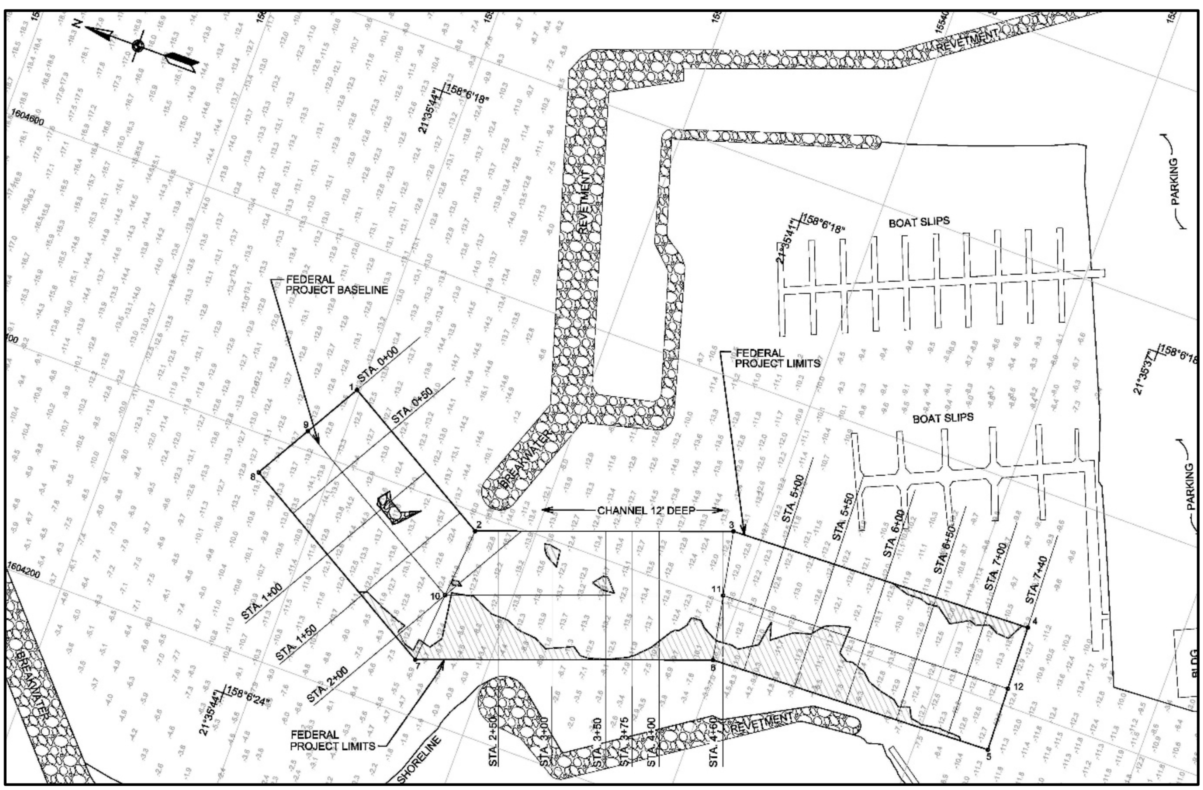

Figure 4. Crosshatched areas are above the authorized project depth in Haleiwa Harbor as of April 2014.

Material Sources

A Regional Sediment Management (RSM) study was conducted in 2013 to identify sediment pathways in the Haleiwa region. The coastal region of Haleiwa is defined by two rocky headlands – Pua`ena Point to the north and Kaiaka Point to the south. For the FY13 RSM study, this region was broken into 6 littoral cells: Kaiaka West, Kaiaka East, Ali`i Beach, Haleiwa Harbor, Haleiwa Beach, and Pua`ena Point (Figure 5). Numerical modeling of the waves and currents was used to identify dominant sediment pathways and to inform the development of the regional sediment budget (Figure 5). Currents were observed to flow along the shoreline and then offshore at the relic stream channels, which can be seen in the aerial photo in Figure 5. The Kaiaka Beach cells were found to be stable, likely due to an onshore/offshore exchange with the nearshore channel in this area, allowing it to act as a storage area. The Ali`i Beach cell is losing sand over the root of the State breakwater and into the harbor as well as along the outside of the breakwater and into the harbor entrance channel. A portion of the sand from Ali`i Beach and Haleiwa Beach is being directed offshore into the channel at the harbor entrance. Some of this sand may be staying within the littoral system, but based on increased erosion rates in recent years, it is likely that some of this sand is being moved into deep water by the offshore current in the channel and is being lost from the system. In the Haleiwa Beach cell, there is strong transport from north to south, which pushes sand up along the groin. It also leaves the section in front of the comfort station severely eroded. Sand leaving the Haleiwa Beach cell but not moving offshore is ending up in the harbor channel in the lee of the State breakwater and nearby areas. In addition, terrestrial sediment enters the back of the harbor from `Anahulu Stream, which passes through agricultural lands before discharging next to the harbor. Figure 5 shows the resulting sediment budget from this study.

