Final
Field Sampling Plan

Operable Unit 6 – Asarco Sediments
Commencement Bay Nearshore/
Tideflats Superfund Site

Tacoma, Washington

Prepared for:

United States Environmental Protection Agency – Region 10

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Acronyms and Abbreviations

Acronym	Definition
ºC	degree(s) Celsius
ASTM	ASTM International
bml	below mudline
CH2M	CH2M HILL, Inc.
DEM	digital elevation model
DOT	U.S. Department of Transportation
EB	equipment blank
EPA	U.S. Environmental Protection Agency
FGDC	Federal Geographic Data Committee
FOP	field operating procedure
FSP	Field Sampling Plan
GNSS	Global Navigation Satellite System
GPS	global positioning system
HASP	health and safety plan
HD	high-definition
HNO_3	nitric acid
ID	Identification
IDW	investigation-derived waste
LiDAR	light detection and ranging
MBES	multibeam echosounder
mL	milliliter(s)
MS	matrix spike

Acronym	Definition
MSD	matrix spike duplicate
N/A	not applicable
NAVD88	North American Vertical Datum of 1988
OU	Operable Unit
PAH	polycyclic aromatic hydrocarbon
PDI	pre-design investigation
PPE	personal protective equipment
PPK	post-processed kinematic
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
ROV	remotely operated vehicle
RTK	real-time kinematic
SAV	submerged aquatic vegetation
SBET	smoothed best estimated trajectory
SOP	standard operating procedure
TCLP	toxicity characteristic leaching procedure
TOC	total organic carbon
WSDOT	Washington State Department of Transportation

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1. Introduction

CH2M HILL, Inc. (CH2M) is conducting a pre-design investigation (PDI) for the former Asarco Smelter in Tacoma, Washington (Operable Unit [OU] 6 (Figure 1-1; figures are located at the end of this document). As part of the investigation, CH2M is performing topographic, hydrographic (multibeam sonar, sub-bottom profiling, and magnetometer), and eelgrass (*Zostera marina*) surveys, and collecting sediment and seep samples. This Field Sampling Plan (FSP) describes the activities associated with the surveys and sample collection. Fieldwork will be performed by CH2M and qualified subcontractors. Additional data collection, including pore water sampling, may occur at a later time upon review of data collected, as described by this FSP. If additional data collection is needed, an addendum to this FSP will be submitted.

CH2M's effort is on behalf of the U.S. Environmental Protection Agency (EPA) Region 10 under Remedial Action Framework – Design and Engineering Services (DES) Contract Line Item Number (CLIN) 3, Contract Number 68HE0318D0004.

The former Asarco Tacoma Smelter Facility (Facility) is located on the western shore of Commencement Bay within the cities of Ruston and Tacoma, Washington. The Facility encompasses 67 acres of property. OU6 includes marine sediments that extend approximately 1,000 feet offshore into Commencement Bay. Intertidal and subtidal slopes range from relatively flat to steep inclines (slopes to approximately 50 percent). The steepest submarine slopes were generally formed by placing molten slag directly into the water where it hardened in massive forms. Water in the steepest gradient areas is up to approximately 300 feet deep. Approximately 30 acres of offshore intertidal and subtidal lands are owned by Point Ruston (a developer); the remainder is owned by the state of Washington and Metro Parks Tacoma. Contaminants of concern are heavy metals (arsenic, copper, lead, and zinc). The shoreline and sediments offshore of the Facility have been capped as part of the OU6 remedy (Figure 1-1); however, the sediments in the Northshore Area, Moderate Impact Area, and Yacht Basin still need to be addressed.

Site conditions may have changed since the OU6 Record of Decision (ROD) was signed in 2000 (EPA 2000). The PDI data described in this FSP will be used to support remedial design and refine remedial alternatives, which will include delineating the areas that require dredging and/or capping.

2. Pre-design Investigation Data Quality Objectives

The data quality objectives are detailed in Table 11-1 of the OU6 Quality Assurance Project Plan (QAPP) (CH2M 2024b). Briefly, the objectives of the PDI are as follows:

- Delineate the vertical and lateral extent of surface and subsurface sediment in the Yacht Basin and Northshore Area with metals concentrations exceeding the sediment cleanup levels provided in the OU6 ROD.
- Delineate the lateral extent of surface sediment in the Moderate Impact Area and Nearshore/Offshore Area with metals exceeding the sediment cleanup levels provided in the OU6 ROD.
- Characterize sediment bed geotechnical characteristics of sediments in the Yacht Basin and Northshore Area to support dredging and/or capping design.
- Assess whether natural recovery through the deposition and accumulation of relatively cleaner sediment has occurred in the Yacht Basin.
- Update bathymetry in the offshore areas and topography along the shoreline adjacent to these areas to determine the stability of the shoreline in areas that may be dredged.
- Collect additional hydrographic survey data in the Yacht Basin to identify debris and support dredging and/or capping design.
- Determine the presence and spatial distribution of eelgrass and macroalgae within the OU6 project area to support dredging and/or capping design.
- Determine an appropriate waste disposal method for dredged sediment based on bulk sediment and toxicity characteristic leaching procedure (TCLP) analysis to support remedial action.

All data gathered during this sampling program will be provided to EPA.

2.1 PDI Study Design

The ROD subdivides the OU6 area into remediation areas based on the specific characteristics of each and the potential to implement sediment cleanup technologies in those areas. These areas are called the Contaminant Effect Areas and are as follows:

1. Nearshore/Offshore: Capping was the selected remedy for the Nearshore/Offshore Area adjacent to the Point Ruston site. The intent is to isolate contaminated materials from the benthic organisms. The cap for the Nearshore/Offshore Area was complete in 2007, and an Operations, Maintenance, and Monitoring Plan (Hydrometrics, 2018) is being implemented to ensure that the remedy is effective. Therefore, only surface sediment samples will be collected.
2. Yacht Basin: Dredging is the selected remedy for the Yacht Basin because it would remove the contaminated material. If all contaminated sediments in the Yacht Basin cannot be practically dredged, or if slag is encountered, then the remaining contaminated sediments will be capped in place to the extent practicable. Surface sediment samples will be collected to determine if natural recovery has occurred in the Yacht Basin through deposition and accumulation of clean sediments over the contaminated sediment. Core samples will be collected to support the development of a dredge prism if it is determined that dredging is an appropriate remedy.
3. Northshore Area: Capping is the selected remedy for the Northshore Area to isolate contaminated materials from the benthic organisms (EPA, 2000).

4. Breakwater Peninsula: No action is planned for the sediments offshore of the Breakwater Peninsula because of the inherent engineering and construction impracticability. The presence of steep slopes makes capping or dredging infeasible. In addition, dredging is not possible because the entire Breakwater Peninsula would need to be removed given that it is constructed entirely of slag (up to 125 feet thick).

In addition to the Contaminant Effect Areas, moderately impacted sediments are located in the Moderate Impact Area. The presence of relatively healthy benthic communities in areas outside of the Contaminant Effect Areas suggests that active cleanup outside of the Contaminant Effect Areas may not be appropriate. Active cleanup might result in greater net negative impacts through destruction of existing habitats, so the areas outside the Contaminant Effect Areas are not planned for remediation, and monitoring is deemed the most appropriate action for the Moderate Impact Area.

3. Surveys

3.1 Sampling Design

The sampling design and rationale for the OU6 PDI are based on the project quality objectives and sampling approach identified in the QAPP. This FSP provides additional detail related to the execution of the following OU6 PDI activities:

- Hydrographic surveys to determine bathymetry, identify debris, and delineate areas of submerged aquatic vegetation (SAV)
- Ecological investigation to determine the presence, spatial distribution, and density of eelgrass and macroalgae
- Surface sediment sampling and chemical analysis in the Moderate Impact Area to determine the extent and magnitude of metals concentrations exceeding ROD cleanup levels
- Surface and subsurface sediment sampling and analysis in the Yacht Basin and Northshore Area to determine the lateral and vertical extent and magnitude of metals concentrations exceeding ROD cleanup levels, characterize the geotechnical properties of sediment, and determine the appropriate offsite disposal method for dredged sediment
- Seep sampling and analysis to determine whether groundwater from the seeps entering the Yacht Basin and Northshore Area have the potential to recontaminate the future sediment remedy

Sections 3.2 through 3.4 present information on the upland survey, the hydrographic surveys, and the eelgrass survey, respectively.

3.2 Upland Survey

The purpose of the upland survey is to collect topographic information within the limits of the survey area shown on Figure 3-1. The upland survey will extend into the nearshore intertidal area at low tide so that the topographic survey and bathymetric survey (Section 3.3.1) data can be used to create a continuous digital elevation model (DEM). The upland survey will support the potential design for remediating contaminated sediments within the project area.

3.2.1 Upland Survey Methods

The topographic survey will be based on existing Washington State Department of Transportation (WSDOT) and National Geodetic Survey control monuments surrounding the upland survey area. A combination of Global Navigation Satellite System (GNSS) and conventional survey observations will be collected within the upland survey area to obtain three-dimensional (3D) points and break lines at an appropriate interval to generate 1-foot contours. Observations will be post-processed, quality checked, and used to generate a digital surface model with 1-foot contours modeling the existing topography of the upland and nearshore area. For more details on survey methods, refer to Field Operating Procedure (FOP) 47 in Appendix A.

The Point Defiance and Harbor Boundary Basemap will be based on an existing record of surveys for Pierce County Parcel Numbers 8950100017, 8950100016, and 8950100015. A field reconnaissance and survey for existing boundary monuments will be conducted to align record information with the site and existing structures/features. The basemap will include the following:

- Inner and Outer Harbor Line
- Point Defiance Ferry Terminal Lease Area

3.2.2 Survey Control

The units of measurement for this project will be in U.S. Survey Feet. Coordinates will be recorded in the following datums (or as agreed upon with CH2M personnel):

- Horizontal Datum – North American Datum 1983 (NAD83) (2011)
- Vertical Datum: North American Vertical Datum of 1988 (NAVD88)
- Coordinate System: Washington State Plane South Zone 4602

The relative horizontal control work accuracy will conform to the 2-centimeter accuracy standard as outlined in the Federal Geographic Data Committee (FGDC) *Geospatial Positioning Accuracy Standards, Part 3: National Standard for Spatial Data Accuracy* (FGDC 1998). Vertical control work will be Third Order, as outlined in the *Geospatial Positioning Accuracy Standards, Part 4: Standards for Architecture, Engineering, Construction (A/E/C) and Facility Management* (FGDC 2002). The final surveys will be stamped and certified by a professional surveyor in the state of Washington.

3.2.3 Deliverables

The deliverable for this task is a topographic map with 1-foot contours of the project area. This includes a portable document format, or PDF, of the topographic map and native files in drawing (DWG) format.

The schedule and deliverable dates for upland surveying are identified in Worksheet #14 and #16 of the QAPP.

3.3 Hydrographic Surveys

The limits of the hydrographic surveys are shown on Figure 3-1. The hydrographic surveys will be performed by a qualified subcontractor with CH2M oversight. The surveys will include all areas within the project limits, including under the boat houses associated with the Tacoma Yacht Club, boats moored at the Tacoma Yacht Club docks, boats and boathouses associated with the Breakwater Marina, under and around the City of Tacoma boat launch docks, the WSDOT ferry landing, the Northshore Area, and the Moderate Impact Area.

Hydrographic surveys to be performed for the OU6 PDI include the following:

- Multibeam bathymetric survey in the Breakwater Peninsula Area, Moderate Impact Area, Nearshore/Offshore Area, Northshore Area, and Yacht Basin. The primary purpose of this survey is to provide updated bathymetry within the project limits shown on Figure 3-1. The multibeam data will also be used to identify debris in the areas designated for dredging and/or capping (as indicated in the OU6 ROD) (Yacht Basin and the Northshore Area), and to identify SAV.
- Sub-bottom profiling survey in the Yacht Basin and Northshore Area. The purpose of this survey is to determine the depth of the native sand/gravel layer and identify and correlate the sediment layers observed in the sediment cores. The sub-bottom profiling data will support the design of a precision dredging approach if precision dredging is included in the remedial design. Sub-bottom profiling data can also be used to identify existing or abandoned utilities.
- Magnetometer survey in the Yacht Basin and Northshore Area. The purpose of this survey is to identify and delineate ferrous materials above and below the sediment surface.

3.3.1 Multibeam Survey

A multibeam echosounder (MBES) survey will be completed during the highest practicable tide levels. This will ensure the greatest overlap in the topographic survey and hydrographic surveys. During survey operations, soundings will be collected as close to the shoreline as can be safely completed. The survey depth will be determined by the contractors and will be based on their equipment capabilities.

The bathymetric data will be collected to cover the extent of the sediments within the work limits. If MBES cannot reach all areas, then alternative methods can be used to fill in the gaps, as long as accuracy requirements are met (e.g., rotating the multibeam beams to cover underneath the docks and dead head piles, shallow water single-beam vessels, light detection and ranging [LiDAR] with shallow water penetration capabilities). Any alternative methods will need to have sufficient backup to show they meet the accuracy requirements of the project.

Positioning will be ensured by using post-processed kinematic (PPK) GNSS solutions, or similar, to create Smoothed Best Estimated Trajectory (SBET) files. The inclusion of PPK and SBET during post-processing should significantly reduce positioning errors to sub-centimeter precisions, both vertically and horizontally, in areas of GNSS-compromised environments. Alternative methods that create a similar precision should be provided and have sufficient backup for approval.

Following completion of MBES surveying, coverage will be evaluated and compared against existing survey coverage. If data gaps still remain (e.g., in difficult to survey areas or because data overlap was not attainable during the first pass), alternate methods will be used to fill the gaps and complete the DEM.

MBES data will be collected with 200 percent coverage throughout the survey extents and to depths as shallow as safely feasible. SBES transect line spacing and other alternate methods will be determined after evaluation of areas requiring data infill, but spacing will be sufficient to develop an accurate final combined DEM.

Acoustic backscatter intensity data will be collected concurrently with the MBES data. Snippets data are time series of reflected acoustic signals and provide results and benefits akin to side-scan sonar. The snippets data provide avoidance of a nadir data gap directly beneath the sonar, which is a disadvantage of side-scan sonar data. Snippets data will be collected with the MBES system and are co-registered (collocated) with the MBES data.

3.3.2 Marine Magnetometer Sweep and Sub-bottom Profile Survey

The subcontractor will perform a marine magnetometer sweep of the Northshore Area and the main channels of the Yacht Basin. The marine magnetometer will be equipped with an altimeter to report distance above the bottom in real time. The magnetometer will be towed from the vessel aft and flown as near to the bottom as safely feasible. The magnetometer survey will identify locations of anomalies, but the data will not be interpreted for the object size or depth. The subcontractor will perform a sub-bottom acoustic profile within the Northshore Area and the main channels of the Yacht Basin (shown on Figure 3-1). Sub-bottom profilers are one of the most effective tools used to identify and characterize layers of sediment or rock under the sediment surface. The sub-bottom profiler is similar to a simple echo sounder, which uses a transducer to release a sound pulse toward the seafloor, and a receiver records the return of the pulse once it has been reflected. Unlike a simple echo sounder, parts of the sound pulse of the sub-bottom profiler at lower frequencies will penetrate the seafloor and be reflected off of the sub-bottom layers or strata layers. This will show density changes, which will indicate something foreign beneath the surface.

The subcontractor will use the following guidelines:

- The subcontractor will use a high-resolution Chirp Sub-Bottom Profiler.
- The subcontractor will determine the thickness and lateral continuity of the sub-bottom strata.
- The equipment transmission power, source, and frequency are at the discretion of the survey subcontractor.
- The method for towing the unit is up to the subcontractor, but ideally, it will be pole mountable for shallow water searching and towable for deeper sections.

3.3.3 Survey Control

The units of measurement for this project will be in U.S. Survey Feet. Coordinates will be recorded in the following datums (or as agreed upon with CH2M personnel):

- Latitude /Longitude – World Geodetic System 1984 (WGS84)
- Vertical Datum: North American Vertical Datum of 1988 (NAVD88)

The relative horizontal control work accuracy will conform to the 2-centimeter accuracy standard as outlined in the FGDC Geospatial Positioning Accuracy Standards, Part 2: National Standard for Spatial Data Accuracy. Vertical control work will be Third Order, as outlined in the FGDC Geospatial Positioning Accuracy Standards, Part 4: Standards for Architecture, Engineering, Construction (A/E/C) and Facility Management. The final surveys will be stamped and certified by a professional engineer in the state of Washington.

