DRAFT Sampling and Analysis Plan

Pu'uloa Range Training Facility Shoreline

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ATTACHMENTS

List of Acronyms and Abbreviations

%D	percent difference
%R	percent recovery
°C	degrees Celsius
bgs	below ground surface
BS	blank spike
C/I	commercial/industrial
COPC	contaminant of potential concern
DQO	data quality objective
DU	decision unit
EAL	Environmental Action Level
ECPD	Environmental Protection and Compliance Division
EPA	United States Environmental Protection Agency
HAZWOPER	Hazardous Waste Operations and Emergency Response
HDOH	State of Hawaii Department of Health
HEER	Hazard Evaluation and Emergency Response
IDW	investigation-derived waste
kg	kilogram
LCS	laboratory control sample
LD	laboratory duplicate
MCBH	Marine Corps Base Hawaii
mg/kg	milligrams per kilogram
mm	millimeter
MS	matrix spike
MSD	matrix spike duplicate
PPE	personal protective equipment
PRTF	Pu'uloa Range Training Facility
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RPD	relative percent difference
RSD	relative standard deviation
SAP	Sampling and Analysis Plan
SHWB	Solid and Hazardous Waste Branch
TAL	Total Analyte List
UIC	Underground Injection Control
USMC	United States Marine Corps

Section 1. Introduction and Purpose

1.1 Project Identification

Project Name and Location	Pu'uloa Range Training Facility (PRTF) Shoreline Sampling Ewa Beach, Oahu, Hawaii
Project Owner:	United States Marine Corps Base Hawaii
Date of Issue:	Oct 7, 2023

1.2 Introduction and Purpose

The United States Marine Corps (USMC), Marine Corps Base Hawaii (MCBH), Environmental Compliance & Protection Division (ECPD) has prepared this Sampling and Analysis Plan (SAP) to evaluate the Pu'uloa Range Training Facility (PRTF) shore for the presence of metals. Specifically, MCBH ECPD will collect soil samples from the ocean side (i.e., southern side) of the firing range berms and shore and analyze them for lead, copper, and antimony. The results of this study will be used in conjunction with previous Department of Defense (DoD) environmental studies to characterize the potential for metals in soils to migrate off-site (i.e., erosional deposition) and may be used to evaluate potential mitigation measures in the future, if warranted. Based on the historic and current operation of PRTF and prior sampling events, MCBH ECPD anticipates samples to confirm the presence of metals in soils. The primary goal of this sampling event is to delineate metals concentrations throughout the approximate 3,000-foot-long shoreline and identify areas (i.e., decision units) that pose the greatest potential for off-site contaminant migration. The work will be conducted in general accordance with the following State of Hawaii Department of Health (HDOH) Hazard Evaluation and Emergency Response (HEER) Office guidance:

- *HDOH 2008 Technical Guidance Manual for the Implementation of the Hawai'i State Contingency Plan, Interim Final*.
- *HDOH 2017 Guidance for Soil Stockpile Characterization and Evaluation of Imported and Exported Fill Material*.

1.3 Soil Characterization Tasks

Representative soil or sand samples will be collected from designated decision units (DUs) using MULTI INCREMENT®[1] sampling methodology to test the soil or sand for lead, antimony, and copper levels. Analytical results will be compared to the HDOH Environmental Action Levels (EALs) for unrestricted land use (herein referred to as Tier 1 EALs) for sites where groundwater is a current or potential drinking water source and surface water is located less than 150 meters from the site and Site-Specific HDOH EALs for commercial/industrial (C/I) land use (herein referred to as C/I EALs) for sites where groundwater is NOT a current or potential drinking water source and surface water is located less than 150 meters from the site.

The Sampling and Analysis Plan consists of the following primary tasks:

- Project planning and coordination: Includes preparation of this SAP, attending meetings with HDOH personnel from HEER Office, and coordination with range control officers of the USMC.

[1] MULTI INCREMENT® *is a registered trademark of EnviroStat, Inc.*

- Field work: Includes site preparation and DU soil/sand sampling.
- Management of investigation-derived waste (IDW): Includes managing waste generated during the investigation (e.g., disposable sampling equipment and personal protective equipment [PPE]).
- Laboratory analysis: Data from off-site analytical laboratories for collected samples.
- Data management: Data from field investigation activities and laboratory analyses will be managed, as appropriate.
- Report preparation: A report will be prepared that briefly discusses the sampling rationale, methodology, and sample locations and results; summarizes the findings; and presents conclusions and recommendations. A DRAFT of the report will be provided to participating HEER Office personnel and subject matter experts from USMC for review & comment. Following the address of comments, a FINAL report will be generated.
- Report Distribution: A FINAL report will be provided to participating HEER Office personnel. Recommendations will be presented directly to MCBH leadership for consideration/action.