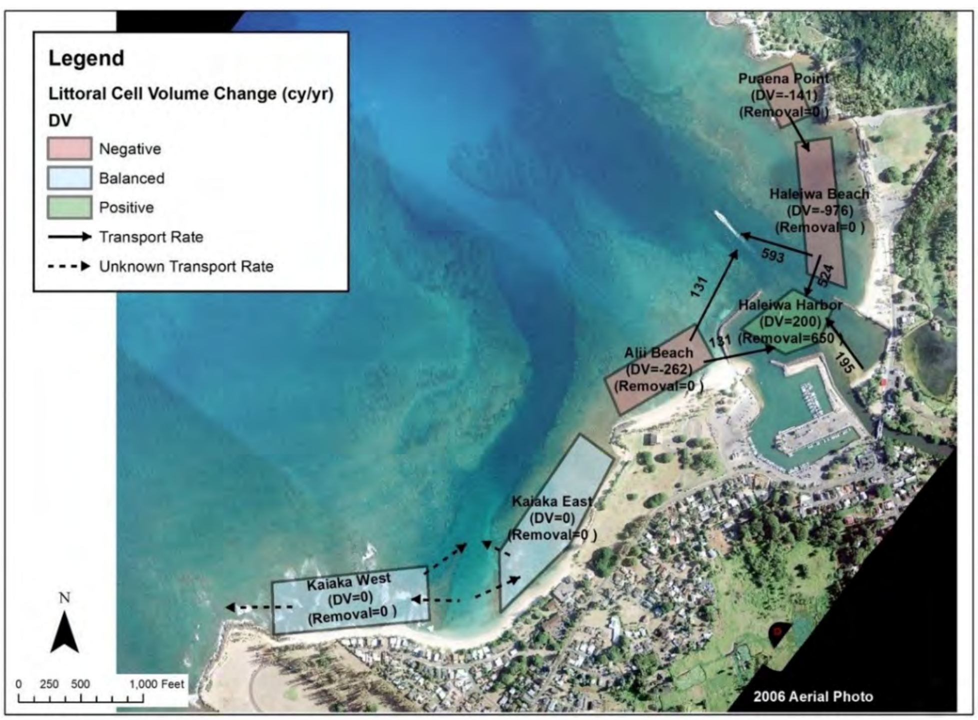

Figure 5. Sediment budget of the Haleiwa Region showing how sediment enters the harbor.

Material Type

Prior to the 2009 maintenance dredging, shoaled areas were characterized for both grain size and chemicals of concern by Marine Research Consultants, Inc. (MRCI) in 2008. MRCI conducted 2 rounds of sampling; the first for grain size analysis (samples 1-6), the second for chemicals of concern (samples 1-5, & 7). Composite sample H123 is in the berthing area, which is the State's dredging responsibility. Composite sample H45 and discrete sample H6 are in the federal channel. Figure 6 shows the sampling locations and Table 3 the grain size results. The data shows the gradation from very fine grained material in the berthing area (sample H123), to clean, well-sorted coarse-grained sand in the outer channel (H6). Since sample H6 had a very small fines fraction, it was considered clean and was not used for the chemical testing, as described in the next section. Figure 6 shows the approximate boundary between the sand/mud areas in the entrance channel.

The U.S. Fish and Wildlife Survey conducted a marine benthic survey in September 2012 to identify living coral and other hard substrate discovered during the 2009 dredging (FWS 2012). Only 1 coral head was identified directly in the entrance channel, and they reported that the benthic substrate was primarily terrigenous sediment. The findings were mapped and will be used as a baseline, for future reference.