3.3.4 Deliverables

A technical memorandum summarizing the surveys and results will be prepared by CH2M and will be attached as an appendix to the overall Field Sampling Report. The Field Sampling Report will present summary information from this survey effort as appropriate, including the method of data collection used in each area. The technical memorandum may include, but will not be limited to, information from the following sources:[1]

- Datum, horizontal coordinates, vertical measurements, and elevations for each survey monument and benchmark used during survey operations.
- Written narrative describing procedures; equipment used, including calibration documents; and quality assurance (QA)/quality control (QC) procedures where applicable.
  - Daily bathymetry calibration checks
- Survey points (in Coordinate Geometry Format): Comma-delimited ASCII file of all survey shots/points will be collected in the following format:
  - Point number, northing, easting, elevation, field code, point description
- All control points, reference points, and positional survey data will be referenced in the field notes and shown on all mapping products.

[1] If differencing analyses are completed, supporting data files for each difference analysis TIFF image and spatial extent of each bathymetric survey used in the difference analysis will be included.

- ASCII XYZ survey data as full-resolution and in gridded format (1-foot by 1-foot uniformly spaced grid).
  - Combined DEM of topographic and bathymetric data from all elevation data collected
  - DEM of upland topographic data
  - DEM of bathymetric data
- Contours
  - Combined DEM contour file (1-foot contours) as a SHP file or similar
  - Topographic DEM contour file (1-foot contours) as a SHP file or similar
  - Bathymetric DEM contour file (1-foot contours) as a SHP file or similar
- GeoTiffs
  - Sun-illuminated (hill-shaded) images of DEMs
  - Three-band orthoimagery collected with manned LiDAR aircraft
  - Acoustic backscatter intensity backscatter mosaic
- Magnetometer data[2]
  - XY coordinate list of targets of interest
  - Contour and/or color-shaded surface map of anomalies (SHP, GeoTiff)
- Google Earth files
  - DEM of topography and bathymetry
  - Target locations identified in marine magnetometer data
- Water level logger data
  - ASCII file format of hydrostatically corrected water level data
- Utilities
  - Shapefiles indicating locations of utilities, if known and/or discerned in the data
  - Source of utility data, including level of accuracy for those data

Metadata associated with any spatial data that are created should be provided in the deliverables following the FGDC Content Standard for Digital Geospatial Metadata (https://www.fgdc.gov/metadata/csdgm-standard).

3.4 Eelgrass Survey

Eelgrass studies performed by the Washington Department of Natural Resources indicate the potential for eelgrass beds in the Yacht Basin and Northshore Area (DNR, 2019). A preliminary eelgrass survey will be performed as part of the multibeam bathymetric survey to confirm the presence and spatial distribution of any existing eelgrass beds to prevent possible adverse effects during sediment collection and coring efforts or during remedial action. The preliminary eelgrass survey will be conducted in accordance with the Washington Department of Fish and Wildlife *Eelgrass/Macroalgae Habitat Interim Survey Guidelines* (WDFW, 2008).

[2] Magnetometer data identify anomalies based on response strength. The magnetometer data could be paired with MBES data for vertical information. This will be evaluated depending on review of the anomalies identified and need for further information on those anomalies.

3.4.1 Eelgrass Survey Area

The limits of the eelgrass inventory are the same as those for the bathymetric survey, shown on Figure 3-1. The survey will include the project area, under the boat houses associated with the Tacoma Yacht Club, boats moored at the Tacoma Yacht Club docks, boats and boathouses associated with the Breakwater Marina, under and around the City of Tacoma boat launch docks, the WSDOT ferry landing, the Northshore Area and the Moderate Impact Area.

3.4.2 Summary of Methods

A preliminary eelgrass survey will be accomplished using any combination of the following survey methods and as dictated by project site constraints. The constraints will be determined following mobilization to the site for the eelgrass inventory and they will be adjusted based on site conditions at the time. The survey methods are the following:

1) **A hydro-acoustic multibeam vegetation-sonar survey**. By using the latest sonar technology specifically designed for mapping SAV distribution, this method allows an entire project site to be surveyed efficiently from a single vessel, either manned or unmanned (remote control) when applicable.
2) **Towed video or drop camera verification**. By using a towed video sled or a drop camera frame, underwater imagery can be collected for not only verification of the hydrographic survey, but also for aiding in aquatic species classification. If imagery data are being used as a QA check of the sonar data, then a minimum of 10 percent of the area covered by sonar should be imaged.
3) **Underwater remotely operated vehicle (ROV)**. The ROV system allows access to areas the survey vessel cannot safely navigate, such as under piers and bridges or shallow areas along rocky shores. The ROV can collect imagery and depth data that can be used to fill gaps in the sonar data coverage where needed.

3.4.3 Data Acquisition

A summary of each method is presented below. Specific methods will be determined following mobilization as to which method is most appropriate given site constraints.

SAV Sonar Survey

Eelgrass and macroalgal species have distinct structural characteristics and densities, which cause variations in the sonar return signals, allowing researchers to differentiate between them. Sonar data will be obtained through an acquisition software depending on the selected subcontractor. All raw sonar data will be recorded and filtered in the appropriate software and native file formats. The acquisition software will save raw sonar data and global positioning system (GPS) data to each sounding recorded. The software will allow the surveyors and observers to have a first-round view of any potential SAV and seafloor targets based on the strength and height of acoustic returns.

Vessel position and navigational track data will be logged by the subcontractor and provided upon request. Survey transects will be spaced at approximately 25 feet apart unless otherwise specified. Transect width and spacing are targets that may be influenced by conditions such as depth, currents, tides, seafloor conditions, and visibility. While every attempt will be made to maintain headings to targets, site -specific conditions (notably wind and tides) may not allow for straight transect lines. Vessel tracking will be completed using the GPS data acquired.

Towed Video Survey

Towed video surveys will utilize a tow sled frame or similar capable of being towed behind a vessel at up to 6 knots. The camera system mounted on the tow sled will be equipped with high-definition (HD) image and video camera with lights. Towed video surveys will be conducted in predefined transect locations. Video transects will be in straight lines, when possible, to avoid tight turning requirements.

Before deploying the towed video sled, a series of checks to ensure the safety of personnel and the vessel, ensure that equipment is satisfactory and to make sure the data being collected meet the project requirements. These checks include the following:

- Inspect the line attached to the tow sled for any shackles, links, or knots.
- Inspect the winch and controller for operability.
- Inspect bolts on the frame and those holding the imaging system to the frame.
- Test the lights on the tow sled.
- Take test photos on deck with a measuring device covering the entire image frame.

To begin the towed video survey, the vessel will navigate to the start of the desired transect, and the vessel operator will attempt to keep the vessel in position while the towed video sled is lowered over the side of the vessel until approximately 1 meter above the bottom. Video will then be recorded as the vessel travels along the transect line. Adjustments to the winch will be necessary as the vessel increases or decreases speed. The vessel speed will be dictated by the water clarity and video quality. Typically, a vessel speed of 2 to 3 knots in calm waters can be achievable. Once the transect is finished, the vessel operator will put the vessel transmission in neutral as the tow sled is brought back onto the deck of the vessel.

Drop Camera Survey

Drop camera surveys can add additional benefit to an SAV survey by allowing closer analysis of the seabed at specific locations. It also allows another method of identifying different types of SAV. This equipment can be a mounted on a separate frame from the tow sled or the tow sled itself may be used. The drop camera deployment is similar to the tow sled as it is lowered to about 1 meter above the seabed at each deployment location. The only difference is that the drop camera is used for imaging the seabed at specific point locations and the tow sled is used for continuous imaging of the seabed along transects. Often times it is useful to use a drop camera in sites where small patches or minimal vegetation is observed on the sonar data. The drop camera allows the survey team to investigate specific point locations where needed. It is also more feasible to use a drop camera in areas with limited vessel maneuverability, such as ports and marinas.

All image and video data will be recorded using a HD recording systems with file date and times stamped onto the images and file names. Transect position data will be logged for reporting. All videos will be available for viewing on the vessel in real time. Field notes will be collected during the survey to include:

- Names of persons collecting and logging samples
- Names of persons operating vessel and/or equipment
- Weather conditions (and/or any changes in weather)
- Water depth
- Date and time of each transect start and end
- Brief description of observations
- Any deviations from the approved plan
- Photos identification of any anomalies

ROV Survey

ROV surveys would be conducted from a vessel at predefined transects or locations unable to be accessed from a vessel. Typically, an ROV is used for SAV surveys following a sonar survey where the sonar was unable to collect data. These areas are usually under piers, docks, and bridges.

The vessel should be equipped with the necessary equipment to safely operate and navigate in and around project site obstructions such as shallow areas or structures such as piers or bridges. Before the ROV survey begins the vessel must come to a complete stop by either trying up to a fixed structure or by deploying an anchor large enough to hold the vessel. The vessels motors must be stopped or in neutral transmission at all times when the ROV is deployed.

Before deploying the ROV, a navigation plan will be established by the survey team to either follow a predefined transect line such as a depth contour or investigate a specific location. After safely deploying the ROV over the side of the vessel, the ROV will drop down to the predefined depth and use the compass or tracking device to navigate along the planned route. During the ROV, survey imagery and video will be collected. All imagery will be date- and time-stamped. Specific targets of interest seen will be logged with a corresponding date and time to match the imagery being collected.

3.4.4 Video Recording and Reporting

All image and video data collected during the SAV survey will be recorded using HD recording systems with file date and times stamped onto the images and file names. Transect position data will be logged for reporting. All videos will be available for viewing on the vessel in real time. The following field notes will also be collected during the survey:

- Names of persons collecting and logging samples
- Names of persons operating vessel and/or equipment
- Weather conditions (and/or any changes in weather)
- Water depth
- Date and time of each transect start and end
- Brief description of observations
- Any deviations from the approved plan
- Photographs identifying any anomalies

3.4.5 Data Quality Assurance/Quality Control

Imaging QA/QC – The quality of the recorded images and video from all the systems can be checked as soon as they are downloaded. In-field quality check of a few images and video files will occur after the first few deployments. These checks will ensure the images are in focus and the speed of the vessel or ROV are acceptable to meet image data requirements. Remedy any faults prior to the next deployment.

3.4.6 Equipment

The following equipment to conduct a SAV survey is necessary:

- Survey vessel or remote vessel appropriate for working in shallow conditions
- Vessel must be outfitted with a mounted sonar pole
- Towed video system with scaling lasers and HD imaging capabilities
- ROV with depth sensor and HD imaging (usually only for areas not vessel accessible)
- GNSS positioning system

- Real-time Kinematic (RTK) GNSS receiver for water level if necessary
- Sound velocity profiler for correcting sonar data
- Survey computer with software for running both vessel navigation and echosounder
- Geographic information system software
- Survey logbook or digital line log software

3.4.7 Positioning and Coordinates

For all surveys, a GNSS receiver will be mounted on the vessel to provide accurate real-time positioning data to both the navigation software and the appropriate survey equipment software. The sonar will be attached to a survey pole and mounted alongside the survey vessel. The sonar will be operated in unison with an accuracy of 0.1foot paired to the GNSS GPS receiver or equivalent. The GPS receiver will send both accurate position data and heading information to the data acquisition platform to create precise position data for each sonar sounding. Additionally, a separate RTK GNSS receiver will be used with a correction service such as Washington State Reference Network, to correct positions if necessary and to record backup water level information.

3.4.8 Deliverable

Data collected would be provided within a technical memorandum containing figures showing the bathymetry of the site and a summary of the condition of the eelgrass within the project area.

4. Sediment Sample Collection Procedures

This section describes the field sampling equipment and procedures to be used by CH2M and its subcontractors for the PDI. All sampling will be conducted in accordance with the quality assurance procedures outlined in the QAPP (CH2M 2024b). Safety guidelines presented in the Asarco OU6 Health and Safety Plan (CH2M, 2024b) will be followed for all field activities. For further details regarding sediment sample collection, reference FOPs 50 and 58 (Appendix A).

4.1 Field Equipment and Supplies

Field equipment and supplies include sampling equipment, utensils, decontamination supplies, sample containers, coolers, shipping containers, logbooks and forms, personal protective equipment (PPE), and personal gear. Sediment grabs will be collected using a power grab sampler deployed from a marine vessel. Sediment cores will be collected using a vessel-deployed vibracore or barge-mounted sonic drill rig. Samples for chemical analysis and physical parameters will be processed using stainless-steel sampling equipment (bowls, spoons, etc.) or single-use aluminum pans.

Level D PPE will be required for all personnel with the addition of a U.S. Coast Guard-approved personal floatation device for personnel working over water. Details on safety procedures and PPE required for this project are provided in the HASP (CH2M 2024a).

Sample jars, preservatives, distilled/deionized water, coolers, and packaging material for the samples will be supplied by the analytical laboratory or the contractor. Details on the number and type of sample containers are provided in Table 4-1.

Samples will either be processed on the vessel/barge or at an upland processing facility located near the project area. The final location will be determined during field planning. The processing area for sediment cores will include a location suitable for core logging, photographs, sample collection, and sample refrigeration (if needed).

4.2 Subsurface Utility Clearance

A Cable Area is located within the OU06 project area (National Oceanic and Atmospheric Association [NOAA] Chart No. 18453). The Cable Area runs from the upland area near the Point Defiance Ferry Terminal, presumably to Vashon Island. Before field activities begin, a utility survey will be conducted to identify all known in-water utilities within the OU06 project area. The Washington Utility Notification Center (811) will be contacted to locate utilities in the project area. If proposed sample locations interfere with utilities, alternate locations will be determined in consultation with the EPA TOCOR.

4.3 Surface Sediment Collection

A total of 48 stations have been identified for collection of surface sediment samples in the Moderate Impact Area, Nearshore/Offshore Area, Northshore Area, and Yacht Basin, as shown on Figure 4-1, Figure 4-2, and Figure 4-3. The purpose of surface sediment sampling the is to determine the lateral extent and magnitude of metals concentrations exceeding ROD cleanup levels and to establish a baseline data set for long-term monitoring in the Moderate Impact Area.

4.3.1 Sampling Vessels and Equipment

It is expected that most sediment sampling will be conducted from an appropriately sized and outfitted research vessel, or equivalent, anchored to the seafloor. The approach for collecting the samples will be made by the field team and selected subcontractor based on field conditions and health and safety considerations.

4.3.2 Positioning and Vertical Control

Planned sampling location coordinates will be entered into the sampling vessel's onboard GPS unit. A handheld GPS unit will be used for any cores collected on foot in the Yacht Basin. Sediment sampling locations will be adjusted in the field if obstructions are encountered or if the initial sampling attempt is unsuccessful. Sampling stations will be located in the field using a differential GPS unit with submeter accuracy. As-sampled locations will be recorded at the time of collection.

At a minimum, vertical control will be established using an onboard fathometer or lead line (or weighted tape) to measure the depth to the mudline (water surface to sediment surface) at sample locations at the time of collection. The fathometer accuracy will be checked regularly by vessel contractor and calibrated when necessary following ASTM International (ASTM) D6318, *Standard Practice for Calibrating a Fathometer Using a Bar Check Method* or other similar practice. Vertical position control at each location will be evaluated using a lead line (or weighted tape) to measure from the water surface to the sediment surface. Depths will be recorded to the nearest one-tenth of a foot. The water surface elevation at the time of sampling at each station will be obtained from NOAA tide gauge 9446484, and mudline elevations will be calculated by subtracting the measured water depth from the water surface elevation. Mudline elevations will be converted from mean lower low water to NAVD88. If the equipment is available, RTK GPS will be used to record elevations. The measurement time will be recorded when the depths are measured.

4.3.3 Sediment Grab Sampling

The surface sediment samples will be collected using a power grab sampler deployed from a marine vessel. The target depth for surface sample collection is 10 centimeters below mudline (bml). Prior to sample collection at each station, the grab sampler will be decontaminated by a site water rinse. Reusable sample collection equipment will be decontaminated following the procedures provided in Section 8.5. Before collecting sediment samples, a clean plastic-covered workspace will be established on the work platform. Sample bottles will remain covered in plastic bags inside the plastic-lined ice chests until ready for filling. The grab sampler will be raised and lowered through the water column by the vessel's winch at a rate no greater than 1 foot per second. This will ensure that the sampler does not flip over on descent and will prevent disturbance of the sediment surface upon retrieval. Once the sampler is brought on board, it will be placed on a stand or table. Access doors in the cover on the top of the sampler will allow visual characterization of the sediment surface in order to assess sample acceptability. Before characterization, the overlying water in the sampler will be removed using a siphon hose, and the depth of sediment collected will be measured using a stainless-steel ruler. Sediment collection methods will follow standard protocols and guidelines provided in FOP 50 (Appendix A).