Section 2. Background

2.1 Project Site Location and Description

PRTF is located on the south-central shore of Oahu, west of the Pearl Harbor entrance channel, between the Kapilina residential area (formerly Iroquois Point Family Housing) to the Range's east, and the off-base residential community of Ewa Beach to the west of the Range (Figure 1). The ocean area directly adjacent to the PRTF shoreline is located within the Pearl Harbor Naval Defensive Sea Area (PHNDSA). The 165-acre range extends along about 3,000 feet of sandy shoreline, and consists of six small-arms ranges (pistols, rifles up to 7.62mm, and shotguns) of different distances. (Figure 3).

2.2 Site Conditions

2.2.1 Climate

The climate of Pu'uloa can be characterized as hot and dry. Annual rainfall averages only 17 inches. Daily temperature range between 62- and 86-degrees Fahrenheit. Prevailing winds vary between predominant northeast trades and upslope winds generated by heating of the land surface. Light and variable "Kona" winds occasionally replace this pattern, most often in winter.

2.2.2 Surface Water

The project area is located within the Pearl Harbor watershed, a 110-square mile watershed subdivided into nine sub-watersheds. These sub-watersheds contain the headwaters of nine streams that drain into Pearl Harbor. The project area is located within the Honouliuli sub-watershed of the Pearl Harbor watershed. Honouliuli is the westernmost sub-watershed within the Pearl Harbor Watershed. Annual rainfall ranges from an average of 47 inches at the Waianae Mountain peaks to 24 inches near the H-1 Freeway. PRTF is located in the coastal plain approximately 3.7 miles to the southwest of the Honouliuli Stream. There are no surface waters or wetlands at PRTF.

2.2.3 Groundwater

On Oahu, groundwater occurs principally as either basal water (a lens of fresh to brackish water that floats on seawater) or high-level water (freshwater that does not rest on seawater). Basal water is the most abundant form of groundwater on Oahu. The site is located below the HDOH defined Underground Injection Control (UIC) line. Areas above the UIC line denote potential underground drinking water sources. Areas below the UIC line generally denote groundwater that is unsuitable for drinking water purposes. Consequently, the underlying groundwater would not be considered a potential drinking water source due to the location below the UIC and general proximity to the ocean. The depth to groundwater is anticipated at approximately seven feet below ground surface (bgs). An Oahu groundwater map is depicted in Figure 5.

2.2.4 Historical Site Use & Conditions

PRTF has been in operation since 1915.PRTF is required for maintenance of small-arms proficiency by all U.S. Armed Forces personnel, as well as for law-enforcement personnel from many other agencies. It is the only range of its kind on Oahu (USMC, 2019)

Ranges A and B on the west are long-distance ranges (up to 1,000 yards) and their ocean end consists of large earthen berms with concrete barrier walls on top. Ranges C, D, E and F are shorter rifle, pistol, and shotgun ranges from 150 to 250 feet long with earthen berms along the beach. The Range extends along about 3,000 feet of sandy shoreline.

This coastline is directly exposed to southern swell, refracted trade wind waves, Kona storm waves, and the infrequent hurricane. The morphology, orientation, and exposure of the beach fronting the firing range is similar to, and connected with, the beach system fronting the Ewa Beach residential neighborhood. The beach has a relatively steep slope for a south facing Hawaiian shoreline and has a narrow, overwash berm that is intermittent along the coastline. Generally, where the berm is present it is lightly vegetated with low-lying, salt tolerant, ground cover such as the non-native Pickleweed (Batis maritima), Akiaki grass (Sporobolus virginicus), Naupaka Kahakai (Scaevola taccada), or Pohuehue/Morning Glory (Ipomoea pes-caprae subsp. Brasiliensis). Kiawe (Prosopis pallid) shrubs are present along sections of the overwash berm. Inland of the overwash berm is the Ewa Plain, which is relatively flat and dominated by carbonate sediments, with the exception of improved areas such as the firing range facilities, including earthen support features (NAVFAC HI, 2015).

The construction of the Iroquois Point beach nourishment and stabilization project was completed in 2013 It consists of nine rock rubble-mound T-head groins along 4,200 feet of shoreline, with beach fill in the cells between the groins. The western-most groin, located about 500 feet east of the Range boundary, now acts as a terminal groin for the vicinity of the east end of the rifle range, trapping the prevailing west to east longshore transport of sand and preventing its loss from the Range shoreline. Shoreline profiles surveyed one-year post-construction indicate accretion and a seaward movement of the shoreline east of the Range. (NAVFAC HI, 2015).

In February of 2023, a project was conducted under the Operational Range Management program, moving the Foxtrot berm back from the barrier dune and ocean. The soils of the berm were processed, and 19 tons of lead and copper were removed and recycled. The soil has been moved 100 feet back from its original position; and will be re-used to build new firing-line berms. The current plan calls for the new line of berms to be established approximately 40 yards back from their current position.

