RED HILL BULK FUEL STORAGE FACILITY

Tank Closure Plan

November 1, 2022

Office of the Secretary of the Navy

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Acronyms

AFFF	Aqueous Film Forming Foam
AOC	Administrative Order on Consent
ASTM	American Society for Testing and Materials
AVGAS	Aviation Gasoline
BBL	Barrels
BGS	Below Ground Surface
BWS	County of Honolulu Board of Water Supply
CF&T	Contaminate Fate and Transport
COPC	Contaminants of Potential Concern
COR	Contracting Officer's Representative
C/I	Commercial/Industrial
CSM	Conceptual Site Model
CTO	Contract Task Order
DLA	Defense Logistics Agency
DO	Diesel Oil
DOD	Department of Defense
DOH	Department of Health, Hawaii
DON	Department of the Navy
DQA	Data Quality Assessment
EALs	Environmental Action Levels
EDD	Electronic Data Deliverable
ELAP	Environmental Laboratory Accreditation Program
EPA	U.S. Environmental Protection Agency
EPC	Exposure Point Concentration
EPP	Environmental Protection Plan
EXWC	Engineering and Expeditionary Warfare Center
Facility	Red Hill Bulk Fuel Storage Facility
FLCPH	Fleet Logistics Center Pearl Harbor
FM	Facility Manager
Ft	Feet
F-24	F-24 Jet Fuel
F-76	Marine Diesel Fuel
°F	Fahrenheit
GWPP	Groundwater Protection Plan
HAR	Hawaii Administrative Rules
HASP	Site Health and Safety Plan
HDOT	Hawai'i Department of Transportation
HEER	Hazard Evaluation and Emergency Response
HW	Hazardous Waste
IDW	Investigation-Derived Waste
JBPHH	Joint Base Pearl Harbor-Hickam
JP-5	Jet Fuel Propellant No. 5
JP-8	Jet Fuel Propellant No. 8
JTF-RH	Joint Task Force – Red Hill
NAPs	Natural Attenuation Parameters
LNAPL	Light Non-Aqueous Phase Liquids
LOD	Limits of Detection
LTM	Long-Term Monitoring
MCLs	Maximum Contaminate Levels

MODFLOW	Modular Groundwater Flow Model
MOGAS	Motor Gasoline
MPC	Measurement Performance Criteria
MS/MSDs	Matrix Spikes/ Matrix Spike Duplicates
MWIWP	Monitoring Well Installation Work Plan
NATO	North Atlantic Treaty Organization
NAVFAC	Naval Facilities Engineering Systems Command
NAVSUP	Naval Supply Systems Command
NAVY	United States Navy
NDAA	National Defense Authorization Act
NPDES	National Pollution Discharge Elimination System
NSFO	Navy Special Fuel Oil
PAH	Polynuclear Aromatic Hydrocarbon
PALs	Project Action Levels
PARCC	Precision, Accuracy, Representativeness, Comparability, and Completeness
PPB	Parts Per Billion
PQO	Project Quality Objectives
QA	Quality Assurance
QC	Quality Control
QCP	Quality Control Plan
RHBFSF	Red Hill Bulk Fuel Storage Facility
RPM	Remedial Project Manager
SAP	Sampling and Analysis Plan
SC	Site Closure
SDG	Sample Delivery Group
SECDEF	Secretary of Defense
SMEs	Subject Matter Experts
SOPs	Standard Operating Procedures
SSRBLs	Site-Specific Risk-Based Level
SVM	Soil Vapor Monitoring
SVMP	Soil Vapor Monitoring Probe
SVMS	Soil Vapor Monitoring System
SW	Solid Waste
TGM	Technical Guidance Manual
TPH	Total Petroleum Hydrocarbons
TPH-D	Total Petroleum Hydrocarbons – Diesel Range Organics
TPH-G	Total Petroleum Hydrocarbons – Gasoline Range Organics
U.S	United States
UST	Underground Storage Tanks
WP	Work Plan
WMP	Waste Management Plan

Executive Summary

The Navy developed this Tank Closure Plan in coordination with the Director, Defense Logistics Agency (DLA) and in accordance with Directive 8 of the Superseding Emergency Order (EO) issued by the State of Hawaii Department of Health (DOH), dated May 6, 2022. This Tank Closure Plan covers the 20 underground storage tanks, four surge tanks, and associated valves and piping systems at the Red Hill Bulk Fuel Storage Facility (RHBFSF), following the Hawaii underground storage tank regulations, Chapter 11-280.1 of the Hawaii Administrative Rules (HAR). Specifically, this plan addresses HAR 11-280.1-70- through 11-280.1-75 on underground storage tank (UST) closure, as well as HAR 11-280.1-60 through 11-280.1-65 on release response actions.

The DOH Superseding EO divides tank closure into two phases: the Defueling Phase and the Closure Phase. To ensure the safe and expeditious completion of defueling, the Secretary of Defense (SECDEF) directed the standup of the Joint Task Force-Red Hill (JTF-RH). As indicated in Defueling Plan Supplement 1.B, the JTF-RH expects to complete defueling by the end of June 2024. In accordance with the EO, the JTF-RH and DOH will determine when the Defueling Phase is complete, and subsequently the Navy will begin the Closure Phase. In considering the six fuel tanks (F-1, F-13, F-14, F-17, F-18, and F-19) that are currently out-of-service and empty, the Navy will work collaboratively DOH and JTF-RH to evaluate potential opportunities to accelerate the closure schedule.

In preparing this Tank Closure Plan, the Navy assembled a team of experts with in-depth knowledge of fuel systems and significant experience with permanent closure of large fuel tanks. The plan herein is evidence-driven and was prepared in accordance with Directive 8 of the DOH Superseding EO, which specifies that this Tank Closure Plan must address the following:

- Facility infrastructure and procedures needed to perform the work and ensure pipeline integrity before the cleaning
- Sequence and process in which the tanks and pipelines are planned to be cleaned
- Ultimate disposition of any accumulated sludge or waste material from the 20 tanks, four surge tanks, and associated piping
- Method of permanent closure (remove, fill, or close in place) and associated design and process
- Site Assessment in connection with the facility's permanent closure

In addition, during the July 14, 2022, Meet and Confer session between DOH and Navy, DOH indicated that the Tank Closure Plan must also address:

- An analysis of the alternatives for permanent closure, with each alternative evaluated for engineering feasibility, practical pros and cons, schedule, and cost. In addition, DOH requested the Navy explore potential options for beneficial non-fuel reuse.
- A detailed schedule for cleaning each tank and the Spill Response Plan requirements for the cleaning task.

In order to address DOH requirements, this Tank Closure Plan is organized into the following sections:

1. Introduction
2. Infrastructure Description and Procedures Needed Before Cleaning
3. Sequence and Process for Cleaning of Tanks and Piping Systems
4. Management of Accumulated Sludge and Materials
5. Method of Permanent Closure and Associated Design and Process
6. Site Assessment and Release Investigation and Response
7. Coordination and Outreach
8. Conclusion

The Navy will perform tank and pipeline closure activities in accordance with the Red Hill Fuel Storage Facility Response Plan (previously submitted on September 7, 2022, as Enclosure d. to the Defueling Plan Supplement 1.A), which provides information and detailed procedures for responding to a potential fuel spill at the RHBFSF.

In accordance with DOH direction, the Navy analyzed the engineering feasibility, pros and cons, schedule, and cost for the following permanent tank closure alternatives:

ALT 1: Closure in Place

ALT 2: Closure in Place for Potential Non-Fuel Reuse of Tanks

ALT 3: Closure with Fill (with inert material)

ALT 4: Remove Tank Steel Liner, and Fill (with inert material)

Section 5 of this report provides a summary of each tank closure alternative. In addition, a robust, third party analysis of these alternatives is currently being written into final report form, and will be provided to the DOH in December 2022, as indicated in the attached Plan of Action and Milestones (POAM) provided in Appendix A.

In evaluating the alternatives, the Navy also considered impacts to the environment and community surrounding Red Hill, safety risks during construction, and the potential for non-fuel reuse. **Based on a consideration of the evaluation factors, the Navy intends to seek DOH approval for Closure in Place as the permanent closure method for the Red Hill underground storage tanks and associated piping systems.** The Navy has identified this as the best alternative for permanent closure because it would allow for beneficial non-fuel reuse of the tanks while minimizing impacts to the environment and local community, safety concerns, and schedule (Table E-1).

Prior to finalizing the design and process for permanent Closure in Place, the Navy will actively engage with DOH, the general public, and other stakeholders in order to solicit input on beneficial non-fuel reuse options. The Navy concept involves an inclusive, science-based approach that will collect ideas from interested parties. After gathering ideas, the Navy will perform a thorough review of the input to make a final determination of the beneficial non-fuel reuse. The Navy will submit the non-fuel reuse evaluation to DOH as a supplement to this Tank Closure Plan, on a timeline commensurate with overall schedule for tank closure (Appendix A). Once the non-fuel reuse option has been selected, the Navy will take appropriate steps to render the tanks unusable for fuel storage, while still supporting the beneficial non-fuel reuse option.

TABLE E-1. SUMMARY OF EVALUATION FACTORS FOR EACH TANK CLOSURE ALTERNATIVE

Alternative	Environmental Impacts	Local Area Impacts	Safety Concerns	Schedule (ROM)	Engineering Feasibility	ROM Cost Ratio*
ALT 1: Closure in Place	**NEGLIGIBLE**	**NEGLIGIBLE**	**NEGLIGIBLE**	**2 to 3 years**	**Constructible**	**1x**
ALT 2: Closure in Place for Potential Non-fuel Reuse	**NEGLIGIBLE**	**NEGLIGIBLE**	**NEGLIGIBLE**	**3 to 4 years**	**Constructible**	**10x**
ALT 3: Closure with Fill	**MODERATE**	**MODERATE**	**MODERATE**	**5 years**	**Possibly Constructible**	**30x**
ALT 4: Remove Tank Steel Liner, and Fill	**CRITICAL**	**CRITICAL**	**CRITICAL**	**7 years**	**Possibly Constructible**	**50x**

***Projected rough order-of-magnitude (ROM) cost ratios do not include ventilation and cleaning, which are constant across the four alternatives.**

In accordance with applicable environmental regulations, the Navy will continue to monitor the RHBFSF site and will work to implement any required long-term release response actions.

The Aqueous Film Forming Foam (AFFF) fire suppression system, which was installed under a 2015 Military Construction project, will be addressed in accordance with the 2020 National Defense Authorization Act (NDAA) requirements for Department of Defense facilities. The Navy will remove the AFFF as directed in the NDAA, and subsequently evaluate the fire suppression system in context of the future beneficial non-fuel reuse of the facility. The AFFF retention line, where fuel was found during the 2021 release, has never held AFFF, and no AFFF was released to the aquifer.

The Navy will submit supplements to this Tank Closure Plan on a timeline commensurate with the overall closure schedule, in accordance with the POAM shown in Appendix A. Throughout the closure process, the Navy will engage in a robust public outreach program and will continue to collaborate fully with U.S. Environmental Protection Agency (EPA), DOH, and other key stakeholders.

1. Introduction

In accordance with Secretary of Defense (SECDEF) direction in his March 7, 2022, memo and the requirements in Directive 8 of the State of Hawaii Department of Health's (DOH) May 6, 2022, superseding Emergency Order (EO), the Navy will safely and permanently close the Red Hill Bulk Fuel Storage Facility (RHBFSF). On behalf of DoD, the Secretary of the Navy (SECNAV) has developed, in coordination with the Director, Defense Logistics Agency (DLA), this plan for closure of the 20 underground storage tanks, their four surge tanks, and associated piping systems at Red Hill in accordance with Hawaii underground storage tank regulations, Chapter 11-280.1 of the Hawaii Administrative Rules (HAR).

The Navy has developed a Plan of Actions and Milestones (POAM) in Appendix A to describe the major events supporting this Tank Closure Plan. Additionally, a detailed schedule of tank closure activities is provided in the form of a Gantt chart (Enclosure 1, submitted separately) and in the form of a network diagram (Enclosure 2, submitted separately). The Gantt chart and network diagram show the relationship between the required activities and display the critical path.

In preparing this Tank Closure Plan, the Navy assembled a team of experts with in-depth knowledge of fuel systems and significant experience with permanent closure of large fuel tanks. This Tank Closure Plan provides a Plan of Action and Milestones (POAM) with interim milestones (Appendix A) for the Navy to achieve throughout the closure process in order to complete tank and pipeline closure activities. Based on the method of permanent Closure in Place (subject to DOH approval) the plan targets completion of closure three years after commencement; i.e., in August, 2027, based on the completion of defueling by the end of June 2024 (as indicated in the Red Hill Defueling Plan Supplement 1.B). The Navy will work to stay on schedule and will inform DOH and the public about any delays or major issues that arise during closure implementation.

SECDEF directed the standup of JTF Red Hill to ensure the safe and expeditious defueling of Red Hill. The Navy designated the Commander, Navy Region Hawaii with the responsibility to lead the closure process and ensure successful implementation of this Tank Closure Plan.

2. Infrastructure Description and Procedures Needed Before Cleaning

Some figures referenced in this section contain defense critical infrastructure security information, and are therefore placed in Appendix C, submitted separately as Enclosure 3 to this Tank Closure Plan.

2.1 Location and Description of Facilities

The activities discussed in this Tank Closure Plan will take place at the Red Hill Bulk Fuel Storage Facility (RHBFSF) on the Island of Oahu, Hawaii (Figure 2-1). The Naval Supply Systems Command Fleet Logistics Center Pearl Harbor (formerly Fleet and Industrial Supply Center) operates the RHBFSF, which was originally constructed between August 1940 and September 1943. The facility consists of 20 underground vertical cylindrical concrete fuel storage tanks (Tanks F-1 to F-20) mined into the igneous rock formation, four underground surge tanks and one above ground Fuel Oil Reclaimed (FOR) tank.

Fuel pipelines associated with the Red Hill tanks include an F-76 Marine Diesel Fuel line, a Jet Fuel Propellant No. 5 (JP-5) line, an F-24 jet fuel pipeline and a 4 inch Fuel Oil Reclaimed (FOR) line that transitions to a 6 inch line. Portions of a 16 inch aviation gas (AVGAS) line to the former Pearl City fueling annex still exist, but records indicate that these pipelines have already been cleaned and capped.

See Table 2-1 for a summary of the Red Hill tanks and pipelines that will be addressed under this Tank Closure Plan. Currently, USTs F-1, F-13, F-14, F-17, F-18, and F-19 are empty of fuel.

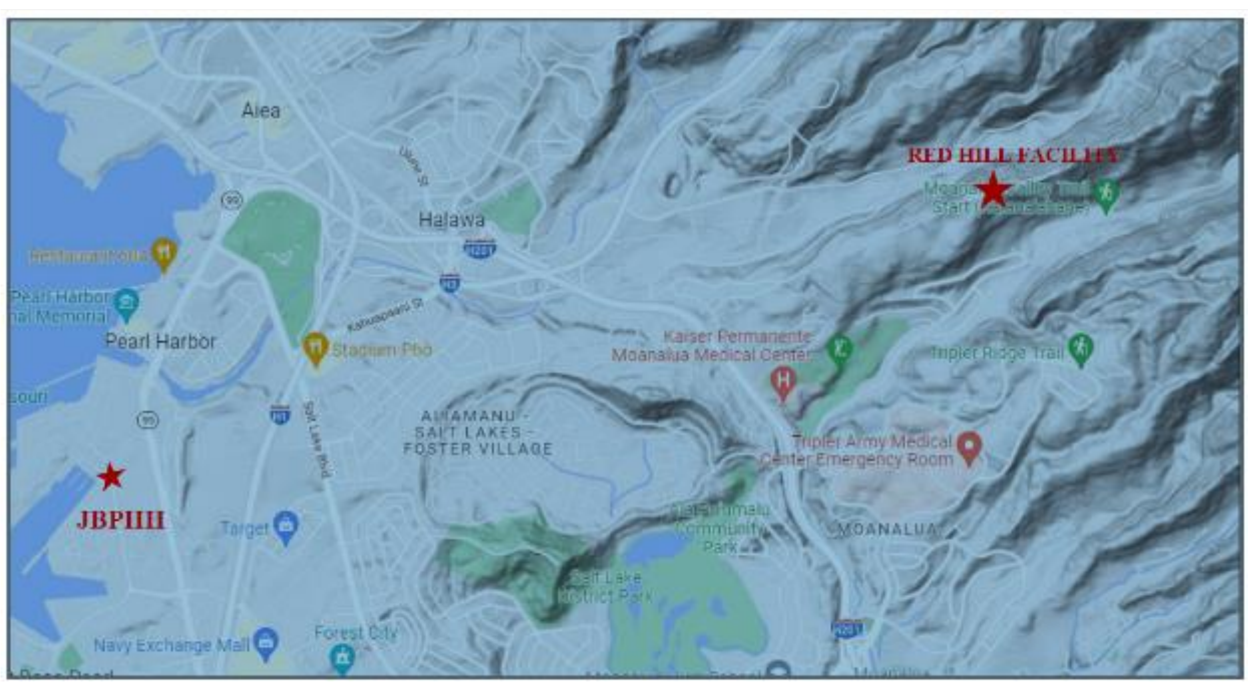

FIGURE 2-1 RED HILL FACILITY LOCATION

TABLE 2-1 SUMMARY OF RED HILL TANKS AND ASSOCIATED INFRASTRUCTURE

Tank ID	Year Built	Capacity (gallons)	Contents	Status
F-1	1943	11.98M	Empty	Defueled in 1997
F-2	1943	11.97M	F-24	In use
F-3	1943	11.98M	F-24	In use
F-4	1943	12.7M	F-24	In use
F-5	1943	12.7M	F-24	In use
F-6	1943	12.7M	JP-5	In use
F-7	1943	12.7M	JP-5	In use
F-8	1943	12.7M	JP-5	In use
F-9	1943	12.7M	JP-5	In use
F-10	1943	12.7M	JP-5	In use
F-11	1943	12.7M	JP-5	In use
F-12	1943	12.7M	JP-5	In use
F-13	1943	12.7M	Empty	Clean and Empty
F-14	1943	12.7M	Empty	Clean and Empty
F-15	1943	12.7M	F-76	In use
F-16	1943	12.7M	F-76	In use
F-17	1943	12.7M	Empty	Clean and Empty
F-18	1943	12.7M	Empty	Clean and Empty
F-19	1943	12.7M	Empty	Defueled in 1997
F-20	1943	12.7M	JP-5	In use

Tank ID	Year Built	Capacity (gallons)	Contents	Status
FOR (AST)	1970	42k	Fuel/water mix	In use
F-ST1	1942	422k	F-24	In use
F-ST2	1942	422k	JP-5	Out-of-service
F-ST3	1942	422k	F-76	In use
F-ST4	1942	422k	Diesel	In use
F-24 Pipeline	Various	152k	F-24	In use
JP-5 Pipeline	Various	205k	JP-5	In use
F-76 Pipeline	Various	660k	F-76	In use
FOR pipeline (4”/6”)	Various	N/A	Fuel/water mix	In use
8” JP-5 slop pipeline	Various	N/A	Empty	Out-of-service Cleaned and capped
16” AVGAS pipeline	Various	N/A	Empty	Out-of-service Cleaned and capped

2.1.1 Underground Storage Tanks

Each underground storage tank (UST) is 100 feet in diameter, between 238–250 feet high, and holds approximately 285,000 to 302,000 barrels (approximately 12.5 million gallons). The 20 USTs have a coated welded steel liner backed up by reinforced concrete which bears against the solid rock from which the tanks were tunneled.

The tank structure consists of an upper dome, barrel section, lower dome, internal steel liner on all surfaces, fuel piping, and tank venting systems. Support facilities and systems include the Upper Access Tunnel, Lower Access Tunnel, and a tunnel that connects the Red Hill Tank Gallery area to the Underground Pumphouse on Joint Base Pearl Harbor Hickam (JBPHH).

The underground surge tanks (Tank numbers F-ST1, 2, 3 and 4) also built in 1942 are located adjacent to the underground receiving pump house at Adit 1 with capacities of 421,722; 422,100; 422,688 and 422,184 gallons respectively. "Adits" are openings or access doors into the tunnels. The surge tanks help regulate the flow of fuel into the Red Hill tanks.

The interior dimensions for each surge tank are 60 feet in diameter by 21 feet in height, as shown in Figure 2-2 in Appendix C (Enclosure 3) (extracted from Drawing No. 294125). The construction of each surge tank consists of a minimum 12 inch-thick reinforced concrete shell with a 1/4 inch-thick interior steel liner plate. Similar to the underground storage tanks, each surge tank was constructed by excavating the volcanic rock formation. The four surge tanks share one integral reinforced concrete roof slab with a minimum slab thickness of six feet. Sufficient access to enter the tanks and set up scaffolding / rigging as needed to clean and degas the tank exists.

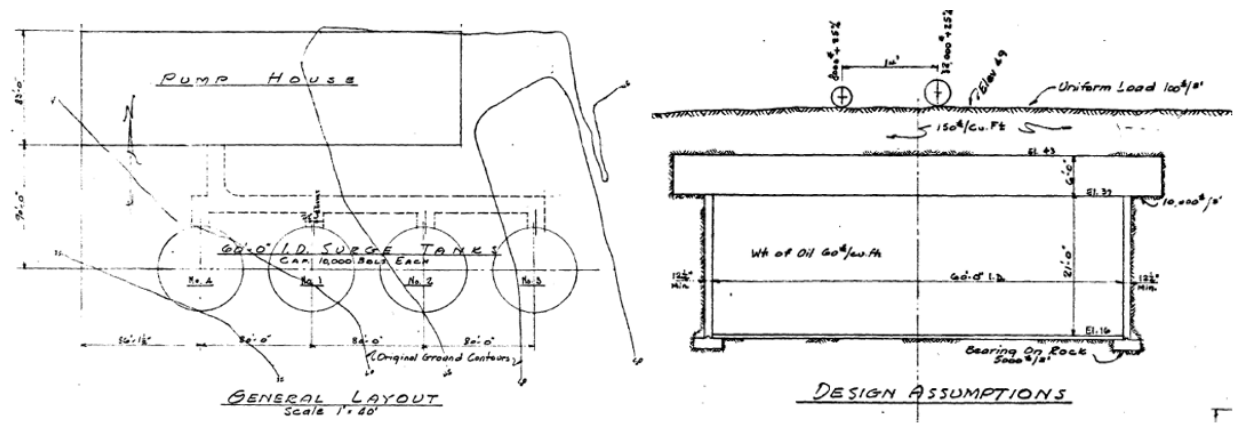

FIGURE 2-3 UNDERGROUND SURGE TANKS 1

The Fuel oil reclaimed (FOR) tank 311 is a 42,000 gallon above ground storage tank (AST) near Adit 3 that collects condensate and oily waste from other sampling activities connected to the bottom of tanks F-1 – F-20 and tunnel sumps via a 4" pipeline.

Figure 2-4 in Appendix C (Enclosure 3) shows the tanks, access tunnels, Adits, and supporting facilities/ systems.

The Upper Access Tunnel provides access to the tank manholes and gauging platforms. The Lower Access Tunnel contains piping and associated infrastructure plus electrical, ventilation, control and fire suppression systems. The Lower Access Tunnel provides access to the tank multi-product common fill/issue piping and valves, tank drain and sampling piping and valves at the bottom of the tanks. Tunnels are interconnected by two elevators: One elevator is uphill of Tank 15 and a second elevator is uphill of Tank 17. Tunnels are accessed by openings or access doors into the tunnels called "Adits."