Sediment samples collected with the grab sampler will be acceptable if the following criteria are met:

1) The sampler did not over-penetrate or overfill, so the sediment surface is not pressed against the top of the sampler or lost through the top of the sampler.

2) Overlying water is present (indicates minimal leakage). This can be very difficult to achieve in areas where gravel or larger material is present, in which case, the field team leader will need to use professional judgement to determine acceptability of the sample. Decisions will be documented in the field notes.
3) The overlying water is not excessively turbid (indicates minimal sample disturbance).
4) No or minimal excess water is leaking from the jaws of the sampler.
5) The sediment surface is relatively flat (indicates minimal disturbance or winnowing).
6) The target recovery depth of 30 centimeters with a minimum of 15 centimeters is achieved, with sample interval of 0 to 10 centimeters.

If the first surface grab attempt meets the acceptance criteria, then no additional grabs will be collected at that station. If not, then up to two additional grabs will be attempted and retained (stored on the vessel deck). Each attempt will be collected and retained in a disposable food-grade aluminum pan. The new station will be offset by 10 to 15 feet. If after three attempts, no recoverable sediment meeting the criteria is collected, the location may be adjusted or abandoned, following discussion with the EPA TOCOR.

4.3.4 Sample Processing

The samples will be field-screened to remove gravel-sized material and unrepresentative material (e.g., woody debris) before field processing. Sediment will be visually classified according to the ASTM 2488 Visual-Soil Classification Method and Sediment Sampling Logging Key. A summary of the method is included in FOP 50. Sediment grab sampling activities will be recorded on the Surface Sediment Sampling Field Form 3.

Samples will be put into a disposable food-grade aluminum pan, thoroughly homogenized to a uniform appearance using a decontaminated, clean stainless-steel spoon, and spooned into appropriate clean containers (Table 4-1). Samples will be transported in coolers on ice to the field lab for packaging and shipment. Any remaining excess sample materials will be returned to the point of collection and any reusable sampling equipment will be decontaminated before reuse.

All surface sediment samples from the Moderate Impact Area, Nearshore/Offshore Area, Yacht Basin, and Northshore Area will be analyzed for arsenic, copper, lead, and zinc. Surface sediment samples from the Yacht Basin and Northshore Area will also be analyzed for grain size, total organic carbon (TOC), percent solids, and Atterberg Limits to support remedial design (i.e., dredging), if warranted.

4.3.5 Sediment Grab Sample Logs

Sampling information for sediment surface grab samples will be recorded on a project-specific form, which will include the following details:

- Time and date – Local time and date when the grab advancement begins at each station
- Location of all grab sample attempts (as-sampled)
- Depth to mudline – Water depth at the sampling station at the time of core collection
- Sediment thickness recovered within each grab
- Gross characteristics of the sediment, such as texture, color, biological structures, presence of debris, presence of sheen, or odor

Additional guidance is included in FOP 50.

4.4 Subsurface Sediment Core Collection

A total of 25 locations are identified for collection of subsurface cores in the Northshore Area and Yacht Basin, as shown on Figure 4-2 and Figure 4-3. The purpose of subsurface sediment core sampling is to determine the vertical extent and magnitude of metals concentrations exceeding ROD cleanup levels and to characterize sediment bed geotechnical characteristics to support dredging and/or capping design. A second core will be collected from four locations (one in the Northshore Area and three in the Yacht Basin) and subsampled to determine the appropriate disposal method for dredged sediment based on TCLP analysis.

4.4.1 Sampling Vessels and Equipment

It is expected that most sediment sampling will be conducted from an appropriately sized and outfitted research vessel, or equivalent, anchored to the seafloor. Some sediment cores nearest to the shoreline in the Yacht Basin may be collected manually using a hand coring device consisting of a coring tube, core liner, core catcher, and handle. Hand coring procedures are described in FOP-50 (Appendix A). The approach for collecting the samples will be decided upon by the field team and selected subcontractor based on field conditions and health and safety considerations.

4.4.2 Positioning and Vertical Control

Planned sampling location coordinates will be entered into the sampling vessel's onboard GPS unit. A handheld GPS unit will be used for any cores collected on foot in the Yacht Basin. Sediment sampling locations will be adjusted in the field if obstructions are encountered or if the initial sampling attempt is unsuccessful. Sampling stations will be located in the field using a differential GPS unit with submeter accuracy. As-sampled locations will be recorded at the time of collection.

At a minimum, vertical control will be established using an onboard fathometer or lead line (or weighted tape) to measure the depth to the mudline (water surface to sediment surface) at sample locations at the time of collection. The fathometer accuracy will be checked regularly by the vessel contractor and calibrated when necessary following ASTM D6318, *Standard Practice for Calibrating a Fathometer Using a Bar Check Method* or other similar practice. Vertical position control at each location will be evaluated using a lead line (or weighted tape) to measure from the water surface to the sediment surface. Depths will be recorded to the nearest one-tenth of a foot. The water surface elevation at the time of sampling at each station will be obtained from NOAA tide gauge 9446484 , and mudline elevations will be calculated by subtracting the measured water depth from the water surface elevation. Mudline elevations will be converted from mean lower low water to NAVD88. If the equipment is available, RTK GPS will be used to record elevations. The measurement time will be recorded when the depths are measured.

4.4.3 Subsurface Sediment Core Sampling

Subsurface sediment cores will be collected with a vibracore or similar method that is able to meet the acceptance criteria outlined in this section. The vibracore will be advanced to a maximum depth of 10 feet bml or to refusal. In general, the vibracore uses a hydraulic system that vibrates and drives the core tube into the sediment. A continuous sample is retained within the core tube, with the aid of a core cutter/catcher attached to the bottom of each tube. The core tube will be driven to the target depth of

10 feet bml or refusal, whichever is shallower. Vibracore sediment collection methods will follow standard protocols and guidelines provided in FOP 58 (Appendix A).

In general, subsurface sediment coring will follow these steps:

1) Where possible, the target sampling area will be probed to determine whether debris or rock are present before attempting to collect a core. If the probing suggests the bottom type will preclude core collection, the station will be offset by several feet to attempt to find an area that can be effectively sampled.
2) Core tube caps will be removed immediately before placement into coring device to minimize potential core contamination.
3) GPS position will be recorded when the vibracore first rests on the sediment surface.
4) The vibracore will be advanced without power (under its own weight), then vibration will be applied until the core tube is advanced to the target depth or refusal.
5) After a brief pause, the core tube will be extracted from the sediment using only the minimum vibratory power needed for extraction.
6) As soon as the core tube daylights to the surface water/air interface, a bottom cap will be placed over the tube to prevent material loss out of the core catcher.
7) Exterior side walls of the core tube will be inspected for scrapes or scoring of the core tube walls from contact with dense gravel.
8) The core will be accepted, rejected, or stored on the vessel based on the acceptance criteria the following acceptance criteria:
   - Overlying water is present and the sediment surface appears intact.
   - Core has at least 80 percent recovery versus penetration (or document why recovery is less after three attempts).
   - Core tube is in good condition (not excessively bent).
   - Target penetration depth has been achieved or refusal encountered. If target depth is not reached because of cobbles, debris, refusal, or other difficult conditions, up to two additional cores will be attempted as described below.
9) If refusal is encountered at similar depths as previous cores collected in the Yacht Basin in 2000 (i.e., less than 5 feet bml) and the 80 percent recovery has been achieved, then additional attempts will not be conducted. After core acceptance and before transfer or processing of the core, water will be carefully decanted from the top of the core tube to minimize sediment disturbance.

If the first core attempt meets the acceptance criteria, then no additional cores will be collected at that station. If not, then up to two additional cores will be attempted and retained (stored on vessel deck). The best (percent recovery) of three attempts will be retained and processed, and the conditions preventing greater recovery will be documented.

If after three attempts, a usable core is not recovered, the station will be offset between 10 and 15 feet and the EPA will be notified that the station was moved. The station may be abandoned or relocated in coordination with the EPA.

The following information at a minimum will be recorded in the field logbook or on project-specific field forms by the project team representative on the vessel:

- Time and date – Local time and date when the vibracore advancement begins at each station.
- Location coordinates (as-sampled).
- Depth to mudline – Water depth at the sampling station at the time of core collection.
- Calculated sediment surface (mudline) elevation (NAVD88).
- Total drive length – Core tube length and depth of the core tube penetration into the subsurface.
- Recovered length – Thickness of the sediment column retained in the core tube prior to removal of the core catcher.
- Sediment observation – Note any problems with core collection (e.g., number of attempts needed) and any debris in area, and provide any other pertinent information.
- Sample labeling – The sediment cores will be clearly labeled with the station identification (ID), core interval, date, and time. Cores will be stored upright prior to processing.

4.4.4 Core and Sample Processing

The processing of each core will occur at an upland processing facility located near the project area. The final location will be determined during field planning. Cores will be processed concurrently with core collection. Every effort will be made to process the cores within 24 hours of collection. Cores awaiting processing will be sealed tightly at both ends. If core collection outpaces processing such that significant delays in core processing appear likely, core collection will be suspended to allow for processing to catch up.

The cores will first be field-screened (visual, olfactory) and logged following standard protocols and guidelines according to the vibracore sediment collection methods provided in FOP 58 (Appendix A). Samples will be collected as described below using a decontaminated, clean, stainless-steel spoon, transferred into the appropriate containers as identified in Table 4-1, and sent to the laboratory for analysis.

Subsurface sediment core processing at the field laboratory will follow these steps:

1) The processing tables will be prepared for each core by covering the table with plastic sheeting and securing the plastic sheeting with heavy duty tape (e.g., duct tape). Cores will be placed on the table so that the top of the core is to the left and the bottom is to the right.

2) The core tube will be split open to preserve the material stratigraphy inside the core tube using a table saw, handheld circular saw, radial saw, shearing tool, exacto knife (if liner used), or similar device.

3) Cores will be photographed before sampling. Digital photographs of each core segment will be taken to visually document the undisturbed core structure. Each photograph will include a scale (that is, tape measure), station ID, indication of depth interval, indication of top orientation, and date of core collection. Appropriate lighting, tripods, and color calibration cards may be installed in the core processing area to collect consistent, high-quality photographs of the opened cores.

4) The sediment cores will be visually characterized for sediment type, color, moisture content, texture, grain size and shape, consistency, visible evidence of staining, and any other observations. Sediment cores will be visually described following Unified Soil Classification System (modified slightly for sediment characterization) based visual-manual identification in accordance with the ASTM-2488 standard practice. A logging key of the visual classification method is provided in FOP 58. The colors will be designated using a Munsell color chart. Sediment logs will be recorded on the Core Log Field Form in Appendix B.

5) Olfactory observations (odors) will be recorded on the Core Log Field Form. Examples of odors may include, but not be limited to, sulfur/sulfide-like, petroleum-like, and fuel-like odors.

6) Subsurface samples will be collected from the sediment cores as follows:
   - Core samples will be collected in 1-foot intervals down to 10 feet or to the bottom of the core if the core is less than 10 feet long.
   - The first five samples (from 0 to 5 feet) will be submitted for immediate analysis and the remaining five samples (5 to 10 feet) will be archived for later analysis, if deemed necessary.
   - Samples from each 1-foot interval will be collected and transferred to a single, disposable food-grade aluminum pan. The samples will be field-screened to remove gravel-sized material and unrepresentative material (e.g., woody debris) before field processing. Samples will then be thoroughly homogenized to a uniform appearance using a decontaminated, clean, stainless-steel spoon, spooned into appropriate clean containers (Table 4-1).
   - For the four cores collected for dredged material disposal characterization, a composite sample will be collected from the 0- to 2-foot depth interval and processed in the same manner as described above.
7) All core sediment samples will be analyzed for arsenic, copper, lead, and zinc, and will also be analyzed for grain size, TOC, percent solids, and Atterberg Limits to support remedial design. An additional four samples will be analyzed for total polycyclic aromatic hydrocarbons (PAHs) in bulk sediment and TCLP 8 Resource Conservation and Recovery Act (RCRA) metals for waste characterization of dredged material in support of design.
8) Following completion of sampling each core, the excess core material will be transferred to a new drum. The drum will labeled appropriately as investigation-derived waste (IDW) pending analysis until such time as the analytical results will determine where the IDW (i.e., core cuttings) will be disposed of.
9) IDW Characterization. A composite sample from each drum (either full or partially full) will be collected using a thief sampler or similar device that collects a sample from the full length/depth of the drum. The collected sample will be placed in a clean stainless bowl or disposable aluminum pan and thoroughly mixed. The mixed sample will be transferred to an appropriately sized glass jar. The composited sample will be analyzed for the eight RCRA metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) and total PAHs in bulk sediment samples and PAHs and TCLP leachate samples.

4.5 Sediment Sample Containers

The sample jars for sediment samples are described in Table 4-1.

Table 4-1. Sample Container and Preservation Requirements for Sediment Samples

Media	Parameter	Sample Jar	Preservative	Holding Time
Sediment	Analysis of Metals, Revision 11.0, 7/25/2022, SW-846-6020D	One time 8-ounce or larger wide-mouth glass jar	0 to 6°C	180 days to analysis
Sediment	TOC in Soil SW-846 Method 9060	One time 4-ounce or larger wide-mouth glass jar	0 to 6°C	28 days
Sediment	TCLP for Inorganic and Non-Volatile Organic Analytes, Revision 13, 06/20 SW 846 1311	Two time 8-ounce or larger wide-mouth glass jar	0 to 6°C	14 days to TCLP 180 days to analysis

Table 4-1. Sample Container and Preservation Requirements for Sediment Samples

Media	Parameter	Sample Jar	Preservative	Holding Time
Sediment	ASTM E112 Grain size number	One time 8-ounce or larger wide-mouth glass jar	N/A	N/A
Sediment	ASTM D4318 Standard test liquid limits - Atterberg	One time 8-ounce or larger wide-mouth glass jar	N/A	N/A
Sediment	ASTM D2216 Standard test method for laboratory determination of water content of soils	One time 8-ounce or larger wide-mouth glass jar	N/A	N/A

°C = degree(s) Celsius

mL = milliliter(s)

N/A = not applicable

5. Seep Sampling

Six stations have been identified for the collection of seep samples. The purpose of seep sampling and analysis is to determine whether groundwater entering the Yacht Basin and Northshore Area has the potential to recontaminate the sediment. Additional sampling of porewater from the Yacht Basin may be required to support remedial design based on review of the PDI data collected under this FSP.

The limits of the seep sample areas are shown on Figure 5-1. Seep samples will be collected along the western beach along the Yacht Basin and near the WSDOT Ferry Terminal. Exact sample locations will be identified during a site reconnaissance prior to mobilization.

5.1 Seep Sampling Methods

Seep samples will be collected from the shoreline and intertidal area using the syringe method (FOP 999, Appendix A). Seep samples will be collected at the surface from visible seeps. Water quality parameters (pH, temperature, conductivity, dissolved oxygen, oxidation-reduction potential, and turbidity) will be measured in seawater and the seeps in the field to assess whether the seeps are influenced by tidal drainage. Seep samples will be analyzed for total and dissolved arsenic, copper, lead, and zinc. Samples will be field-screened for dissolved metals by attaching a 0.45-micron filter to the syringe and purging the water through the filter and into the sample container. Silicon tubing will be replaced between each station.

5.2 Water Quality Parameters

Water quality parameters (pH, temperature, conductivity, dissolved oxygen, oxidation-reduction potential, and turbidity) in seawater and seep water will be measured using a Myron L 6P multimeter or equivalent water quality meter. The meter will be calibrated following manufacturers recommendation using a standardized calibration fluid. For further detail, reference FOP 03 in Appendix A. Seep samples will be collected on flood tide while the seep is still exposed to allow for as much seawater as possible to drain prior to sampling.

5.2.1 Seep Sampling Log

Seep sampling data will be recorded using project-specific forms in the field for the following observations and information:

- Seep sampling location
- Purge volume
- Water quality parameters (pH, temperature, conductivity, dissolved oxygen, oxidation-reduction potential, and turbidity)

The field log form is provided in Appendix B.