USMC ranges, including PRTF, are governed by DOD Instruction 4715.14 (Operational Range Assessments) which prescribes procedures to assess the potential human health and environmental impacts to off-range receptors from the use of military munitions on operational ranges in the United States in accordance with the authority in DoD Directives (DoDDs) 5134.01, 4715.1E, and 6055.09E, and the July 13, 2018, Deputy Secretary of Defense Memorandum.

USMC ranges are also maintained under the Operational Range Clearance (ORC) Program. ORC is designed to clear munitions and target debris from the surface of ranges. ORC scheduling is dependent on range use frequency. Typical ORC execution at PRTF includes processing soil from the berm faces through mechanized screens to remove bullets and debris. Dust control activities are utilized for this process. Sifted soil is then used to reestablish berm faces with a compacted and stable 1:1. Berms are covered with jute matting and hydroseeded to promote regrowth of vegetation and stabilize the berm slopes. Debris that is mined from the berms are put in drums and subcontracted for recycling (NAVFAC HI, 2020).

2.3 Previous Environmental Studies

In November 2020, the MCBH Range Environmental Vulnerability Assessment (REVA) periodic review was completed by AECOM Technical Services, Inc. The REVA Periodic Review was conducted to ensure continued sustainability and usability of USMC training ranges. Under the REVA program, per Department of Defense (DoD) Instruction 4715.14, the USMC evaluates whether there is a release or substantial threat of a release of munitions constituents (MC) from an operational range to off range areas. The REVA Program focuses on comparison of MC concentration data to state-specific regulatory values. If a release is identified, the evaluation determines if it creates an unacceptable risk to human health or the environment. The 2020 REVA indicated that there is no known off-range MC migration that presents a potential unacceptable risk to human health or the environment (AECOM, 2020).

In August 2019, an Environmental Assessment for Shoreline Stabilization at Pu'uloa Range Training Facility, Oahu, Hawaii was completed by Naval Facilities Engineering Command, Pacific, on behalf of the Marine Corps. The Proposed Action was to initiate measures to mitigate coastal erosion from wave action associated with sea-level rise and potential seismic-wave events at PRTF. The Environmental Assessment evaluated potential environmental impacts associated with the Proposed Action and Alternatives relative to environmental components including water resources, geological resources, biological resources, recreational resources, land-use, and public health and safety. The preferred alternative of the Environmental Assessment included retreating ranges C – F, installing protective sheet pile along the fast land boundary of ranges A – B, and revegetation (USMC, 2019).

In April 2015, the Pu'uloa Shoreline Erosion Study was completed. The study was done by SSFM International, Inc., Sea Engineering, Inc., & Brownlie & Lee. The purpose of this study was to investigate coastal processes in the project area and the condition and characteristics of the shoreline, determine historical shoreline changes, analyze wave induced sand transport mechanisms, and develop possible erosion control alternatives. The profile measurements showed small shoreline/beach changes that would be expected for this area, and no significant long-term change in the shoreline position fronting the Range over the 10-year period from 2003 to 2014. (NAVFAC HI, 2015).

2.4 Contaminants of Potential Concern

Contaminants of Potential Concern (COPCs) identified for the earthen berm soil are the metals lead, antimony, and copper.

Section 3. Project and Data Quality Objectives

The data quality objective (DQO) for this project is to collect soil samples from the ocean side (i.e., southern side) of the firing range berms and shore and analyze them for lead, copper, and antimony. Guidance used in the development of the project specific DQO is included in the EPA 2006 *Guidance for the Data Quality Objectives Process* and 2000 *Guidance for Data Quality Assessment*.

3.1 Problem Definition

Based on the objective of this project, the following problem statement is applied:

The earthen berm soils and shore on the ocean side of Pu'uloa Range Training Facility will be sampled and characterized in accordance with HDOH MULTI INCREMENT soil sampling guidance to identify any areas of concern for lead, antimony, and copper release outside the range boundary.

3.2 The Decision

The primary objective of this project is to answer the following questions:

1. Is lead present in the ocean side earthen berm soil and shoreline at concentrations exceeding screening criteria?
2. Is antimony present in the ocean side earthen berm soil and shoreline at concentrations exceeding screening criteria?
3. Is copper present in the ocean side earthen berm soil and shoreline at concentrations exceeding screening criteria?

3.3 Decision Inputs

3.3.1 Analysis of *MULTI INCREMENT* Soil Samples

MULTI INCREMENT soil samples from the shore soil and sand DUs will be analyzed by FQ Labs in Honolulu, Hawaii for total lead, antimony, and copper using EPA SW-846 method 6020B.

3.3.2 Soil Screening Criteria

The results of the sample analysis are compared to HDOH Tier 1 EALs for commercial/industrial land use, for sites where groundwater is not a current or potential drinking water source and surface water is located less than 150 meters from the site.