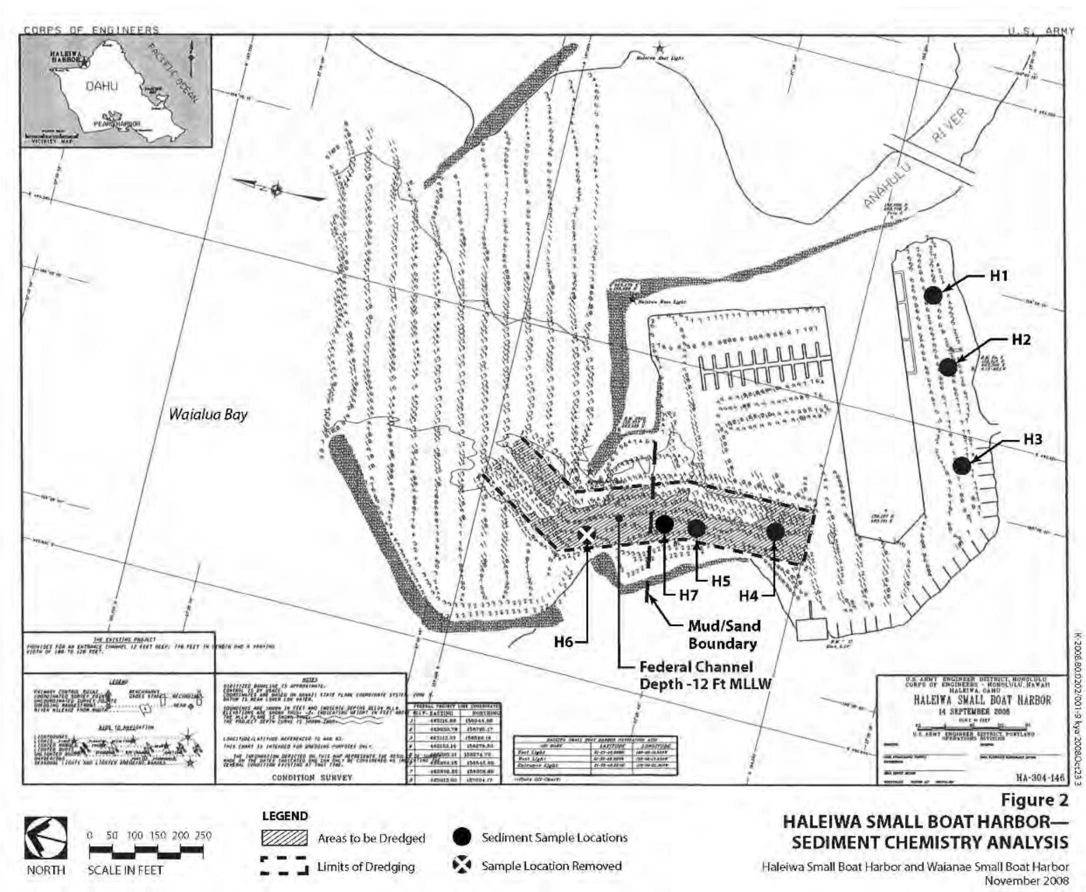

Figure 6. Haleiwa Harbor with sediment sampling locations and estimated sand/mud boundary (MRCI 2008).

Table 3. Particle size distribution by sample (MRCI 2008).

Sample	H123 (%)	H45 (%)	H6 (%)
Gravel (>2 mm)	1.63	1.74	7.29
Sand (>63 μm)	8.11	43.67	92.35
Silt/Clay (<63 μm)	91.89	54.59	0.37

Contaminants

During the 2008 sediment sampling program, the first round of testing quantified grain size distribution as discussed above. Since sample H6 was found to be <1% fines, it was not used for the second round of testing, which was a chemical analysis on material with greater than 15% fines. Instead, another sample location (H7) was added to create composite sample H457 as shown in Figure 6. Although chemical concentrations were detected in sample H457, they were determined to be below the Department of Health's Environmental Action Limits for unrestricted uses. They were also below the criteria for landfill acceptance. Thus, contaminates will not restrict disposal options.

Material Disposal Options

Beach Nourishment

The State of Hawaii is very interested in obtaining sand for beach nourishment as sand is a limited resource on the islands and relatively expensive given its scarcity. Hawaii's beach nourishment projects to date have been relatively small volumes when compared to mainland projects, and at a higher cubic yard cost (Welp 2014). An example of a nourishment project is Waikiki Beach, where sand was dredged from nearby offshore with an 8 inch discharge barge-mounted submersible. A 6 inch diameter discharge booster pump sent 27,000 cy of sand approximately 3,000 ft onshore in an 8 inch diameter HDPE pipeline, where it was dewatered and subsequently placed on the beach at a cost of $47.00/cy. Borrow material percent fines content allowed to be placed on the beach in the state of Hawaii is 0 to 5 percent and due to the HDOH requirement of "no return water", it is very difficult and expensive to find and place acceptable sand (Welp 2014).

For Haleiwa Harbor, the Honolulu District would place clean sand on Haleiwa Beach in the area of greatest erosion, which is immediately in front of the seawall by the bathrooms. It is estimated to be an area of about 8,000 sf (Figure 7). This would help to protect the seawall and the structures behind it. While the C&C and State are interested in renourishing the entire Haleiwa Beach SPP, the beneficial reuse of this dredged material would help protect the most critical shore side facilities before a full renourishment can take place.

Stockpiling

Based on discussion with the City and County of Honolulu (C&C), clean sand material could be stockpiled at Haleiwa Beach Park (HBP) (Figure 8). This material would be turned over to the C&C. Since the C&C is responsible for the maintenance of HBP, they are interested in using the sand to repair the area around the restrooms. They could do this by working with the State to renourish the beach fronting the structures, or by placing sand in the cavities that have eroded behind the seawall. Since the public is very concerned about the sand loss there, the C&C isn't concerned about stockpiling at HBP since it will be used to improve the beach and park. For this option, the C&C would be responsible for all meeting environmental requirements.

Figure 7. Location of potential beach placement for beneficial reuse.