5.3 Seep Sample Containers

The sample containers for the seep samples are described in Table 5-1.

Table 5-1. Sample Container and Preservation Requirements for Seep Samples

Media	Parameter	Sample Jar	Preservative	Holding Time
Groundwater	Analysis of Dissolved Metals, Revision 11.0, 7/25/2022, SW-846-6020D	500 mL poly	0 to 6°C HNO_3 (field filtered)	180 days to analysis (28 days for mercury
Groundwater	Analysis of Metals, Revision 11.0, 7/25/2022, SW-846-6020D	500 mL poly	0 to 6°C HNO_3	180 days to analysis (28 days for mercury

HNO_3 = nitric acid

mL = milliliter(s)

6. Analytical Requirements

Surface sediment samples from the Moderate Impact Area, the Nearshore/Offshore Area, the Northshore Area, and the Yacht Basin will be analyzed for arsenic, copper, lead, and zinc. Additionally, surface sediment samples from the Northshore Area and the Yacht Basin will be analyzed for grain size, TOC, percent solids, and Atterberg Limits to support remedial design.

Sediment core samples in the Yacht Basin and Northshore Area will be analyzed for arsenic, copper, lead, and zinc, and will also be analyzed for grain size, TOC, percent solids, and Atterberg Limits to support remedial design. An additional four core samples (one from the Northshore Area and three from the Yacht Basin) will be analyzed for TCLP 8 RCRA metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) and total PAHs for waste characterization of dredged material in support of design.

Seep samples collected will be analyzed for total and dissolved select metals (arsenic, copper, lead, and zinc).

Sample containers, analytical methods, preservation requirements, holding times, and sample sizes are provided for all analyses in Tables 4-1 and 5-1.

7. Field Quality Assurance and Quality Control

QC samples will be collected to assist in determining data quality and reliability. QC samples will be collected using the same procedures and immediately following collection of the target or normal sample. Field QA and QC samples for chemical and physical analyses on environmental media will be collected at the following frequencies:

- **Field duplicates:** 10 percent (1 per 10 field samples). A field duplicate is an independent sample collected as close as possible to the original sample from the same source and is used to assess sampling precision. Field duplicates will be labeled in accordance with procedures outlined in Section 8.2.2 and packaged in the same manner as normal samples. Each duplicate will be taken using the same sampling and preservation method as other samples.
- **Matrix spike/matrix spike duplicate (MS/MSD) (collect triple sample volume):** 10 percent (1 per 10 field samples for bulk sediment and surface water). An MS is an aliquot of a sample spiked with a known concentration of target analyte(s). An MS analysis provides a measure of the method accuracy. An MSD is a laboratory split sample of the MS and is used to determine the precision of the method. Twice the normal sample volume will be collected for these QC samples. Laboratory QC samples will be labeled as such (that is, MS/MSD) on sample bottles and chain-of-custody forms.
- **Equipment blanks (EBs):** Blanks will be collected on sampling equipment (aluminum pan, spoon, and metal spatula and power grab) for each matrix sampled and will be collected at a rate of one per week per matrix per equipment. EBs are collected by passing Type II (deionized) water over sampling equipment and collecting the rinsate into laboratory provided containers. EBs will not be collected from the syringes that will be used for the seep samples. They are disposable and a new one will be used each time.

Refer to Worksheet #20, Field Quality Control Summary, in the QAPP for more details.

8. General Field Procedures

This section describes the general field procedures to be followed during the PDI field activities. The FOPs are provided in Appendix A, and field forms are provided in Appendix B.

8.1 Recordkeeping

A written record of sampling activities and field observations will be maintained in a bound, water-resistant field notebook with consecutively numbered pages. Entries will be legibly written in black or blue, indelible ink. Entry errors will be corrected by drawing one solid line through the incorrect entry, followed by the user's initials and date. The end of each workday or task will be signed and dated by the individual making the entries. Factual and objective language will be used. Entries will be complete and accurate enough to allow reconstruction of each field activity. Activities should be recorded contemporaneously. When not in use, the logbook will be stored in the permanent project file. After completion of sampling activities, the field notebooks will be in the custody of the CH2M project manager. Additional guidance is included in FOP 1.

Daily entries of the following information at a minimum will be recorded in the logbook, when applicable:

- Date and time, expressed in 24-hour format
- Time of arrival and departure from the site
- Meteorological and water conditions (including tidal conditions)
- Project personnel and subcontractor personnel onsite
- Any visitors onsite, their representative company, and their level of protection
- Health and safety hazards and precautions
- Level of personal protection
- Field observations
- Task start/stop times
- Time of each entry
- Duration of sampling activities
- Site ID (visual sketches where appropriate)
- Location of sampling points (visual sketches where appropriate)
- Description of sample
- Sample ID and analyses to be completed
- Number of samples taken
- Time of sample collection
- QA and QC samples taken
- Type of field instrumentation (if any)
- Names of people collecting samples
- Water depth per station location
- Comments on sampling (e.g., equipment or sampling difficulties)
- Volume of sample return
- Decontamination procedures
- Equipment calibration records and all calibrations done
- Any other field instruments, general observations, or notes
- Any deviations from the sampling plan or sampling protocol, if any
- Health and safety observations
- Signature of recorder

8.1.1 Daily Report

A Daily Field Report will be provided to the client by 1200 PST the following day after any sampling or field activities. The Daily Field Report will include CH2M staff, subcontractors, EPA staff, visitors, weather conditions, tidal information, deviations from the QAPP, summary of daily tasks, future activities, and photos that capture the activities conducted (approximately 10).

8.1.2 Photographic Log

Digital photographs will be taken in the field to document sampling locations, collected samples, site conditions, and any other site-related observations. A photographic log will be kept in which the date, location, photograph ID number, brief photographic description, and direction the photographer is facing (if appropriate), and photographer. Photographs and relevant log information will be downloaded onto a field computer on a regular basis and uploaded into the Photographic Log in Appendix B.

8.2 Sample Management

Sample management will be performed in accordance with FOP 7 and the procedures presented in Sections 8.2.1 and 8.2.2.

8.2.1 Sample and Analysis Database

A planning electronic data deliverable will be submitted to the laboratories requesting specified analyses by the field lead. Data from the field will be collected, recorded on standardized forms, entered into a field electronic data deliverable, and submitted to a database. The laboratory will submit a laboratory electronic data document with the electronic data deliverable.

8.2.2 Sample Identification

A sample numbering system will be used to identify each sample, including duplicate samples. The sample number will be a unique identifier.

Each sample, regardless of analytical protocol, will also be assigned a CH2M site-specific identifier, which will contain a site, media, and sample specific location identifier that indicates where the sample was obtained. Sediment samples will also use a numbering system that will include the sample depth.

The sample number and station location identifier, as described in Section 8.2.2.1, will be included on the sample tag and the chain-of-custody record.

The site-specific identifier is based on the following system.

8.2.2.1 Surface and Core Sediment Samples

Sediment samples will be identified as follows:

[Site]-[Media]-[Station Location]-[Depth Indicator]

Where:

[Site] = The site references the OU6 Asarco Sediments Superfund Site, which will be identified as “OU6” on the sample.

[Media] = This refences the media sampled:

- Surface Sediment "SS"
- Core Sediment "CS"

[Station Location] = This identifier identifies the unique name of the sampling location. For example, a sediment sample collected from sediment location 1 would be identified as "001" on the sample.

[Depth Indicator] = This identifies the top and bottom depth intervals, separated by a slash. The depth will be represented in feet bml. For example, "1.0/2.0" indicates a sample collected from an interval of 1.0 to 2.0 foot bml.

Example:

OU6-SS-001-1.0/2.0 is a subsurface sediment sample collected from soil core location 1, collected from an interval of 1.0 to 2.0 foot bml.

8.2.2.2 Aqueous Samples

Seep samples will be identified as follows:

[Site]-[Media]-[Station Location]-[Date]

Where:

[Site] = The site references the OU6 Asarco Sediments Superfund Site, which will be identified as "OU6" on the sample.

[Media] = This refences the media sampled:

- Seep Water "SW"

[Date] = This identifier indicates the date the sample was collected. The date will be identified using a MMDDYY format.

Example:

OU6-SW-SP01-101624 is a seep sample collected from seep location SP-01 on October 16, 2024.

8.2.2.3 Field Quality Assurance and Quality Control Samples

Field QA/QC samples will be identified using the following identifiers:

- EBs that are not associated with an individual station location, are numbered sequentially, and are identified by the first two letters of the station location code.
- Field duplicates will be submitted in the same format as the normal sample, but with "-FD" at the end.
- MS/MSD samples are not identified in the station location identifier but on the chain-of-custody form.

Examples:

- OU6-EB-001 is the first EB collected.
- OU6-SW-SP01-101624-FD is a field duplicate for the groundwater sample collected from seep location SP-01 on October 16, 2024.

8.2.2.4 Investigation-derived Waste Samples

IDW samples will be identified as follows:

[Site]-[IDW]-[Media]-[Date]

Where:

[Site] = The site references the OU6 Asarco Sediments Superfund Site, which will be identified as "OU6" on the sample.

[IDW] = This indicates the sample is an IDW sample.

[Media] = This refences the media sampled, or "SO" for soil and "W" for liquid.

[Date] = This identifier indicates the date the sample was collected. This is required for IDW samples because multiple IDW samples may be collected in a day. The date will be identified using a MMDDYY format.

Examples:

- OU6-IDW-SO-101624 is a soil IDW sample collected on October 16, 2024.
- OU6 -IDW-W-101624 is a liquid IDW sample collected on October 16, 2024.

8.2.2.5 Field Quality Assurance and Quality Control Samples

Field QA/QC samples will be identified using the following identifiers:

- EBs that are not associated with an individual station location, are numbered sequentially, and are identified by the first two letters of the station location code.
- Field duplicates will be submitted in the same format as the normal sample, but with "-FD" at the end.
- MS/MSD samples are not identified in the station location identifier but on the chain-of-custody form.

Examples:

- OU6-EB-001 is the first EB collected.
- OU6-SW-SP01-101624-FD is a field duplicate for the groundwater sample collected from seep location SP-01 on October 16, 2024.

8.3 Sample Shipment

Sediment and all associated QA/QC samples will be shipped to the following analytical laboratories:

Laboratory and Analyses	Point of Contact and Shipping Address
TBD	TBD

To minimize the potential for sample degradation and to maintain a temperature from 0 to 6°C, sediment samples will be chilled in a cooler with ice in resealable plastic bags. The chain-of-custody form and a QA sample form, if required, will be filled out in indelible ink, placed in a resealable plastic bag, and taped to the inside lid of the shipping cooler.

The following procedures will be implemented in packing environmental samples:

- Check the sample container caps to make sure they are tightened properly. (Samples for volatile components must be discarded and recollected if the cap is loose.)
- Tape over the drain hole on the inside of the cooler.
- Place a layer of cushioning material in the bottom of the cooler.
- Enclose each bottle in a separate, clear, plastic bag and seal each bag. Place the bottles upright in the cooler and separate with packing materials so that they will not touch against each other during shipment. Place additional cushioning material around sample bottles, and fill voids between bottles.
- Place ice substitute between samples and over the containers to preserve them at or below 4°C. (Note: Loose bagged ice is not acceptable if coolers are transported by commercial aircraft.)
- Fill the cooler with cushioning material.
- Tape the cooler drain shut from the outside of the cooler.
- Place completed chain-of-custody form inside a resealable bag and tape the bag to the inside lid of the cooler.
- Close and latch the cooler. Wrap a strong adhesive tape around the ends of the cooler to secure it, making sure to cover the spigots at the bottom and any open space between the lid and the cooler. Tape the cooler latch closed with strapping tape.
- Seal the cooler with custody seals on the front and the sides and seal the cooler with strapping tape. The signature on the custody seals should match the signature on the chain-of-custody form.
- Attach the completed shipping label to the top of the cooler; print “Laboratory Samples” and “This End Up” on the top of the cooler; and put upward-pointing arrows on all four sides. Place “Fragile” and “Chill, Do Not Freeze” labels on at least one side.

Samples will be packaged for shipment according to U.S. Department of Transportation (DOT) regulations. Marking and labeling procedures will be consistent with DOT regulations. The method of shipment, courier name(s), and other pertinent information will be entered on the chain-of-custody form. Air bills will be properly completed, and copies will be retained and placed in the project file.

For environmental samples, no DOT marking, labeling, or shipping papers are required, and there are no DOT restrictions on the mode of transportation. DOT regulations do not apply to transport by government-owned vehicles, including aircraft.

8.4 Equipment Calibration and Inspections

All equipment used at the site will be calibrated according to the manufacturer specifications, if necessary. Field equipment will be calibrated before the start of work and at the end of the sampling day.

Any instrument drift from prior calibration will be recorded in the field notebook. Equipment found to be damaged, inoperable, or out of calibration will not be used until the discrepancy is corrected and verified by the field task manager or designee. As necessary, a detector sensitivity or test grid may be used to test the functionality before daily use, and results documented accordingly. Once equipment has been used, it will be maintained following manufacturer recommendations, and at intervals recommended by the manufacturer.

8.5 Equipment Decontamination

Decontamination of reusable sampling equipment will be conducted consistently to minimize the potential for cross-contamination.

The decontamination procedure will be used between sampling locations using the procedures outlined in FOP 6 (Appendix A). Large sampling equipment that does not come into direct contact with the sediment samples (specifically, the grab sampler and vibracore barrel) will be decontaminated prior to mobilization, then rinsed with site water between stations.

Disposable equipment intended for one-time use that is factory wrapped generally does not need to be decontaminated before use (if evidence of contamination is present, the disposable equipment will be discarded and not used). One-time use, disposable, sampling equipment and accessories will be discarded once used and a new set of equipment will be used for each subsequent sample. Disposable sampling equipment will be used as much as practical including nitrile gloves. Decontamination liquids and solids will be collected and disposed on land in an approved wastewater receptacle.

8.6 Waste Management and Disposal

Waste generated during this investigation will consist primarily of decontamination water, PPE, disposable materials used for sample collection and processing, and leftover sediment from core processing.

8.6.1 Management and Disposal Practices

Containerized solid wastes will be placed in appropriately sized and rated containers, characterized, and disposed of at an appropriate EPA-approved waste facility in accordance with the waste management plan. To the extent possible, any excess water or sediment remaining after surface sediment will be returned to the collection site. The deck of the sampling vessel will be washed down using site water before the vessel moves to the next station. Sediment cores will collected and processed on shore, and excess sediment will be containerized and disposed of as IDW. Containerized liquid wastes, including decontamination water from the processing area, will be accumulated at the onsite designated waste accumulation area in secondary containment. PPE and disposable materials associated with nonhazardous wastes will be put into black trash bags and disposed of in a municipal waste bin onsite. Used core tubes will either be cleaned and recycled or managed with miscellaneous debris.

The drum/container log will be completed, and photographic documentation of the secure onsite waste accumulation area will be completed in accordance with FOP 1. Waste sampling will be performed in accordance with FOP-10 and managed in accordance with applicable local, state, and federal regulations, and the waste management plan.

The waste disposal subcontractor will provide services including preparation of profiles and manifests and transportation and waste disposal. Waste management activities will be coordinated with CH2M

waste management specialists. and a qualified subcontractor. Treatment, storage, and disposal facilities review and approve in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act Offsite Rule (40 *Code of Federal Regulations* 400.330), and appropriate out-of-state notification will be made in accordance with the requirements of the Settlement Agreement.

8.6.2 IDW Sample Containers

The sample jars for waste characterization sampling are described in Table 8-1.

Table 8-1. Sample Container and Preservation Requirements for IDW Sampling

Media	Parameter	Sample Jar	Preservative	Holding Time
IDW–Solid	TCLP RCRA 8 Metals - TCLP for Inorganic and Non-Volatile Organic Analytes, 06/20 SW 846 1311, 6020/7470, 8270	Two time 8-ounce or larger wide-mouth glass jar	0 to 6°C	14 days to TCLP 180 days to analysis
IDW–Solid	Total PAHs SW846 8270C	One time 4-ounce or larger wide-mouth glass jar	0 to 6°C	14 days to extraction 40 days to analysis
IDW–Aqueous	Total RCRA 8 Metals - Analysis of Metals, 7/25/2022, SW-846-6020D	One time 500 mL poly	0 to 6°C HNO_3	180 days to analysis (28 days for mercury)
IDW–Aqueous	Total PAHs SW846 8270C	Two time 1-liter glass amber	0 to 6°C	7 days to extraction 40 days to analysis

9. Field Data Management

Field observations and measurement data will be recorded on dedicated field forms or field notebooks to create a permanent record of field activities. All hand-entered data will be reviewed by a second person to minimize data entry errors. A check for completeness of field records (e.g., logbooks, field forms, databases, and electronic spreadsheets) will ensure that all requirements for field activities have been fulfilled, complete records exist for each activity, and the procedures specified in this FSP have been implemented. Field documentation will ensure sample integrity and provide enough technical information to re-create each field event using the guidelines in FOP 1.