Two adits are on base at JBPHH. One of these on base adits leads to the Underground Pump house, which is used to move fuel up to the Red Hill Tanks. Four more adits are at Red Hill at the end of Halawa Valley. Tunnels from the second on base adit to tanks contains FOR lines and not the potable water line as seen in Figure 2-4 in Appendix C (Enclosure 3).

Access to Red Hill is currently available at the manned guard shack next to the Halawa Correctional Facility and through the privatized Army housing area. There are two roads: the guard house entrance is connected to the lower access road and the privatized housing area gate connects to the upper access road with direct access to an adit.

Access into the Upper Access tunnel is through a Red Hill adit located downhill from Tanks 1 and 2 and a second adit located between Tanks 13 and 15). Another Red Hill adit is at a lower elevation than the first two adits and it provides access to one of the elevators. That elevator provides access to the Lower Access and Upper Access tunnels. A fourth Red Hill adit provides access to the Lower Tunnel below Tanks 1 and 2. Access into each tank is via a manhole at the Upper Access Tunnel level. Figure 2-7 in Appendix C (Enclosure 3) shows the locations of the Red Hill adits.

Each tank has a steel frame tower in the center of the tank extending from the floor of the lower dome to the top of the upper dome with a walkway from the manhole at the Upper Tunnel level (190 feet above the floor) to the tower. The center tower was used during original construction to construct the tanks and remains in the tanks to provide access to the tank lower dome floor via stairs. Over the years, the center towers have been retrofitted with booms and hoists with man-baskets for tank maintenance and repair. Booms are generally removed from tanks after repairs and not left in place.

Tanks 1 to 4 are 100-feet diameter, 238-feet 6-inches overall height, and have a container volume of 285,148 barrels (Bbl) (11,976,216 gallons) (59,250 cubic yards) each. Tanks 5 to 20 are 100-feet diameter, 250-feet 6-inches overall height, and have a container volume of 301,934 Bbl (12,681,228 gallons) (62,750 cubic yards) each.

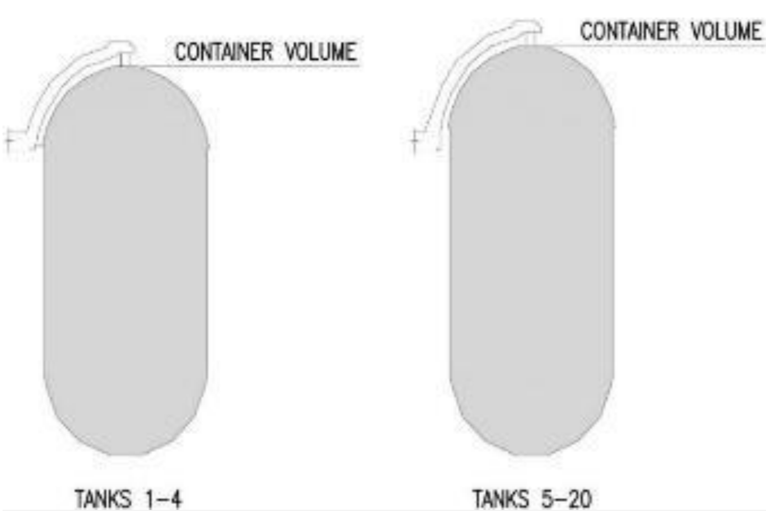

FIGURE 2-8: CONTAINER VOLUME EXHIBIT

The container volume represents maximum volume. Working storage volumes are less than maximum volumes to accommodate safety, liquid expansion from temperature change, regulatory limitations, and any other Navy policy consideration. The top of the tanks (top of the upper dome) is 110-feet to 175 feet below ground. The bottoms of the tanks range in elevation from 123 feet to 151 feet above sea level. The tanks are arranged in two rows of 10 tanks, spaced 200 feet on center. 100 feet of lava rock separates the tanks from each other.

The tank construction sequence started with Tanks 1 and 2, and each crew moved to the next excavation/construction, ending with Tanks 19 and 20. The tanks were constructed by excavating the lava rock formation of Red Hill to create a cavity for each tank, which was then lined with gunite, reinforced concrete, and a 1/4-inch-thick steel liner. A shaft from the ground surface, down to the elevation of the lower access gallery was first excavated, to serve as the excavation spoil shaft to conveyors in the Lower Access Tunnel. The upper dome was constructed next. The lava rock was excavated to create a cavity for the upper dome. The diameter of the upper dome excavation is larger than that of the tank barrel, allowing for it to be constructed on the existing rock. Steel framing and liner plates were then installed, followed by filling the cavity between the liner plates and lava rock with reinforced concrete, 4 feet thick. This provided a structural dome permitting safe excavation of the tank below the dome and its overburden of 110 to 175 feet of vertical rock.

After the upper dome was constructed, the barrel was excavated to approximately the elevation of the Lower Access Tunnel floor (Figures 2-6, 7, and 8). The rock face was lined with 6 inches of gunite (i.e., spray-applied concrete, a dry-mix form of shotcrete) to seal the rock face. In some locations additional grouting into the lava was required to fill voids. The lower dome was constructed next, including the tank piping between the tank cavity and lower access tunnel. The lower dome was then poured as a plug to approximately the elevation of the tank floor. A steel structure was fabricated, and concrete filled behind the plates, in lifts up to the spring line of the dome, 50 feet above the dome floor. The floor of the lower dome (20-foot diameter) is flat and consists of 1/2-inch-thick steel plates that serve as the foundation for the tower.

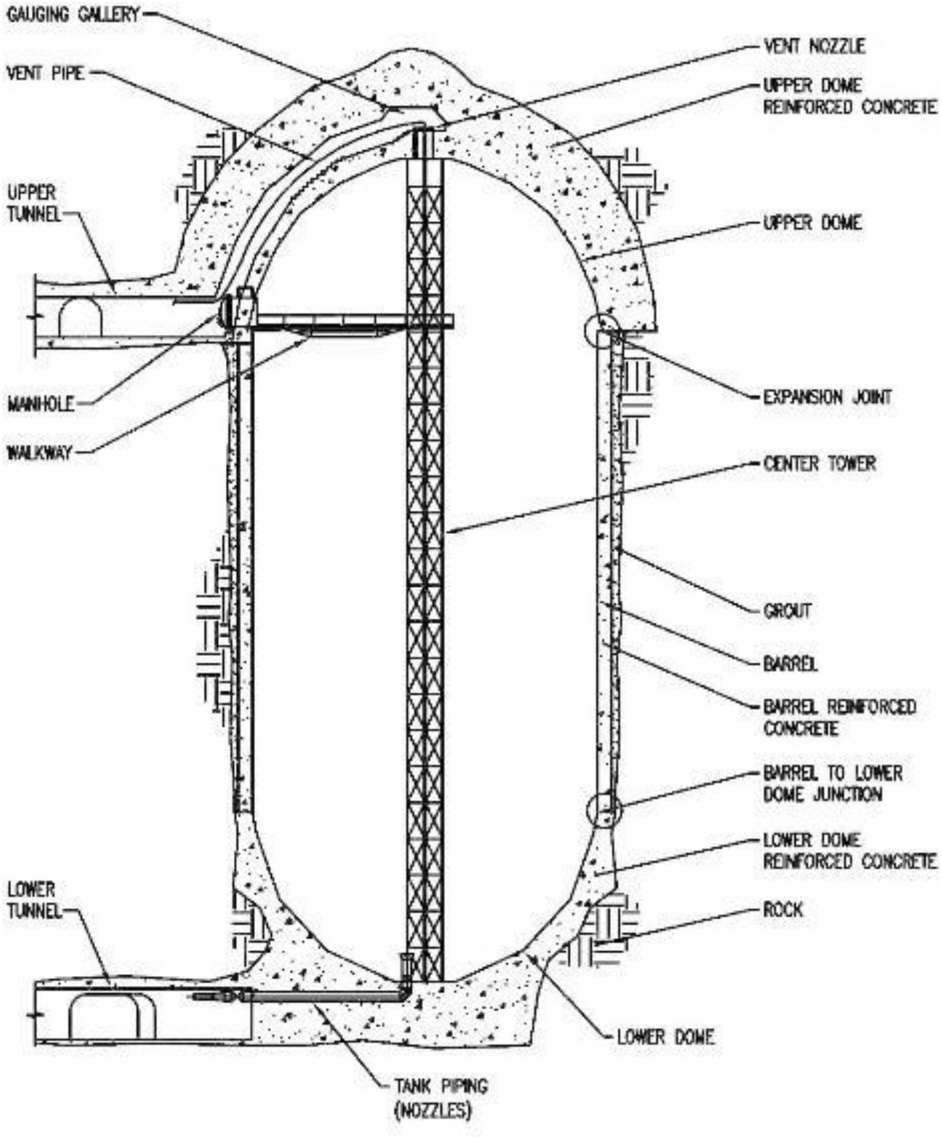

FIGURE 2-9: EXISTING TANKS 1-4 ELEVATION

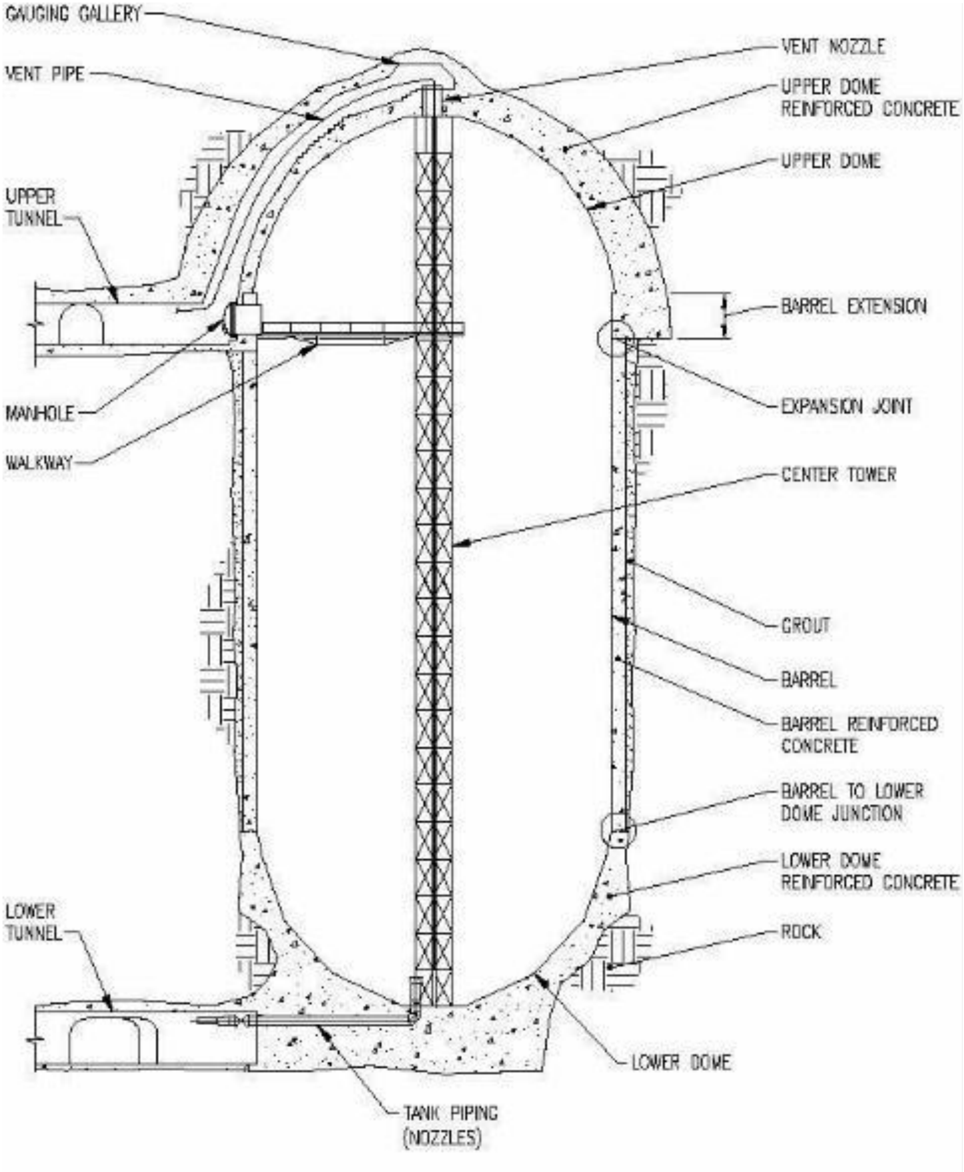

FIGURE 2-10: EXISTING TANKS 5-20 ELEVATION

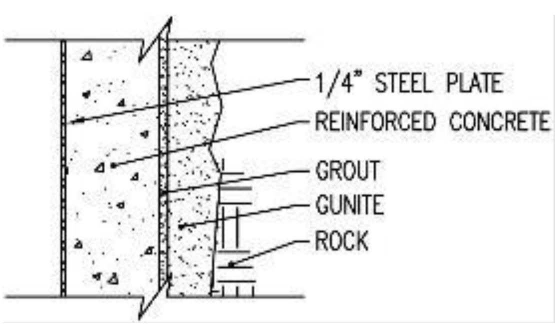

FIGURE 2-11: EXISTING BARREL CONFIGURATION

The barrel was constructed of reinforced concrete (2 feet-6 inches thick minimum at the top, 4 feet thick minimum at the bottom). The steel liner plates on the barrel are arranged 5-feet tall horizontal courses and served as forms for placing concrete. Horizontal steel angles were welded to the backside of the steel plates at the top and bottom of the plates. The horizontal and vertical joints in the steel liner are butt welded plates. Reinforcing steel for concrete was then placed in the forms. The horizontal angles were then anchored to the reinforcing steel with 3/4-inch diameter anchor rods. Concrete was placed in the forms in 5-feet lifts. After the concrete cured, water was injected between the concrete and gunite layer to check for gross leaks in the steel liner. If no gross leaks were identified, the barrel was pre-stressed by injecting grout between the reinforced concrete and gunite layer, thus compressing the barrel. Grout was injected via tubes that penetrated the steel liner and extended through the concrete to the gunite layer. Grouting pressure was monitored with strain gauges in strain gauge tubes in the barrel. The strain gauge tubes penetrate the steel liner and extend through the concrete and gunite into the lava rock. Grout tube and strain gauge tube penetrations in the steel liner were sealed with plates welded over the penetrations.

The tanks are currently vented (for fill and issue air displacement) at several locations throughout the Upper Tunnel areas. There are vents extended to above the surface of three tanks, and an additional vent outside an adit. Various tanks vent to different locations. Most of the vent piping from the tanks is set in concrete below the floor in the upper tank gallery and has very little access for inspection or repair.

A separate fresh air ventilation system was installed to make tunnels suitable for workers. Inlet/outlet shafts were installed above the elevator downhill from Tank 20 and above the water plant. Other fresh inlet/outlets can be found at two other adits. Ventilation fans are located at the adit near the water plant.

2.1.2 Above-Ground Storage Tank

The Fuel Oil Reclaimed (FOR) tank 311 is a 42,000 gallon above ground storage tank (AST) near an adit that receives liquid from the 4 inch FOR pipeline, which collects condensate and oily waste from the bottom of tanks F-1 – F-20 and various tunnel sumps. Post tank closure, the FOR tank will need to stay in place in order to manage condensate that is expected to drain from the 20 tanks over time.

2.1.3 Pipelines

The FOR tank 4” pipeline is located within a tunnel floor trench until it transitions to a 6 inch line at a sump station near an adit, then extends to another adit where it is direct buried for approximately 48 feet and then runs aboveground to AST S311 (see Figure 2-3). Valves on the FOR line at the tank or sumps can be opened or closed to drain water.

Other piping consists of three steel pipelines that carry fuel from the storage tanks to Pearl Harbor. The pipelines run down the Lower Access Tunnel (LAT) in a stacked configuration on the side of the tunnel. The F-76 pipeline is supported on a concrete cradle on the tunnel floor, while the JP-5 pipeline is offset above the F-76 line and is supported on dual angle pipe supports, and the F-24 pipeline is offset above the JP-5 pipeline and supported on dual angel pipe supports (See Figure 2-6 in Appendix C, Enclosure 3). Along the length of each pipeline are a number of Motor Operated Valves (MOVs), which allow the fuel operators to isolate sections of the pipeline remotely from their control room. Table 2-1 provides further details on the RHBFSF pipelines. Portions of secondary containment for former FOR lines at F-2, F-10, F-12 will need to be inspected and closed.

Over the years, cleaning pigs (cylindrical devices places inside the pipes) have been used to scrape and clean the Red Hill fuel pipelines. The most recent work occurred in 2005 and 2019, when an intelligent pigging system was operated to perform inspections and cleaning of the pipelines. Due to these recent cleaning efforts, the Navy expects the pipelines currently contain minimal debris or sludge.

2.1.4 Sumps

Seven drainage sumps are located in the tunnels and will need to be evaluated and cleaned as part of the closure process.

2.2 Infrastructure Repairs Required For Tank Closure

Infrastructure needing repair but not involved with defueling include the 4-inch FOR pipeline and interior tank systems. This infrastructure will be improved as necessary to continue to operate the facility in a manner that is safe and protective of the environment and public health. Timelines for repair will vary with priority in order to support timely closure activities.

The FOR pipeline will be used to drain water accumulations after closure. Repairs to this pipeline have been identified in Third Party Assessment report (See Section 2.3). Repairs to the catwalks and the central tower systems in the USTs may be required after inspections are made. In addition, the following infrastructure is needed before cleaning can begin, unless it was already addressed during recent Clean, Inspect, and Repair (CIR) work:

1. Install temporary power to support contractor equipment since installed electrical system will not support the projected requirement
2. Install and operate a ventilation system to degas the tanks undergoing cleaning through the adit to the atmosphere (it is a life and safety requirement to provide adequate air exchanges)
3. Replace 8-foot diameter hatch cover with temporary lockable to provide efficient access for equipment
4. Install lifelines on catwalk and lighting as a life and safety protection measure
5. Install spider buggy for center tower to support interior tank cleaning
6. Inspect catwalk and central structural tower for safety and structural integrity
7. Repair catwalk and tower, if necessary to support worker safety
8. Install booms with suspended scaffolds to support interior tank cleaning

2.3 Infrastructure Repairs Required For Defueling

Deficiencies associated with infrastructure required for defueling have been identified in the Third Party Assessment and the pipeline inspection report required by Section 318 of the FY22 National Defense Authorization Act. A full list of scheduled repairs and maintenance work required for defueling and closure was provided as part the Defueling Plan Supplement I.B on October 28, 2022. Any deficiencies in infrastructure required defueling will be corrected prior to the Closure Phase.

2.4 Infrastructure Assessment

The Navy intends to conduct an assessment of each tank after cleaning is complete in order to identify any issues with structural integrity. Any issues will be addressed before closure.

3. Sequence and Process for Cleaning of Tanks and Piping Systems

3.1 General

The Navy will perform tank and pipeline cleaning activities in accordance with the Red Hill Fuel Storage Facility Response Plan (previously submitted on September 7, 2022, as Enclosure d. to the Defueling Plan Supplement 1.A), which provides information and detailed procedures for responding to a potential spill at the RHBFSF. Spill containment measures installed for defueling will remain in place for tank closure.

3.1.1 Cleaning Methodology

Currently, USTs F-1, F-13, F-14, F-17, F-18, and F-19 are empty of fuel. Tanks F-1, F-13, F-14, F-17, and F-18 have been cleaned using the methodology described in the Tank Inspection and Repair Maintenance (TIRM) Report approved by EPA/DOH on September 5, 2017. Under this Tank Closure Plan, the Navy will use the cleaning methodology that is specified in American Petroleum Institute (API) RP 1604 "Closure of Underground Petroleum Storage Tanks." This methodology is also part of the previously approved TIRM Report and Decision Document for the remaining cleaning operations as needed. The tank cleaning will be performed by contract and all work will comply with EM 385-1-1, API Std 2015, ANSI Z117.1, API RP 575, API RP 2219, API STD 2217A, HAR 11-280.1 subchapter 7, Federal, State and local laws, ordinances, criteria, rules and regulations. Where requirements differ among applicable laws, criteria, ordinances, and regulations, the most stringent requirements shall apply.

Mobilization and cleaning tasks will be performed in the following general sequence:

1. Install temporary power (typically a generator with containment as needed)
2. After the tank is drained as much as possible through the sump, remove residual fuels
3. Install and operate ventilation system to degas the tanks undergoing cleaning through the adit to atmosphere. The tanks will be ventilated through the lower tunnel through a filtration system.
4. Replace 8 foot diameter hatch cover with temporary lockable entryway
5. Install life lines on catwalk and lighting
6. Install spider buggy for center tower
7. Inspect catwalk and central structural tower
8. Repair catwalk and tower, if necessary
9. Install booms with suspended scaffolds
10. Perform final tank cleaning

3.1.2 Quality Assurance/Quality Control (QA/QC)

The contractor performing the closure design and construction will be required to establish and maintain a QC program that is administered by a design and construction Quality Control organization, using Quality Control and Commissioning Plans, and timely reports, and regular meetings. Construction quality management procedures will adhere to Naval Facilities Engineering Systems Command (NAVFAC) P-445 and ER 1180-1-6. The QC program shall cover on-site and off-site work. No construction work or testing will be performed unless the QC Manager is on the work site.

3.2 Sequence for Cleaning

The sequence and schedule for tank and pipeline cleaning has been developed using the Critical Path Method, and a network diagram is provided in Enclosure 2. Based on previous contracts awarded for Clean, Inspect, and Repair (CIR) at Red Hill, Navy expects that four large tanks can be cleaned at a time during the tank closure process. The specific sequence of tank and pipeline cleaning is summarized as follows.

For the large tanks, the process will start with tanks F-1 – F-4 being cleaned simultaneously. When one of these tanks is finished, the cleaning will move to tank F-5. Subsequently, throughout the cleaning process, as one tank is finished, the next tank will be started, such that four large tanks will always be underway at a time. Overall, the sequence will move from the lower numbered tanks to the higher numbers until reaching tank F-20.

Cleaning of surge tank 1 will begin at the same time as tanks F-1 – F-4. When surge tank 1 is finished, the cleaning will move to surge tank 2, then 3, and finally 4. Due to their smaller size, Navy expects that the surge tanks will be cleaned much sooner than the large tanks (see Enclosure 1).

Pipeline cleaning will begin at the same time as tanks F-1 – F-4 and surge tank 1. Cleaning will start with the JP-5 pipeline, then move to the F-76 pipeline, and then the F-24 pipeline.

During cleaning, it is expected that the sequence described above may be modified somewhat, in order for the work to proceed in the most efficient manner based on field conditions.

3.2.1 Process for Cleaning of Storage Tanks Surge Tanks and Piping Systems

Tank and pipeline cleaning will be part of a contract for tank closure that will conform to Unified Facilities Guide Specifications (UFGS) 33 01 50.55, "Cleaning of Petroleum Storage Tanks," and applicable industry and government standards specified therein. While this UFGS is written specifically for tanks, it will be adapted as necessary and appropriate to encompass cleaning of pipelines as well.