Sample results will determine COPC concentrations in specific areas of the shoreline to characterize the potential for metals in soils to migrate off-site (i.e., erosional deposition) and to evaluate potential mitigation measures in the future, if warranted.

3.4 Characterize Soil

3.4.1 Decision Units

The shoreline of PRTF is approximately 3,000 feet in length. DU size has been set at 150 feet long and 50 feet wide. In most DUs, the width of the soil sloping towards the ocean is narrower than 50 feet. For these narrower DUs, the 100 collected increments will come from the part of the DU where soil is present. The depth of all Decision Unit *MULTI INCREMENT* Sample (DU-MIS) will be the top 4 to 6 inches of soil bgs. Figure 4 depicts the typical beach profile schematic for PRTF.

3.5 Decision Statements

The following decision rules will apply following completion of characterization sampling:

- If any of the COPCs exceed the HDOH Tier 1 EALs:
    - MCBH stakeholders will meet with HDOH to discuss the soil sample results and available options for reuse/disposal.

3.6 Limiting Decision Error

Errors are possible in any sampling event due to a variety of variables, including but not limited to site conditions, unknown subsurface conditions, influence from adjacent sites, and sample locations. To limit errors, this project will be conducted using strict sampling protocol and scrutiny of data generated using industry standard quality assurance (QA)/quality control (QC) protocol.

3.7 Project Boundaries

The field effort is anticipated to begin in 2023, and will be completed within approximately one week, based on access to the site, availability of field teams, and conditions at the time of the field effort. Physical boundaries are shown on Figure 2.

3.8 Optimizing the Design for Obtaining Data

This SAP has been designed to collect data in an efficient manner while generally meeting the requirements of the HDOH 2017 HEER guidance and recommendations.

Section 4. Sampling and Analysis Plan

This section describes soil sample collection and analysis activities to be completed during this project.

4.1 Proposed Soil Samples

Representative samples will be collected using DU-MIS methodology to analyze the soil or sand for lead, antimony, and copper. The soil and sand on the ocean-side berm and shore will be characterized by establishing 24 DUs. 20 of the DUs will be from the ocean-side earthen berm soil. 4 of the DUs will be established in the ocean-side sand (2 on the east edge, 2 on the west edge). Each DU-MIS sample will be comprised of 100 individual increments taken throughout the DU.

4.1.1 Mobilization and Decision Unit Layout

MCBH will mobilize to the site to mark the DU boundaries. Representative samples will be collected from 100 random locations within each DU. Proposed DUs are depicted in Figure 6.

4.1.2 Soil Sample Collection

MULTI INCREMENT samples will be collected following HDOH HEER Office guidance. Samples will not be collected for volatile analysis. Samples for non-volatile analysis will be collected using a disposable scoop that will collect an approximate mass of 30-grams from the entire length of the soil core. Each soil sample will consist of 100 increments, for a total sample mass of approximately 3.0 kilograms (kg).

To ensure that sufficient sample material is available for analysis, the sampled material will be sieved in the field to remove larger debris. Sieve screens No. 4 (4.72 mm) or No. 10 (2.0 mm) would be sufficient for removing larger debris in the field. Any bullet fragments that are sieved from the sample increments will be logged and reported. After sieving, sample increments will be placed directly into a resealable freezer bag, stored in the field.

Soil samples will be analyzed by FQ Labs for total lead, antimony, and copper using EPA SW-846 method 6020B.

Laboratory processing and subsampling will be completed in accordance with HDOH guidance. Laboratory subsampling will be completed using a sectorial splitter to minimize the "nugget" effect of the lead.

4.1.2.1 Field Replicate Sample Collection and Preparation

Two Replicate "triplicate" samples will be collected from a minimum of 10% of the DUs to provide a measure of contaminant heterogeneity for a single DU. Specifically, triplicates will be collected from DUs 1, 20, 21, and 24 as these are areas with greatest potential for exposure due to proximity to public land. Triplicates will also be collected in a minimum of two areas from DUs 2-19. These will be selected from areas with the greatest potential for contamination or exposure as determined in the field. Replicate samples will be collected from increments off-set from the primary increments at a distance to be determined in the field and processed in accordance with standard soil sample collection efforts.

4.1.3 Sample Identification, Sample Logs, and Chain-of-Custody

The Field Manager will maintain field notebooks to provide daily records of significant events, observations, and measurements during field investigations.

MCBH will log the soil condition encountered in each DU and annotate the areas where obviously contaminated soil was encountered.

Each sample container sent to the laboratory shall have its own sample identification label. The following information may be included on the sample label and/or the chain-of-custody:

- Site name;
- Sample identification number;
- Date and time of sample collection;
- Type of sample matrix;
- Initials of the sampling personnel;
- Sample preservative used; and
- Types of analyses to be performed.

4.2 General Activities

4.2.1 Field Procedures

A copy of this SAP will be maintained in the field by the MCBH personnel during sample collection activities.