Field data collected will be reviewed by the respective field sampling leaders to determine whether the qualitative parameters of representativeness and comparability have been achieved. In general, the review will be accomplished by comparing the chain-of-custody and field notebook entries with the sampling requirements. Any deficiencies will be communicated to the project manager immediately to determine what corrective action, if any, should be implemented.

The analytical data from the laboratory will be reviewed and validated in accordance with the QAPP.

10. Health and Safety

All field survey and sediment sampling activities will be conducted according to CH2M's Health, Safety, and Environment program requirements, which include project-specific field safety instructions. In accordance with CH2M policy, all CH2M field team members and subcontractors must successfully satisfy all CH2M and site-specific health and safety requirements before working on the site, including Drug-Free Workplace training, wearing required PPE, and other requirements of the field safety instructions. Employees working over or near water will be provided with U.S. Coast Guard-approved life jackets or buoyant work vests.

For more information, reference the project-specific Asarco OU6 HASP (which includes an emergency response plan).

11. References

CH2M HILL, Inc. (CH2M). 2024a. *Revised Health and Safety Plan*. January.

CH2M HILL, Inc. (CH2M). 2024b. *Uniform Federal Policy Quality Assurance Project Plan, Operable Unit 6 – Asarco Sediments, Commencement Bay Nearshore/Tideflats Superfund Site*. July.

Federal Geographic Data Committee (FGDC). 2002. *Geospatial Positioning Accuracy Standards, Part 4: Standards for Architecture, Engineering, Construction (A/E/C) and Facility Management*. FGDC-STD-007.4-2002.

Federal Geographic Data Committee (FGDC). 1998. *Geospatial Positioning Accuracy Standards, Part 3: National Standard for Spatial Data Accuracy*. FGDC-STD-007.3-1998.

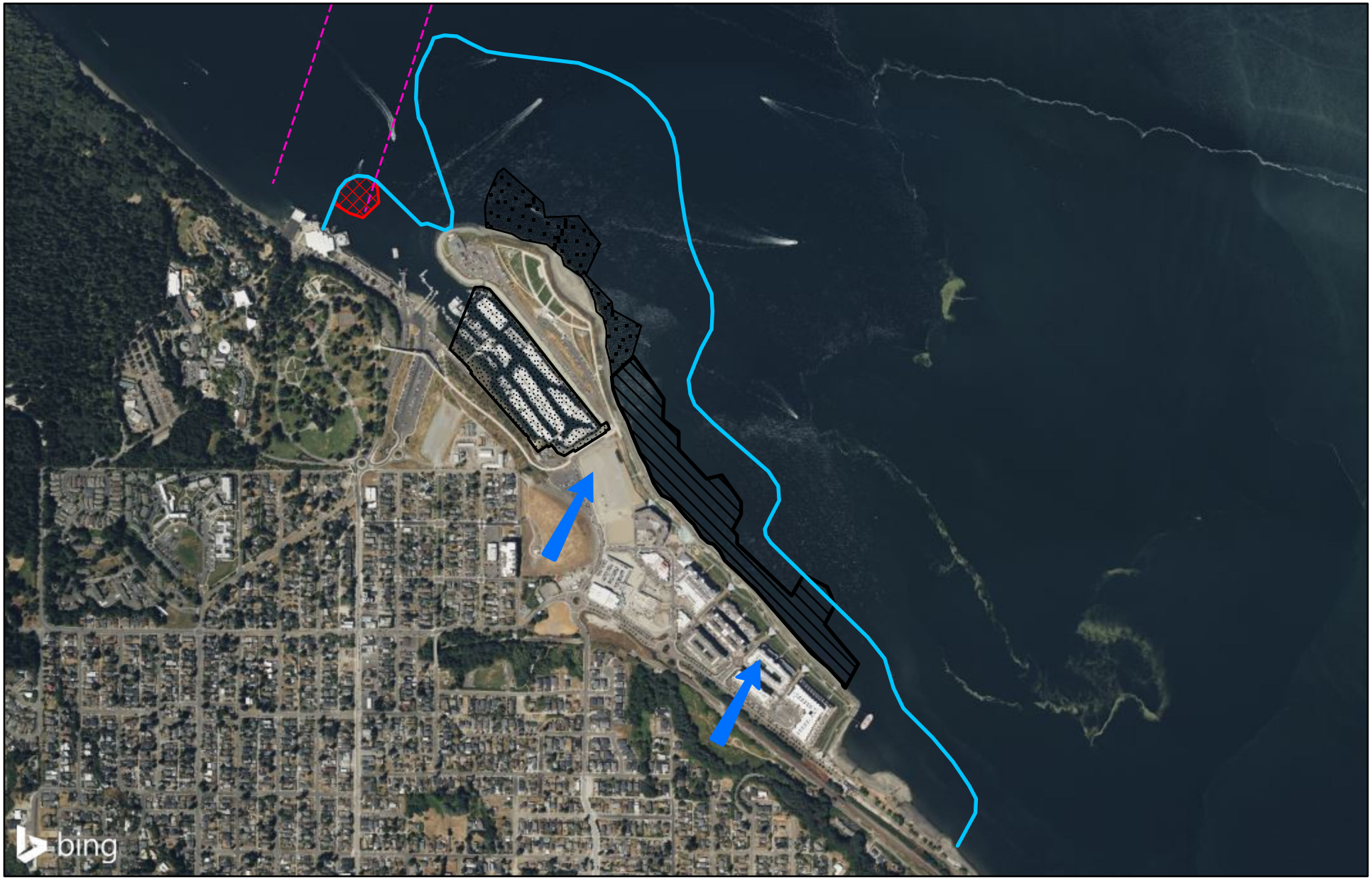
Hydrometrics, Inc. 2018. *Operation, Maintenance, and Monitoring Plan for Smelter Cap Shoreline Armoring and Utilities*. September.

U.S. Environmental Protection Agency (EPA). 2000. *Superfund Record of Decision, Commencement Bay, Near Shore/Tide Flats, OU6, Pierce County, WA*. July. 2000.

Washington Department of Fish and Wildlife (WDFW). 2008. *Eelgrass/Macroalgae Habitat Interim Survey Guidelines.* June.

Washington Department of Natural Resources (DNR). 2019. Puget Sound Eelgrass Monitoring Data Viewer.

Figures



LEGEND

- Groundwater Flow
- Moderate Impact Area
- Nearshore Cap by Point Ruston
- Northshore Area
- Breakwater Peninsula Area
- Yacht Basin
- Cable Area

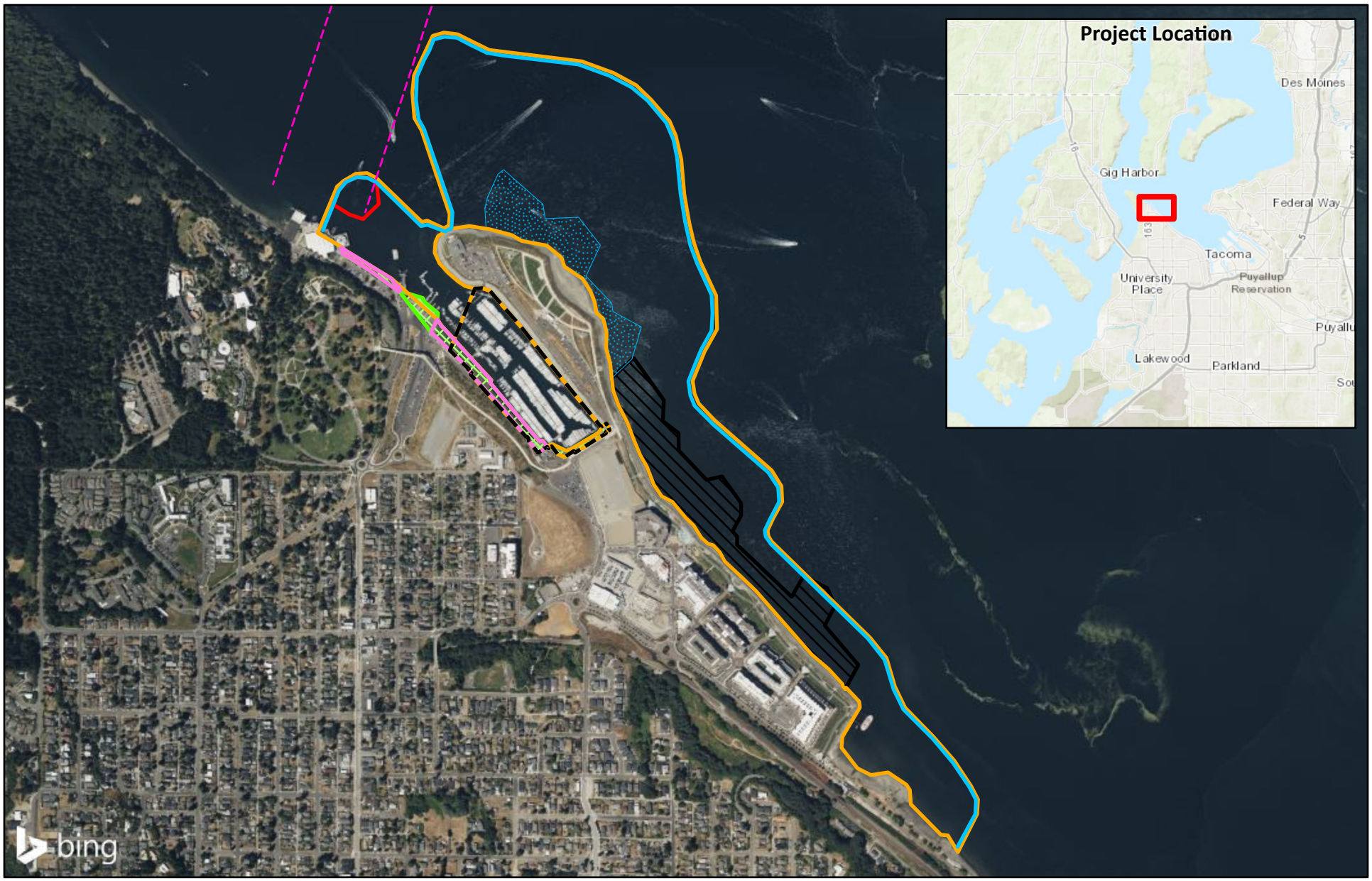
N

0 1,600 Feet

Scale: 1:20,000 1 in. = 1,667 ft.

Figure 1-1
Marine Sediment Remedy
ASARCO Operable Unit 6
Tacoma, Washington

ch2m



LEGEND

- Sediment Sampling and Bathymetric Survey Boundary
- Seep Sampling Boundary
- Upland Survey Boundary
- Breakwater Peninsula Area
- Moderate Impact Area
- Northshore Area
- Yacht Basin
- Nearshore Cap by Point Ruston
- Cable Area

N

0 1,600 Feet

Scale: 1:20,000 1 in. = 1,667 ft.

Figure 3-1
Site Layout
ASARCO Operable Unit 6
Tacoma, Washington

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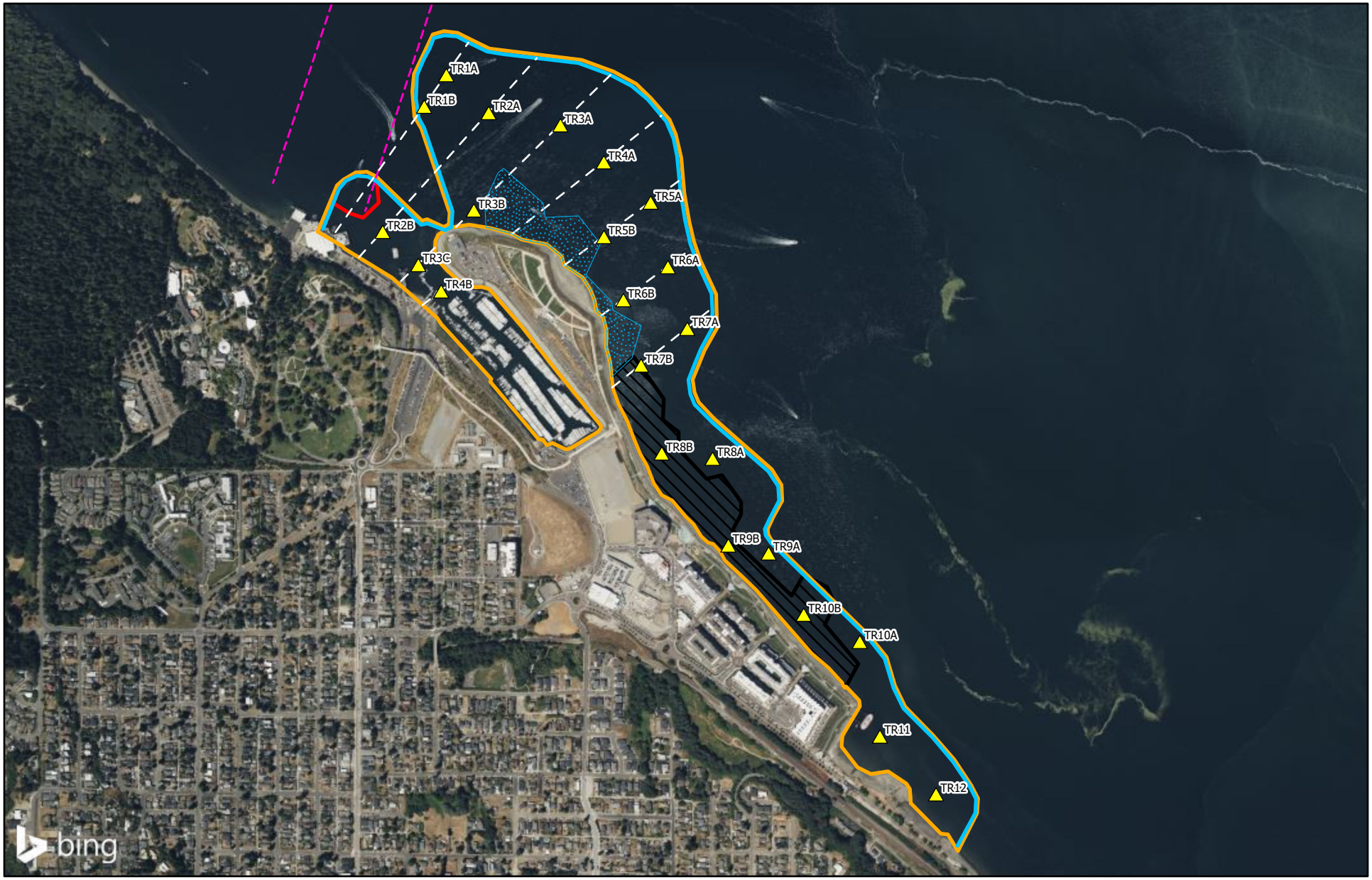

LEGEND

- Proposed Surface Sediment Sample Locations
- Proposed Sample Transects
- Sampling and Bathymetric Survey Boundaries
- Moderate Impact Area
- Northshore Area
- Breakwater Peninsula Area
- Nearshore Cap by Point Ruston
- Cable Area

N

0 1,600 Feet

Scale: 1:20,000 1 in. = 1,667 ft.