3.2.2 Underground Storage Tanks F-1 – F-20.

3.2.2.1 Preparing to Clean the Tanks.

The contractor, to be selected by the Navy, will proceed with cleaning of the tanks and associated piping as follows:

a. Removal of remaining useable fuel from tanks: Useable fuel will be removed during defueling. Specifically, the Joint Task Force will drain each tank to the maximum extent using the outlet pipe and low point drains. The contractor will prepare and obtain Navy approval for a Spill Response Plan to cover the contractor's activities and address any possible spillage during closure.

b. Unusable Fuel: After removal of usable fuel (if any), any remaining product will be considered waste. If determined to be a waste fuel, the Navy will characterize the material to determine whether it is hazardous, and pump it into suitable containers for temporary storage and/or transportation in accordance with approved procedures meeting local, State, and Federal regulations. See Section 4 of this Tank Closure Plan for information on disposal of this material.

c. Degassing: Degassing involves ventilating the tank to make it safe for human occupancy. Each tank will be ventilated and air testing performed until requirements of Section 33 01 50.55, "Cleaning Petroleum Storage Tanks," the accepted Accident Prevention Plan, API Std 2015, and 29 CFR 1910.146, are met and the tank has been certified gas-free by an Industrial Hygienist. The gas-free certification will be maintained on-site and available for review at all times.

d. Ventilation. The underground fuel complex utilizes a single ventilation system; the tanks do not have their own dedicated fresh air or exhaust systems. Control of temperature, humidity, dust, and fumes will take into account the different modes of the facility ventilation system operation. The Navy's contractor will maintain a vapor-free condition throughout the course of the work inside the tank. The air movers shall be non-sparking, explosion-proof, electrically operated or air-driven exhaust type. A rate of one air change per hour is normally the lowest acceptable rate for tanks under 30,000 Bbl. Because the Red Hill tanks are greater than 30,000 Bbl, 10,000 cubic feet per minute (cfm) will be used in accordance with UFGS 33 01 50.55 "Cleaning of Petroleum Storage Tanks." Air movers shall be kept in operation whenever workers are in the tanks, except the air movers shall be shut down 15 minutes before taking air quality tests.

3.2.2.2 Tank Interior Cleaning

The interior of each tank, including the shell, bottom, columns, roof, roof beams, and interior accessory equipment such as pumps, piping, and ladders, will be cleaned using the cleaning methodology specified in API RP 1604 "Closure of Underground Petroleum Storage Tanks." This methodology was also used in the Tank Inspection and Repair Maintenance (TIRM) Report approved by EPA/DOH on September 5, 2017, and has been used for the most recently cleaned underground storage tanks at Red Hill. The cleaning method is summarized below.

Washing will commence using methods using methods described below. Washing will start at the top of the tank and tower and work down to the lower dome, with the lower dome and tank floor being washed last. Washing will remove oil, sludge (solid material), wax, tar, carbon, and other fuel residue adhering to the surface. Washing will be performed by:

a. Application of an environmentally acceptable cleaning solution, typically done with a power washer

b. Rinsing the surfaces thoroughly with fresh water

c. Removal of debris, equipment and materials used for the cleaning operations from the site, and restoration of the site to its original condition

3.2.2.3 Wash Water, Detergent Solution, and Sediment Removal

During the washing process, personnel will operate a portable pump continuously with suction hose extended to the tank bottom to remove water, detergent, dirt, oil, or other loose materials washed off. After washing the tank interior will be rinsed. Prior to disposal, the wash water, sediment, and sludge (solid material) will be characterized for disposal as described in Section 4 of this Tank Closure Plan.

3.2.2.4. Labeling of Cleaned Tanks

Adjacent to the manhole openings of each tank, the Navy's contractor will stencil onto the tank in 3/4-inch letters adjacent to the manhole openings the following information: date cleaned, contractor name, and address. This will occur following cleaning and prior to final acceptance by the Navy.

3.2.3 Surge Tanks

The contractor will set up rigging and scaffolding as needed to follow the same protocol used on Tanks F-1 – F-20 on the surge tanks.

3.2.4 Pipelines

Pipelines previously containing fuel will be cleaned by ventilation for an amount of time sufficient to remove fuel vapors and trace contaminants.

3.3 Health and Safety Considerations during Cleaning

3.3.1 Air Monitoring Requirements.

The Navy's contractor will identify a qualified individual to serve as the Site Safety and Health Officer (SSHO) in accordance with EM 385-1-1. The SSHO will provide day-to-day industrial hygiene support, including air monitoring, training, and daily site safety inspections. The SSHO will be trained in the use of the monitoring and sampling equipment, and interpretation of air monitoring data. Monitoring of airborne concentrations of lead will be in accordance with 29 CFR 1910.1025 and benzene in accordance with 29 CFR 1910.1028.

3.3.2 Accident Prevention Plan.

The Navy will require pre-design and pre-construction Accident Prevention Plans (APPs) in accordance with EM 385-1-1 as part of the tank closure contract. Each APP will include Activity Hazard Analyses (AHA) for personnel while on-site. APPs will be updated as needed to reflect changing site conditions.

3.3.3 Confined Space Requirements.

The Navy will require a confined and enclosed space entry plan in accordance with EM 385-1-1, applicable OSHA standards 29 CFR 1910, 29 CFR 1915, and 29 CFR 1926, CPL 2.100, and any other Federal, State, and local regulatory requirements as part of the tank closure design and construction contract. The plan will identify the person qualified to assess confined spaces, direct work stoppages, and seek confined space entry permits and procedures for rescue from such spaces if required.

3.3.4 Safety Plan.

The Navy will require a safety plan be developed and implemented in accordance with OSHA and EM 385-1-1 requirements, as part of the tank closure design and construction contract. The Safety plan will be incorporated in the APP. It will identify and evaluate specific hazards and risks, and safety related activities required at each location within the job site.

3.3.5 Scaffolding Plan.

If scaffolding will be utilized, the Navy will require the contractor to submit an installation plan in accordance with ANSI/ASSE A10.8. This plan will be completed under the supervision of a registered Professional Engineer with experience in this field. The scaffolding plan will include a description of equipment, operational procedures, rigging instructions, load test procedures, and a list of contractor personnel trained and qualified to operate the equipment.

3.3.6 Fall Protection and Prevention (FP&P) Plan.

The Navy will require the contractor selected to perform the RHBFSF tank closure design and construction to develop and implement a FP&P plan as part of the APP. The FP&P plan will be site specific and address fall hazards, fall prevention, related safety equipment, in the work place and during different phases of construction. It will address how to protect and prevent workers from falling to lower levels when they are exposed to fall hazards above six feet or when there is a possibility of a fall from any height onto dangerous equipment, into a hazardous environment, or onto an impalement hazard. The FP&P Plan will include a Rescue and Evacuation Plan in accordance with EM 385-1-1.

4. Management of Accumulated Sludge and Materials

This plan provides procedures which will be used to ensure materials generated by tank closure activities are properly managed, containerized, labeled and disposed. The Navy will manage accumulated sludge and materials in accordance with the Red Hill Fuel Storage Facility Response Plan (previously submitted on September 7, 2022, as Enclosure d. to the Defueling Plan Supplement 1.A), which provides information and detailed procedures for responding to a potential spill at the RHBFSF.

This section provides information on the requirements and procedures to properly collect, store, and manage materials generated from the closure of the RHBFSF. The types of waste expected from the closure of the facility include:

- Recovered fuel
- Oil and water emulsions
- Oil-contaminated wastes such as:
  - Spent sorbents
  - Oil-contaminated debris and materials such as disposable personal protection equipment, rags, plastic bags or sheets, etc.
  - Oiled vegetation, soil and gravel
- Waste decontamination solutions and effluents from equipment and PPE decontamination operations
- Non-contaminated solid wastes from closure operations
- Floating pan seals
- Waste potentially generated by contractor operations and equipment include
  - Oil and latex based painting and caulking products
  - Solvents
  - Adhesives
  - Aerosols
  - New and used containers of the original materials of the same.

4.1 Requirements

4.1.1 Introduction

The Defueling Phase of the tank closure process will be managed by the Joint Task Force-Red Hill (JTF-RH) and considered complete when the tanks have been emptied of recoverable fuel. Once the JTF has removed the recoverable fuel from the tanks, the process will move into the Closure Phase, where the Navy assumes responsibility for the actions required to close the facility per HAR Section 11-280.1. Following completion of the defueling operations, the remaining contents of the tank, commonly referred to as tank bottoms, may include some amount of residual fuel, waste, sludge, and water, the presence of which is expected to preclude reclamation as waste oil. As such, the Navy, as part of the comprehensive closure process, will characterize, remove, and dispose of the tank bottoms in accordance with Federal, State and local regulations.

Materials management and disposal operations must comply with regulatory requirements and prevent risk to health and safety of response personnel and the public. The contractor shall:

- Collect residue, other contaminated material, and all non-reusable materials, including disposable clothing, sorbents, brushes, rags, brooms, and containers. Package material in United States Department of Transportation (DOT) approved containers. Mark and label containers in accordance with DOT, EPA, and state requirements.

- Thoroughly ventilate affected areas, especially if it is within an enclosed area. Comply with all safety, health and fire protection requirements.

4.1.2 Waste Regulatory Framework

To manage Hazardous Waste (HW), generators, transporters, and treatment facilities must have an HW EPA identification number, and the HW must be manifested when it leaves the generator's control through final disposal. The contractor selected to perform the design and closure of the RHBFSF will utilize the Navy's HW EPA ID # HIR000050401 as the co-generator of HW for waste generated at the RHBFSF. For hazardous waste generated on JBPHH (including waste generated at or removed from Adits 1 and 2), the contractor will utilize the Navy's HW EPA # HI1170024334 as the co-generator of HW. The contract will require the contractor to conduct waste determinations, prepare HW manifests, and arrange for appropriate disposal in accordance with applicable Federal and State regulations including Hawaii Administrative Rules (HAR) solid waste regulatory requirements.

4.2 Waste Generation

Waste streams generated may be hazardous depending on the waste determination. The contractor shall manage wastes in appropriate containers, marked and labeled at or near the point of generation, until a waste determination is performed.

The rinsate (oily water from tank cleaning) and sludge (solid material) are to be removed through one of the nozzles in the bottom of the tank. The rinsate is normally drained into Intermediate Bulk Container (IBC) totes (275 gallons) and sludge is placed into drums. The contractor will transport totes and drums using towed flat cars with an electric rubber-tired cart or contractor-supplied locomotive through the lower tunnel to the lower tunnel access point at Red Hill. The totes and drums will be transferred to trucks for disposal at the lower tunnel access point. The contractor will package, label, store, transport, treat, and dispose of the material in accordance with Federal and State regulations.

The existing Fuel Oil Reclaimed FOR lines were considered for waste transfer but cannot be used since these lines are used by the operators to remove the water from the tank bottoms on adjacent tanks.

4.3 Waste Accumulation Management

The contractor shall collect waste in United Nations (UN) and DOT approved drums, totes, tanks, dumpsters or other appropriate containers that are compatible with the contents to avoid leaks, corrosion or adverse chemical reactions. All containers that hold liquids shall be stored on spill pallets or within impervious berms to prevent any leaks from entering streams, storm drains or other waterways. Large containers shall be placed on plastic sheets. Dumpsters that hold oil-contaminated debris shall be lined with plastic to prevent leaks. Containers that hold flammable or combustible materials shall be stored per fire prevention regulations and National Fire Protection Association (NFPA) 30 fire prevention code and standard.

The contractor shall store wastes in areas as determined by Joint Base Pearl Harbor Hickam (JBPHH) Environmental. Waste accumulation areas shall be at or as practicably near the point where the waste is initially generated, but outside the tunnel. This reduces the distance that the waste is transported. This also reduces the chances of spills or leaks while the wastes are moved. However, if the quantity of non-HW is large and the storage area interferes with the closure activities, it may be necessary to store the wastes farther from the RHBSF site. For non-HW, a paved area at Naval Supply Systems Command (NAVSUP) Fleet Logistics Center Pearl Harbor (FLCPH) adjacent to Building 550 can be used as a non-HW storage area.

Waste accumulation areas will be located as far away practicably as possible from storm drains, ditches, swales or any drainage system that leads to streams, rivers or Pearl Harbor. Existing paved areas in the area will be considered for use as a waste accumulation area. Where liquids or sludge are stored, secondary containment shall be employed to prevent releases. Spill kits will be placed in close proximity to these storage areas and personnel will be trained in the proper use of these kits. Waste accumulation areas shall be inspected weekly and the inspections will be documented.

Table 4-1 is an overview of the Navy-owned temporary storage equipment that may be available for collected RHBFSF Closure waste.

TABLE 4-1: TEMPORARY STORAGE FOR COLLECTED FUEL AND DEBRIS WASTE

Equipment	Capacity	Location / Poc / Telephone
Bulk Storage Equipment for Recovered Fuel		
Ship Waste Offload Barge (SWOB) Barge # 12 and 48	2 @ 70,000 gals.	Waterfront Operations Officer 474-6262
Oil Storage Bladders	1 @ 290,000 gals 2 @ 136,000 gal. 2 @ 26,000 gals. 1 @ 21,000 gals. 6 @ 500 gals.	Navy SUPSALV Hawaii ESSM Base (As of 12/2015) (202) 781-1731, Option #2 (during work hours) (202) 781-3889 (Duty Officer, after hours)
Storage Equipment for Contaminated Wastes, Hazardous Wastes, and Other Response Wastes and Debris		
Drums	Multiple @ 55 gals.	NAVFAC HI Environmental Services (808)471-1171
Dumpsters	Multiple @ Varies	NAVFAC HI Environmental Services (808)471-1171
Totes	Multiple @Varies	NAVFAC HI Environmental Services (808)471-1171

Other storage equipment or containers are available from commercial sources. This includes but is not limited to oil-water separators, fractionalization (frac) tanks, Intermodal Portable Tanks (IMO), Intermediate Bulk Container (IBC), tri-wall boxes, and drums. Requests to obtain Navy managed containers or storage equipment are submitted to and processed by JBPHH Environmental.

The contractor shall label all waste containers when required by applicable Federal and State regulations. Figure 4-1 shows samples of the various labels that shall be applied to containers with waste. Other labels may be used if approved by JBPHH Environmental.

Hazardous Waste **Non- Hazardous Waste** **Pending Analysis**

FIGURE 4-1: WASTE CONTAINER LABELS

Where the waste container also requires a DOT hazardous material (HM) label based on its proper shipping name per 49 CFR 172.101, the HM label shall also be placed on the container next to the waste label while the container is in a storage area. Although not required by law when the container is not being transported, the DOT label alerts others on the hazardous contents of the container. If DOT regulated materials are stored in IMOs, tanker trucks, or other bulk containers, placards will be placed per DOT regulations.

The contractor shall ensure all containers are in good condition with no signs of holes, tears, leaks, excessive corrosion, or bulging. Containers must be compatible with the materials stored within them. They must be kept closed at all times except when adding or removing materials. All bungs, vents, or drum lids must have gaskets that are in good condition to ensure that the container is liquid and vapor tight. All container closures (bungs, vents, retaining bolts, etc.) shall be secured with a wrench, i.e., not just “finger” tight.

Containers to be transported on public roads must meet DOT requirements, including the appropriate performance-oriented packaging packing group for that waste per 49 CFR 172.101.

The contractor will comply with fire prevention regulations when storing containers that hold flammable or combustible materials by using appropriate containers and segregating containers that hold incompatible materials. Fire extinguishers of the proper size and type shall be placed near the containers with these flammable or combustible materials. If required, flammable liquids will be stored in approved flammable liquid storage cabinets per NFPA 30.

Wastes shall be tracked in a waste log spreadsheet that is managed by JBPHH Environmental. Each container shall have a unique identifier consisting of the container code, date on which waste was first added into it followed by a sequential number. Container codes as shown in Table 4-2 shall be used. The date shall be in “yyyymmdd” format. For example, DM-20150218-1 is the identifier for the first metal drum that received waste on February 18, 2015 (see Form 2 Container Log in Appendix B).

JBPHH Environmental shall notify DOH the intent to close HW accumulation areas 30 days prior to the cessation of HW generation. The contractor shall complete closure of the HW accumulation areas in accordance with Federal and State requirements. JBPHH Environmental will notify DOH within 90 days of the completion of closure of the HW accumulation areas.

TABLE 4-2: WASTE CONTAINER CODES

Container Type	Container Code	Container Type	Container Code
Burlap, cloth, paper, or plastic bags	BA	Dump truck	DT
Fiber or plastic boxes, cartons, cases	CF	Wooden drums, barrels, kegs	DW
Metal boxes, cartons, cases (and roll-offs)	CM	Hopper or gondola cars	HG
Wooden boxes, cartons, cases	CW	Tank cars	TC
Cylinders	CY	Portable tanks	TP
Fiberboard or plastic drums, barrels, kegs	DF	Cargo tanks (tank trucks)	TT
Metal drums, barrels, kegs	DM	-	-

4.4 Waste Determination

Prior to disposal, waste profiles, laboratory analyses, waste manifests, and other documents shall be reviewed and approved by JBPHH Environmental. Each waste stream will be characterized to determine if it is a regulated hazardous waste (HW) per Federal and State Regulations. This will be done through user's knowledge of the materials or the process by which these materials became wastes. For example, Safety Data Sheets (SDSs) can provide data on certain characteristics such as flash point or pH that can be used to make the HW determination.

In some cases, laboratory analysis may be necessary to determine solid waste treatability or disposal options, such as possible disposal in the sewer system, at a bioremediation land farm facility, at the City's H-Power facility where it would be burned for energy recovery or disposal at a permitted industrial landfill. Analysis may also be necessary to determine if the wastes are regulated by the EPA as a Hazardous Waste. Sampling methods shall follow EPA Solid Waste (SW)-846. Proper sample preparation and storage protocols will be used as required by the analytical laboratory (e.g., sample preservatives, proper containers, cooling, QC blanks, etc.). A chain of custody document shall include the waste container identifier. A waste management log shall also use this same identifier and the sample number for tracking purposes.

The Navy's contractor for the tank closure effort will complete a waste determination for all closure derived wastes generated. The waste determination will be based upon either knowledge of a constituent listing from the manufacturer used in conjunction with consideration of the process by which the waste was generated or laboratory analysis via EPA methods in SW-846 (Safety Data Sheets (SDS) by themselves are not adequate). As a minimum, a written waste determination will be provided for the following wastes (this listing is not all inclusive): fuel/water mixtures, tank sludge, spent blast media, floating pan seals, rinsate, oil and latex based painting and caulking products, solvents, adhesives, aerosols, petroleum products, and containers of the original materials. For those wastes determined to be hazardous waste under Federal and State rules, the contractor will place the proper waste code on the container and determine the appropriate means of disposal.

Disposal of non-hazardous waste will be at appropriately permitted solid or National Pollution Discharge Elimination System (NPDES) recovery, treatment or disposal facility. Non-hazardous wastes that are to be disposed at local permitted landfills will meet the requirements of the destination facility. When required, a request for a clearance number from the landfill facility shall be signed by JBPHH Environmental. When ready for transport, non-hazardous waste shipping papers shall be signed by JBPHH Environmental.

All areas used to store waste containers shall be inspected for signs of leaks or spills. Any spills will be addressed per local procedures and any generated wastes will be disposed per this disposal plan.

4.5 Waste Disposal

The Navy's contractors will manifest, pack/containerize, ship and dispose of hazardous or toxic waste and universal waste that is generated as a result of the RHBFSF closure, including tank cleaning. Contractors will be responsible for utilizing the existing EPA Identification Number (EPA ID) for the duration of the closure effort. Hazardous waste manifests must be reviewed, signed, and approved by the Navy before Contractors may ship waste. To obtain specific disposal instructions contractors will coordinate with the JBPHH Environmental office.

All prime contractors and subcontractors involved with transporting, storage, treatment and disposal of hazardous waste will be certified and have an HW EPA ID number. The Navy's contractors will submit copies of EPA State and local hazardous waste permits and EPA Identification numbers of the transporter, treatment, storage and disposal facility that will be accepting hazardous waste to the DOH in advance of tank cleaning. If the material is hazardous waste, a completed hazardous waste manifest from the treatment or disposal facility will be returned, and a copy furnished to the Navy.

Table 4-3 provides general guidance on waste material classification and the appropriate disposal strategy. This is a general guide only and it is essential that the classification be verified for each specific waste stream. If necessary, samples should be analyzed to determine whether the waste meets the criteria of a hazardous waste or whether disposal or recycling options exist. Laboratory analysis may also be necessary for disposal in permitted industrial landfill.

TABLE 4-3: MATERIAL CLASSIFICATION AND DISPOSAL STRATEGY

Material	Classification	Disposal Strategy	Disposal Facility
Recovered Oil	HW	Containerize, label and dispose as HW according to regulatory requirements.	Permitted Treatment, Storage, and Disposal Facility (TSDF)
Oil-Contaminated Wastes	Non-HW	Dispose as ordinary solid waste.	Permitted solid waste landfill
	HW	Containerize, label as HW according to regulatory requirements.	Permitted TSDF
Sludge and Contaminated Soil	Non-HW	Consult with Hawaii Dept. of Health to determine disposal or treatment method.	To be determined
	HW	Containerize, label as HW according to regulatory requirements.	Permitted TSDF
Contaminated Equipment	Non-HW	Clean according to section maintenance procedures.	N/A
	HW	Decontaminate.	N/A
Waste Chemicals to Include DECON Solutions	Non-HW	Process through NAVFAC HI Industrial Waste Treatment Center (IWTC) or contractor.	NAVFAC HI IWTC or contractor
	HW	Containerize, label as HW according to regulatory requirements.	Permitted TSDF
Personal Protection Equipment	Non-HW	Clean and reuse where possible; dispose of as ordinary solid waste if unable to reuse.	Permitted solid waste landfill
	HW	Containerize, label as HW according to regulatory requirements.	Permitted TSDF
Sorbents	Non-HW	Dispose of as ordinary solid waste.	Permitted solid waste landfill
	HW	Containerize, label as HW according to regulatory requirements.	Permitted TSDF
Other Closure Wastes	Non-HW	Dispose of as ordinary solid waste.	Permitted solid waste landfill
	HW	Containerize, label as HW according to regulatory requirements.	Permitted TSDF
Nickel-cadmium Batteries, Mercury Containing Lamps	HW or Universal Waste	Containerize, label as HW or universal waste according to regulatory requirements.	Permitted TSDF or universal waste destination facility
Lead-acid Batteries	Spent Batteries Being Reclaimed	Turn in to lead-acid battery reclaimer.	Permitted battery reclaimer
Recyclable Materials	Nonhazardous	Recycle at the Region Recycling Center Bldg. 159 (474-9207).	Recycling Center Bldg. 159

4.6. Additional Requirements

The Navy will require the contractor selected for the tank closure to prepare an Environmental Protection Plan (EPP) that includes measures for protecting natural resources, required reports, required permits and their provisions. Work will not begin until the Navy approves the EPP. The EPP includes a HW Management section that covers:

a. Procedures to be employed to ensure a written waste determination is made for appropriate wastes which are to be generated
b. Sampling/analysis plan
c. Methods of hazardous waste accumulation and storage, including Waste Accumulation Area closure
d. Management procedures for storage, labeling, transportation, and disposal of waste
e. Management procedures and regulatory documentation ensuring disposal of hazardous waste complies with Land Disposal Restrictions (40 CFR 268)
f. Management procedures for recyclable hazardous materials such as waste oil
g. Pollution prevention\hazardous waste minimization procedures
h. Plans for the disposal of hazardous waste at permitted facilities
i. Procedures to be employed to ensure all required employee training records are maintained
j. Non-Hazardous Waste Construction Waste Management Plan

4.7 Other Disposal Considerations

The Navy is aware of nationwide HW transportation issues impacting HW shipping as well as waste backlogs for disposal via incineration impacting HW management activities as of the date of this Tank Closure Plan. The Navy will continue to monitor developments impacting HW disposal and require that the contractor selected to perform the RHBFSF closure design and construction provide an analysis of expected waste volumes, availability of HW transport, and disposal capacity of selected disposal facilities prior to commencing work. The Navy will not allow work to be performed unless safe and timely handling, transportation, and disposal can be assured.