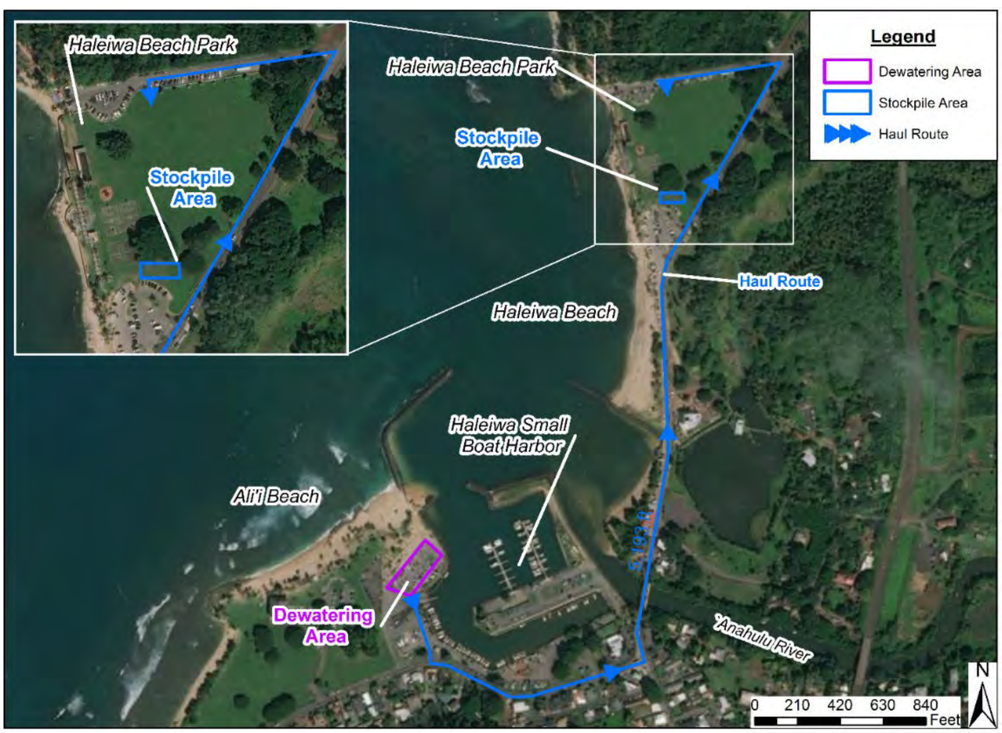

Figure 8. Potential stockpile area for dredged material.

Landfill

Dredged sediment would be taken to the PVT Landfill in west Oahu (Figure 9). This landfill is the only landfill on Oahu that accepts construction and demolition material, including dirt. The dredged material could be used to cap sections of the landfill. The distance to the landfill is about 34.4 miles.

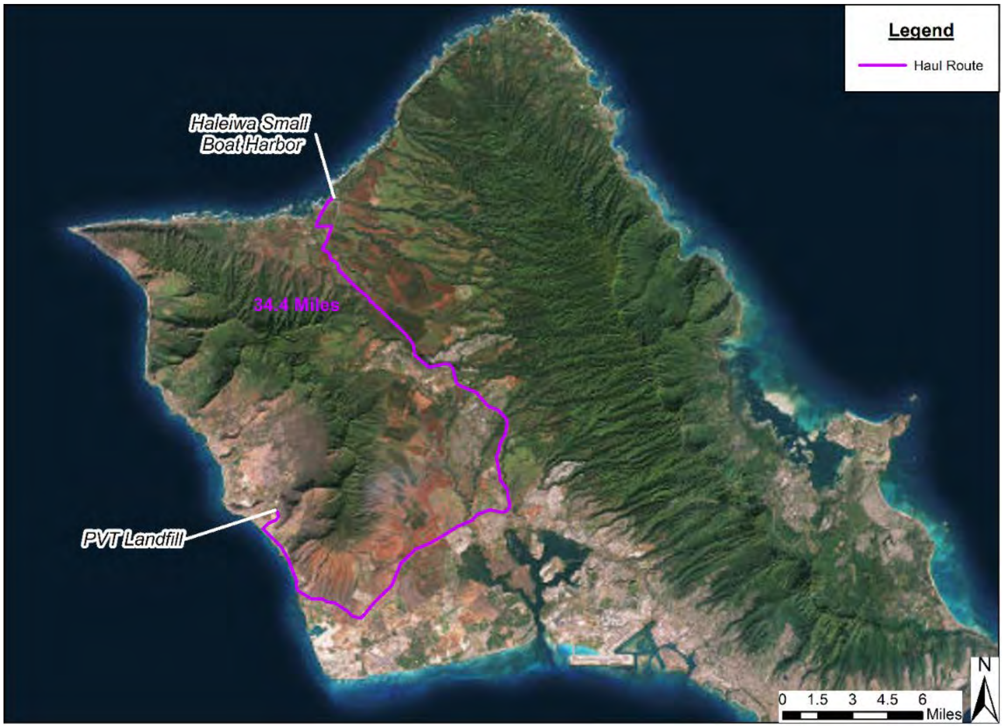

Figure 9. The distance from Haleiwa SBH to the PVT Landfill is 34.4 miles.

ODMDS

The South Oahu Ocean Dredged Material Disposal Site (ODMDS) is 3.3 nautical miles (nmi) offshore of the south shore of Oahu in Mamala Bay (Figure 10). The site lies on the shelf-slope junction in 3,000 ft to 1,560 ft (400 to 475 meters (m)) depth of water. The site is rectangular with sides 1.1 by 1.4 nmi. The bottom terrain is a sloping plain, dropping approximately 250 ft to 6,500 ft (75 m across the 2,000 m). Native sediment is primarily silty sand.