Figure 4-1
Surface Sediment Sample Locations-
Moderate Impact Area
ASARCO Operable Unit 6
Tacoma, Washington

ch2m

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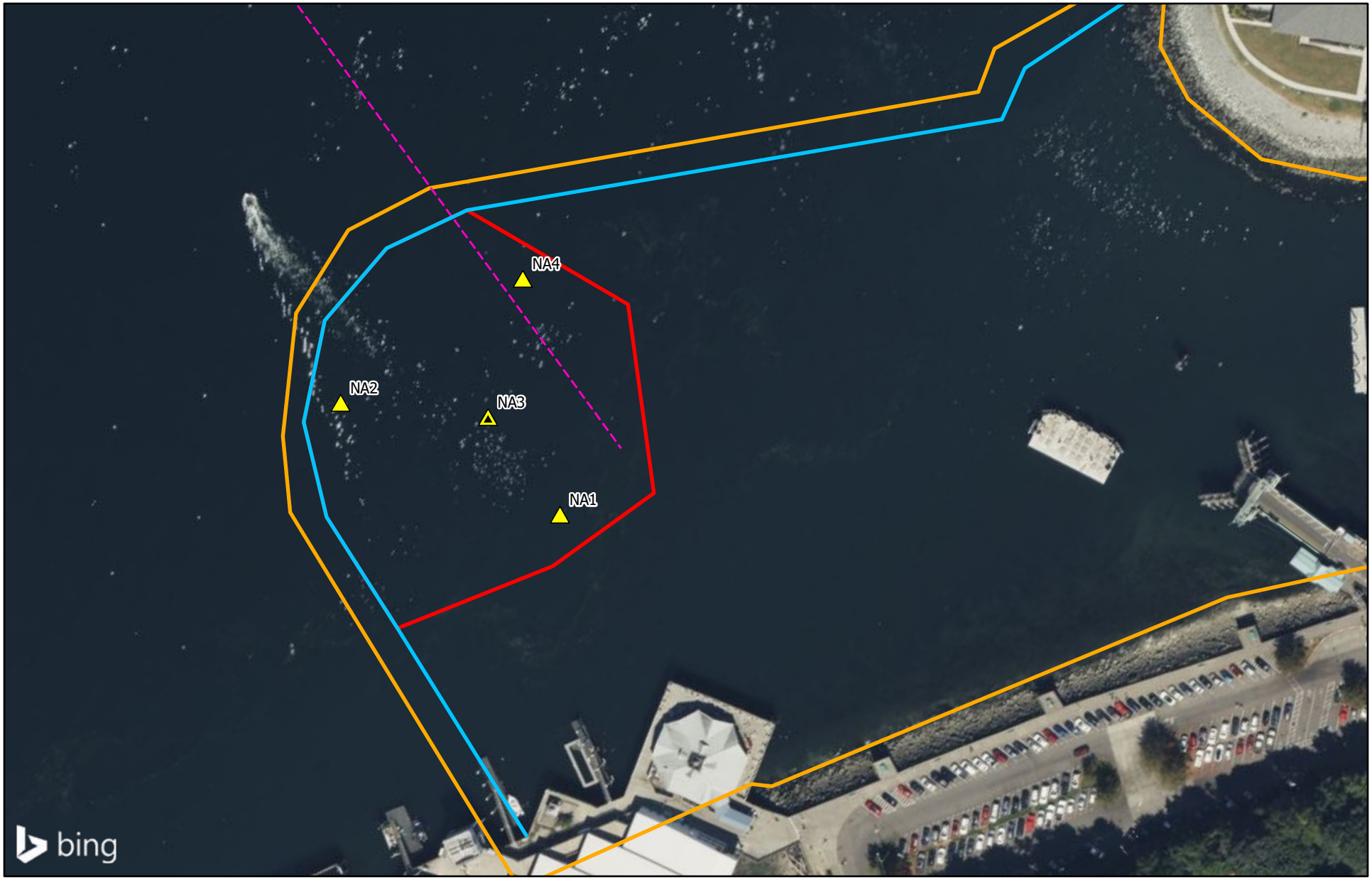

LEGEND

- Proposed Surface Sediment and Core Location
- Core Sample for TCLP Analysis
- Sediment Sampling and Bathymetric Survey Boundary
- Moderate Impact Area
- Northshore Area
- Cable Area

N

0 240 Feet

Scale: 1:2,284 1 in. = 190 ft.

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Figure 4-2
Surface Sediment and Core Sample Locations - Northshore Area
ASARCO Operable Unit 6
Tacoma, Washington

ch2m

LEGEND

- Proposed Surface Sediment and Core Location
- Core Sample for TCLP Analysis

N

0 240 Feet

Scale: 1:3,200 1 in. = 267 ft.

**Points were digitized from Parametrix (2004) and represent the approximate station locations. Locations YB16 and YB18 were slightly adjusted to avoid structures.*

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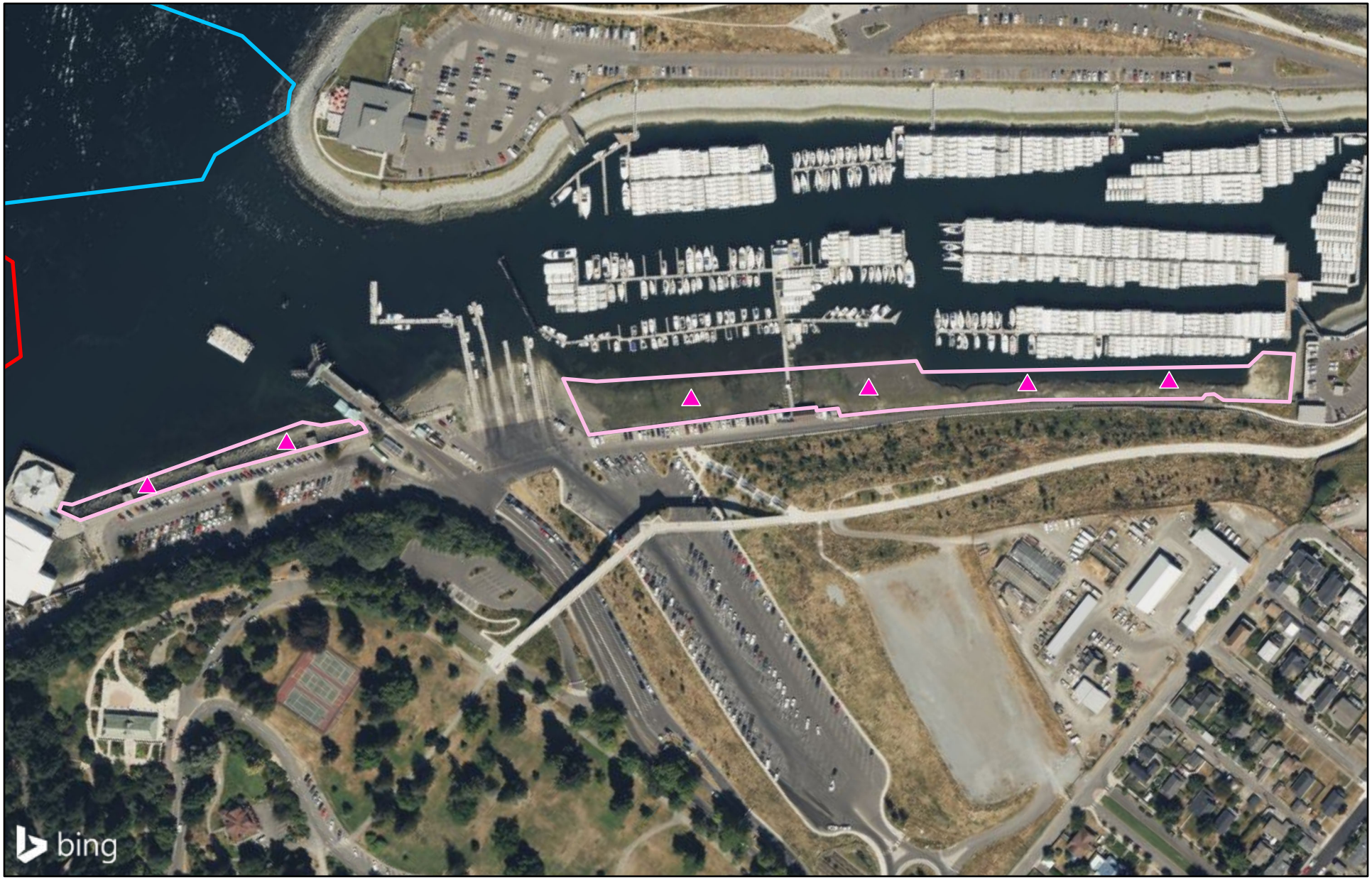
Figure 4-3
Surface Sediment and Core Sample Locations - Yacht Basin
ASARCO Operable Unit 6
Tacoma, Washington

ch2m



LEGEND

- Proposed Conceptual Seep Sample Location
- Moderate Impact Area
- Northshore Area
- Seep Sample Boundaries

Note: Actual seep sample locations will be identified during a site reconnaissance.

0 400 Feet

Scale: 1:4,600 1 in. = 383 ft.

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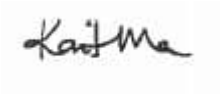
Figure 5-1
Seep Sample Locations
ASARCO Operable Unit 6
Tacoma, Washington

ch2m

Appendix A
Field Operating Procedures

Field Operating Procedure-01
Note Taking and Field Logbook

Author: Kaitlin Ma 5/4/2022 

Author

Approver: Kimberly Amley 5/4/2022 

Program Quality Manager

FIELD OPERATING PROCEDURE 01

Note Taking and Field Logbook

1.1 Purpose

This Field Operating Procedures (FOP) presents general guidelines for recording field and sampling information in a field logbook.

1.2 Scope

This is a general description of how to record field and sampling information in a field logbook to support site characterization, risk assessment, and evaluation of remedial alternatives.

1.3 Equipment and Materials

- Field logbook
- Indelible black ink pen
- Write-in-the-rain pen (for extreme weather conditions—cold/rain)

1.4 Procedures and Guidelines

- All information pertinent to a field or sampling effort will be recorded in a bound field logbook that will be initiated at the start of the first onsite activity. The field logbook will consist of a bound notebook with consecutively numbered pages that cannot be removed. The outside front cover of the logbook will contain the project (site) name and the specific activity (for example, supplemental remedial investigation). The inside front cover will include the following:
- Site name and U.S. Environmental Protection Agency task order number
- Project number
- Project Manager's name and mailing address
- Sequential logbook number
- Start date and end date of logbook

Each page will be consecutively numbered, dated, and initialed. All entries will be made in indelible black ink, and all corrections will consist of line-out deletions that are initialed and dated. If only part of a page is used, the remainder of the page should have an "X" drawn across it. At a minimum, entries in the logbook will include the following:

- Time of arrival and departure of site personnel, site visitors, and equipment
- Instrument calibration information, including make, model, and serial number of the equipment calibrated
- Description of significant activities for the day

- Documentation of photographs taken during field activities (for example, date, time, and description of photograph)
- Field observations (for example, sample description, weather, unusual site conditions or observations, and sources of potential contamination)
- Detailed description of the sampling location, including a sketch when necessary
- Details of the sample site (for example, coordinates [*x*, *y*], water elevation [*z*], casing diameter and depth, and integrity of the casing)
- Sampling methodology and matrix, including distinction between grab and composite samples
- Names of field team members and subcontractors
- Start or completion time of sample collection activities
- Field measurements (for example, water depths and sediment probe depths)
- Type of sample (for example, sediment, groundwater, surface water, soil, and debris)
- Number, depth, and volume of sample collected
- Field sample number
- Requested analytical determinations
- Sample preservation
- Quality control samples associated with the sample
- Sample shipment information including chain-of-custody form number and laboratory, carrier, date, and time
- Health and safety issues (including level of personal protective equipment)
- Signature and date by personnel responsible for observations

Sampling situations vary widely. No general rules can specify the extent of information that must be entered in a logbook. However, records should contain sufficient information so that someone can reconstruct the sampling activity without relying on the collector's memory.

1.5 Records Retention and Management

Project records will be managed in accordance with the DES CLIN 3 Quality Management Plan. Project documents and records will be retained for 10 years after the closing date of the prime contract. All information generated under this program is considered to be confidential and shall not be released to others without the written consent of the Contract Officer.

1.6 Quality Control and Quality Assurance

The field notes will be reviewed by the Site Quality Control Manager at the end of each work day performed.

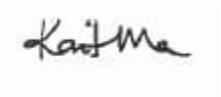
1.7 Attachments

None.

1.8 References

CH2M HILL, INC. *Quality Management Plan for U.S. Environmental Protection Agency Remedial Acquisition Framework (RAF) Design and Engineering Services (DES) Contract CLIN 3*. May 2022.

Field Operating Procedure-03
Field Water Quality Measurements and Calibration

Author: Kaitlin Ma 5/4/2022 

Author

Approver: Kimberly Amley 5/4/2022 

Program Quality Manager

FIELD OPERATING PROCEDURE-03

Field Water Quality Measurements and Calibration

1.1 Purpose

This field operating procedure (FOP) provides a general guideline for using the YSI 600XLM or similar device for field water quality measurements such as pH, specific conductance, dissolved oxygen, ORP, and temperature and using a HACH turbidity meter or similar device for measuring turbidity. The operator's manual should be consulted for detailed calibration and operating procedures.

1.2 Scope

All water quality measurements will be taken in accordance with this FOP. Record keeping to document calibration activities and environmental sample results will be documented in the field log book in accordance with *FOP-01 Note Taking and Field Logbook*.

1.3 Equipment and Materials

- Nitrile gloves
- Field Notebook
- YSI 600XLM Water Quality Meter, or similar device
- Distilled or deionized water in spray bottle
- Nonionic detergent in spray bottle
- Calibration standard solution for pH (4, 7, and 10), conductivity, and ORP
- HACH turbidity meter, or similar device

1.4 Procedures and Guidelines

1.4.1 Calibration

Prior to each day's use, clean the YSI probe according to the manufacturer's direction and calibrate using specified solutions. Follow the instructions provided with the water quality meter. If there is a problem with calibration, the meter will return an error. In this case, the cause of the error must be researched in the manual or with the supplier of the equipment before using. Calibrate temperature probe with a laboratory grade thermometer using hot and cold tap water to establish accuracy over a range of temperatures.

Prior to each day's use, confirm calibration of the HACH turbidity meter according to the manufacturer's direction. Turbidity will be measured in NTUs.

1.4.2 Sample Measurement

As the water passes through the probe, allow readings to stabilize and record in the field notebook or on proper documentation sheets.

1.5 Records Retention and Management

Project records will be managed in accordance with the DES CLIN 3 Quality Management Plan. Project documents and records will be retained for 10 years after the closing date of the prime contract. All information generated under this program is considered to be confidential and shall not be released to others without the written consent of the Contract Officer.

1.6 Quality Control and Quality Assurance

- Verify meters are calibrated
- Clean probe with nonionic detergent such as Alconox® Powdered Precision Cleaner and rinse with deionized or distilled water before calibrating, between calibration fluids, and when done
- Refer to operations manual for recommended maintenance
- Check batteries, and have a replacement set on hand
- Store the YSI probe must be stored in non-deionized water when not in use to prevent damage to the DO membrane. If the membrane is damaged, the replacement method can be found in the manual.
- The field notes will be reviewed by the Site Quality Control Manager at the end of each work day performed.

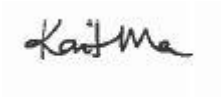
1.7 Attachments

None.

1.8 References

CH2M HILL, INC. *Quality Management Plan for U.S. Environmental Protection Agency Remedial Acquisition Framework (RAF) Design and Engineering Services (DES) Contract CLIN 3*. May 2022.

Field Operating Procedure-04
Groundwater Sampling Procedures

Author: Kaitlin Ma 5/4/2022 

Author

Approver: Kimberly Amley 5/4/2022 

Program Quality Manager

FIELD OPERATING PROCEDURE-04

Groundwater Sampling Procedures

1.1 Purpose

This field operating procedure (FOP) presents general guidelines for collecting groundwater or groundwater grab samples from monitoring wells using low-flow sampling techniques. *FOP-02 Water Level and Total Depth Measurements* should be consulted in conjunction with this FOP.

1.2 Scope

This FOP is applicable to low-flow sampling techniques. This FOP does not cover purging and sampling of monitoring wells by bailing or other high-flow methods. Refer project-specific requirements for material or equipment substitutions, as applicable.

1.2.1 Water Quality Indicator Parameters

The six field indicator parameters to be monitored include dissolved oxygen, turbidity, ORP, specific conductance, pH, and temperature. Of the parameters, dissolved oxygen, ORP, specific conductance, pH, and temperature are moderately to extremely sensitive to contact with atmospheric oxygen and will be measured in-line using a flow-through cell. Turbidity also will be measured separately to reduce the influence of suspended solids that are retained in the flow-through cell. Indicator parameters will be monitored continuously during purging and values recorded every 5 minutes or whenever at least one system volume has cycled through the flow cell.