5. Method of Permanent Closure and Associated Design and Process

5.1 Introduction

This section summarizes the analysis of alternatives for permanent closure of the 20 USTs, four surge tanks, and associated piping and appurtenances comprising the RHBFSF. The Navy will provide a robust, third party analysis of the alternatives for permanent closure as a separate report to DOH in December 2022. The tank closure process will be performed in accordance with Hawaii underground storage tank corrective action regulations, Chapter 11-280.1 of the HAR, and in accordance with relevant Federal, State, and local regulations.

Under the HAR, permanent UST closure requires one of the following approaches: removal of the UST or tank system from the ground, filling the UST or tank system with an inert solid material, or closing the tank in place in a manner approved by the DOH (after the tank is emptied and cleaned). Each option requires a site assessment and investigation.

The large USTs (tanks F-1 to F-20) are single-wall steel tanks, six of which are currently empty. Tanks 1 and 19 were taken out of service in 2007, and tanks 13, 14, 17 and 18 were taken offline for the regularly scheduled clean, inspect, repair process in 2021.

5.2 Analysis of Tank Closure Alternatives

The DOH required the Navy to analyze three alternatives for permanent closure of the Red Hill USTs (close in place, fill, and remove), with the additional consideration of options for beneficial non-fuel reuse of the tanks. As a result, the Navy considered the following alternative (ALTs) for permanent closure:

ALT 1: Closure in Place

ALT 2: Closure in Place for Potential Non-Fuel Reuse of Tanks

ALT 3: Closure with Fill (with inert material)

ALT 4: Remove Tank Steel Liner, and Fill (with inert material)

For each alternative, the Navy evaluated the engineering feasibility, pros and cons, and schedule. In addition, the Navy evaluated the alternatives for impacts to the environment, local community, and safety. As requested by the DOH, the Navy also estimated a rough order of magnitude (ROM) cost for each alternative, but the Navy did not consider cost as an evaluation factor in selecting the preferred the alternative. The ROM costs will be provided in the robust analysis of tank closure alternatives, to be submitted to DOH in December 2022.

In order to evaluate the impacts to Environment, Local Community, and Safety, the Navy used a risk matrix (Figured 5-1) to document the probability and severity of each potential impact. In the matrix, probability ranges from “Unlikely” to “Likely,” and severity ranges from “Little or None” to “Major.” The matrix assigns a Risk Assessment Code (RAC), ranging from “Critical” to “Negligible,” for each evaluation factor.

For the Schedule factor, the Navy estimated the field execution time required under each alternative to accomplish closure of the 20 tanks and associated pipelines. The resulting timelines are planning-level, ROM estimates that do not include front-end processes such as project planning, historical preservation consultation, programming of funds, design, acquisition of contracts, or tank ventilation and cleaning.

For the Engineering Feasibility factor, the Navy evaluated the practical construction means and methods for each alternative, delivery of materials to the island, and the present constraints in utilizing the upper and lower access tunnels for material supply or removal.

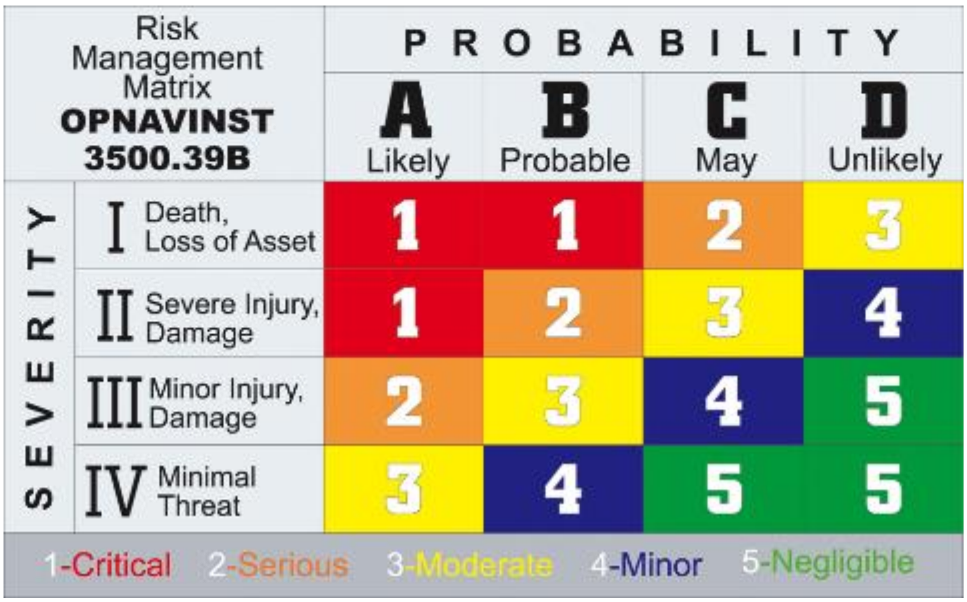

FIGURE 5-1. RISK ASSESSMENT MATRIX

The analysis of each alternative is described briefly below, and an overall summary of the evaluation factors is provided in Table 5-1.

5.2.1 Alt 1: Closure in Place

Based on a consideration of the evaluation factors, upon the December 2022 submission of the analysis of closure alternatives, the Navy intends to seek DOH approval for Closure in Place as the permanent closure method for the Red Hill underground storage tanks and associated piping systems. The Navy has identified this as the best alternative for permanent closure because it would allow for beneficial non-fuel reuse of the tanks, while minimizing impacts to the environment and local community, safety concerns, and schedule, as described below.

Under this alternative, the Navy would permanently close the tanks by eliminating them from service and leaving them in the ground. The tanks would not be filled with inert material, but the Navy would take steps to prevent them from being used again for fuel purposes. After the stakeholders have had the opportunity to explore the various beneficial non-fuel reuse options and provide input, the Navy will consult with DOH and EPA to determine the specific steps that will be taken to prevent future fuel storage while still allowing the beneficial non-fuel reuse.

This alternative would address tank venting, security, water accumulation, electrical power, and access for ongoing maintenance and environmental monitoring. Overall, permanent Closure in Place is the alternative with the lowest impact to the environment and local community. In addition, it has the shortest schedule and would be the safest alternative to execute, with no significant issues related to engineering feasibility. Significantly, this alternative would allow for beneficial non-fuel reuse of the tanks, and Navy would support a study of non-fuel reuse options, as described in ALT 2 below.

The method of Closure in Place would require DOH approval. In order to support the approval process, the Navy would perform a structural analysis to evaluate the long-term integrity of the empty tanks, and submit this analysis to DOH in accordance with the Plan of Action and Milestones (POAM) in Appendix A.

5.2.2 ALT 2: Closure in Place for Potential Non-Fuel Reuse

This alternative includes the same permanent closure processes described above for ALT 1. For estimation purposes, this alternative assumes the installation of a protective coating over the tank internal surfaces in order to support storage of other products besides fuel. Since the beneficial non-fuel reuse option has not yet been determined, the evaluation of this alternative includes only the tank closure activities, and it does not include potential activities related to beneficial non-fuel reuse. Compared to ALT 1, this alternative receives similar scores for environmental impacts, local area impacts, engineering feasibility, and safety, with a slightly longer schedule than ALT 1 (Table 5-1).

The Navy would collaborate with stakeholders to evaluate the options for beneficial non-fuel reuse of the tanks. The Navy concept is to engage a third party to design and implement a study of beneficial non-fuel reuse options. The study would collect ideas from various groups, including community, academic, and political stakeholders; and the ideas would be evaluated through surveys and community meetings. Based on this input, the Navy will work with DOH and EPA to make a final determination of the beneficial non-fuel reuse. The following example demonstrates one potential option for non-fuel reuse, but in making a final determination, Navy will solicit and consider a full range of reuse options.

The Red Hill Bulk Fuel Storage Facility (RHBFSF) is recognized as a National Civil Engineering Landmark for its exceptional design, engineering and construction. Although the Navy has long treated the facility as eligible for listing in the National Register of Historic Places, its eligibility has not yet been consulted on or documented. With appropriate safety measures in place, preservation of the Red Hill facility for historical purposes in partnership with local or national organizations could serve the public interest.

5.2.3 ALT 3: Closure with Fill

Under this alternative, the Navy would completely fill the tanks with inert material, while the steel and concrete shell of each tank would remain in place. The implementation of this alternative would require transport of large amounts of fill material, thereby creating significant concerns, including:

- Safety risks due to limited access and insufficient area to stage equipment and materials.
- Impacts to the surrounding community due to heavy traffic involving dump trucks and construction equipment for a prolonged period of time, estimated at 5 years (Table 5-1).

Overall, the Closure with Fill alternative would negatively impact the environment and the local community, create moderate safety risks, and have a schedule twice as long as permanent Closure in

Place. In addition, it would pose potential problems for engineering feasibility. Significantly, this alternative would not allow for beneficial non-fuel reuse of the tanks.

5.2.4 ALT 4: Remove Tank Steel Liner, and Fill

This alternative would demolish and remove the steel liner of each tank, leaving the concrete barrel, imbedded structural steel, gunite, and grout-in-place. The material other than steel would be left in place because there would be extreme safety concerns associated with the removal of the concrete, gunite, and grout, including a risk of catastrophic failure due to destabilization of the substrate. In order to meet the typical expectations for tank removal, this alternative currently includes removal of the steel liner from the upper dome of each tank, but for structural reasons, serious consideration should be given to leaving the upper dome steel liner in place. Even if the upper dome steel liner is left in place, the removal of the steel barrel would affect the structural integrity of the remaining material and surrounding rock. Therefore, the tank cavities would need to be filled under this alternative.

Overall, this alternative would raise the same concerns as ALT 3, but compared with ALT 3, the impacts would be more severe, the safety concerns would be greater, and the schedule would be longer (Table 5-1). In addition, this alternative presents serious engineering feasibility challenges. Significantly, this alternative would not allow for beneficial non-fuel reuse of the tanks.

TABLE 5-1. SUMMARY OF EVALUATION FACTORS FOR EACH TANK CLOSURE ALTERNATIVE

Alternative	Environmental Impacts	Local Area Impacts	Safety Concerns	Schedule (ROM)	Engineering Feasibility	ROM Cost Ratio*
ALT 1: Closure in Place	**NEGLIGIBLE**	**NEGLIGIBLE**	**NEGLIGIBLE**	**2 to 3 years**	**Constructible**	**1x**
ALT 2: Closure in Place for Potential Non-fuel Reuse	**NEGLIGIBLE**	**NEGLIGIBLE**	**NEGLIGIBLE**	**3 to 4 years**	**Constructible**	**10x**
ALT 3: Closure with Fill	**MODERATE**	**MODERATE**	**MODERATE**	**5 years**	**Possibly Constructible**	**30x**
ALT 4: Remove Tank Steel Liner, and Fill	**CRITICAL**	**CRITICAL**	**CRITICAL**	**7 years**	**Possibly Constructible**	**50x**

***Projected rough order-of-magnitude (ROM) cost ratios do not include ventilation and cleaning, which are constant across the four alternatives.**

For all of the alternatives, continued use of the lower and upper access tunnels to the tanks will be needed to allow maintenance activities and/or access to monitoring wells. Therefore, all alternatives would require some degree of ongoing maintenance of these tunnels (e.g., electrical, ventilation, fire protection systems, etc.) to support required use of the tunnels.

Based on an analysis of alternatives using the evaluation factors described above, the Navy intends to seek DOH approval for ALT 1 - Closure in Place as the permanent closure method for the Red Hill tanks and piplines.

5.3 Tank Closure in Place: Design and Process

1. The Navy will complete, sign and submit the "PART I: Notice of Intent to Close Underground Storage Tanks (DOH Form 30-DAY NOTIFICATION (05/2021))" to DOH at least 30 days prior to the date of planned permanent USTs closure. The required assessment of the excavation zone under Section 11-280.1 must be performed after notifying DOH, but before completion of the permanent closure.

2. The Navy will complete, sign, and submit "PART II: 7-Day Notification (DOH Form 7-DAY NOTIFICATION (05/2021))". This form must be submitted to the DOH at least seven days prior to the scheduled permanent USTs closure and/or change-in-service. The owners must notify DOH of the exact date that the work will occur.

3. The Red Hill Facility is eligible for listing under the National Historic Preservation Act.

4. The Navy will coordinate with DOH to obtain approval for the permanent UST Closure in Place. DOH Environmental Materials Division (EMD) Compliance staff are responsible for the review of all closure documentation, including the DOH notice of intent form. EMD Compliance staff are also responsible for communicating with tank owners regarding the status of their closure documentation. Once EMD receives the 30-DAY notice of intent form, it is assigned to a specialist to schedule the closure of the UST with the owner.

    a. Tanks 1 and 19 have been out of service since 2007. The Defense Logistics Agency (DLA) has stated that the tanks were cleaned and rendered inert, and all the valves, piping, and appurtenances were removed between the tank and the main supply/issue line. At the time, the Navy submitted the notification form to DOH to change the status of the tanks to "permanently out of use;" however, the DOH UST database currently lists these tanks as "temporarily out of use." As a result, the Navy will close Tanks 1 and 19 using the same method as will be used for the other tanks.

    b. Under Closure in Place, each tank will be eliminated from service and left in the ground. The closure process will isolate the tanks from the tank vent system, the piping system in the lower access tunnel, and the tank openings in upper access tunnel and gaugers gallery. Unneeded electrical systems will be disconnected. Access tunnels will remain in place to provide water draw off from tanks. No fill will be introduced into the tank and pipes. Vents will be left in place but isolated from tunnel piping. The following items will be addressed for Closure in Place:

        i. Venting: The tanks have venting to the outside, with combined ductwork to the outside vent. Each tank's vent must be isolated from the system and used during the cleaning and tank closing process. At the conclusion of work, the vent should be closed off to the outside.

        ii. Secured access: The tank center structure tower and platform to the access manhole at the 190-foot level must be secured to prevent unauthorized access or use.

        iii. Water accumulation: Given the properties of water and the nature of its movement underground, it is expected that water and/or condensation will eventually intrude into the tank cavity. This liquid will be monitored and removed periodically from the bottom of the tank. The lines in the Lower Access Tunnel would need to be modified to allow monitoring of tank interior for water accumulation.

iv. Electrical disconnect: Disconnect all tank electrical connections (primarily gauging and level alarms).

v. Access Tunnels: Lower and Upper Tunnel access to the tanks would be required. The electrical lighting, communication, water, power, ordinary fire sprinkler systems, and fresh air tunnel ventilation systems would have to remain in place and be maintained.

5. The Navy will coordinate with the Federal Fire Marshall and obtain a building permit. The Fire Marshall or designated fire official will usually be on site during the work closure of the tank system.
6. The Navy will execute the specified closure preparation work. The UST, tank system, and associated pipes will be drained and cleaned, in accordance with the methods identified in this plan.
7. Regulated substances, including sludge and rinse water removed from the USTs, will be properly disposed of, in accordance with HAR Solid Waste Management regulations. Copies of disposal manifests will be included in the closure report.
8. The contractor, to be selected by the Navy, must perform and submit a site closure assessment report to DOH within 30 days after one or more of the regulated USTs are permanently closed. The closure report must contain the following:
    - An amended or updated DOH notice of intent form
    - A copy of the building permit
    - All soil and water analytical results and chain of custody forms. Samples must be analyzed using an approved DOH laboratory method
    - A site map showing USTs, piping, sample locations and sample depths (including depth to groundwater, if known)
    - Copies of tank and soil disposal manifests
9. DOH Environmental Materials Division (EMD) Compliance staff will review UST closure reports for compliance with the UST regulations. If the documentation is incomplete or indicates that closure was not performed correctly, DOH will send a letter to the Navy outlining the deficiencies. If there are no deficient items found during the closure report review and no evidence of a petroleum release is indicated in the documentation, DOH will send a letter to the Navy approving the tank closure.
10. Site investigation, cleanup and long-term monitoring will be executed in accordance with Section 6 of this plan. The Navy will ensure post closure sampling requirements, data quality objectives, screening criteria, exit criteria, and corrective action/long term monitoring are completed.

6. Site Assessment and Release Investigation and Response

Some figures referenced in this section contain defense critical infrastructure security information, and are therefore placed in Appendix C, submitted separately as Enclosure 3 to this Tank Closure Plan.

6.1 Introduction

As part of Red Hill Bulk Fuel Storage Facility (RHBFSF) tank and pipeline closure, the Navy will conduct a site assessment and release investigation and response for soil and groundwater cleanup in accordance with Subchapter 6 of HAR §11-280.1. Section 8 of the DOH Superseding Emergency Order specifies that the Tank Closure Plan shall describe the "site assessment in connection with the Facility's permanent closure." It also specifies that the Navy will "…continue to characterize the release(s) and develop strategies for remediation of impacted groundwater in accordance with 11-280.1, HAR."

The activities described below will be performed in conjunction with the long-term monitoring (LTM) program described in the *Groundwater Protection Plan* (GWPP) (DON 2014) and applicable Navy, State, and Federal regulations and requirements.

6.1.1 Site Description

The RHBFSF occupies 144-acres in south-central Oʻahu, approximately two miles east of Pearl Harbor, within the Red Hill ridge that divides South Hālawa Valley from Moanalua Valley on the southwest flank of Oʻahu's Koʻolau mountain range. The tank bottoms sit approximately 100–130 feet above an underlying basal aquifer that is a major municipal and military drinking water source.

6.1.2 Soils and Geology

The RHBFSF is located within the Koʻolau Volcanic series. The valleys on either side of the Red Hill ridge were formed as a result of fluvial erosion and are filled with sedimentary deposits (alluvium and colluvium), also known as valley fill, underlain by residual (weathered basalt), also known as saprolite. A recent seismic survey in North and South Hālawa Valleys, Red Hill, and Moanalua Valley (Department of the Navy (DON), 2018a) found that valley fill and saprolite extend deeper than 300 feet in the valleys surrounding Red Hill, particularly in the center of the valleys and below the streambeds. Soils in the vicinity of the RHBFSF are mapped as Helemano-Wahiawā association consisting of well drained, moderately fine-textured and fine-textured soils (United States Department of Agriculture (USDA), 1972). The surfaces of the basaltic flows have been weathered to form reddish-brown clayey silt, which is the basis for the local name "Red Hill." The northwestern slope of Red Hill is generally barren of soil and consists of outcropping basalt lava flows to the valley floor.

6.1.3 Groundwater

In the vicinity of the RHBFSF, the basal aquifer water table lies between 15 and 20 feet above mean sea level, and regionally, groundwater flows toward Pearl Harbor, although potential exists for variability in localized flow directions depending on geologic formations and other factors. The RHBFSF is located at the administrative boundary between the Waimalu Aquifer System of the Pearl Harbor Aquifer Sector and the Moanalua Aquifer System of the Honolulu Aquifer Sector. The underlying aquifer is classified as a basal, unconfined, flank-type aquifer and is currently used as a drinking water source.

The RHBFSF is located upgradient of the Hawaii State Underground Injection Control Line, which separates potable groundwater from non-potable groundwater. The drinking water supply well closest to the tanks is the Red Hill Shaft, located within the RHBFSF's lower access tunnel, which is approximately 2,600 feet topographically downgradient of the nearest fuel tank. The Red Hill Shaft formerly provided potable water to the JBPHH Water Distribution System, which serves approximately 65,200 military customers. Potable water is now supplied by the Waiawa Shaft, located far to the west of the RHBFSF. Naval Facilities Engineering Systems Command (NAVFAC), Hawaii, Utilities Management Division operates this drinking water system. The nearest Honolulu Board of Water Supply (BWS) public drinking water supply well (BWS Hālawa Shaft Well 2354-01) lies within the basal aquifer and is located hydraulically cross-gradient of the RHBFSF, approximately 4,400 feet northwest of the tanks.

6.2 Previous Red Hill Investigations

Previous environmental investigations at the RHBFSF (summarized in Table 6-1) are divided into two categories: those preceding the 2015 Administrative Order on Consent (AOC), and those subsequent to its issuance.

TABLE 6-1 RED HILL INVESTIGATION REPORTS

Investigation Report	**Summary**
Pre-2015 AOC Investigations	
Remedial Investigation Phase I and II, Red Hill Oily Waste Disposal Facility (DON 1996; 2000)	A two-phase Remedial Investigation (RI) was initiated in the early 1990s at the Red Hill Oily Waste Disposal Facility. No contaminants were detected in the basal aquifer beneath the site, and DOH issued a concurrence letter for a No Further Action determination in 2005 (DOH 2005).
Facility Site Characterization and Investigation (DON 1999, 2002)	A two-phase investigation initiated in 1998 evaluated the presence of petroleum constituents at the RHBFSF. DOH requested the Navy to conduct quarterly groundwater monitoring, conduct a Tier 3 risk assessment, and develop a contingency plan.
Quarterly Groundwater Monitoring Reports (DON 2005 to present)	Sampling and analysis of Red Hill network groundwater monitoring wells were initiated in 2005 and incorporated into the Red Hill Groundwater Protection Plan (GWPP) (DON 2008b; 2014b); results are reported to DOH.
Technical Report (DON 2007)	An environmental investigation and risk assessment initiated in 2004 included installation of soil vapor monitoring plan (SVMP) in angle borings under the active fuel storage tanks, three additional groundwater monitoring wells in the lower access tunnel, a three-dimensional groundwater model, and a Tier 3 human health risk assessment.
Tank 17 Removal Action Report (DON 2008c)	A limited removal action and site characterization investigation was conducted in June 2008; the report's Environmental Hazard Analysis determined that the release posed no further significant environmental hazards.