This site has an almost unlimited capacity to accommodate clean dredged material, which it receives from Pearl Harbor, Barbers Point Harbor, and Honolulu Harbor. The EPA does not allow cobbles or other larger substrate to be placed in the ODMDS, as it may create desirable habitat, which will later be buried by subsequent disposal operations.

While this site is far from Haleiwa Harbor, it is the only ODMDS for the island of Oahu. Dredged sediment would be taken via barge to the South ODMDS. The site is 48 miles from Haleiwa Harbor.

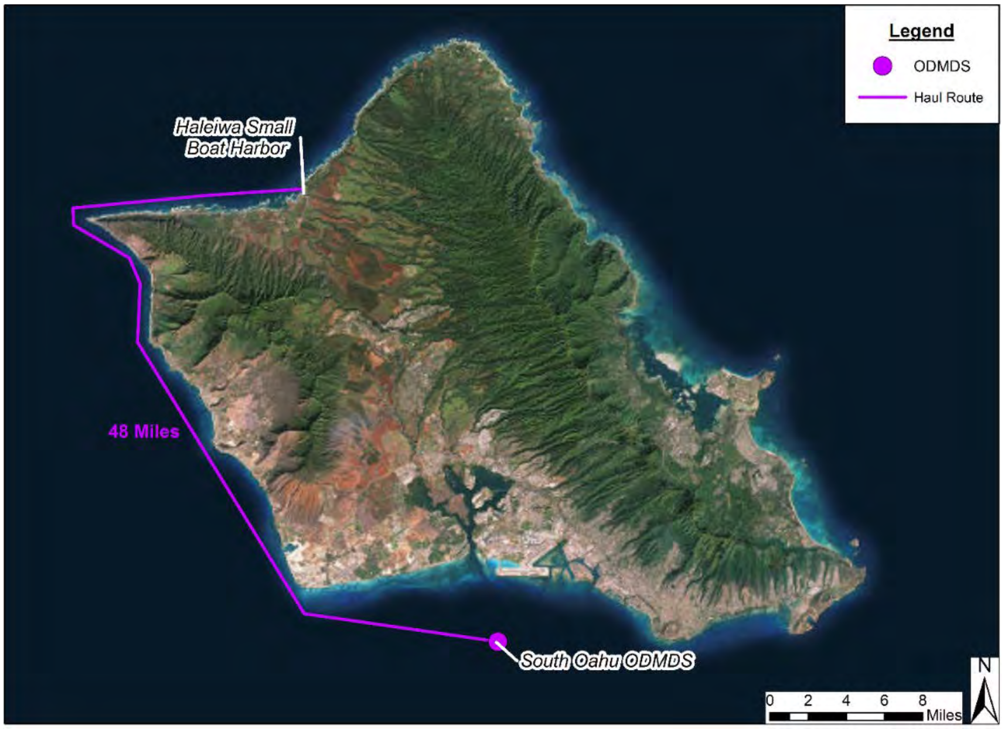

Figure 10. The South Oahu ODMDS is 48 miles from the Haleiwa SBH.

O&M Dredging: 20 Year Horizon

Based on the hyrdosurvey and dredging data, Haleiwa SBH typically shoals at about 100-200 cy/year. However, it seems that episodic events introduce large volumes of sediment to the harbor, accelerating the need to dredge. Thus, as a conservative estimate, the most recent dredging information will be used to predict future dredging needs. Over a ten year period (1999-2009) 6,500 cy of material shoaled in the harbor, giving an average shoaling rate of 650 cy/yr. Assuming the harbor will need to be dredged every 10-15 years, and balancing the Honolulu District's other dredging projections, it's estimated that Haleiwa SBH will be dredged again in 2022 and 2035. Each event would have 8,450 cy of material, or 16,900 cy over the next twenty years. Table 4 is a summary of past dredging events and the 20 year horizon predicted future dredging events and volumes.

Table 4. Past and Predicted Dredging

Year	Volume (cy)
1999	7,214
2009	6,500
2022	8,450
2035	8,450

The sediment sampling from 2008 shows that there are two different types of material in the entrance channel. The sediment in the outer portion of the harbor is beach quality sand that has come from the neighboring beaches via regional sediment transport processes. The material in the inner part of the harbor is finer grained terrestrial sediment. This material cannot be placed on beaches, but since it is not contaminated could be used for other beneficial uses. If beneficial use options were pursued for sediment disposal, it's estimated that for each dredging event 5,070 cy of sand would be available for beach placement and 3,380 cy of silty material for other beneficial use options. Any of the material could be taken to the landfill or to the South Oahu ODMDS. Due to the relatively small volumes of material expected to be dredged from this harbor, none of the evaluated disposal options are limited in capacity. As discussed below, different cost and environmental considerations will be the main factor in deciding how material should be disposed of.