1.2.1.1 Dissolved Oxygen, ORP, Specific Conductance, pH, and Temperature

The stabilization criteria for dissolved oxygen, ORP, specific conductance, pH, and temperature are three successive readings separated by a time interval sufficient to pump at least one sampling tubing volume plus flow-through cell volume of water through the system at a flow rate equal to or greater than 100 milliliters per minute (mL/min) but less than 500 mL/min while not lowering the water level in the well more than 0.3 foot, within the following ranges:

- Dissolved oxygen: ±10 percent for values greater than 0.5 mg/L
- Eh (ORP): ±10 millivolts (mV)
- Conductivity: ±3 percent (micromhos per centimeter (μmho/cm))
- pH: ±0.1 unit
- Temperature: ±3 percent (degrees Celsius,°C)

Note: A minimum of three system volumes must be purged before evaluating whether stabilization criteria are met and purging is complete before sampling.

1.2.1.2 Turbidity

It should be noted that natural turbidity levels in ground water may exceed 5 nephelometric turbidity units (NTU). If the other parameters stabilize but turbidity remains greater than 5 NTUs, field personnel should continue purging at the determined sustainable flow rate until turbidity readings are ±10 percent NTUs. If turbidity does not stabilize, the project manager should be notified. It should be noted that

turbidity measurements may not stabilize within the aforementioned criteria before collecting a sample in accordance with the procedures for purging a low-recovery well.

1.3 Equipment and Materials

- Field logbook and waterproof pen
- Clean latex or nitrile gloves
- New United Nations (UN)-approved 55-gallon steel drums steel drums with labels or other Environmental Manager-approved container
- Clean 5-gallon bucket
- Groundwater pump
  - Adjustable rate, submersible pumps are preferred (centrifugal or bladder pump)
  - Peristaltic pump with portable battery may be used with caution. U.S Environmental Protection Agency (EPA) guidance states that that "suction pumps are not recommended because they may cause degassing, pH modification, and loss of volatile compounds."
- Water level meter
- Groundwater quality meter capable of collecting groundwater quality parameters using a flow-through cell (YSI or similar water quality meter; capable of measuring temperature, specific conductance, dissolved oxygen, turbidity, pH, and oxidation-reduction potential [Eh, or ORP] or equivalent)
- Turbidity meter to obtain more accurate turbidity readings
- T connector
- Disposable Teflon tubing
- Disposable silicone tubing (for peristaltic)
- Measuring cup to assess flow rate
- 1-micron filter for dissolved phase target analyte list (TAL) metals sample collection
- Stopwatch
- Equipment/instrument decontamination materials (see *FOP-06 Personnel and Equipment Decontamination Procedures*)
- Laboratory-supplied analytical sample containers

1.4 Procedures and Guidelines

1. Set up and calibrate instruments in accordance with manufacturer's instructions.
2. Decontaminate sampling equipment and other instruments to be placed in the monitoring well riser before sampling in accordance with the *FOP-06 Personnel and Equipment Decontamination Procedures.*
3. Measure the depth to groundwater before performing low-flow sampling, as described in the *FOP-02 Water Level and Total Depth Measurements*. Do not measure the depth to the bottom of the

well at this time in order to reduce the possibility that accumulated sediment in the well will be disturbed. Obtain total well depth from the monitoring well development log, or acquire total depth during water level measurements, but the well should not be sampled the same day as depth to bottom is measured.

4. Place field equipment and supplies on clean plastic sheeting to minimize contamination.
5. Determine the system volume, which is the volume of water that will pass through the tubing in the well, pump, and flow-through cell. A minimum of three system volumes must be purged before evaluating whether stabilization criteria are met and purging is complete before sampling.
6. Follow these procedures if using a peristaltic pump:
    a. Connect the silicone tubing to the peristaltic pump.
    b. Lower the Teflon tubing slowly to the top of the water column. The field team should use a tape measure to measure out the tubing.
    c. Place the Teflon tubing intake at the depth where the highest contaminant concentrations are present. If this depth is unknown, place the tubing intake in the middle of the well screen if the entire length of the well screen is below the potentiometric surface. If the potentiometric surface is within the well screen, the intake should be set approximately 2 feet off the bottom of the well to minimize the intake of fines accumulated on the bottom of the well and maximize the length of water column above the Teflon tubing intake.
    d. Cut the Teflon tubing, secure to the top of the well riser with a clamp, and connect to the silicone tubing in the peristaltic pump. Allow extra tubing in case the water does not recharge as fast as the pumping rate, so the tubing can be lowered farther into the well.
    e. Ensure that the pump flow direction is correct on the peristaltic pump. It is best to verify the flow direction before connecting the Teflon tubing by inserting the silicone tubing in a cup of distilled water.
    f. Connect silicone tubing to the water quality meter flow through cell (bottom connector). Run the outlet tubing (upper connector) to the 5-gallon bucket.
7. Follow these procedures if using a centrifugal pump:
    a. Connect Teflon tubing to pump.
    b. Lower the pump slowly to the required depth, and use a tape measure to measure the tubing.
    c. Place the pump intake at the depth where the highest contaminant concentrations are present. If this depth is unknown, place the pump intake in the middle of the well screen if the entire length of the well screen is below the potentiometric surface. If the potentiometric surface is within the well screen, the intake should be set approximately 2 feet off the bottom of the well to minimize the intake of fines accumulated on the bottom of the well and maximize the length of water column above the tubing intake.
    d. Connect the Teflon tubing to the bottom of the flow through cell. Run the outlet tubing from the upper connector to the 5-gallon bucket.
8. Start pumping. Purge rate should be less than 500 mL/min. Monitor the water level carefully after beginning the pumping process.

9. Turn on the groundwater parameter field instrument and let the readings stabilize. Once temperature has stabilized for 30 seconds, record initial groundwater parameters and depth to groundwater on a groundwater purging and sampling form.
10. Containerize purged groundwater initially in a plastic 5-gallon bucket and subsequently transfer to a 55-gallon steel drum or other labeled storage container.
11. Purge to stability with a total water surface drop of 0.3 foot or less if water level is stable or only slowly dropping, to ensure stagnant water stored in the well casing is not being sampled and that only fresh groundwater is sampled.
12. Monitor carefully if water level has dropped more than 0.3 foot. Consider lowering the purge rate to keep the water level drop to less than 0.3 foot.
13. If the water level has dropped more than 0.3 feet, calculate the volume of water between the initial water level and the stabilized water level. Add the volume of water which occupies the pump's tubing to this calculation. This combined volume of water needs to be purged from the well after the water level has stabilized before samples are collected.
14. Disconnect the Teflon tubing from the flow-through cell if the well was purged. Groundwater samples must never be collected from the outlet of the flow-through cell. When collecting samples, ensure that the flow rate of the pump is equal to or less than the flow rate used to purge the monitoring well. Collect groundwater samples directly from the outlet of the Teflon tubing starting with volatile organic compound (VOC) samples first.
15. Dissolved phase TAL metals are to be collected by attaching a 1-micron filter to the silicone tubing and purging the water through the filter and into the sample container.
16. Label the sample containers following the collection of groundwater samples, and place the samples in an ice-bearing cooler away from sources of cross-contamination.
17. Remove the Teflon tubing from monitoring well and discard. Secure the well cap and lid on the well immediately after removing the tubing to prevent objects from being dropped in the well.
18. Decontaminate all equipment and instruments in accordance with the *FOP-06 Personnel and Equipment Decontamination Procedures*.
19. Store instruments in accordance with the manufacturer's instructions.
20. Purged groundwater will be handled in accordance with the project-specific plans.

1.5 Records Retention and Management

Project records will be managed in accordance with the DES CLIN 3 Quality Management Plan. Project documents and records will be retained for 10 years after the closing date of the prime contract. All information generated under this program is considered to be confidential and shall not be released to others without the written consent of the Contract Officer.

1.6 Quality Control and Quality Assurance

- Ensure that the water quality meters are calibrated and cared for in accordance with manufacturer's instructions.
- Keep sampling system and monitoring probes out of direct sunlight.

- Verify dissolved oxygen readings by checking reported dissolved oxygen against a chart and correlating theoretical readings at actual site temperatures. Do not record any dissolved oxygen readings that are outside theoretical limits, such as negative concentrations.
- Check that the flow direction switch on the peristaltic pump is in the correct direction. Flow in the wrong direction may create bubbles in the well riser, thus affecting dissolved oxygen readings.
- Charge battery to peristaltic pump and water quality meter when not in use. Low battery on the water quality meter may not allow unit to connect properly with sonde.
- The field notes will be reviewed by the Site Quality Control Manager at the end of each work day performed.

1.7 Attachments

- Groundwater Purging and Sampling Form.

1.8 References

CH2M HILL, INC. *Quality Management Plan for U.S. Environmental Protection Agency Remedial Acquisition Framework (RAF) Design and Engineering Services (DES) Contract CLIN 3*. May 2022.

EPA. *Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells.* September 19, 2017.

Monitoring Well

Field Data Sheet

Well Number: Field Crew: Purpose of Sampling:

Site: Field Conditions:

WELL CONDITION

Well Pad	Acceptable	Not Acceptable	Explain:
Protective Casing	Acceptable	Not Acceptable	Explain:
Well Casing	Acceptable	Not Acceptable	Explain:
Locking Cap	Acceptable	Not Acceptable	Explain:
Well Label	Acceptable	Not Acceptable	Explain:

PURGE METHOD

Date: Time: Method:

Total Well Depth (ft) =

Depth to Water (ft): =

Water Column (ft): =

1 volume

Comments:

OBSERVATIONS

Odor: None , Low , High , H_2S , Fuel Like , Other:

Comments:

FIELD PARAMETERS

Time	Volume (gal) --	Rate (mL/min) --	pH (s.u.) +/- 0.1 s,u,	DO (mg/L) +/- 10%	ORP (mV) +/- 10 mV	Specific Conductance (mS/cmc) +/- 3%	Temp (^oC) +/- 3%	Turbidity (NTU) <10 NTU	Depth to water (feet) --

SAMPLING

Date: Time:

Sample ID: Method of Sample Collection:

Analytical Parameters:

Q.C. Sample Type: MS/MSD Duplicate Duplicate Sample ID:

Q.C. Parameters:

Trash picked up? Well locked?

SIGNED/SAMPLER:

Field Operating Procedure-05
Field Quality Assurance/Quality Control Sample Preparation

Author: Kimberly Amley 5/4/2022

Author

Approver: Scott Pratt 5/4/2022

Technical Reviewer

FIELD OPERATING PROCEDURE-05

Field Quality Assurance/Quality Control Sample Preparation

1.1 Purpose

The purpose of this field operating procedure (FOP) is to describe the methods for collecting quality assurance (QA)/quality control (QC) samples for soil, water, and air matrices. Not all QA/QC samples presented in this FOP will be required on every project. Refer to project-specific plans for the required QA/QC samples and frequency.

1.2 Scope

The general protocols for preparing QA/QC samples are outlined. These standard procedures may be changed as required, dependent upon site conditions, equipment, or project-specific requirements.

1.3 Equipment and Materials

Generally, the equipment/apparatus required to collect QA/QC samples is the same as the equipment/apparatus required to collect the environmental samples. Refer to the specific FOP for sample matrix-specific information (i.e., sampling procedures, reagents/preservative, and equipment required). QA/QC samples will require some or all of the following equipment:

- Blank liquid (use ASTM International [ASTM] Type II or laboratory-grade water)
- Millipore (or similar) deionized water
- Laboratory-provided performance evaluation (PE) sample
- Sample bottles or canisters as appropriate
- Gloves
- Preservatives as appropriate

1.4 Procedures and Guidelines

The following subsections discuss QA/QC samples for soil, water, and air matrices.

1.4.1 Field Duplicate and Split Samples

Field duplicate and split samples are field samples obtained from one location, homogenized, and divided into separate containers. They are treated as separate samples throughout the sample handling and analytical process. The samples are used to assess precision by comparing analytical results for two parts of the sample from the same location.

Requests from clients, regulatory agencies, or primary responsible parties for split samples should be honored. Split samples are collected following the sample procedures for field duplicate samples using sample containers, blank samples, preservatives, sample courier, chain-of-custody forms, etc. provided by the requesting agency or party.

Field duplicate and split samples must be prepared and analyzed for the same parameters by the same methods to demonstrate the reproducibility of the sampling and analytical techniques. Refer to project-specific requirements for minimum field duplicate and split sample frequency, or if required by the project.

- Aqueous Sample Matrix: Alternatively fill sample containers from the same sampling device for duplicate and split samples of aqueous matrices. Volatile organic compound (VOC) samples should be collected first into two 40-milliter vials until there is a positive meniscus, then seal the vials. Fill containers by alternating between the two sample container sets during filling.
- Nonaqueous Volatiles Sample Matrix: Volatile duplicate samples must be taken before mixing the sample and before collecting any samples for nonvolatile organic analyses. For VOC samples of soil, isolate the depth stratum from which the sample is taken, fill the VOC sample container, and seal the container as quickly as possible.
- Nonaqueous Nonvolatile Sample Matrix: Homogenize (mix) the sample by filling a decontaminated stainless-steel bowl with the collected sample and mixing with a decontaminated stainless-steel instrument. Once mixed, the sample should be divided in half, and the sample containers should be filled by scooping sample material alternatively from each half.
- Air Sample Matrix: Place two identical samplers next to each other, pull air from one source, and split into two canisters with a manifold.

Document and ship samples in accordance with the procedures for other samples.

1.4.2 Equipment Blank Samples

Equipment blanks (also referred to as rinsate blanks) are used to assess the effectiveness of decontamination procedures using laboratory-grade water. Equipment blank samples are collected after decontaminating sampling equipment that has contacted the sample. Refer to project-specific requirements for minimum equipment blank sample frequency, or if required by the project..

To collect an equipment blank for VOC analysis from the surface of sampling equipment other than pumps, pour blank water over one piece of equipment and into two 40-milliter vials until there is a positive meniscus, then seal the vials. Note the sample number and associated piece of equipment in the field notebook, as well as the type and lot number of the water used.

For nonvolatiles analyses, one aliquot is to be used for equipment. For example, if a pan and trowel are used, place trowel in pan and pour blank fluid in pan such that pan and trowel surfaces that contacted the sample are contacted by the blank fluid. Pour blank fluid from pan into appropriate sample bottles. Do not let the blank fluid come in contact with any equipment that has not been decontaminated.

When collecting an equipment blank from a pump, run an extra gallon of deionized water through the pump while collecting the pump outflow into appropriate containers. Make sure the flow rate is low when sampling VOCs. If a Grundfos Redi-Flo2 pump with disposable tubing is used, remove the disposable tubing after sampling but before decontamination. When decontamination is complete, put a 3- to 5-foot segment of new tubing onto the pump to collect the equipment blank.

Document and ship samples in accordance with the procedures for other samples.

1.4.3 Collocated Samples

Collocated samples are collected adjacent to the primary field sample to determine variability of the soil and contaminant(s) within a small area. Analytical results are used to assess site variation in the

immediate sample area. Typically, collocated samples are collected between 1 to 3 feet away from the primary sample location.

Collocated air samples are collected by placing two identical samplers next to each other, and either: (1) air is drawn from one source and split with a manifold, or (2) two pumps are set adjacent to each other and each collect a sample at the same flow rate. Depending upon the methods used to collect and analyze the samples, collocated samples can determine the variation due to both sampling error and precision in the analyses (e.g., using thermally desorbed adsorbent tubes), or to isolate the variation due to sampling error only (e.g., using solvent-extracted tubes and Summa canisters).

Collocated samples are collected from the same sample interval, using the same method, and for the same parameters as the primary sample. Refer to the project-specific requirements on the minimum frequency for collocated samples, or if required by the project.

1.4.4 PE Samples

PE samples are used to assess the overall accuracy of the analytical laboratory and detect any bias in the analytical method used. These samples are usually prepared by a third party, using a quantity of analyte(s) that is known to the preparer but unknown to the laboratory. The analyte(s) used to prepare the PE sample is the same as the analyte(s) of concern. Laboratory accuracy is evaluated by comparing the percentage of analyte identified in the PE sample (percent recovery) with the analytical results of the site samples. Refer to project-specific requirements for the minimum frequency of PE samples per analyte of interest per matrix, or if required by the project.