Type 1 Letter Report (DON 2010)	A 2010 investigation re-evaluated the DON (2007) groundwater model assumptions and results, as well as the Tier 3 risk assessment results.
Monthly Soil Vapor Monitoring Reports (DON 2008a)	Soil vapor photoionization detector (PID) measurements are collected monthly under the RHBFSF's fuel storage tanks with SVMPs in accordance with the Red Hill GWPP (DON 2008a; 2014b); results are reported to DOH.
Investigations Subsequent to the 2015 AOC	
Tank 5 Quarterly Release Response Reports (DON 2014a to present)	In response to the 2014 fuel release from Tank 5, the Navy reported release response actions undertaken in the last 90 days to DOH.
Seismic Profiling to Map Hydrostratigraphy in the Red Hill Area (DON 2018a)	Presented results and evaluation of nine seismic profiling transects conducted at Red Hill and in North and South Hālawa Valleys and Moanalua Valley to improve understanding of subsurface conditions that affect groundwater flow and contaminate fate and transport (CF&T).
Groundwater Protection and Evaluation Considerations for the Red Hill Bulk Fuel Storage Facility (DON 2018c)	Presented an interim environmental analysis of data and an initial analysis of potential environmental risks; interim results of the groundwater flow model; and an evaluation of hypothetical release scenarios.
Conceptual Site Model (DON 2018b; 2019)	Established a basis for evaluating contaminant transport pathways and potential for exposure of human receptors to potentially impacted drinking water.
Groundwater Flow Model Report (DON 2020a)	Refined the previous groundwater flow model to improve understanding of the direction and rate of groundwater flow within the aquifers around the RHBFSF.
Investigation and Remediation of Releases Report (DON 2020b)	Releases Report (DON 2020b) Documented the response to the January 2014 Tank 5 release and evaluated potential remedial alternatives for that release and any potential future release.
Evaluation of Chromatograms for Understanding TPH Detections in Monitoring Wells (DON 2020c)	Provided an evaluation of Total Petroleum Hydrocarbon (TPH) detections in monitoring wells to determine whether those detections are indicative of potential fuel impacts from the RHBFSF.
Initial and Quarterly Release Response Reports, Pipeline Breach in Tunnel and Fire Suppression Drain Line (DON 2021a; 2021b; 2021d; 2022c; 2022d; 2022f)	Documented the results of release response efforts for the May 6, 2021 Tunnel Pipeline Breach and the November 20, 2021 Fire Suppression Drain Line releases.

6.3 Previous Release Response

6.3.1 Release Response Activities

To date the following release response activities have been performed to address the May 6 and November 20 Releases:

The DOH issued Notice of Interest (NOI) letters for the two events:

- May 6 Release
  - DOH Hazard Evaluation and Emergency Response Release Incident Case Number (No.) 20210507-0852 on May 10, 2021 (DOH 2021a)
  - DOH Underground Storage Tank (UST) Release Identification No. 210012 (DOH 2021b)
- November 20 Release
  - DOH Hazard Evaluation and Emergency Response Release Incident Case No. 20211120-2330 on November 24, 2021 (DOH 2021d)

6.3.2 Release Response Reports

The following documents have been submitted previously to DOH:

- Response to Notice of Interest in a Release or Threatened Release of Hazardous Substance, May 21, 2021
- Confirmed Release Notification Form, Pipeline Breach in Tunnel, June 21, 2021
- Initial Abatement Measures and Site Assessment Report, July 12, 2021
- Initial Site Characterization Report, Pipeline Breach in Tunnel, August 19, 2021
- Initial Release Response Report, Pipeline Breach in Tunnel, September 17, 2021
- Red Hill Bulk Fuel Storage Facility Request for Information – Addendum, October 1, 2021
- Quarterly Release Response Report, Pipeline Breach in Tunnel, December 30, 2021
- Response to Notice of Interest in a Release or Threatened Release of Hazardous Substance, December 3, 2021 and January 7, 2022
- Confirmed Release Notification for Fire Suppression Drain Line, December 3, 2021
- Initial Abatement Measures and Site Assessment Report, December 11, 2021
- Initial Site Characterization Report, Fire Suppression Drain Line, January 7, 2022
- Free Product Removal Report, January 7, 2022
- Technical Memorandum, Analysis of Samples from Sump (11/24/2021), Adit 3 (11/24/2021), and Red Hill Shaft Water Gallery (12/2/2021), January 13, 2022
- Preliminary Site Characterization Plan, January 12, 2022
- Technical Memorandum, Holding Tank and Leach Tank Site Characterization, January 29, 2022; revised February 23, 2022
- Initial Release Response Report, Fire Suppression Drain Line, February 24, 2022
- Quarterly Release Response Report, May 6 and November 20, 2021 Releases, April 6, 2022
- Quarterly Release Response Report, May 6 and November 20, 2021 Releases, July 7, 2022

The Figure 6-3 on the following page provides a visual representation of the timeline of environmental actions taken at RHBFSF.

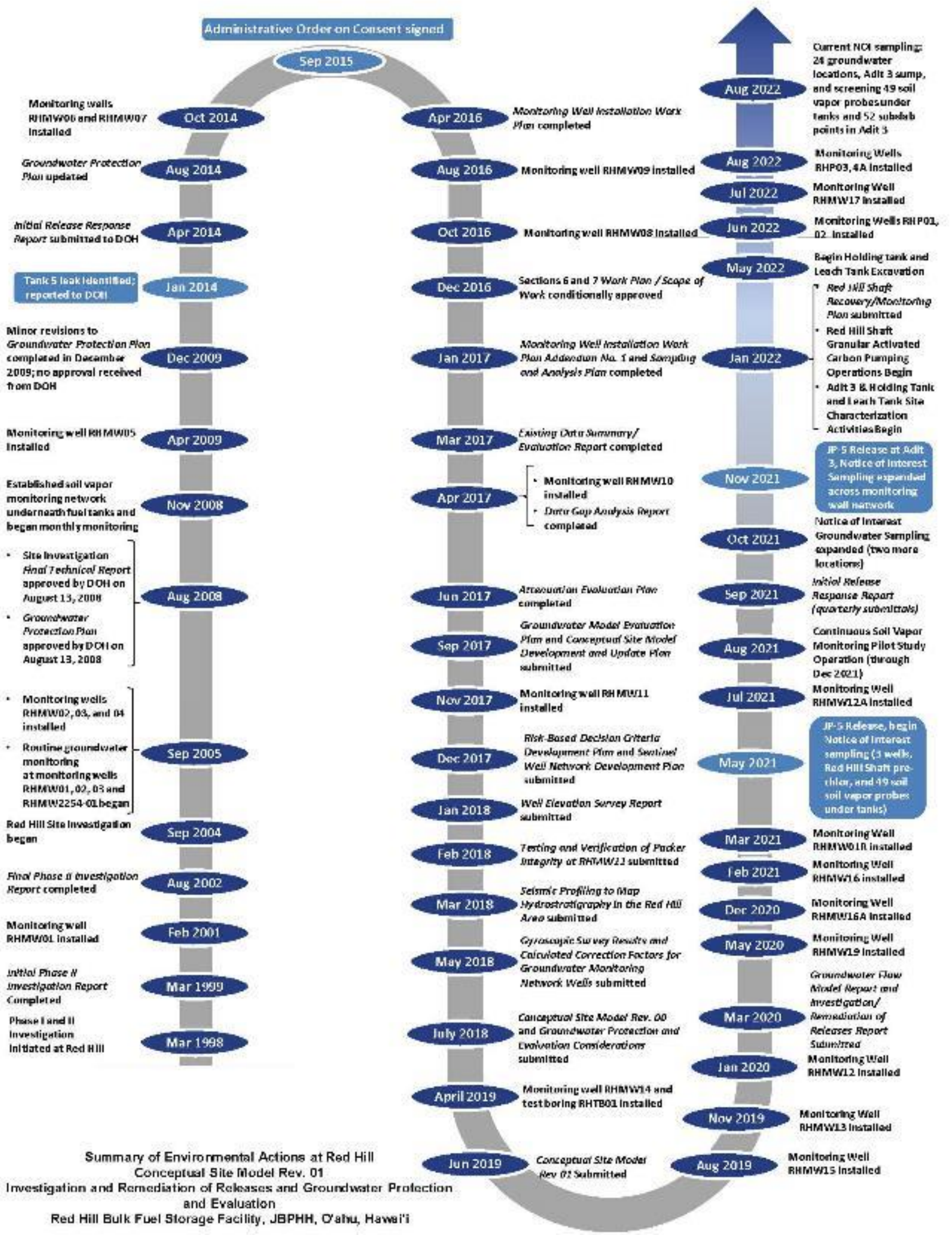

FIGURE 6-1 RED HILL ENVIRONMENTAL ACTIONS TIMELINE

6.4 Ongoing Investigations

The Site Investigation phase of the tank closure process will further delineate and characterize the petroleum contamination at the site, and build upon previous and ongoing investigations to support establishing Site Cleanup Criteria (HAR § 11-280.1-65.3) and developing a Corrective Action Plan (HAR § 11-280.1-66), as needed to achieve tank closure. Previous results of the investigations for the May 6 and November 20 releases are provided in the published reports to DOH listed in Section 6.4.2. Groundwater and soil vapor monitoring requirements for the two releases are now combined in a single plan (NOI Groundwater Sampling Plan, 2022) to assess and evaluate groundwater impacts and soil vapor concentrations in the subsurface from both releases and their potential migration pathways. The summary of ongoing investigations for the May and November 2021 releases are described below.

6.4.1. May 6 Release Investigation

Investigation activities in response to the May 6 release began on May 10, 2021. A site assessment was initiated that included soil vapor PID field measurements and laboratory sample collection and analysis, free product gauging and headspace measurements in groundwater monitoring wells, groundwater sampling and analysis, and drinking water sampling and analysis. Groundwater sampling locations and the soil vapor monitoring network are presented on Figure 6-1 and Figure 6-3, respectively.

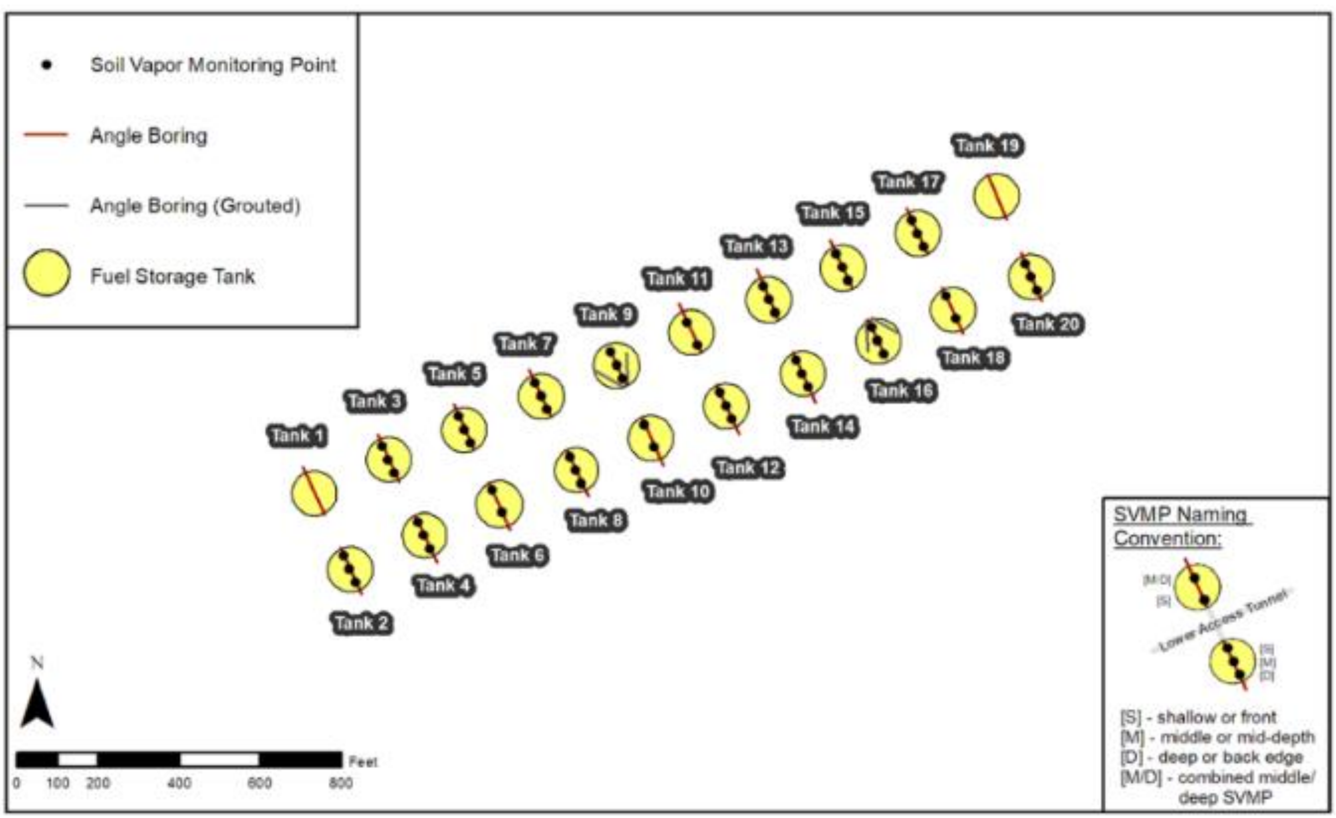

FIGURE 6-3 SOIL VAPOR MONITORING NETWORK UNDERNEATH RED HILL

Soil vapor monitoring initially included collection of soil vapor PID readings from probes at Tanks 2 – 18 and Tank 20 in May 2021, and reduced in June 2021 to include Tanks 11 – 18 and Tank 20. Summa canister samples for laboratory analyses were collected at least monthly at probes SV15S, SV15D, SV17S, SV17D, SV18S, SV18D, SV20S, and SV20M.

Groundwater samples were initially collected from RHMW01R, RHMW02, and RHMW03 as seen in Figure 6-5 in Appendix C (Enclosure 3) beginning in May 2021. In conjunction with groundwater sampling, the collection of drinking water samples at the pre-chlorination spigot began in June 2021. The groundwater sampling locations were increased to include RHMW05 and RHMW2254-01 in September 2021 following the detection of total petroleum hydrocarbons (TPH)-diesel range organics (TPH-d) and TPH-residual range organics (i.e., TPH-oil) (TPH-o) in the Red Hill Shaft pre-chlorination samples, including detections of TPH-o above the DOH Environmental Action Level (EAL) that occurred in August and September 2021.

Free product gauging and headspace measurements were collected as part of the NOI sampling activities and also from the entire Red Hill monitoring network as part of the Red Hill groundwater long-term monitoring program. Free product has never been detected in any monitoring well outside of Red Hill Shaft.

6.4.2 November 20 Release Investigation

Investigation and sampling activities in response to the November 20 release began on November 29, 2021. An in-tunnel characterization effort focused on developing remedial alternatives to mitigate impacts of the release, as described in a Preliminary Site Characterization Plan (DON 2022a). Investigation activities included installation of 52 subslab soil vapor monitoring points (SVMPs) in the impacted tunnel floor during two events occurring from December 15 to 17, 2021 and on January 11, 2022.

Subslab SVMPs were sampled weekly between December 31, 2021 and June 20, 2022, and are currently being sampled monthly, as negotiated with DOH. Additional sampling is required when rain events in the study area exceed 1 inch in a 24-hour period. The Navy reports the data within a week of data gathering for each sampling event.

The Preliminary Site Characterization Plan identified the first actions to be taken to characterize the November 20, 2021 JP-5 release in near-surface soil, rock and perched water. These included:

- In-Tunnel Characterization
    - Geophysical characterization of shallow and deep subsurface features
    - Near-surface intrusive trench soil, perched water and soil vapor
    - Shallow, intermediate, and deep subsurface SVMPs

- External Characterization
    - Holding Tank and Leach Tank subsurface characterization

6.4.3 Ongoing Groundwater Investigations

The subsections below describe the various ongoing groundwater investigations at the RHBFSF.

6.4.3.1 Ongoing Groundwater Monitoring

Across the RHBFSF there is an extensive network of groundwater monitoring wells and sentinel wells used to track the petroleum impacted groundwater plume. Five groundwater monitoring wells are located within the lower access tunnel, and one sampling point is located at the Red Hill Shaft. Twenty-one groundwater monitoring wells are located outside of the RHBFSF tunnel system.

The groundwater monitoring program consists of regular sampling events, and a detailed groundwater monitoring program has been developed for RHBFSF in collaboration with BWS. The Navy will continue to sample the groundwater monitoring wells as required by the DOH release response requirements, and in continued collaboration with BWS.

In conjunction with ongoing monitoring activities, the Navy is working to install a series of onsite plume delineation wells (P-Wells) and off-site sentinel wells (S-Wells) to further understand the aquifer conditions, plume extents, and potential movement of contamination. Ultimately, the purpose of these wells is to provide awareness of potential plume migration in order to allow for treatment as needed to protect the aquifer. In total, the Navy is planning to install 10 P-wells and 10 S-Wells. At present, five P-wells have been installed, and the remaining P-Wells and S-Wells are in various stages of the permitting and installation process.

In December 2021 and January 2022, groundwater sampling was increased to include weekly sampling at the following additional locations: RHMW04, RHMW06, RHMW08, RHMW09, RHMW12A, RHMW16, RHMW19, OWDFMW01, OWDFMW04A, OWDFMW05A, OWDFMW07A, OWDFMW09A, and multilevel wells RHMW11-05 (Zone 5), RHMW13-05 (Zone 5), RHMW14-03 (Zone 3), and RHMW15-05 (Zone 5). In addition, RHMW17 was installed and added to the sampling program on June 15, 2022. Figure 6-5 in Appendix C (Enclosure 3) shows the existing and planned monitoring wells at the RHBFSF as of September 2022.

6.4.3.2 Plume Delineation at the Red Hill Shaft

Plume delineation wells are being installed in the vicinity of Red Hill Shaft as seen in Figure 6-4 in Appendix C (Enclosure 3). The purpose of plume delineation wells is to evaluate groundwater quality in the vicinity of Red Hill Shaft, provide data on the extent and magnitude of groundwater impacted during the November 20 release, measure groundwater flow, and determine the effect of pumping the Red Hill Shaft on the local hydraulic gradient. These wells will provide data to evaluate if contamination is migrating from the site toward potential offsite receptors.

The plume delineation wells are installed as 2-inch-diameter wells screened across the basal aquifer water table (approximately 10 feet of screen above and 20 feet of screen below) to provide water quality and water level data from the basal aquifer and allow for detection of any fuel product on the water table surface. Data collected during drilling are also evaluated to detect potential impacts to the vadose (unsaturated) zone.

At present, the Navy has completed three wells (RHP01, RHP02, and RHP03) to depths of 141– 160 feet below ground surface (bgs). The wells are initially being sampled for BTEX, TPH-g, TPH-d, TPH-o, N, 1MN, and 2MN, at a minimum of twice a month for two months. Initial sampling of each well also includes natural attenuation parameters (alkalinity, bicarbonate alkalinity as calcium carbonate [CaCO3], carbonate alkalinity as CaCO3, nitrate as nitrogen, chloride, sulfate, methane, ferrous iron, and total organic carbon [TOC]). In collaboration with the regulatory agencies, the Navy will evaluate the data to determine future sampling requirements.

The Navy uploads additional details (e.g., boring logs and well construction details) on well installation and water quality data to the Red Hill Electronic Data Management System (EDMS).

6.4.3.3 Ongoing Adit 3 Shallow Step-Out Soil and Groundwater Borings

In the Adit 3 and Pearl Harbor tunnels, shallow borings are being installed to delineate the presence of Jet Propellant No. 5 (JP-5) light non-aqueous phase liquid (LNAPL) and characterize dissolved-phase JP-5 constituents in the shallow water-bearing zone observed beneath the tunnel floors. Up to 20 borings will be installed, 6 feet below the tunnel floor (btf). (Department of the Navy, 2022).

Investigation activities from March to May 2022 observed JP-5 LNAPL in shallow borings located in the Adit 3 tunnel. The LNAPL was observed using an oil/water interface probe and through visual inspection of liquids collected from the boring using a translucent bailer.

The purpose of this phase of the investigation is to:

1. Evaluate the extent of shallow groundwater (less than 6 feet btf) within the Adit 3 and Pearl Harbor tunnels as observed between the sump and A3-150.
2. Assess the extent and magnitude of JP-5 impact in shallow soil (less than 6 feet btf) within the Adit 3 and Pearl Harbor tunnels as observed between the sump and A3-150.
3. Delineate the extent and magnitude of JP-5 LNAPL in shallow soil less than 6 feet btf within the Adit 3 and Pearl Harbor tunnels as observed between the sump and A3-150.
4. Assess the extent and magnitude of JP-5 dissolved in the shallow groundwater (less than 6 feet btf) within the Adit 3 and Pearl Harbor tunnels as observed between the sump and A3-150.

6.4.3.4 Ongoing Drinking Water Sampling

The Red Hill Shaft has been isolated and offline since November 28, 2021. The Navy has discontinued Safe Drinking Water Act compliant water sampling at the Red Hill Shaft, and has implemented recovery efforts. Drinking water sampling results conducted as part of the recovery plans and long term monitoring are available to the public at www.JBPHH-SAFEWATERS.ORG.

6.4.3.5 Inspection of Water Development Tunnel

During June 14–15, 2022, investigators conducted a second inspection of the Red Hill Shaft water development tunnel using a cable-controlled, submersible, remotely operated vehicle (ROV) outfitted with cameras that recorded downward, forward, and upward video of the first 515 feet of the tunnel. This second inspection augmented the findings of an initial ROV inspection conducted on January 13, 2022 to better understand the extent of impact in the tunnel and to potentially identify areas of fluid infiltration. The findings are reported in a technical memorandum entitled “Findings from ROV Inspection #2 Video Review of Red Hill Water Development Tunnel” (DON 2022g).

6.4.4 Ongoing Groundwater Modeling

In 2020, the Navy completed groundwater flow modeling and submitted report. While awaiting comments from regulatory agencies, but after the November 2021 release, the Navy used the available

2020 models to assess potential dissolved fuel migration directions and distances with Red Hill Shaft turned off, as well as the potential effectiveness of using Red Hill Shaft for remediation and capture. After a review of the modeling report, the DOH and EPA provided a disapproval letter ("Letter") to the Navy on March 17, 2022. The Navy responded on June 15, 2022, with proposed tasks to resolve DOH and EPA comments. Since receiving the official response, the Navy has corrected the deficiencies outlined in the Letter as follows:

- Calculated preliminary order-of-magnitude fate & transport simulations with BIOSCREEN, an EPA natural attenuation decision support model for dissolved hydrocarbons at controlled release sites
- Used alternate model calibration techniques for improved match to field observations
- Implemented recommendations made by EPA subject matter experts (SMEs)
- Updated the existing 3D geologic conceptual model to improve the site conceptual site model (CSM)
- Experimented with High-Contrast Permeability Simulation realizations using simple box modeling
- Attempted dozens of model modifications overall, with thousands of model simulation performed

The Navy continues to make improvements to the existing groundwater flow models in collaboration with regulatory SMEs. Groundwater modeling efforts are scheduled to be completed by September 2024.

6.4.5 Ongoing Soil Sampling

The subsections below describe the ongoing soil investigations occurring in relation to RHBFSF.

6.4.5.1 Adit 3 Geophysical Characterization

The Navy conducted geophysical characterizations of subsurface features using two survey lines of electrical resistivity (induced polarization and ground-penetrating radar) between January 28 and February 2, 2022 in sections of the Adit 3 Lower Access and Pearl Harbor tunnels. The purpose of the characterization was to facilitate understanding of LNAPL downward migration and potentially identify pooled LNAPL in the vadose zone. A ground-penetrating radar survey consisting of 16 survey lines was also conducted in the Lower Access tunnel in the vicinity of Tanks 17 through 20. Additional activities conducted after February 5, 2022 in Adit 3 and Pearl Harbor tunnels included concrete cutouts in the tunnel floor and soil, water, and soil vapor sample collection.

6.4.5.2 Adit 3 Shallow Trenches

Between March 2 and April 12, 2022, the Navy excavated six shallow trenches through the Adit 3 and Pearl Harbor tunnel floors. The purpose of the excavations was to:

- Evaluate hotspots identified by subslab SVMP monitoring.
- Uncover a concrete drain line called a Hume drain that was observed in early design drawings of the Adit 3 and Pearl Harbor tunnels, in proximity to the November 20 release.