In order to reduce the dredging needs at Haleiwa Harbor, there may be justification to authorize a deposition basin adjacent to the federal channel. Between the federal stub breakwater and state's outer breakwater, a large volume of sand has accumulated (Figure 11). The sand is transported by wind and high waves from Ali`i Beach over the root of the state breakwater and fills in this area. That sand ultimately shoals in the channel and requires maintenance dredging. While the area between the breakwaters is outside of the federal channel limits, USACE may pursue authorization to conduct advanced maintenance, such as construction of a deposition basin. Since this sand will eventually enter the channel via this pathway, this location would be a logical choice for a deposition basin, so that any sand coming over the breakwater would settle there rather than moving into the channel.

The deposition basin would also need to be maintained (using land-based equipment with a limited reach), but would reduce channel maintenance requirements (which require a floating dredge plant). Based on 2013 JABLTCX LiDAR data, it is estimated that 1,200 cy of sand could be removed from the shoaled area to create a 100 ft long by 60 ft wide by 8ft deep (MLLW) deposition basin, at a cost of approximately $180,000. Given the harbor's dredging history, the deposition basin would need to be excavated at a three to five year interval. Assuming a reduced future channel shoaling rate, the dredging interval would increase to well beyond 10 years. In addition, all of the material from the deposition basin would be beach quality material that could be used for beach placement.

In addition, reducing the amount of terrigenous sediment entering the back of the harbor from the `Anahulu River would both reduce the dredging needs and improve the quality of material that is dredged. A culvert connects the river to the harbor for circulation, however, the river water carries suspended fine grained material that settles out in the calmer harbor waters. To reduce the amount of sediment coming through culvert, a few alternatives should be further investigated. These include but are not limited to retrofitting the culvert with a screen to filter out sediment, an upstream settling basin, or closing off the culvert.

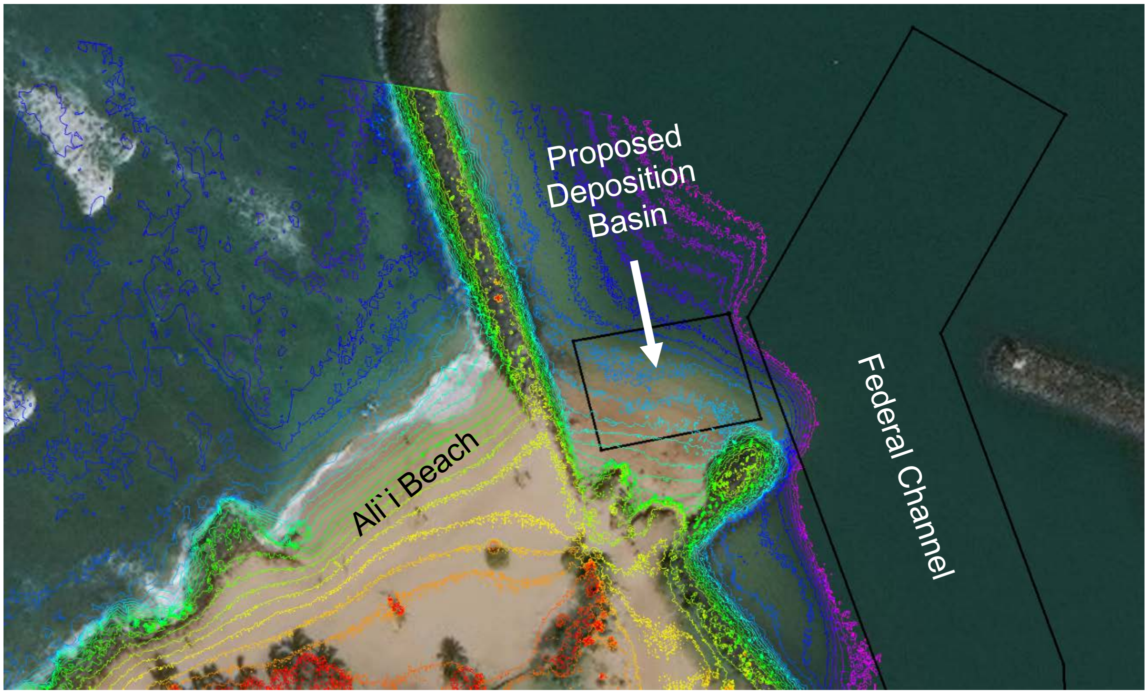

Figure 11. Location of proposed deposition basin to capture sediment from Ali`i Beach before it enters the federal channel.

Economic Assessment

A rough order of magnitude cost estimate is presented in Table 5 to compare the different disposal options. For each option, it is assumed that channel will be dredged to authorized depth and that all material will be disposed of with a single disposal method (i.e. stockpile, beach placement, landfill, or ODMDS). The estimate shows that disposing of the material at the ODMDS is the least cost option, at $33/cy. Taking the material to the ODMDS eliminates the need for landside equipment, and dewatering and trucking the material. Stockpiling and beach placement are very similar in unit cost, pointing to the fact that for construction cost there is not much difference with placing the material at HBP verse placing it on the beach. Trucking the material to the landfill is the most expensive option, about double the stockpile/beach placement options (i.e. $188/cy vs. $91-96/cy).

Table 5. Rough Order of Magnitude cost comparison of disposal options.