If required, project personnel will establish a safe perimeter around each work area. Prior to starting work, a safety and health meeting will be conducted by the MCBH personnel. The Field Manager will ensure coordination is completed with PRTF personnel and deconflict firing and sampling events.

Project personnel will be responsible for collecting samples and decontaminating the sampling equipment. To avoid cross-contamination of the samples and to protect worker safety and health, the person performing the sample collection will don a disposable nitrile or latex gloves and change gloves between DUs.

Field notes will be maintained by MCBH personnel recording the location, sample media, number, date, and time for each sample collected as well as any appropriate observations. Digital color photographs will be taken to document the field investigation, with select photographs to be included in the report.

4.2.2 Decontamination

Decontamination of sampling equipment may be necessary for this project if disposable sampling tools are not used to collect the samples. If decontamination is necessary, the process will consist of the following steps:

1. Potable water with phosphate-free detergent scrub;
2. Potable water double rinse; and
3. Air dry.

4.2.3 Sample Handling, Packing, and Shipment

Upon collection, samples will be labeled and bagged in individual resealable plastic bags, following industry standards. Samples will be transported to the analytical laboratory for analysis.

Chain-of-custody forms will be placed inside sealable plastic storage bags and placed inside the sample container for shipment, while project copies will be maintained on-site. Containers will then be closed, and the lid sealed with two custody seals to enable detection of tampering.

4.2.4 Laboratory Processing and Testing

The laboratory will process the soil samples in accordance with HDOH guidance, including air drying, sieving to less than two mm, with a minimum of 30 subsamples of at least 10 grams each. Upon completion of processing, sub-samples will be analyzed using the standard EPA methods.

4.2.5 Investigation-Derived Waste

MCBH will be responsible for the proper disposal of all IDW generated during field work. Potential IDW for this project includes excess soil from the soil samples and decontamination water, both of which will be returned to the DU from which it was collected/derived. Disposable sampling tools, gloves, and other materials will be placed in the trash for disposal as solid waste at a municipal waste landfill.

4.2.6 Soil Characterization Report

Upon receipt of analytical data from the laboratory, MCBH will complete a report that will document the sample collection activities and laboratory analyses. The report will include a description of field activities completed (including sample locations), select field photographs and a summary of the analytical results for the soil samples collected.

Section 5. Quality Assurance Project Plan

5.1 Introduction

This section presents the Quality Assurance Project Plan (QAPP) for environmental sampling activities. The field activities will consist of the collection of soil samples from the project area. This QAPP is intended to be used in conjunction with the SAP to ensure that all activities included with this project are conducted in a manner consistent with industry standard methods and techniques to provide data representative of conditions present at the site. The QAPP includes discussions of the following:

- Laboratory and field QA measurements and acceptable criteria
- Field and laboratory documentation and data management
- Data validation requirements
- Data evaluation procedures
- Performance and system audits
- Preventative maintenance
- Corrective actions
- QA/QC reporting

The MCBH Project Manager will be responsible for ensuring that the appropriate project personnel have the most current version of this QAPP.

The usability of the data collected during this project will depend on its quality. Many factors along the sample collection and analysis process have the potential to impact the overall quality of the data generated during this project. Adhering to proper sample collection techniques, observing, and documenting chain-of-custody procedures and using certified laboratories and approved analytical methods will ensure that the quality of data generated during the project will accurately represent conditions at the site.

5.2 Sample Collection and Sample Handling Procedures

Prior to sampling, the Project Manager or the QA/QC Officer will inspect all supplies and consumables to ensure that they are acceptable for use. Soil sample collection will be overseen by a qualified environmental professional with adequate experience conducting DU-MIS collection and that all workers who may handle contaminated soil directly will have adequate safety training, including 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) certification and current refresher training. Sample containers and equipment will be used only if they have been certified pre-cleaned or if their packaging or seals have not been broken. Sampling and sample handling procedures are designed to ensure that samples are consistently collected, labeled, preserved, and transported in a manner that maintains their integrity for their intended purposes. Copies of this SAP and appropriate field procedures will be carried by field personnel during field data collection.

5.2.1 Sample Collection Method

Samples will be collected in accordance with the procedures detailed in Section 4.

5.2.2 Acceptance of Supplies and Consumables

The Project Manager will inspect all field consumables prior to use, and they will be discarded if the integrity has been altered and there is any possibility of the use of the consumable will sacrifice the integrity of the sampling effort.

5.3 Sampling Quality Control and Corrective Action

Laboratory QC samples may be analyzed in accordance with industry standard methods and practices.

5.3.1 Field Quality Control

QA of samples collected in the field will be ensured using trained sampling personnel, documented and standardized procedures, and second-party review of field logs and notes.

5.4 Laboratory Analytical Procedures

The laboratory selected to perform the analyses is FQ Labs and has a QA/QC program in place. All analyses will be conducted according to the guidance outlined in EPA SW-846.