The Navy used multi-increment sampling (MIS) to collect soil samples beneath the concrete tunnel floor at the locations shown in Figure 6-6 in Appendix C (Enclosure 3). The MIS samples were analyzed for TPH-g, TPH-d, and TPH-o; BTEX; and N, 1MN, and 2MN.

Initially, the Navy excavated five trenches; however, the Hume drain was not found, so a sixth trench was excavated along the northern side of the tunnel. Similar MIS samples were collected, and the Hume drain was observed at approximately 3 feet below the tunnel floor in this sixth trench. Within the trench, a 3-inch hole was cut into the Hume drain, and a 3-inch-diameter riser pipe and cap were installed within a metal vault to allow access to the line for data gathering or potential future remedial actions. PID samples from the pipe indicated it had been impacted with hydrocarbons, likely from the November 20 release. In addition, the Navy installed shallow borings into the five initial trenches for the purpose of near-surface soil vapor monitoring (5–6 feet below tunnel floor). A perched water system was encountered in three of the borings located between 250 and 650 feet into the Adit 3 tunnel, and fuel oil identified by laboratory analysis as JP-5 was observed in the trench boring located adjacent to the U.S. Navy Well 2254-01 Pump Station. Near-surface SVMPs were not installed in borings that contained water. Two trench boring locations did not encounter liquids, and near-surface SVMPs were installed in these dry borings in early April 2022 and have been sampled along with the subslab SVMPs since April 13, 2022. The two locations are within the Pearl Harbor tunnel approximately 75 feet from the Adit 3 eastern merge; and within the Adit 3 tunnel where the November 20, 2021 valve break occurred and JP-5 was released to the tunnel floor.

6.4.5.3 Adit 3 Soil Borings

Based on the observation of LNAPL in the trench boring at A3+000 and consultation with DOH as seen in Figure 6-7 in Appendix C (Enclosure 3), the Navy is implementing an LNAPL Site Characterization Plan (DON 2022e), which includes:

- Installation of 20 shallow soil borings using a manual hammer drill and 1.5-inch auger drill bit to a depth of 6 feet below tunnel floor along the Adit 3 and Pearl Harbor tunnel
    - 18 soil borings in the Adit 3 tunnel at A3+250 and extending to A3-350
    - One soil boring in the western spur of the Pearl Harbor tunnel approximately 25 feet south of the merge with the Adit 3 tunnel
    - One soil boring in eastern spur of the Pearl Harbor tunnel approximately 25 feet south of the merge with the Adit 3 tunnel
- Installation of up to eight temporary wells in these boring, which includes reaming to 2.5-inch diameter and installation of 5-foot prepack well screens

eFigure 6-6 in Appendix C (Enclosure 3) shows the shallow borehole sampling locations for this Adit 3 site characterization effort. Between June 24 and August 5, 2022, the Navy advanced 18 soil borings to 6 feet below tunnel floor and screened the soil cuttings for organic vapor with a PID. The soil interval with the maximum PID result was collected for field tests and for laboratory analysis for the COPCs TPH-d, N, 1MN, and 2MN.

The Navy plans to install intermediate SVMPs at up to four locations below the observed perched water layer observed between A3+325 and A3-150 within the Adit 3 tunnel as seen in Figure 6-7 in Appendix C

(Enclosure 3). Deep nested SVMPs are planned at two locations within the Adit 3 tunnel and one location overlaying the water development tunnel in the Pearl Harbor tunnel.

The forthcoming Adit 3 and Pearl Harbor Tunnel Area investigation report will contain more details regarding this work within Adit 3.

6.4.5.4 Holding Tank and Leach Tank Soil Excavation

In January, 2022, the Navy conducted a subsurface investigation of the Holding Tank and Leach Tank area outside Adit 3 was also conducted. Subsurface soil borings seen in Figure 6-8 in Appendix C (Enclosure 3) were drilled and sampled as part of the Phase 1 characterization in the vicinity of the Adit 3 Holding Tank and Leach Tank. The Phase 1 investigation was conducted using the direct-push drilling method and was unable to delineate the extent of contamination in the perched aquifer due to encountering shallow refusal. Phase 1 activities and results are documented in a Technical Memorandum November 2021 Pipeline Release Red Hill Fuel Storage Facility, February 2022 (DON 2022b).

Following consultation with DOH and EPA, the Navy conducted Phase 2 field work during March 9–17, 2022 to vertically delineate the petroleum in subsurface soil and to characterize petroleum in the shallow perched water body located at approximately 30 feet bgs in the study area. During the Phase 2 investigation, subsurface soil samples and organic vapor headspace readings were collected at eight soil borings from data gap locations, and groundwater grab samples were collected from three temporary wells within the perched groundwater zone. The chemical constituents evaluated were TPH-g, TPH-d, and TPH-o; benzene, toluene, ethylbenzene, and xylenes (BTEX); and naphthalene (N), 1-methylnaphthalene (1MN), and 2-methylnaphthalene (2MN).

The Navy conducted soil excavation activities at the Holding Tank and Leach Tank area. Delineation of the areas excavated was based on the Phase I and Phase II investigation activities conducted in January and March 2022, respectively. The two tanks were uncovered and removed in May 2022. As part of this action, approximately 97 tons of soil were excavated and hauled to a landfill. Waste characterization soil samples were collected and analyzed for TPH-g, TPH-d, and TPH-o prior to the excavation event.

6.4.6 Ongoing Soil Vapor Monitoring

The SVMS consists of two or more probes located at various points in existing boreholes beneath 18 underground storage tanks. Each probe is used to draw vapor from isolated segments of the borehole associated with the front, middle, and back of the tanks. Vapors are withdrawn from each probe via a pump and sampled in the field using a hand-held organic compound detector. Total volatile organic vapors are measured down to 1 part per billion (ppb) and compared to baseline measurements from the same location. Increasing concentrations over time are an indication of fuel leaks at the tested tank.

The SVMS at RHBFSF falls into three categories. The types of soil vapor monitoring are as follows:

1. Upper tank farm soil vapor monitoring. Sampling of these UST SVMPs began in 2008.
2. Adit 3 and Pearl Harbor Tunnel shallow soil vapor monitoring. Sampling of these shallow SVMPs began in 2021.
3. Adit 3 and Pearl Harbor Tunnel nested soil vapor monitoring points. These nested SVMPs are currently being installed.

Between December 15 and 17, 2021, The Navy installed 47 subslab SVMPs into petroleum-impacted segments of the Adit 3 and Pearl Harbor tunnels. Depths were approximately 6 inches or greater through the bottom of the concrete subslab of the tunnel floor. Results from hand-held organic vapor detectors (photoionization detectors [PIDs]) that sampled these SVMPs between December 17 and 24, 2021 indicated elevated petroleum vapors under the concrete tunnel floors. Organic vapor maxima, or hotspots, were noted directly over the water development tunnel in the vicinity of the release area, and at just below the merge of the Adit 3 tunnel and the Pearl Harbor tunnel. Organic vapors were also elevated throughout the lower portion of the Adit 3 tunnel, highest surrounding the sump.

The Navy is conducting shallow soil vapor monitoring to identify locations in Adit 3 and the Pearl Harbor Tunnel where fuel released in November 2021 has impacted the tunnel subsurface. These data are used to identify locations for further investigations, which included the deep nested soil vapor monitoring points, as well as the LNAPL step-out boring locations.

The Navy is currently constructing deep SVMPs (Figure 6-9 and Figure 6-10) in Adit 3 and the Pearl Harbor Tunnel area, and will begin sampling in the fall of 2022.

The Navy will continue the soil vapor monitoring program which currently includes 18 Red Hill tanks. Soil vapor monitoring has been conducted consistently from March 2008 to the present. The Navy will continue to coordinate vapor monitoring of the tanks with the well water monitoring cycle.

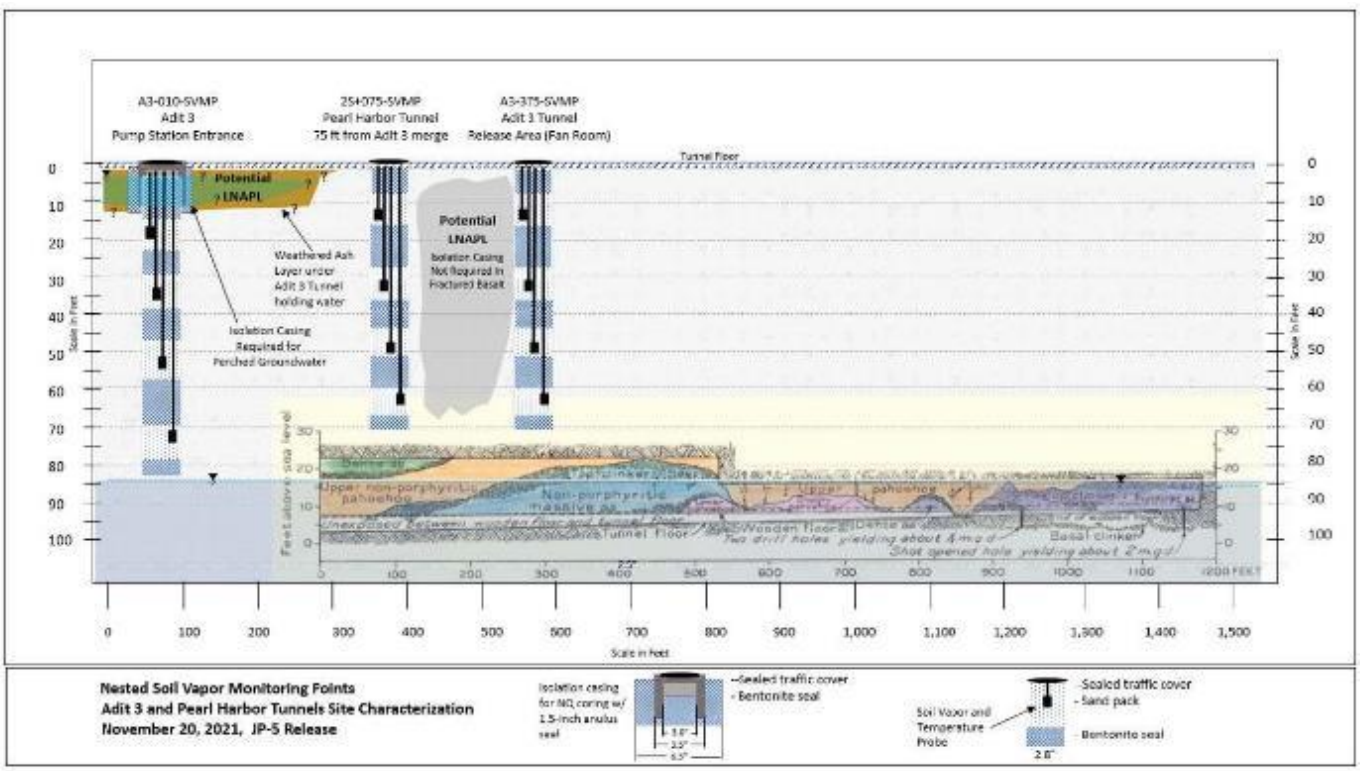

FIGURE 6-9 SCHEMATIC OF DEEP NESTED SOIL VAPOR MONITORING PLAN 1

6.4.7 Ongoing Research Efforts

The Navy's Office of Naval Research (ONR) is currently coordinating with the University of Hawaii (UH) in support of a large scale groundwater and hydrogeological investigation of the RHBFSF, Halawa, and Moanaloa regions. This UH investigation is comprised of a sequence of hydrological, geochemical, geophysical, and petrophysical surveys in the region of the Navy's RHBFSF. The investigation includes: borehole measurements of groundwater flow velocity and direction; design and execution of a tracer test; detailed analysis of the distribution of naturally occurring isotope and ion tracer concentrations; marine-based electrical surveys to assess groundwater discharge into Pearl Harbor down gradient of the RHBFSF; land-based electrical, seismic, and gravity surveys to characterize the major geological structures that are likely to impact groundwater, fuel, and contaminant flow through the vadose zone as well as within the onshore saturated zone; petrophysical studies of the interaction between relevant hydrocarbon fuels (JP-8, Marine Diesel) and basalt morphologies including weathered pahoehoe, 'a'ā clinker, and massive a'a core lavas (geological features within Red Hill). UH will use electrical sounding methods to identify and map confined saturated zones within the vadose zone in both the basalts as well as in the alluvial and saprolite wedges present in the valleys flanking Red Hill Ridge. These data, along with the results of a detailed evaluation of cores recovered from multiple wells in the region will be integrated into a more detailed conceptual site model that will, in turn, be used to inform the development of a numerical groundwater model that will describe groundwater flow rates and directions under both non-pumping and pumping conditions. The Navy continues to coordinate with UH on the following:

- Scientific and engineering research performed by UH under ONR funding on the hydrogeology at RHBFSF and the surrounding region on O'ahu, Hawaii.
- Engineering research and services performed or contracted by NAVFAC Engineering and Expeditionary Warfare Center (EXWC) on the hydrogeology at RHBFSF and the surrounding region on O'ahu, Hawaii.
- Scientific and engineering research performed by UH under ONR funding on water resiliency and safety at RHBFSF and the surrounding region on O'ahu, Hawaii.
- Engineering research and services performed or contracted by NAVFAC EXWC on water resilience and safety at RHBFSF and the surrounding region on O'ahu, Hawaii.
- Scientific and engineering research performed by UH under ONR funding to establish and sustain a long-term water resiliency program for the State of Hawaii and the Pacific region as part of a broader climate change mitigation and adaptation strategy.

The ultimate goal of this effort will be to provide the Navy, DOH, EPA, and BWS with a groundwater flow model that can be used to estimate the risk of contamination posed by a release from the RHBFSF to surrounding sources of drinking water and to develop plans for minimizing those risks and mitigating potential impacts on the groundwater resource in the region.

6.5 Site Investigation for Tank Closure

"In order to determine the full extent and location of soils contaminated by the release and the presence and concentrations of dissolved product contamination in the groundwater and surface water" (HAR §11-280.1-65), the Navy must conduct soil and groundwater investigation for cleanup in accordance with HAR §11-280.1-65 to facilitate closure for the fuel tanks. Herein details the objectives, ongoing efforts, and proposed tasks to determine extent and location of contaminants of potential concern (COPCs) in connection with RHBFSF.

Since contaminated groundwater and free product has already been discovered and releases are known to have occurred at RHBFSF, the Navy began release response action in accordance with Subchapter 6 on Release Response Actions (HAR §11-280.1-60 through HAR §11-280.1-67). The Navy has already taken immediate response actions and initial abatement measures to the 2021 (as well as the 2014) releases. HAR §11-280.1-63 discusses initial site characterization, which includes assembling information about the site and the nature of the release, and completing the initial abatement measures. According to the HAR, this information must include:

(1) data on the nature and estimated quantity of release;
(2) data from available sources and all previous site investigations concerning the surrounding populations, water quality, locations of wells potentially affected by the release, subsurface soil conditions;
(3) results of the free product investigations.

The Navy has already complied with these requirements by submitting “Initial Site Characterization, Fire Suppression Drain Line, State of Hawaii Department of Health (DOH) Facility ID No. 9-102271, DOH HEER Incident Release Case No. 20211120-2330" (submitted January 7, 2022) within 45 days following the confirmed release notification of the November 2021 release.

Based on the results of the free product investigation, the Navy also conducted free product removal to address the 2021 release consistent with HAR §11-280.1-64 (Free product removal). The Navy submitted a free product removal report “Free Product Removal Report, Fire Suppression Drain Line, Red Hill Bulk Fuel Storage Facility, DOH Facility ID No. 9-102271, DOH HEER Release Incident Case No. 20211120-2330" to DOH on January 7, 2021. In an ongoing effort to address free product, groundwater monitoring wells located within the lower access tunnel are gauged on a monthly basis to determine water levels and measure for the presence of LNAPLs using an interface meter. The interface meter is lowered into groundwater monitoring wells to determine the depth of water to the nearest 0.01 foot, and the existence of any immiscible layers of fuel.

Because releases at RHBFSF are known to have occurred and will be addressed as part of Tank Closure, this section will focus on Site Investigation. The Navy will continue to use the release detection mechanisms in place at RHBFSF to monitor for any other potential releases until defueling is completed at RHBFSF. In addition, the Navy will continue to collaborate with BWS, DOH, and EPA in developing additional monitoring and sentinel wells as needed.

6.5.1 Site Investigation Objective

The principal objective of the Site Investigation is to identify COPCS and determine the extent of release from RHBFSF which will be used to establish Site Cleanup Criteria (HAR § 11-280.1-65.3) and developing a Corrective Action Plan (HAR § 11-280.1-66), if necessary to achieve tank closure. This investigation will build upon ongoing and historical investigations to refine the CSM that will provide information on what is known or suspected for contaminant releases and mechanisms (e.g. groundwater flow), fate and transport, exposure pathways, potential receptors and site risk.

In addition to refining the CSM, this investigation will help to inform the need for further characterization, assess the potential for recovering LNAPL released to the environment, and evaluate the impacts from potential releases during closure operations.

6.5.2 Principal Study Questions

The Principal Study Questions (PSQ) related to this Site Investigation include:

1. What is the general nature of the RHBFSF vadose zone and how do the characteristics of the vadose zone, including perched groundwater conditions, affect the movement of petroleum from the original source area?
2. How do the characteristics of the vadose zone impact the alternatives for investigating and remediating LNAPL?
3. What are the contaminants of concern that should be investigated?
4. How much further evaluation of the nature and extent of groundwater contamination is necessary?
5. What are the groundwater flow patterns in the study area and within the modeling domain?
6. What are the appropriate hydrologic boundaries to be used for the groundwater flow model?
7. What fate and transport processes affect the petroleum constituents released from the RHBFSF to groundwater?
8. What are the alternatives for further investigating and remediating any petroleum products that are both present in groundwater and may pose unacceptable risk to receptors?
9. What is the potential for recovering LNAPL released to the environment?
10. What are the potential impacts from potential releases during closure operations on the groundwater resource?

6.5.3 Design for Collecting Data

The Site Investigation has been designed to collect data in a manner consistent with the existing GWPP. The Sampling and Analysis Plan (SAP) will include details on sampling locations (including additional locations if needed to address data gaps), frequency, methodology, and procedures. Data collected will be used to evaluate trends and overall study area risk.

6.5.4 Minimizing Potential Errors

The Site Investigation will use decision-error minimization techniques in sampling design, sampling methodologies, and laboratory measurement of COPCs. The sampling design (location, frequency, response to exceedances) is based on the current best understanding of the study area lithology, vadose zone, and groundwater behavior, and on the contaminant distribution model. The Site Investigation will use the following methods to minimize potential errors associated with sampling design, sampling methodologies, and laboratory analysis of COPCs:

1. Evaluate historical data to validate COPCs, sampling locations, and study area characteristics.
2. Evaluate historical and existing data to ensure adequacy and usability for meeting the objective of the Site Investigation (Historical Document Review).
3. Implement appropriate quality assurance (QA)/quality control (QC) procedures to ensure that data collected (e.g., groundwater elevation, lithologic, and analytical data) are accurate and sufficient to meet the requirements of the investigation.

4. Select locations within the study area where data gaps are identified to install groundwater monitoring wells to further characterize groundwater flow and delineate the nature and extent of contamination.
5. Apply standardized field sampling methodologies. Ensure use of applicable EPA SW-846 analytical methods for sample chemistry analysis by an analytical laboratory accredited by the Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP) to reduce testing errors.
6. Ensure use of applicable American Society for Testing and Materials (ASTM) methods for geotechnical analysis by an accredited geotechnical laboratory to reduce measurement errors.
7. Identify and control potential laboratory error and sampling error by using matrix spikes, blanks, and duplicates.
8. Implement appropriate measures to minimize potential error in groundwater flow and contaminant fate and transport (CF&T) modeling, which include at a minimum ensuring data used in the models are usable and of good quality, model boundaries are sufficient, the models are properly calibrated, sensitivity analyses are conducted to address uncertainty associated with input parameters, and conservative assumptions are made in the absence of site-specific data.

6.6 Project Tasks

This Site Investigation includes the following tasks to achieve project objectives:

- Task 1: Historical Document Review
- Task 2: Site-Specific Action Levels
- Task 3: Subsurface LNAPL Investigation
- Task 4: Update Existing Groundwater Flow Model
- Task 5: Update CF&T Model
- Task 6: Determine LNAPL Preferential Pathway
- Task 7: Identify Data Gaps
- Task 8: Exposure Assessment

The Navy will conduct all field, data validation, and QC activities in accordance with established standard operating procedures (SOPs). The tasks listed above, their purpose, and derivative deliverables associated with each task are summarized in Table 6-2. The following subsections describe the tasks, subtasks, and outputs associated with each task.

TABLE 6-2 PROJECT TASKS, PURPOSE, AND DELIVERABLES

Task	Purpose	Associated Derivative Deliverables
1: Historical Document Review	Compile and evaluate existing and new data, conduct geological mapping, and use the information to develop a site-specific CSM to inform the other tasks of this site investigation.	• Existing-Data Evaluation • Data Gap Analysis Report • SAP • CSM Development and Update Plan
2: Site-Specific Action Levels	Determine investigation-specific COPCs for analytical samples submitted for chemical analysis.	• Existing-Data Evaluation • Data Gap Analysis Report • SAP • CSM Development and Update Plan • Groundwater Model Evaluation
3: Subsurface LNAPL Investigation	Collect new data to evaluate subsurface petroleum impacts to include soil, groundwater, and soil gas within the RHBFSF to inform the objectives of this site investigation.	• Existing-Data Evaluation • Data Gap Analysis Report • SAP • CSM Development and Update Plan
4: Update Existing Groundwater Flow Model	Input and assess existing and newly collected data to revise, modify, and update the existing groundwater flow model to improve the understanding of the direction and rate of groundwater flow within the aquifers around RHBFSF.	• Existing-Data Evaluation • Data Gap Analysis Report • SAP • CSM Development and Update Plan • Groundwater Model Evaluation • Sentinel Well Network Development Plan
5: Update CF&T Model	The CF&M Model will be used with the groundwater flow model to improve the understanding of the potential fate and transport, degradation, and transformation of contaminants that have been and could be released form the RHBFSF.	• Existing-Data Evaluation • Data Gap Analysis Report • SAP • CSM Development and Update Plan • Groundwater Model Evaluation • Sentinel Well Network Development Plan
6: Determine LNAPL Preferential Pathway	Identify potential preferential flow pathways, evaluate the feasibility of LNAPL recovery, and map the structural geology of the RHBFSF area with minimal intrusive impact.	• Existing-Data Evaluation • Data Gap Analysis Report • SAP • CSM Development and Update Plan
7: Identify Data Gaps	Evaluate collected data and determine the need for follow-on investigation to address site risks and inform potential mitigation options.	• Existing-Data Evaluation • Data Gap Analysis Report • SAP • CSM Development and Update Plan • Groundwater Model Evaluation • Sentinel Well Network Development Plan
8: Exposure Assessment	Update risk assessment based on collected data to support risk based decisions.	• CSM Development and Update Plan • Groundwater Model Evaluation • Sentinel Well Network Development Plan

6.7 Historical Document Review

The contractor will review all relevant and available historical data to validate COPCs, identify potential LNAPL source areas, and select appropriate sampling locations, and define site characteristics. This task will include performing a document and literature search; review existing, ongoing, and newly acquired geological literature, maps, photographs, aerial imagery, tank barrel logs, drilling and boring logs, and rock core. This will be supported by the *Existing-Data Evaluation Report* and the *Data Gap Summary Report* that will identify additional data needs.