Disposal Method	Mob/ Demob	Dredging Project Costs	Total Project Costs	Dredging Unit Costs ($/cy)
Stockpile	$501,121	$593,948	$1,095,069	$91
Beach Placement	$501,121	$621,450	$1,122,571	$96
Landfill	$501,121	$1,220,902	$1,722,023	$188
South Oahu ODMDS	$626,888	$212,880	$839,768	$33

The Federal Standard. The Federal Standard is defined in USACE regulations as the least costly dredged material disposal or placement alternative identified by USACE that is consistent with sound engineering practices and meets all federal environmental requirements. It is also USACE policy to fully consider all aspects of the dredging and placement operations while maximizing benefits to the public. Beneficial use options for the dredged material should be given full and equal consideration with other alternatives. Based on the cost analysis above, open water placement of dredged material in the South Oahu ODMDS is the Federal Standard (or “base plan”).

Beneficial use project costs exceeding the cost of the Federal Standard (or “base plan”) option become either a shared federal and non-federal responsibility, or entirely a non-federal responsibility, depending on the type of beneficial use. Section 145 of WRDA 1976, as amended by Section 933 of WRDA 1986, Section 207 of WRDA 1992, and Section 217 of WRDA 1999, authorizes USACE to place suitable dredged material on local beaches if a state or local government requests it. Although placement for restoration purposes may be authorized under it, this provision is primarily used for storm damage control purposes. The incremental costs of beach nourishment are shared on a 65 percent federal and 35 percent non-federal basis.

Environmental Compliance

An Environmental Impact Statement was prepared for all USACE harbors in 1975. Based on this analysis, the primary environmental impacts of concern were disruption of the benthic community during dredging, increased turbidity in the water column both during dredging and disposal at the offshore site, and possible degradation of the deep ocean environment at the ODMDS. During dredging and disposal, these impacts are minimized to the extent possible through the use of best management practices.

Based on discussions with the resource and permitting agencies in 2017, their concerns with dredging Haleiwa Harbor are primarily related to the potential beach placement disposal option. The dredging operation would only need a Section 402 NPDES permit, however, beach placement would require an Environmental Assessment and several additional permits to be obtained. Details of these requirements can be reviewed in the “Hawaii RSM: Advance Planning for the Beneficial Reuse of Dredged Material at Haleiwa Harbor” report (Molina 2017).

Marine Benthic Survey

The FWS conducted a Marine Survey in 2012 to classify the bottom substrate in the federal channel. Some corals were found along the base of the wave absorber and breakwater. Only one coral head was found in the outer entrance channel (Figure 12). FWS stated that they “would anticipate that future maintenance dredging activities would result in the direct, but temporary loss of infauna and a species of bryozoan that was observed on the sediment. They would also expect to observe the degradation or loss of corals, non-coral macroinvertebrates and marine plants through indirect impacts due to reduced water quality conditions during dredging activities.” FWS recommended that silt curtains be used during dredging operations and provided as list of recommended best management practices (FWS 2012).