5.5 Laboratory Analysis Quality Assurance Objectives

Laboratory control samples (LCSs) will be analyzed by the laboratory concurrently with the samples collected during this investigation.

Laboratory QC checks may include the following QC samples:

- Method blanks and reagent blanks
- Matrix spike (MS) samples
- Matrix spike duplicate (MSD) samples
- Surrogates (applicable to organic analyses only)
- Blank spike (BS) or LCSs

5.5.1 Matrix Spike and Matrix Spike Duplicate

A MS sample is an aliquot of sample spiked with a known concentration of target analyte(s). The spiking occurs prior to sample preparation and analysis. A MS sample is used to document the bias of a method in each sample matrix. MSD samples are internal laboratory split samples spiked with identical concentrations of target analyte(s). The spiking occurs prior to sample preparation and analysis. They are used to document the precision and bias of a method in a given sample matrix.

5.5.2 Laboratory Duplicate (Surrogate)

A laboratory duplicate (LD) sample is an internal laboratory split sample that is prepared and analyzed in a manner identical to that of the original project sample. The results will be used to evaluate the precision of the laboratory analyses. Results will be expressed as relative percent difference (RPD) between analytical results for the duplicate and the original sample.

5.5.3 Laboratory Control Sample

An LCS is a well-characterized sample matrix spiked with compound(s) representative of the target analytes that documents laboratory performance. LCSs are used to monitor the accuracy of the analytical process independent of project sample matrix and to identify potential background interference or contamination of the analytical system. LCSs will be analyzed and reported for each analytical batch. Duplicate LCS is an internal laboratory split of an LCS. Accuracy (recovery) and batch precision are determined using LCS/duplicate LCS.

Controlling laboratory operations with LCSs (as opposed to MS/MSD samples) offers the advantage of being able to differentiate recoveries due to procedural or errors from those due to sample matrix effects.

5.5.4 Laboratory Equipment Calibration and Preventative Maintenance

Laboratory equipment will be maintained in accordance with the approved laboratory QA program and as specified by the analytical method employed for sample analyses.

The laboratory equipment will be calibrated following the procedures and frequency specified by the analytical methods used. The laboratories are required to document calibration procedures and preventative maintenance in accordance with industry standard guidance and their established QA/QC program. A control system indicating the date of required maintenance, the person maintaining the equipment, and the next maintenance date will be used by laboratory personnel for laboratory equipment requiring routine maintenance. Most of the major instruments found in laboratories are covered by service agreements. Information pertaining to historical maintenance will be recorded in individual logs for each instrument.

5.5.5 Documentation and Deliverables

The laboratory will provide reports that include a case summary and the QC reports. The laboratory will also provide data deliverables in a specified electronic format.

5.5.6 Intended Laboratory Standard Operating Procedures Deviations

No deviations are intended for the analytical methods specified in this plan. Use of the laboratory QC data will be consistent with the procedures for data evaluation. The laboratory QC data will assist in evaluating the usability of the data for the project objectives.

5.5.7 Reporting Limits Objectives

Detection limits will be the lowest possible by the contracted laboratory per analytical method. The detection limits listed may not be achievable in individual samples for any of the following reasons:

- When analytes are present in the sample at concentrations that exceed the calibration range, dilutions may be necessary, resulting in elevated reporting limits for all analytes. The laboratory will report both the diluted and undiluted sample results to allow acceptance of the lower detection limits for analytes not detected from the undiluted sample.
- If matrix problems occur, dilutions may be necessary and the listed detection limits may not be met for each sample for each analyte.

Compounds detected above the detection limit but below the reporting limit may be qualified as estimated with a "J" qualifier.

5.6 Data Validation

5.6.1 Data Quality Assessment

Data quality will be assessed by evaluating the precision, accuracy, representativeness, completeness, and comparability parameters both qualitatively and quantitatively. Statistical evaluation of replicate sample data precision will be conducted in a two-step process:

1. Calculating the relative standard deviation (RSD) of the contaminant concentrations for the data set and
2. Evaluate the RSD of the data set:
    a. An RSD for replicate sample data ≤35 percent suggests that the sampling method has good reproducibility and, assuming the samples were properly collected and processed, the data can be used for reliable decision making.
    b. An RSD >35 percent but ≤50 percent indicates less reliable but still acceptable data for decision making, given the typical safety factor built into risk-based action levels.
    c. An RSD >50 percent but ≤100 percent indicates poor data precision.

5.6.1.1 Precision

Precision is defined as the agreement between a set of replicate measurements without assumption or regard about the true value. Precision limits for laboratory measurements will be evaluated from the sample/sample duplicate analyses results.

LD samples, MS/MSD or LCS/duplicate LCS analyses results will be used to assess analytical precision by the laboratory.