6.7.1 Contaminants of Potential Concern

Each tank at the RHBFSF has contained at least one of the following fuels: diesel oil (DO), Navy Special Fuel Oil (NSFO), Navy Distillate, Marine Diesel Fuel (F-76), aviation gasoline (AVGAS), motor gasoline (MOGAS), JP-5, and JP-8 (DON 2002). Since the early 2000s, the RHBFSF has stored only JP-5, JP-8, and F-76. The RHBFSF has not stored leaded fuels since 1968. At the time of the January 2021 reported release, Tank 5 contained JP-8, a kerosene-based fuel.

Table 6-3 presents the current DOH and EPA approved list of COPCs and screening criteria. As more data are obtained and evaluated. The primary petroleum-based COPCs were chosen by using implementing guidance from HAR §11-280.1-65.3, in accordance with the DOH TGM (DOH 2016, Section 9), based on their potential presence in fuel stored on site and on previous groundwater monitoring results.

TABLE 6-3 CONTAMINANTS OF POTENTIAL CONCERN AND SCREENING CRITERIA

Parameter	Analytical Method	Analyte(s)	Screening Criterion (ug/L)
Total Petroleum Hydrocarbons (TPH)	EPA SW-846 8015	TPH-G	100
		TPH-D	100
		TPH-O	100
TPH with Silica Gel Cleanup	EPA SW-846 3630/8015	TPH-D	100
		TPH-O	100
Volatile Organic Compounds (VOCs)	EPA SW-846 8260	Benzene	5
		Ethylbenzene	30
		Toluene	40
		Total Xylenes	20
Polynuclear Aromatic Hydrocarbon (PAHs)	EPA SW-846 8270 SIM	1-Methylnapthalene	4.7
		2-Methylnapthalene	10
		Naphthalene	17
Natural Attenuation Parameters (NAPs)	Field Parameter	Dissolved Oxygen	-
	SM 3500-Fe	Ferrous Iron	-
	RSK 175M	Methane	-
	EPA 300.0	Nitrate, Sulfate, Chloride	-
	SM2320	Alkalinity	-
Lead Scavengers	SW-846 8260	1,2-Dibromoethane	0.04
		1,2-Dichloroethane	5
Fuel Additives	SW-846 8270	Phenol	5.0[a]
	Lab Procedure	2-(2-methoxyethoxy)-ethanol	800[b]
Groundwater Chemistry	EPA 300.0	Bromide, chloride, fluoride, and sulfate	-
	EPA SW-846 6010	Total calcium, total magnesium, total manganese, total potassium, and total sodium	-
	SM4500-SID	Total and dissolved silica	-
Note: COPC screening criteria were provided in the February 4, 2016, scoping completion letter (Appendix A)			
-	no criterion		
ug/L	microgram per liter		
PAH	Polynuclear aromatic hydrocarbon		
TPH	Total Petroleum Hydrocarbons		
TPH-D	Total Petroleum Hydrocarbons - Diesel Range Organics		
TPH-G	Total Petroleum Hydrocarbons - Gasoline Range Organics		
TPH-O	Total Petroleum Hydrocarbons - Residual Range Organics		
a Screening criterion from DOH Tier 1 EALs, Table D-1b, Groundwater Action Levels (groundwater is a current or potential drinking water resource, and surface water body is not located within 150m of release site)(DOH 2016)			
b Screening criterion from EPA Tap Water Regional Screening Levels, THQ - 1.0, May 2016 (EPA 2016)			

6.8 Site-Specific Action Levels

Site-specific action levels used for decisions at the RHBFSF will require regulatory agreement and reference HAR §11-280.1-65.3 to establish EALs and site-specific risk-based levels (SSRBLs) for COPCs within impacted environmental media (soil, groundwater, surface water). Through ongoing modeling efforts, it was determined that Total Petroleum Hydrocarbons (TPH) and benzene are the primary risk drivers for migration of dissolved petroleum from jet fuel. Through regulatory collaboration, appropriate SSRBLs will be developed for TPH, benzene, and other COPCs deemed necessary for inclusion.

6.9 Subsurface Light Non-aqueous Phase Liquid Investigation

The contractor (to be acquired by the Navy) will collect new data, evaluate data, and conduct geological mapping using surface geophysical methods. Subsurface geology will be evaluated to help develop a more detailed understanding site characteristics within the study area. The geological evaluation will focus on identifying, characterizing, and illustrating geologic features that are likely to influence LNAPL and dissolved-phase contamination migration pathways or serve as potential barriers in the vadose zone or saturated zone. These features include interbedded zones of high and low horizontal permeability, low-permeability zones of unfractured basalt, dikes, fine-grained valley fill sediments, and saprolite beneath the valley fill. The evaluation will include, at a minimum, descriptions of the physical characteristics of the basalt layers, intervening clinker beds, and mechanisms that may affect LNAPL and groundwater movement within the boundaries of the RHBFSF.

Integrating this information into a conceptual model will improve the understanding of contaminant and groundwater movement, and will help develop a rational basis for estimating the volume of contaminant mass that could be retained in the vadose zone (i.e., by residual saturation) and movement, direction, and extent of LNAPL and dissolved-phase contaminant. The data will also help in supporting the groundwater modeling effort and making decisions on subsequent sampling and analyses.

The data required to refine the geological model for the RHBFSF area include, but are not limited to, the following:

- Conduct a field survey to map visible outcrops and evidence of other geologic features, such as dikes and large fractures, which may allow for mapping to identify the locations of major rock types and features. To the extent possible, measure and plot the dip and strike of bedding, fractures, dikes, faults, and potential preferential flow pathways. Measure thicknesses of individual flow units at available rock outcrops. Estimate the trend and plume site within the groundwater.

- Evaluate subsurface geology to help develop a more detailed understanding of the geology in the study area. A separate derivative deliverable, *CSM Development and Update*, will be prepared that details the process to be followed during development of the necessary tasks. The geological evaluation will focus on identifying, characterizing, and illustrating geologic features that are likely to influence LNAPL and dissolved-phase contamination migration pathways or serve as potential barriers in the vadose zone or saturated zone. These features include interbedded zones of high and low horizontal permeability, low-permeability zones of unfractured basalt, dikes, fine-grained valley fill sediments, and saprolite beneath the valley fill. The evaluation will include, at a minimum, descriptions of the physical characteristics of the basalt layers, intervening clinker beds, and mechanisms that may affect LNAPL and groundwater movement. Integrating this information into a conceptual model will improve the understanding of contaminant and groundwater movement, and will help develop a rational basis for estimating the volume of contaminant mass that could be retained in the vadose zone (e.g., by residual saturation) and movement, direction, and extent of LNAPL and dissolved-phase contaminant. The data will also help in supporting the groundwater modeling effort and making decisions on subsequent sampling and analyses.

6.10 Expanding Groundwater and Soil Vapor Monitoring Network

The Navy is installing a network of 10 new sentinel wells (S wells), as well as 10 new plume delineation wells (P wells). Of these 20 new monitoring wells, five P wells have been installed as of September 2022, and the remaining P Wells and S Wells are in various stages of the permitting and installation process. These new monitoring wells are being installed to optimize and refine the existing RHBFSF groundwater monitoring network. During frequent monitoring events, groundwater sampling will be conducted at all monitoring locations in the newly expanded groundwater monitoring network. These data will be evaluated and reported LTM reports. Meetings and discussions will be held as needed with DOH and EPA to further evaluate any data gaps that may be identified based on the sampling results or refine the current sampling requirements. Proposed activities for installation of any additional new monitoring wells will be documented in MWIWP addendums.

6.10.1 Groundwater Sampling and Analysis

The Navy will collect groundwater samples in accordance with state approved procedures for laboratory analytical effort to ensure that data collected are consistent and meet the project objectives. Additionally, the file review, site reconnaissance, and subsurface geology will be further evaluated to minimize the probability of missing a preferential flow path that may indicate that LNAPL and dissolved-phase constituents are migrating toward Navy Supply Well 2254-01, the Hālawa Shaft, or other potential offsite receptors. Field procedures for sampling activities and other tasks supporting the investigation will be presented in the SAP.

The Navy will screen the analytical data reported for the groundwater samples against regulatory approved project action levels (PALs). In order to minimize the occurrence of non-detect analytical results that exceed the PALs, the analytical laboratories will be evaluated for technical capability to meet the PALs and other laboratory requirements.

6.11 Update the Existing Groundwater Flow Model

The Navy contractor will input and assess existing and newly collected data to revise, modify, and update the existing groundwater flow model to improve the understanding of the direction and rate of groundwater flow within the aquifers around RHBFSF. The groundwater flow model will then be used to support and refine the CF&T model and update the SSRBLs, and to evaluate remedial alternatives.

The groundwater flow model previously developed for the study area (DON 2020) will be updated, revised, and modified with newly collected data (e.g., lithological data, water level data) provided by contracted SMEs and other agencies and data acquired during the activities described in this Site Investigation plan.

The objectives of updating the numerical flow model are as follows:

- Develop groundwater flow and CF&T models
- Refine existing flow model to improve understanding of flow in the vicinity of the RHBFSF
- Evaluate exposure pathways to potential receptors
- Improve models for use as planning tools:
  - Validate SSRBLs
  - Support alternatives analysis
  - Inform the contingency planning

The Navy will use the groundwater flow model to improve the understanding of the direction and rate of groundwater flow within the aquifers around the RHBFSF. The numerical model will be calibrated to include groundwater data obtained since 2007, including transient calibration to match pumping rate and drawdown data from available pumping tests. The calibrated Modular Groundwater Flow Model (MODFLOW) will also employ MODPATH to simulate groundwater flow paths from the source area and evaluate capture zones of pumping wells. The calibrated flow model will also be used to support the CF&T modeling.

The updated groundwater model will be compared with the detailed hydrogeologic information for the site. The *Existing-Data Evaluation/Summary Report*, *Data Gap Analysis Report*, and *CSM Development and Update Plan* will be prepared to further evaluate data and identify data needs. Additional data needs include, but are not limited to, the following:

- Groundwater level and groundwater quality monitoring data collected since 2005 by the Navy from the existing RHBFSF monitoring wells
- Groundwater data to be collected during this Site Investigation using surveyed (first-order) top-of-casing measurement points for existing and new wells
- Groundwater level monitoring data from the USGS, including May 2015 and other historical pumping test data
- Groundwater modeling data and electronic files available from current USGS studies
- Geologic logs of borings available from the Navy, USGS, DOH, City and County of Honolulu BWS, and State of Hawaiʻi Department of Transportation (HDOT)
- Geologic logs of historical excavations and borings to be installed during this investigation
- Published reports of hydrogeology and groundwater resources studies

In collaboration with the BWS, the Navy will evaluate the need for additional monitoring wells in a *Sentinel Well Network Development Plan* and as part the groundwater flow modeling effort. As described in Section 6.12, the Navy is in the process of installing a network of 10 new sentinel wells (S wells), as well as 10 new plume delineation wells (P wells). Of these 20 new monitoring wells, five P wells have been installed as of September 2022, and the remaining P Wells and S Wells are in various stages of the permitting and installation process.

The available groundwater level data are not sufficient to resolve uncertainties in the groundwater hydraulic gradients between RHBFSF and the water supply wells of interest. Thus, as part of this sites assessment, identifying the location of additional monitoring wells will be necessary to better define the hydraulic gradients. Collecting water quality data from the new wells will also improve the current understanding of contaminant migration directions from RHBFSF.

The Navy will develop a collaborative process for reviewing and revising the model parameters that will include DOH and EPA input on the model setup and parameter values. The Navy will submit progress reports for DOH and EPA review and comment, and by preparing a *Groundwater Model Evaluation Plan* that describes the process for reviewing the existing groundwater flow and CF&T model in a manner that identifies uncertainties and describes options for reducing uncertainty.

After calibrating the updated MODFLOW model to reflect the site information, the Navy will provide the calibration methods, statistics, and initial results in an interim progress report for DOH and EPA review and comment. After receiving DOH and EPA input and resolving comments on the initial modeling results, the Navy plans to prepare a *Groundwater Flow Modeling Report* containing, at a minimum, the following information:

- Description of model construction, including boundary conditions, wells, and flow rates.
- Flow model calibration results and sensitivity analyses.
- Groundwater flow model predictive simulation results.
- Conclusions and recommendations.
- Model files will be included on optical disc.

The Navy is currently in the process of preparing a scope of work for the CLEAN contractor, AECOM, to expand on the modeling work. Figure 6-11 below provides a visual representation of how the conceptual site model, groundwater flow model, and CF&T model are related.

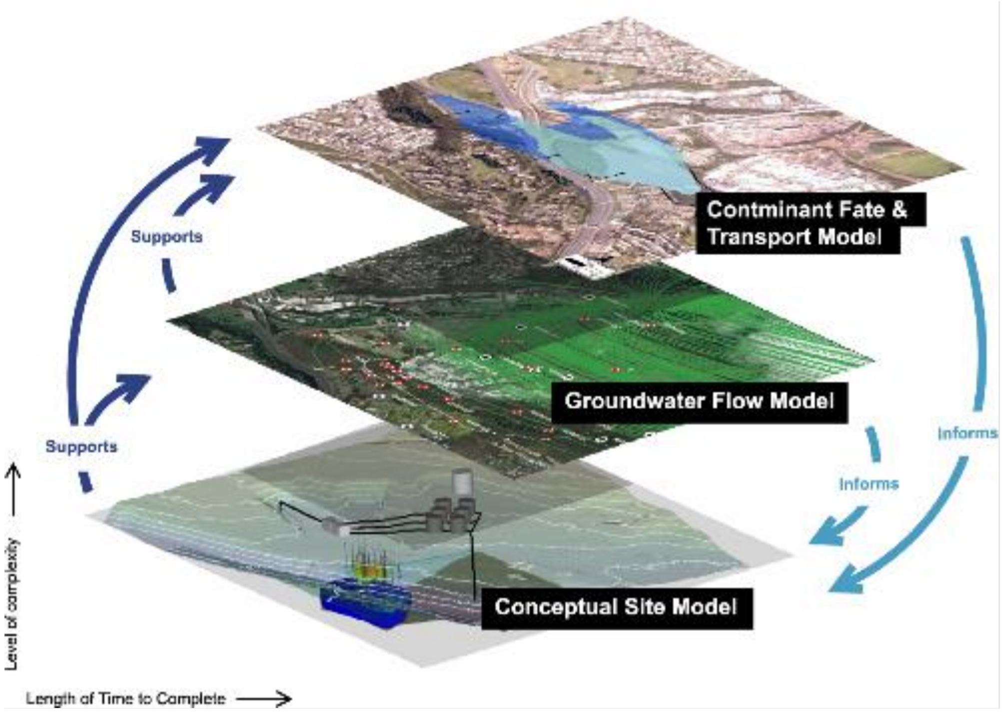

FIGURE 6-10 GROUNDWATER AND CONTAMINANT FATE AND TRANSPORT MODEL CONNECTION TO CONCEPTUAL SITE MODEL

6.12 Update the Contaminant Fate and Transport Model

The Navy will use the CF&T model with the groundwater flow model to improve the understanding of the potential fate and transport, degradation, and transformation of contaminants released from the RHBFSF. This task will include, at a minimum, updating the existing CF&T model to refine existing SSRBLs, assess potential impacts to groundwater by modeling different hypothetical release scenarios, and evaluate remedial alternatives.

The Navy will update the existing CF&T model with any newly collected data (e.g., water quality data) provided by others (potentially including the USGS) and resulting from the activities in this Site Investigation. Existing data will be evaluated in the *Existing-Data Evaluation Report*, which will be used to evaluate all existing data and ensure that it is of the quality needed to meet the modeling objectives. Data gaps identified based on the existing-data review will be presented in a *Data Gap Analysis Report*. The CSM will also be updated, which may also identify additional data needed to complete the modeling effort. The plan to update the CSM will be presented in the *CSM Development and Update Plan*. Additionally, a *Sentinel Well Network Plan* will be prepared that may identify the need for additional monitoring wells that could support the modeling effort. Procedures for collecting new field investigation data will be described in the SAP or a SAP addendum. The updated CF&T model will be used with the updated groundwater flow model to support updating the SSRBLs and evaluate remedial alternatives. Details of the approach proposed to update the CF&T model will be included in a forthcoming *Groundwater Model Evaluation Plan*. The approach to update SSRBLs for the GWPP will be presented in the *Risk-Based Decision Criteria Development Plan*.

As planned for the flow modeling, the Navy intends to obtain DOH and EPA input on the CF&T model setup and parameter values. This process will include meetings to update the DOH and EPA on the development and progress of the modeling effort so that they can provide review and comment. The timing of each meeting will be consistent with reasonable endpoints during the course of modeling. The Navy expects to resolve DOH and EPA comments prior to continuing with the next stage of modeling.

The primary objective of the CF&T modeling is to assist in evaluating the potential water quality effects of groundwater migrating from areas affected by fuel leaks from the RHBFSF, including an evaluation of currently occurring natural attenuation processes, to support updating the site-specific risk assessment. This risk assessment will address the potential migration of dissolved COPCs from the RHBFSF during anticipated pumping scenarios. One question to be addressed by the updated CF&T model is how far LNAPL could move from the RHBFSF before dissolved-phase COPC concentrations exceed the MCLs or EALs at the nearest water supply well. Another objective is to support an evaluation of remedial alternatives, including predicting any water quality changes as a result of implementing potential feasible remedial alternatives.

The CF&T model refinement plans to utilize the updated MODFLOW model in conjunction with the MT3DMS model (Zheng and Wang 1999; Zheng 2010; Zheng, Weaver, and Tonkin 2010). The MT3DMS program is a modular three-dimensional multispecies transport model that uses the flow field generated by the MODFLOW model to solve the three-dimensional advection-dispersion equations to simulate groundwater flow by advection and dispersion. The MT3DMS model can also simulate sorption, degradation, and other chemical reactions of contaminants dissolved in groundwater. In applying MT3DMS, the refined model will use conservative, technically defendable assumptions for decay rates of COPCs. The CF&T model will be the same as the updated MODFLOW model in terms of model domain, grid, layers, and aquifer properties, but additional parameters for solute transport will be specified based on available data, in consultation with the EPA, DOH, and SMEs.

The CF&T modeling plans to initially use the parameter values reported in DON (2020), and will be updated as more site-specific data (e.g., chemical concentrations in groundwater) are collected. During the CF&T model calibration process, hydraulic, transport, and chemical parameters will be adjusted to match the observed spatial distribution of contaminant concentrations and groundwater concentrations over time. Calibration will be performed using a systematic, objective, iterative process involving both flow and transport models.

The Navy will make available to DOH and EPA the additional time-series concentration data for these fuel-related parameters and the NAPs from the wells installed in January 2014. In collaboration with DOH and EPA, the Navy will begin the CF&T modeling with a detailed evaluation of those data to develop a conceptual model describing the natural attenuation processes. Any changes to the CF&T modeling suggested by the new data will be presented along with recommendations to the DOH and EPA for review. The newly collected data and initial modeling results will also be evaluated and discussed with the DOH and EPA to determine whether a tracer study is warranted, feasible, and likely to produce meaningful data.

During the CF&T modeling activities, the Navy will collaborate with DOH and EPA on the following items regarding the work's progress and initial findings: the rationale for selecting COPCs to be simulated, the conceptual model of the LNAPL source for model setup, the numerical CF&T model setup, CF&T model calibration, the base case and future pumping scenarios to be specified in the CF&T model, the initial CF&T modeling results, and recommendation as to whether a tracer study is needed. After receiving DOH and EPA input, the final step in this task will involve preparing a *Groundwater CF&T Model Report* with the following information:

- Description of model construction, including parameter values, boundary conditions, and well pumping rates.
- Model calibration results.
- Description of transport model input parameters, calibration, and sensitivity analysis.
- CF&T model source area extent, rationale, concentrations, and predictive simulation results.
- Conclusions and recommendations.
- Model files will be included on digital media.

In order to allow input from the DOH, EPA, and SMEs, the Navy will report predictive modeling results (such as future plume migration to support updated SSRBLs, remedial alternatives evaluation, and contingency planning) as the model is being developed.

6.13 Determine Light Non-Aqueous Phase Liquid Preferential Pathway

Once known or potential sources of LNAPL releases are identified, the contractor will determine the potential preferential flow pathways of LNAPL within the RHBFSF (to include water and soil and soil gas), and map the structural geology of the RHBFSF area with minimal intrusive impact to the site (e.g., surface geophysical methods). This information will be considered in the development of the CSM and evaluation of data gaps. Identification of preferential pathways can help in the understanding of the fate and transport of LNAPL and rate of attenuation in the subsurface and feasibility of recovering potential LNAPL. This site assessment will evaluate known and potential release areas within the RHBFSF to include the fuel tanks, associated adit tunnels, and network of fuel distribution lines (including known and abandoned fuel distribution lines).

The evaluation of preferential pathways for LNAPL migration includes, at a minimum, evaluating available data (e.g., lithological data, soil vapor data, and presence of perched zones). Methods and technologies in current use by the environmental industry for assessing the nature and extent of subsurface LNAPL will be evaluated for potential feasibility and success at the study area. An assessment of LNAPL investigative techniques will be included as part of the *CSM Development and Update Plan*. Investigative techniques will be evaluated for their potential to produce usable data for evaluating the subsurface for anomalous zones that may indicate the presence of LNAPL and potential preferential flow pathways, while still being protective of the underlying basal aquifer.

Other data including available soil vapor, groundwater quality, water level, and precipitation data will also be evaluated. Available data will be compiled and further evaluated in the *Existing-Data Evaluation Report*, and the *Data Gap Summary Report* will identify additional data needs.

The proposed plan for evaluating the presence and migration of LNAPL will be included in a derivative deliverable, such as the *CSM Development and Update Plan*. In addition, field observations for evaluating the presence of LNAPL will be made during drilling activities for installation of new monitoring wells as described in the Monitoring Well Installation Work Plan (MWIWP) (DON 2016).

6.14 Identify Data Gaps

Through consultation with the DOH and EPA, the Navy is undertaking this Site Investigation to resolve initial uncertainties, including but not limited to:

- Nature and extent of the fuel-affected groundwater at the RHBFSF area, including potential LNAPL on the water table and dissolved-phase constituents within the water table aquifer
- Flow directions, rates, and migration of groundwater impacted by COPCs from the RHBFSF
- Potential water quality impacts to the groundwater resources

Additional uncertainties may be identified as existing data are further evaluated and new data are collected. Details regarding data gaps will be presented in the *Data Gap Analysis Report*.

Briefly summarized, the work to be conducted during this Site Investigation includes geologic mapping, conducting borehole geologic logging, measuring water levels, analyzing water samples, and identifying locations for additional monitoring/sentinel wells. Data from the monitoring well grid will be used together with hydrogeologic information available from other sources to develop an updated CSM and numerical groundwater models to evaluate groundwater flow and contaminant migration.

Some of the identified uncertainties, tasks or information needs, and more specific data needs includes location of abandoned fuel lines, integrity of fuel tanks, location of LNAPL source areas within the RHBFSF, and boundary of LNAPL plume.