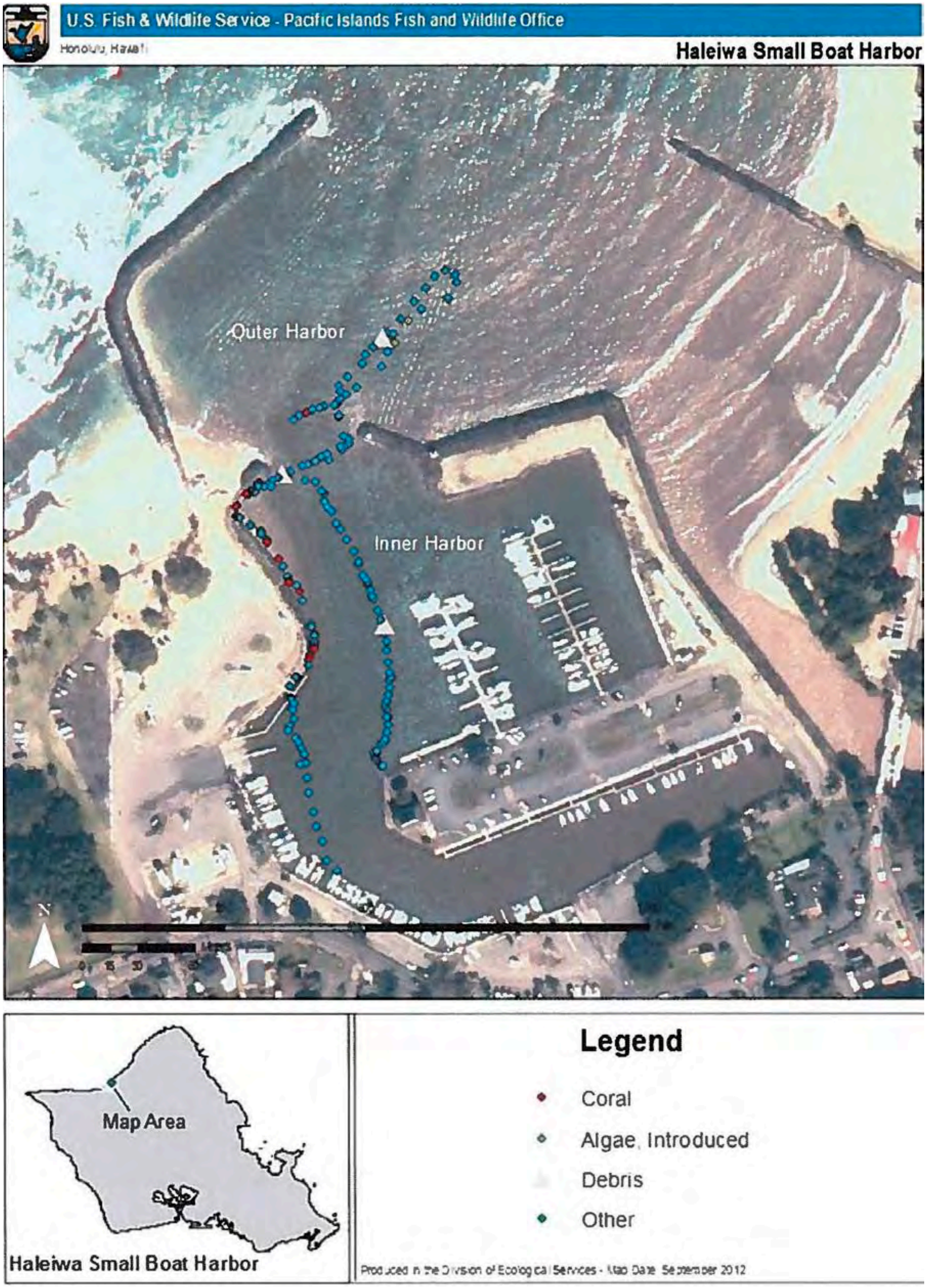

Figure 12. Location track of the FWS marine survey at Haleiwa SBH in 2012, with coral colonies highlighted in red.

Recommendations

The Base Plan for management of material dredged from Haleiwa Harbor is the use of the existing EPA designated ODMDS for all materials able to be deposited within it. It is not expected that any material will have contaminates of concern above EPA's limits, nor that it will exceed the ODMDS grain size requirements. The ODMDS has ample capacity to meet the 20 year dredging needs of Haleiwa Harbor.

In the State of Hawaii, sand is considered a valuable and limited resource that needs to be comprehensively managed. Although offshore disposal is the federal standard, options to keep the sand in the littoral system are preferred and need to be further pursued. The preferred alternative for the beneficial use of sandy material is to stockpile it at Haleiwa Beach Park for future use, when logistically and economically practicable. Once stockpiled, the material would be available for any future city, state, or federal renourishment needs. It is further recommended that the State, C&C, and POH begin working on developing a detailed plan and obtaining the permitting necessary to stockpile and place sand at Haleiwa Beach. A non-federal sponsor would need to fund the incremental cost over that of disposal at the ODMDS of approximately $300,000 for stockpiling the dredged material.

A Dredge Material Management Plan is not required for this project.

References

Hawaii Department of Land and Natural Resources, Division of Boating and Ocean Recreation (DBOR) website, accessed July 1, 2017. http://dlnr.hawaii.gov/dobor/haleiwa-harbor/

Marine Research Consultants, Inc. (MRCI). 2008. *Final Sampling and Analysis Report for Maintenance Dredging – Haleiwa and Waianae Small Boat Harbors*. Prepared in association with Belt Collins Hawaii, Ltd. for the U.S. Army Corps of Engineers, Honolulu District.

Molina, L.K. and J. H. Podoski. 2017. *Hawaii RSM: Advance Planning for the Beneficial Reuse of Dredged Material at Haleiwa Harbor*. ERDC/CHL RSM TN (Draft). Vicksburg, MS: U.S. Army Engineer Research and Development Center.

Podoski, J. H. 2014. *Regional Sediment Budgets for the Haleiwa Region, Oahu, Hawaii*. ERDC/CHL CHETN-XIV-38. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

Smith, T. D. 2014. *Potential regional sediment management (RSM) projects in the Haleiwa Region, Oahu, Hawaii*. ERDC/CHL CHETN-XIV-37. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

U.S. Army Corps of Engineers (USACE), Honolulu District. 1975. *Final Environmental Statement, Harbor Maintenance Dredging in the State of Hawaii*. September 1975.

U.S. Army Corps of Engineers (USACE), Pacific Ocean Division. 1973. *National Shoreline Study, State of Hawaii Regional Inventory Report*. U.S. Government Printing Office, Washington, June 29. Volume 5, pp. 41-42. Prepared in 1971.

Welp, T., Maglio, C.K. 2014 Letter Report - Dredging Operations Technical Support (DOTS) Response. US Army Corps of Engineers (USACE) Honolulu District Request USACE Engineer Research and Development Center (ERDC). April 2014.

U.S. Fish and Wildlife Service (FWS). 2012. *Geospatial mapping of coral reef resources at Haleiwa Small Boat Harbor and Waianae Small Boat Harbor, Oahu Island, Hawaii*. Letter, September 14.

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