5.6.1.2 Accuracy

Accuracy is defined as the degree of agreement of a measurement to an accepted reference or true value. When applied to a set of observed values or measurements, accuracy will be a combination of random and systematic (bias) error. Analytical accuracy will be defined as the percent recovery (%R) of an analyte in a reference standard or spiked sample. Accuracy limits for LCS and MS/MSD samples are established by individual laboratories. The acceptance criteria for accuracy are dependent on the analytical method and are based on historical laboratory data.

The percent differences (%Ds) of the continuing calibration are also an indication of accuracy. Sample results are qualified "UJ" for non-detects and "J" for detects, if the %D for a continuing calibration is out of control.

5.6.1.3 Representativeness

Representativeness is the degree that data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness will be achieved by conducting sampling in compliance with the sample collection procedures described in the Section 4.1.2.

5.6.1.4 Completeness

Completeness is defined as the overall percentage of valid analytical results (including estimated values) compared to the total number of analytical results reported by the laboratory. The completeness goal for this project will be 90%. Successful completion of data acquisition can only be accomplished if both the field and laboratory portions of the project are performed according to the procedures described in the QAPP.

5.6.1.5 Comparability

Comparability expresses the confidence with which one data set can be compared to another. Comparability can be related to accuracy and precision because these quantities are measures of data reliability. Data are considered comparable if collection techniques, measurement procedures, methods, and reporting are equivalent for the samples within a sample set. Comparability for sampling will be determined to be acceptable based on the following criteria:

- A consistent approach to sampling was applied throughout the program and
- Samples were consistently preserved.

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Section 6. References

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ATTACHMENTS

Figure 1: Location Map

(USMC, 2019)

Figure 2: Site Layout Diagram
(USMC, 2019)