6.14.1 Process to Identify Future Data Gaps

During data collection, the Navy intends to facilitate an iterative and collaborative process to obtain DOH, EPA, and SME input. This will include submitting derivative reports for DOH and EPA review and resolution of comments. Soon after this investigation begins, an *Existing-Data Evaluation Report* will be prepared that describes the currently available hydrogeologic data to be used in the modeling effort and assesses the adequacy of the data for the planned groundwater modeling. This interim report will be submitted for DOH and EPA review after the existing data are compiled. In addition, a *CSM Development and Update Plan* will be prepared to describe the detailed geologic CSM for RHBFSF. Initially this CSM will be based on the existing CSM. The CSM will include a thorough evaluation of the vadose zone and mechanisms and processes that affect a release as it moves from its source through the vadose zone to potential receptors. The CSM will be updated with existing geologic logs. As new data (e.g., geologic, water level elevations, chemical) are obtained, the CSM will be updated for discussion with the DOH, EPA, and SMEs.

Where data gaps are identified based on the interim report findings, recommendations to resolve them will be provided and discussed with the DOH, EPA, and SMEs during future meetings. The nature and extent of groundwater contamination will be further evaluated using groundwater level measurements, groundwater level contour maps, and water quality analyses from the new and existing monitoring wells. Data gaps would need to be resolved if the new data indicate situations such as:

- No well is located hydraulically down-gradient from the RHBFSF fuel tanks under current conditions or groundwater model predictions for future pumping scenarios; or

- No well is located hydraulically down-gradient of the groundwater plume in the direction of an existing groundwater supply source or future supply well.

6.15 Evaluation of Risk to Human Health and Environment

Following completion of the investigation and modeling efforts, the Navy will conduct a Risk Vulnerability/Assessment. This risk assessment will capture historical data and data collected during this site investigation to evaluate the uncertainties of the groundwater model and CF&T model to predict COPC impacts to the drinking water aquifer at current and future use conditions. Results will be disseminated within the derivative deliverable *Risk-Based Decision Criteria Development Plan*, which will be used to establish action levels.

6.16 Data Acquisition and Management

To evaluate the risk to drinking water resources from current and potential future releases at the RHBFSF, the Navy intends to collect and analyze sufficient hydrogeologic and groundwater data to characterize the contamination extent and groundwater flow directions beneath and around RHBFSF, and evaluate the impacts of contaminant movement on receptors. During this effort, the new data will be provided and discussed with the DOH and EPA, including SMEs, to evaluate the results as they become available. The Navy intends to collaborate with the DOH and EPA to resolve issues and assess the adequacy of the data to meet project objectives.

During this process, new data gaps may be identified that require additional data collection and analysis. The overall goal of this process is to build consensus with the DOH and EPA and other stakeholders that sufficient information will be obtained to reasonably and defensibly evaluate the past and potential future impacts to drinking water resources, and to make decisions regarding additional actions needed for monitoring, risk management, and remediation.

6.17 Data Generation

The investigational activities will generate new data, including geological mapping, topographic and gyroscopic surveys, monitoring well installation and development, groundwater sampling and analysis, water level monitoring study, groundwater flow and CF&T modeling, and investigation-derived waste (IDW) disposal activities.

Field Data: Types of field data generated will include but are not limited to the following:

- Geologic logs
- Field instrument screening
- Field measurements
- Videos

- Photographs
- Logbooks
- Field QC sampling
- Water quality measurements
- Groundwater level measurements
- *Analytical Data:* Generated analytical data will include the following:
- Analytical results of groundwater samples (chemistry, NAPs, lead scavengers, fuel additives, and major ions and silica)
- Analytical and geotechnical results of unconsolidated material and rock core samples

6.18 Data Management

The subsections below describe the data management process.

6.18.1 Field and Analytical Data

The contractor (to be selected by the Navy) will record field observations and measurements in field notebooks and project-specific field data sheets. Samples will have Hawaiʻi State Plane Zone 3, NAD 83 coordinate locations. Chain-of-custody (COC) forms, air bills, and sample logs will be prepared and retained for each sample. The data will be included in the investigation report. The electronic copies of analytical data, field notes, data sheets, and other data necessary to support the project will be stored on local servers maintained by the contractor and on offsite servers as a measure of redundancy. Both servers will be backed up daily to prevent loss of information.

To assist data tracking and adherence to the sampling and analytical objectives, field or office personnel will track samples using a spreadsheet that typically includes field sample information associated with site location information. Receipt of hard copy data, electronic hard copies (PDF), and an electronic data deliverable (EDD) will be tracked. One copy will be delivered from the laboratory to the project analytical and data validation advisor, the project Contract Task Order (CTO) manager, or both, and to the data validators.

EDDs will be received via e-mail from the contractor in the format specified in the analytical laboratory statement of work. EDDs will be loaded onto a SQL server that is backed up daily and routinely maintained by the contractor database manager. EDDs are reviewed for completeness and errors. Part of this check involves verifying that all requested analyses for each sample were performed and reported. This may be accomplished by comparing the delivered results with those recorded in the COC tracking system. If errors are encountered or data are not complete, the laboratory will be notified, and a revised EDD will be submitted. Once the EDD is in usable form, data will be moved to a read-only location accessible for use by project personnel. Data can then be queried, reduced, and reported.

Early in the project, the electronic data will be checked against the hard copy data for the entire sample delivery group (SDG). Later, if no problems have been encountered, a small portion of data in the EDD for each analytical method will be checked against the hard copy version to ensure that the data types match. Data validators who enter validation qualifiers for each result will be tasked to check hard copy results against the results in the electronic version.

The Navy will preserve the records related to the RHBFSF in accordance with the appropriate Federal records retention schedule. In addition, the Navy will preserve the documents shared with the DOH and EPA relating to the work performed under the Tank Closure Plan, monitoring data, and other raw data generated pursuant to the Tank Closure Plan, for at least 10 years following closure of the RHBFSF. The Navy will make such records available to DOH or EPA at their request.

Substantive documents exchanged between the DOH and EPA relating to the work performed under the Site Investigation and monitoring data related to the RHBFSF will be stored by the Navy in a centralized location onsite at the RHBFSF until it is closed, and then at an alternative location mutually approved by the RHBFSF Coordinators to promote easy access by the DOH, EPA, or their representatives.

6.18.2 Modeling Data

The overall goal for managing the groundwater modeling files for the RHBFSF groundwater modeling effort will be to maintain a complete record of the modeling work from start to finish. This model project archive will be stored in a project sub-directory on existing contractor computer systems. Each project sub-directory will include the published references used to develop the conceptual model and copies of the data used to construct, set up, and calibrate the numerical models. The archive will also include model logs of the initial and final model calibration simulations, the electronic model output files, logs of predictive simulations, with electronic input and output files that provide the results for each modeled scenario. The modeling directory structure and naming conventions for the model files will follow practices used by USGS (2016) where applicable.

The senior technical advisor for the groundwater modeling task will review and consult with the project numerical modeler as requested regarding management of the modeling information and data. The contractor CTO manager will periodically check and verify that the groundwater modeling files are organized and up-to-date.

6.19 Making Decisions Based on Data Quality/Accuracy

Analytical data quality will be quantitatively and qualitatively evaluated by assessing PARCC parameters and comparing collected data against PQOs. Future data needs will be identified and resolved following an iterative collaborative. Whether the data are of adequate quality and accuracy will be judged not only by the Navy but also by the SMEs, based on whether the information can satisfy the specific project objectives and provide a sound technical basis for making the necessary decisions for risk management and remediation.

The overall goal of this data quality review process is to build consensus with the DOH, EPA, and other stakeholders that sufficiently accurate and representative information has been collected to assess the impact of past and potential future fuel releases and make good decisions for risk management and remediation. For instance, the analytical data quality evaluation will need to address the following key questions:

1. Are the laboratory analyses of the monitoring well samples sufficiently accurate to identify the COPCs, establish dissolved COPC concentrations in the source area, and define the extent of the groundwater affected releases from the RHBFSF?
2. Are the water sample analyses (e.g., NAP parameters) sufficiently accurate to estimate degradation rates of COPCs for the CF&T modeling purposes?

The physical data quality evaluation will need to address the following key questions:

1. Are the wellhead elevations and water levels measured with sufficient accuracy to establish the groundwater level elevations needed to prepare potentiometric maps to define hydraulic gradients and flow directions throughout the study area and provide an adequate basis for groundwater model calibration?
2. Are flow measurements taken at the water supply wells accurate enough to represent the pumping rates for each well to allow adequate flow model calibration for simulation of future pumping scenarios?
3. Are the borehole geologic logs and barrel logs from the RHBFSF area of adequate quality to develop the geologic model and provide a reasonable basis for estimating the direction and extent of LNAPL movement?
4. Are well logs of sufficient quality available to define the thickness of valley fill and saprolite in areas to the north of the RHBFSF?
5. Are the available data for effective porosity and dispersivity of the basalt aquifer of sufficient quality and representative of site conditions for the planned CF&T modeling?

During this data quality evaluation process, if data are found to not be sufficiently accurate or representative for these purposes, then additional data collection may be needed. Alternatively, involved Parties may decide to apply conservative assumptions in lieu of collecting additional data in some instances.

6.20 Communication between Parties

The Navy will maintain effective and timely communications with the DOH and EPA to facilitate implementation of the Site Investigation Plan and promote collaboration.

In-person, teleconference, and online meetings between Navy, DOH, and EPA will be held as provided for in the Site Investigation Plan and additionally on an as-needed basis. At least one discussion meeting will be held with the closure team prior to initial submittal of each derivative deliverable, and at least one meeting will be held with after DOH and EPA review of each initial submittal. During each meeting, the team will identify applicable guidance, policies, and procedures for the future work to be performed that follows from such meeting. Within 10 business days of a meeting, the Navy will provide a summary of the meeting to the DOH and EPA for concurrence.

6.21 Deliverables

The Navy will present conclusions and recommendations in the Site Investigation Report, which will compile the findings from all the subsequent derivative reports.

Throughout the Site Investigation process, the Navy will conduct an iterative and collaborative approach with DOH and EPA in order to exchange information and data used in the development of each report. Meetings will occur regularly and as needed to ensure that the objectives of the Site Investigation are met.

The Navy will prepare each derivative deliverable to compile and evaluate available data that can be used to develop other derivative deliverables and reports in the site assessment effort. For example, the Existing Data Evaluation Report will provide information that will help in drafting the Data Gap Analysis Report that will then lend to the development of the Sampling and Analysis Plan. The derivative deliverable schedule is shown in Table 6-4. After comments have been addressed and concurrence on the derivative deliverable has been received, the document will be used to gather and provide data, as appropriate and applicable. Deliverables will include at least one discussion meeting with the closure team prior to initial submittal.

6.22 Corrective Action Plan

Completion of the Site Investigation effort (HAR § 11-280.1-65) will enable progression to the next phase of tank closure under HAR § 11-280.1 Subchapter 6, which entails identifying Site Cleanup Criteria (HAR § 11-280.1-65.3) for COPCs and developing a Corrective Action Plan (HAR § 11-280.1-66) to achieve tank closure. The development of the UST Corrective Action Plan will abide by the requirements of the HAR §11-280.1-66 and HAR §11-280.1-67 for public participation. As noted above, many corrective actions are already ongoing, but the full Corrective Action Plan cannot be developed until the site assessment and investigations are complete.

6.23 Schedule

TABLE 6-4 DERIVATIVE DELIVERABLE SCHEDULE

Derivative Deliverable	Purpose	Proposed Initial Submittal Schedule
Existing-Data Evaluation Report	Compile existing data in an organized fashion to facilitate regulatory review, describe the existing data available, and assess data's quality to achieve the objectives of the site investigation.	Aug-23
Data Gap Analysis Report	Evaluate existing data to identify data gaps and how to fill those data gaps.	Sep-23
Sampling and Analytical Program	Specify detailed field investigation and sampling and analytical program procedures.	Nov-23
CSM Development and Update Plan	Describe the process and approach that will be used to create a defensible initial CSM, and subsequent updates; describe an approach for evaluating the potential migration rates and directions for NAPL and dissolved-phase contaminant movement from all areas of the RHBFSF; prepare a currently updated CSM	Apr-24
Groundwater Model Update Report	Describe the process for reviewing the existing groundwater flow and CF&T model in a manner that identifies uncertainties and describes options for reducing uncertainty	Sept-24
Site Investigation Report	Summary of findings from the Site Investigation inclusive of historical review, LNAPL investigation, and subsurface investigations.	Jan-25
Sentinel Well Update Plan	Describe the approach for evaluating and establishing a sentinel network for the existing drinking water production points, to enable early detection of contaminants approaching these production points	Feb-25

6.24 References

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7. Coordination and Outreach

Prior to, throughout the execution of, and beyond the completion of this Tank Closure Plan, the Department of the Navy (DON) intends to actively engage with and inform all Federal, State, and local stakeholders, including regulatory agencies, along with the impacted community members. The following section details the DON's planned coordination and engagements with regards to closure status updates, required deliverables, potential incidents, and major milestones.

7.1 Timeline of Major Milestones and Deliverables

See Appendix A

7.2 Closure Progress Stakeholder Meetings

The DON will lead regular meetings, approximately twice a month, with the Department of Defense (DoD), the Hawaii Department of Health (DOH), the Environmental Protection agency (EPA), and any other relevant Hawaii stakeholder agencies and officials to provide updates on closure-related activities as they arise. These meetings are intended to maintain the regular communication and transparency established by the Red Hill JTF stakeholder meetings that have been established throughout the defueling process.

Details regarding closure status updates and any expected deliverables will be briefed and provided during these progress meetings, along with any potential changes to the closure timeline and procedure.

7.3 Inspections and Red Hill Site Visits

The Navy will accommodate any Red Hill inspection and site visit requests by regulators and stakeholders as needed.

7.4 Public Outreach

The Navy will provide regular public updates on closure status at all closure milestones. The updates will be provided via a combination of website updates, social media, press releases, and public meetings depending on the update content.

HAR §11-280.1-67 will guide the initiation of public participation throughout the closure process. Technical advice and input from subject matter experts and other Federal and State agency stakeholders, such as the United States Geological Survey, the Honolulu Board of Water Supply, and Hawaii Department of Land and Natural Resources, will support scoping and review of deliverables.

In the interest of transparency, information sharing will be facilitated with the public with consideration and exception of any materials protected from public disclosure. Identification of data gaps and any decisions recommending additional monitoring well installation including their locations will be made in collaboration with relevant Federal and State agencies.

7.4.1 Red Hill Website Updates

Regular status updates on the progress of Red Hill closure activities will be published to the Navy's public-facing website at https://cnrh.cnic.navy.mil/Operations-and-Management/Red-Hill/.

Redacted versions of all deliverables, and redacted versions of any reports, shall be made available on the Red Hill website within ten business days of submittal to the DOH and EPA. Deliverables uploaded to the website shall be accompanied by a brief description of the content of the document.

The Navy will also make environmental data generated during closure directly to the public on the Navy Red Hill website, ensuring it is presented in an electronic form approved by EPA.

The website shall include contact information for Navy representatives who can respond to public inquiries related to closure execution activities.

7.4.2 Red Hill Public Meetings

The DON, with support from DoD, will host a public meeting with opportunities for comments and questions prior to the beginning of closure activities and upon completion. Other public meetings may be identified as closure activities commence. The Hawaii DOH and EPA will be invited to participate in all public updates.

8. Conclusion

The Navy, in collaboration with Federal, State, and community stakeholders, is committed to the successful permanent closure of the Red Hill underground storage tanks (USTs) and associated pipelines. After analyzing the alternatives for permanent closure (remove, fill, or close in place), the Navy intends to seek Hawaii Department of Health (DOH) approval for Closure in Place as the permanent tank closure method. Unlike the fill alternative or the removal alternative, permanent Closure in Place allows the option for beneficial non-fuel reuse of the tanks. In addition, it minimizes safety concerns, schedule, and impacts to the environment and the local community. The Navy will continue to work with DOH and the U.S. Environmental Protection Agency to implement the permanent closure of the RHBFSF in a manner that complies with applicable laws and regulations. Concurrent with the tank closure efforts, the Navy will continue to implement long-term monitoring and release response actions, which are already ongoing, to address risk to public health and the environment.

Appendix A - Plan of Action and Milestones

Target Date	AO	Milestone or Deliverable
1 NOV 2022	SECDEF	Tank Closure Plan Submittal
1 NOV 2022	CNRH	Press Release
NOV 2022	CNRH	Public Stakeholder Engagement
DEC 2022	CNRH	Notice of Intent to Close Underground Storage Tanks (at least 30 days before closure commences)
DEC 2022	NAVFAC PAC	Provide detailed evaluation of closure alternatives to DOH
JAN 2023	CNRH	Beneficial Non-Fuel Reuse Engagement
JAN 2023	NAVFAC HI	Acquisition Strategy Planning Begins
FEB 2023	CNRH	Tank Closure Plan Supplemental 1 with Updated CPM
MAR 2023	CNRH	Public Stakeholder Engagement
MAR 2023	NAVFAC HI	Structural Analysis Completed
APR 2023	CNRH	Tank Closure Plan Supplemental 2 (If required)
JUN 2023	DOH	Tank Closure Plan Concurrence
JUN 2023	CNRH	Press Release
JUN 2023	CNRH	Public Stakeholder Engagement
JUL 2023	NAVFAC HI	Acquisition Pre-Award Phase
NOV 2023	CNRH	Public Stakeholder Engagement
NOV 2023	NAVFAC HI	Draft Sampling & Analysis Plan for tank Site Assessment
SEP 2023	NAVFAC HI	Contract Award - Closure
DEC 2023	CNRH	Press Release
JUN 2024	JTF	Notice of official transfer of command from JTF (for defueling) to Navy (for closure)
JUN 2024	CNRH	Press Release (Semi-annually as needed during closure)
JUN 2024	NAVFAC HI	Tank Closure Operations Begin
AUG 2027	NAVFAC HI	Tank Closure Operations End
AUG 2027	CNRH	Press Release
TBD	CNRH	UST Closure Assessment Report (within 30 days after UST permanently closed)

Appendix B Forms

Form 1 Waste Management Plan

<table>
<tr><td>1. Name</td><td>2. Operational Period (Date/Time)
From: To:</td><td colspan="2">WASTE MANAGEMENT AND DISPOSAL PLAN</td></tr>
<tr><td colspan="4">SOLID WASTES Covered by Plan</td></tr>
<tr><td colspan="4">Type Description Est. Volume(s)</td></tr>
<tr><td colspan="4">☐ Oiled Natural Inorganic (Dirt, Gravel, Etc.)</td></tr>
<tr><td colspan="4">☐ Oiled Natural Organic (Grass, Branches, Etc.)</td></tr>
<tr><td colspan="4">☐ Oiled Man-made Materials (PPE, Sorbents, Etc.)</td></tr>
<tr><td colspan="4">☐ Oil-contaminated Wildlife Carcasses</td></tr>
<tr><td colspan="4">☐ Other</td></tr>
<tr><td>Waste Stream</td><td>Suspected HW?</td><td>HW Code(s)</td><td>Determined by:</td></tr>
<tr><td></td><td>☐ Yes
☐ No</td><td></td><td>☐ User Knowledge?
☐ Laboratory Analysis?</td></tr>
<tr><td></td><td>☐ Yes
☐ No</td><td></td><td>☐ User Knowledge?
☐ Laboratory Analysis?</td></tr>
<tr><td></td><td>☐ Yes
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<tr><td colspan="4">Comments:</td></tr>
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<tr><td colspan="4">WASTE MANAGEMENT AND DISPOSAL PLAN Page 1 of _____</td></tr>
</table>

LIQUID WASTES Covered by Plan			
Type	Description		Est Volume(s).
☐ Oil / Water Mixtures			
☐ Reclaimable Petroleum Products: ☐ JP-5, ☐ F-24, ☐ F-76, ☐ __			
☐ Waste Water			
☐ Decontamination Liquids			
☐ Other			

Waste Stream	Suspected HW?	HW Code(s)	Determined by:
	☐ Yes ☐ No		☐ User Knowledge? ☐ Laboratory Analysis?
	☐ Yes ☐ No		☐ User Knowledge? ☐ Laboratory Analysis?
	☐ Yes ☐ No		☐ User Knowledge? ☐ Laboratory Analysis?
	☐ Yes ☐ No		☐ User Knowledge? ☐ Laboratory Analysis?
	☐ Yes ☐ No		☐ User Knowledge? ☐ Laboratory Analysis?
	☐ Yes ☐ No		☐ User Knowledge? ☐ Laboratory Analysis?
Comments:			

WASTE MANAGEMENT AND DISPOSAL PLAN	Page___of _____

Samples (If no samples to be taken, check box: ☐ and explain in comments below)			
Media to be sample:			
Laboratory Name(s):			
Sampling / Analysis Plan Attached? ☐ Yes ☐ No			
Comments:			
Temporary Waste Storage			
Waste Stream	Storage Container Type	Estimated Capacity / Number Required	
Storage Locations			
Preferred Location, Site Manager		Ground/Runoff Protection Required for Storage Area?	Liners/Cover Protection Required for Storage?
		☐ Yes ☐ No	☐ Yes ☐ No
		☐ Yes ☐ No	☐ Yes ☐ No
		☐ Yes ☐ No	☐ Yes ☐ No
		☐ Yes ☐ No	☐ Yes ☐ No
		☐ Yes ☐ No	☐ Yes ☐ No
Comments:			
WASTE MANAGEMENT AND DISPOSAL PLAN Page___of _____			

Disposal Methods		
Disposal Method	Waste Stream	Disposal Resource (Provide EPA ID No. for TSDF)
Permitted Landfill on Oahu		
Land farm / Soil Bioremediation		
Wastewater Treatment Plant		
Industrial Wastewater Treatment		
Permitted HW TSDF		
Permitted Mainland Landfill		
Reclaiming		
Recycling		
Other:		
Permits Required for Disposal:		
Comments:		
WASTE MANAGEMENT AND DISPOSAL PLAN Page___of _____		

Waste Transportation			
Waste Stream	Is Waste a DOT HM?	Waste Transportation Method	Transportation Resource
	☐ Yes ☐ No		
	☐ Yes ☐ No		
	☐ Yes ☐ No		
	☐ Yes ☐ No		
	☐ Yes ☐ No		
	☐ Yes ☐ No		
	☐ Yes ☐ No		
	☐ Yes ☐ No		
	☐ Yes ☐ No		
	☐ Yes ☐ No		
Permits Required for Disposal:			
Comments:			
WASTE MANAGEMENT AND DISPOSAL PLAN Page___of _____			

Form 2 Container Log

CONTAINER LOG													
Container ID	Description, Volume	Contents	Location	Date Tested	Sample ID	Waste Type	Date Waste Transported	Manifest No.	Destination Facility	TSDF EPA ID	First Transporter	Transporter EPA ID	Date TSDF Rec'd
EXAMPLE DM-20090304-1	1A1 55 gal steel	PPE	Staging Area 1	3/29/15	xxxx	Non-HW	4/16/09		*** Landfill		A Transporter	Hixxxxx	
EXAMPLE DM-20090304-2	1H2 55 gal, poly	Decon rinse water	Adit 3 Decon station	3/25/15	xxxx	Non-HW	5/1/09		***Disposal Co.		B Transporter	Hixxxxx	