Figure 3: Range Layout

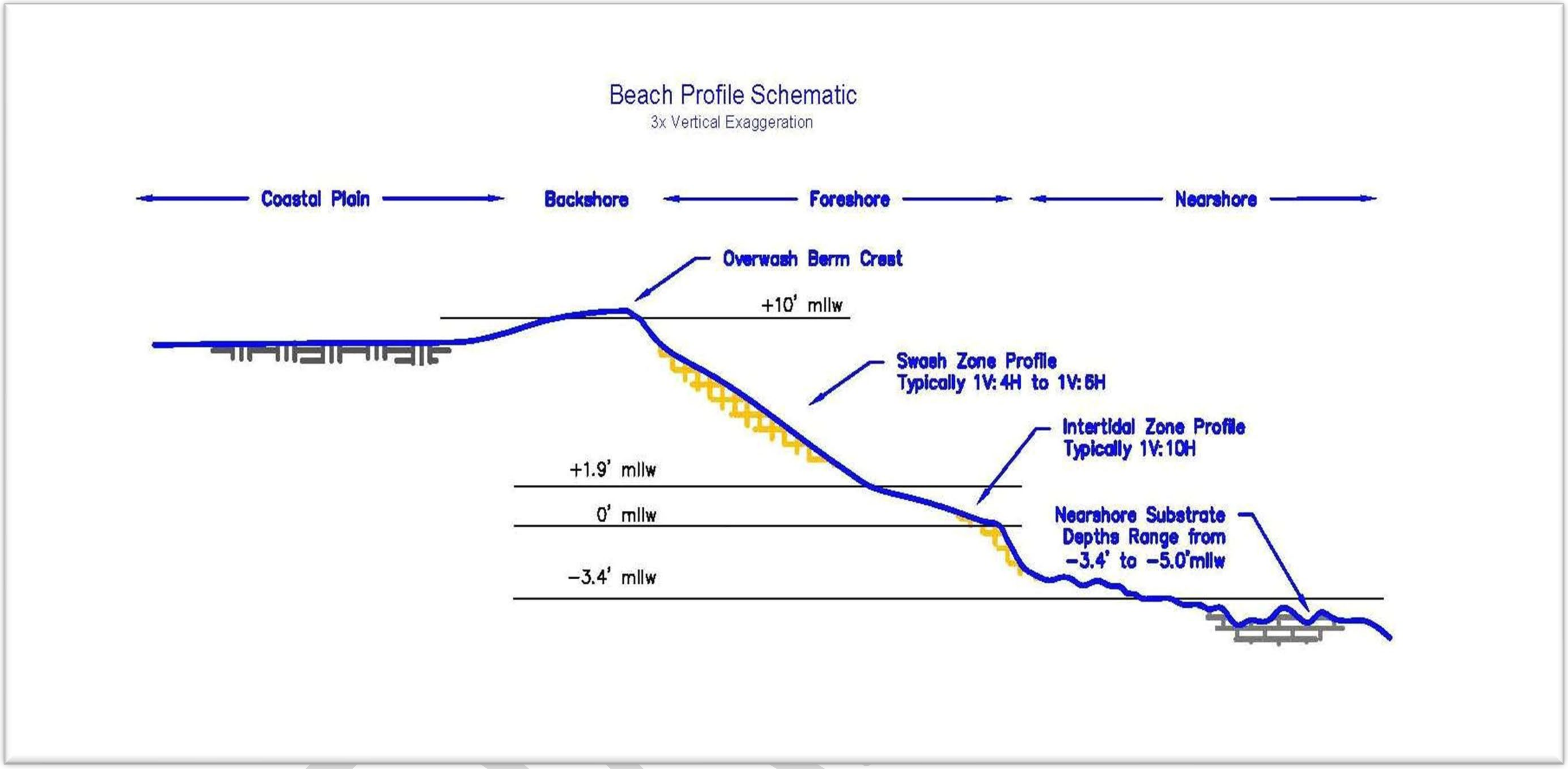

Figure 4: Beach Profile Schematic
(USMC 2019)

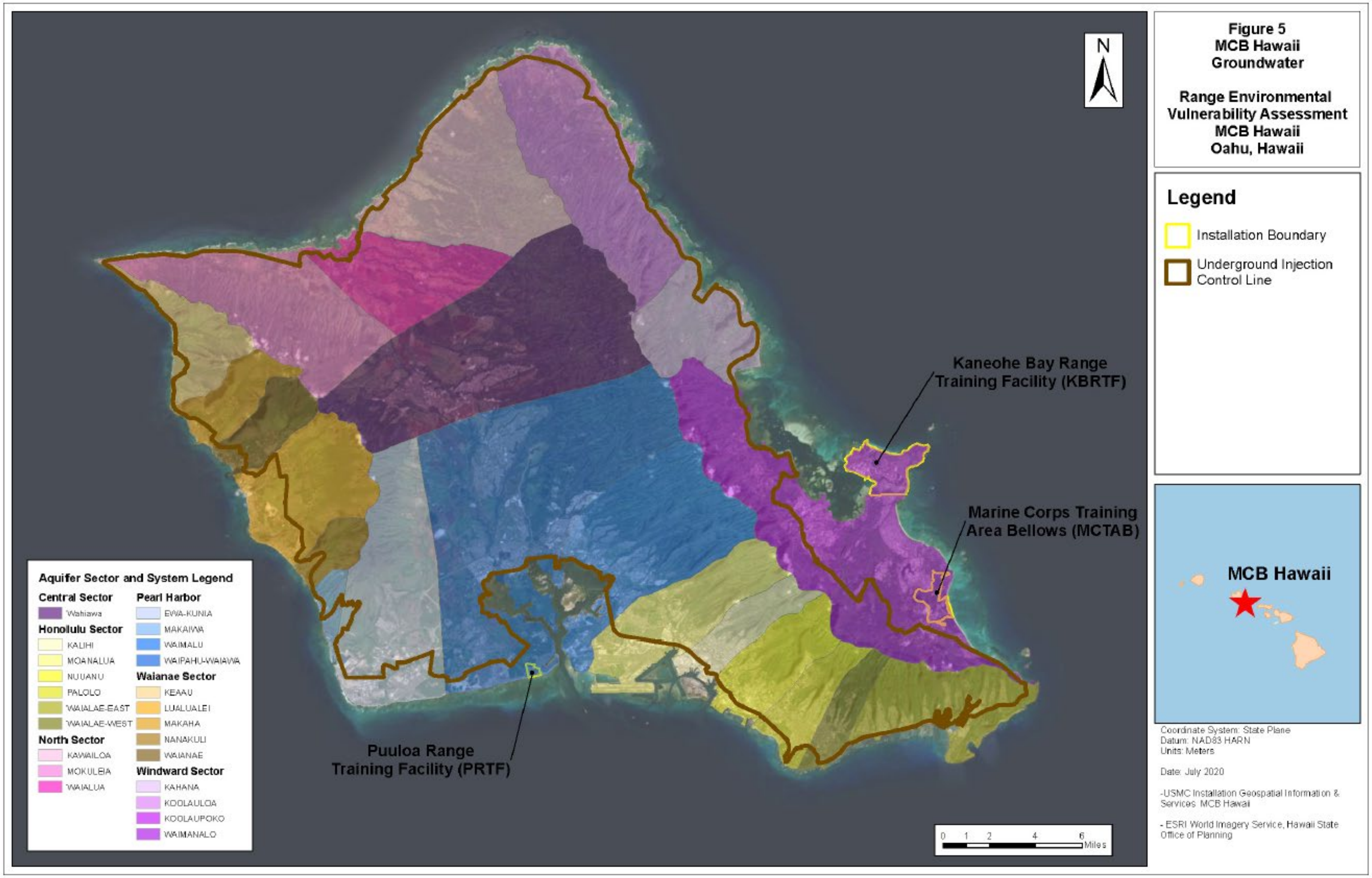

Figure 5: Oahu Groundwater Sector Map
(USMC 2020)

Figure 6: Decision Unit Plan Map