1.4.5 Field Blank Samples

Field blanks are collected for aqueous and air sample matrixes. Field blanks are used to assess potential sources of contamination resulting from exposure to the ambient air. Field blanks are samples that undergo the full handling and shipping process of an actual sample. Field blanks are designed to detect potential sample contamination that may occur during field operations or during shipment. An aqueous sample field blank consists of two identical sets of laboratory-cleaned sample containers. One set of containers is filled at the laboratory with deionized water and the other set is taken to the site empty. At the most contaminated area of the site, pour Millipore or deionized water directly in the empty sample containers. An air sample field blank is opened with the other sampling media, resealed, and carried through the sampling process.

Field blanks are analyzed for the same parameters as site samples. Refer to project-specific requirements for minimum field blank sample frequency, or if required by the project. The field blank must be associated with an actual sampling period. Document and ship field blank samples in accordance with the procedures for other samples.

1.4.6 Trip Blank Samples

Trip blanks (also referred to as travel blanks) are only required for volatile organics analysis and are prepared by the laboratory and shipped with the empty sample containers. Trip blanks are handled, transported, and analyzed in the same manner as the other volatile organic samples. The trip blank shall be placed in the container at the beginning of the day. Trip blanks are used to evaluate contamination error associated with sample handling and shipment, or laboratory handling and analysis. Trip blank contamination indicates the blank water itself was of questionable quality or contamination occurred during transport and/or storage of the samples. Refer to the project-specific requirements for the

minimum frequency of trip blanks per container used to transport volatile organic samples, or if required on the project.

The air matrix trip blank is prepared and added to the site samples after sampling has been completed, just prior to shipping samples for analysis. If the absorbent tubes were sealed from the manufacturer, their seals should be broken at this point. For absorbent tubes that have been recycled and resealed by the laboratory, there is no need to break these temporary seals prior to shipping. Canister trip blanks are evacuated containers that are shipped to and from the site with the canisters used for air sampling. A trip blank for an impinger-based sampling method consists of an aliquot of impinger reagent that is shipped back to the laboratory with the samples. Submit trip blanks at a rate of 5 percent of the total samples or a minimum of one per sampling event, or as outlined in the project-specific requiremetns.

1.4.7 Matrix Spike and Matrix Spike Duplicate Samples

Matrix spike (MS)/matrix spike duplicate (MSD) samples are used to assess proficiency on analyte recovery as a function of analyte loss during transport and storage of the collected samples and as a function of the analytical procedures and equipment. MS/MSD samples shall be collected following the same procedure as a field duplicate but at triple volume, Refer to project-specific requirements for minimum MS/MSD sample frequency, or if required by the project.

1.5 Records Retention and Management

Project records will be managed in accordance with the DES CLIN 3 Quality Management Plan. Project documents and records will be retained for 10 years after the closing date of the prime contract. All information generated under this program is considered to be confidential and shall not be released to others without the written consent of the Contract Officer.

1.6 Quality Control and Quality Assurance

- Verify sampling procedures with project-specific modifications.
- Verify documentation of sufficient volume to collect QA/QC samples.
- Verify QA/QC samples are collected at the requested frequency.
- Do not use non-decontaminated equipment to prepare blank(s).
- Use ASTM-Type II or laboratory-grade water to prepare blank(s).
- Field quality control sample and frequency will be reviewed by the Site Quality Control Manager.

1.7 Attachments

None.

1.8 References

CH2M HILL, INC. *Quality Management Plan for U.S. Environmental Protection Agency Remedial Acquisition Framework (RAF) Design and Engineering Services (DES) Contract CLIN 3*. May 2022.

Field Operating Procedure-06
Field Personnel and Equipment Decontamination Procedures

Author: Kaitlin Ma 5/4/2022 

Author

Approver: Kimberly Amley 5/4/2022 

Program Quality Manager

FIELD OPERATING PROCEDURE-06

Field Personnel and Equipment Decontamination Procedures

1.1 Purpose

This Field Operating Procedure (FOP) provides general guidelines for the decontamination of personnel, sampling equipment, and monitoring equipment used in potentially-contaminated environments.

1.2 Scope

This FOP provides a general description of decontamination procedures. Refer project-specific requirements for material or equipment substitutions, as applicable. Wastes will be managed in accordance with *FOP-10 Investigation and Remdiation-derived Waste Management*.

1.3 Equipment and Materials

- Distilled or deionized water
- Nonionic detergent such as Alconox® Powdered Precision Cleaner, 2.5 percent Liquinox, or equivalent phosphate-free detergent and water solution
- Large plastic pails or tubs for nonionic detergent and water, scrub brushes, squirt bottles for detergent solution, resealable plastic bags, and paper towels
- United Nations (UN)-approved 55-gallon steel drum, trash bags, or other approved equivalent for disposal of waste
- Chemical-resistant gloves (that is, nitrile gloves)
- Aluminum foil

1.4 Procedures and Guidelines

This FOP describes the general guidelines for the decontamination of personnel, sampling equipment, and monitoring equipment used in potentially contaminated environments.

1.4.1 Personnel Decontamination Procedures

The following procedures are to be performed after the completion of tasks, when the potential for contamination exists, and upon leaving the exclusion zone:

1. Wash boots in detergent solution, and then rinse with water. If disposable latex booties are worn over boots in the work area, remove and discard into a UN-approved 55-gallon drum, trash bag, or project-specific approved container.
2. Remove and discard outer chemical-resistant gloves into a UN-approved 55-gallon drum, trash bag, or project-specific approved container.

3. Remove disposable coveralls (Tyveks) and discard into a UN-approved 55-gallon drum, trash bag, or project-specific approved container (if worn).
4. Remove respirator (if worn). Dispose of filter cartridges in a UN-approved 55-gallon drum, trash bag, or project-specific approved container and replace daily.
5. Remove inner gloves and discard in a UN-approved 55-gallon drum, trash bag, or project-specific approved container.
6. Shower entire body at the end of the work day, including hair, either at the work site or at home.
7. Sanitize respirator if worn.

1.4.2 Nondedicated Sampling Equipment Decontamination

Reusable sampling equipment is decontaminated after each use as follows:

1. Wear chemical-resistant gloves.
2. Rinse and scrub with potable water to remove gross contamination, as applicable.
3. Wash all equipment surfaces that come into contact with potentially contaminated soil and water with nonionic detergent solution.
4. Rinse with approved water.
5. Rinse with distilled water.
6. Completely air dry or wipe dry with a clean paper towel. Wrap exposed areas with aluminum foil (shiny side out) and/or enclose equipment in clean plastic for transport and handling if equipment will not be used immediately.
7. Collect all rinsate and place in a UN-approved 55-gallon drum or project-specific approved container.
8. Dispose of decontamination materials (for example, plastic sheeting and tubing) that have come into contact with used decontamination fluids or sampling equipment in UN-approved 55-gallon drum, trash bag, or project-specific approved container.

1.4.3 Health and Safety Monitoring Equipment Decontamination

1. Wrap soil contact points in plastic before use to reduce need for subsequent cleaning.
2. Wipe all surfaces that had possible contact with contaminated materials with a paper towel wet with detergent solution, and finally two times with a towel wet with distilled water.
3. Dispose of all used paper towels in a UN-approved 55-gallon drum, trash bag, or project-specific approved container.

1.4.4 Sample Container Decontamination

The outside of sample bottles or containers filled in the field may need to be decontaminated before being packed for shipment or handled by personnel without hand protection. The procedures for sample container decontamination are as follows:

1. Wipe container with a paper towel dampened with detergent solution, or immerse in the solution after the containers have been sealed. Repeat the above steps using potable water.

2. Dispose of all used detergent solution and paper towels in a UN-approved 55-gallon drum, trash bag, or project-specific approved container, keeping liquids and solids in separate containers.

1.5 Records Retention and Management

Project records will be managed in accordance with the DES CLIN 3 Quality Management Plan. Project documents and records will be retained for 10 years after the closing date of the prime contract. All information generated under this program is considered to be confidential and shall not be released to others without the written consent of the Contract Officer.

1.6 Quality Control and Quality Assurance

- Record equipment decontamination procedures in the field logbook.
- The Site Quality Control Manager will verify decontamination procedures are performed and documented in the field logbook.

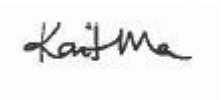
1.7 Attachments

None.

1.8 References

CH2M HILL, INC. *Quality Management Plan for U.S. Environmental Protection Agency Remedial Acquisition Framework (RAF) Design and Engineering Services (DES) Contract CLIN 3*. May 2022.

Field Operating Procedure-07
Sample Handling and Chain-of-Custody

Author: Kaitlin Ma 5/4/2022 

Author

Approver: Kimberly Amley 5/4/2022 

Program Quality Manager

FIELD OPERATING PROCEDURE 07

Sample Handling and Chain-of-Custody

1.1 Purpose

This Field Operating Procedure (FOP) defines "custody" and describe protocols for documenting the transfer of custody from one party to the next (for example, from the site to the laboratory). A documented custody trail is established using a U.S. Environmental Protection Agency (EPA) chain-of-custody form that uniquely identifies each sample container, and who has possession of it from the sample's origin to its destination. The chain-of-custody form also describes the sampling point, date, time, and analysis parameters.

1.2 Scope

This is a general description of how to document the transfer of custody of samples from one party to the next. Sample personnel should be aware that a sample is considered n a person's custody if the sample meets the following conditions:

- It is in a person's actual possession
- It is in view after being in a person's possession
- It is locked up so that no one can tamper with it after it has been in physical custody

When samples leave the custody of the sampler, possession must be documented and the cooler must be custody-sealed, if shipped. Data generated from the use of this FOP may be used to support the following activities: site characterization, risk assessment, and evaluation of remedial alternatives.

1.3 Equipment and Materials

- Computer with Scribe software loaded
- Laser printer with paper (8.5 × 11 inch) and ink cartridge (black)
- Printable labels
- Adhesive labels (generated by Scribe software)
- Indelible black ink pen
- Bubble wrap
- 2-gallon resealable plastic bags for ice
- Packing/strapping tape
- Custody seals

1.4 Procedures and Guidelines

1.4.1 Chain-of-Custody Forms

The chain-of-custody form (see Attachment 1 for example) must contain the following information:

- Case Number/Client Number: If a Contract Laboratory Program (CLP) laboratory is used, enter the case number provided by EPA's Regional Sample Control Center Coordinator. If the CLP is not used, enter the SAS number provided by the sample and analytical coordinator.
- EPA Region: Enter Region "5", for example.
- Site Name/State: Enter the site name and state.
- Project Leader: Enter the project manager's name.
- Action: "Remedial Investigation" or "Site Characterization", for example
- Sampling Co.: "CH2M"
- Sample No.: This is the unique number that will be used for sample tracking. For CLP, this number is taken from a block of numbers assigned by the EPA Regional Sample Control Center Coordinator. For non-CLP, the CH2M sample coordinator will assign the number.
- Matrix: Describes the sample media (for example, "Sediment").
- Sampler Name: The name of the sampler or sample team leader.
- Concentration (of chemicals of concern if known, from previous sampling events): Low (L), Low/Medium (M) or High (H).
- Sample type: "Grab" or "Composite."
- Analysis: This indicates the analyses required for each sample.
- Preservative: Document what preservative has been added to the sample (for example, "HCl," "Ice Only," "None").
- Station Location: This is the CH2M Station Location Identifier.
- Sample Collect Date/Time: Use military time.
- Quality Control (QC) Type: This is for field QC only, and includes field duplicates.
- Date shipped: The date that samples are relinquished to the shipping carrier.
- Carrier Name: (for example, "FedEx").
- Airbill: Air bill number used for shipping.
- Shipped to: This is the laboratory name and full address, including the laboratory contact. If the contact is not known, use "Sample Custodian".
- Chain-of-Custody Record fields: The sampler's signature must appear in the "Relinquished By" field. The date and time (military time) must also be included.
- Although the samples are "relinquished" to the shipping carrier, the shipping carrier does not have access to the samples if the shipping cooler is custody sealed. Consequently, the shipping carrier does not sign the chain-of-custody form.

- Sample(s) to be used for laboratory QC: This identifies which samples are to be used for matrix spike/matrix spike duplicate analyses.
- Indicate if shipment for case is complete: Use “Y” or “N”.
- Chain-of-Custody Seal Number: Record the custody seal numbers that appear on the Regional custody seals, as applicable, that can be found on the shipping container. There is usually a minimum of two per shipping container during shipment.

1.5 Records Retention and Management

Project records will be managed in accordance with the DES CLIN 3 Quality Management Plan. Project documents and records will be retained for 10 years after the closing date of the prime contract. All information generated under this program is considered to be confidential and shall not be released to others without the written consent of the Contract Officer.

1.6 Quality Control and Quality Assurance

1. All sample containers must be properly labeled.
2. Each cooler/box (canisters only) must have a chain-of-custody form, and the samples in the cooler/box (canisters only) must match what is on the chain-of-custody form (as identified by the laboratory-provided sample tags for the canisters).
3. Each chain-of-custody form must be properly relinquished (signature, date, time).
4. If shipped, the custody seal numbers must be written on each chain-of-custody form.
5. The shipping cooler/box (canisters only) must be custody sealed in two places: front and back; coolers/boxes (canisters only) transported by laboratory courier do not require custody seals.
6. Chain-of-custody forms will be completed with required sampling information.
7. If the designated sampler relinquishes samples to other sampling or field crew members for packing or other purposes, the sampler will complete the chain-of-custody form prior to this transfer.
8. Appropriate personnel will sign and date chain-of-custody forms to document the sample custody transfer.
9. Original chain-of-custody forms will be placed in resealable plastic bags and will accompany the shipment; copies will be retained by the sampler for sampling records.
10. If samples are sent by common carrier, bills of lading will be used. Receipts or bills of lading will be retained as part of the permanent project documentation.
11. Commercial carriers will not be required to sign off on chain-of-custody forms if the forms are sealed inside the sample cooler and the custody seals remain intact.
12. Packaging, marking, labeling, and shipping of samples will comply with the regulations promulgated by the U.S. Department of Transportation in the *Code of Federal Regulations* (49 CFR 171-177).

1.7 Attachments

Attachment 1. Quick Guide to Using Scribe.

1.8 References

CH2M HILL, INC. *Quality Management Plan for U.S. Environmental Protection Agency Remedial Acquisition Framework (RAF) Design and Engineering Services (DES) Contract CLIN 3*. May 2022.

ERT

USER MANUAL for

SCRIBE CLP SAMPLING

TABLE OF CONTENTS

Modification Date: June 11, 2010

INTRODUCTION

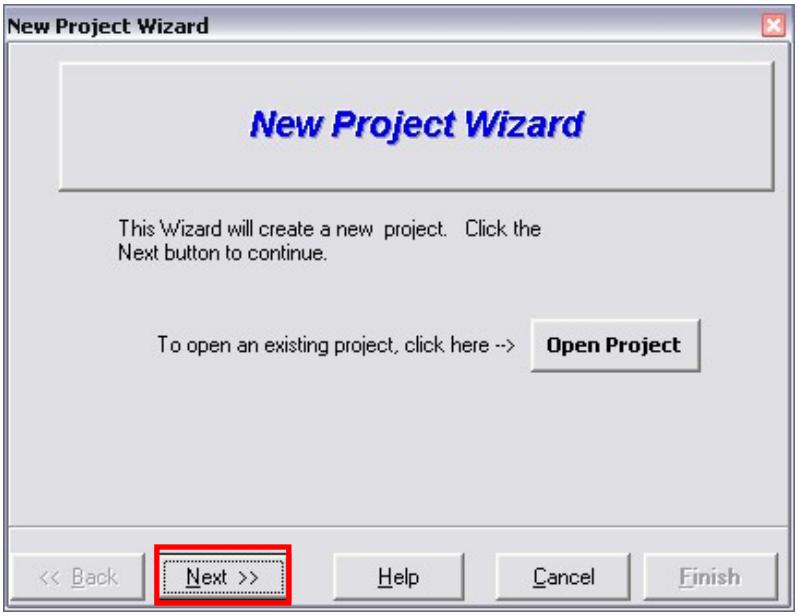
The intent of this User Guide is to provide a basic overview of how to use Scribe to create a new sampling project and manage samples collected for the EPA's Contract Lab Program (CLP). Scribe provides support for CLP sample documentation including the CLP Chain of Custody (COC) reports and the CLP XML format.Query. This document also assumes that the user is already familiar with the Scribe application for sampling. Otherwise, please refer to the Scribe User guides for detailed Scribe application instructions.

Create a New Project

New Project Wizard

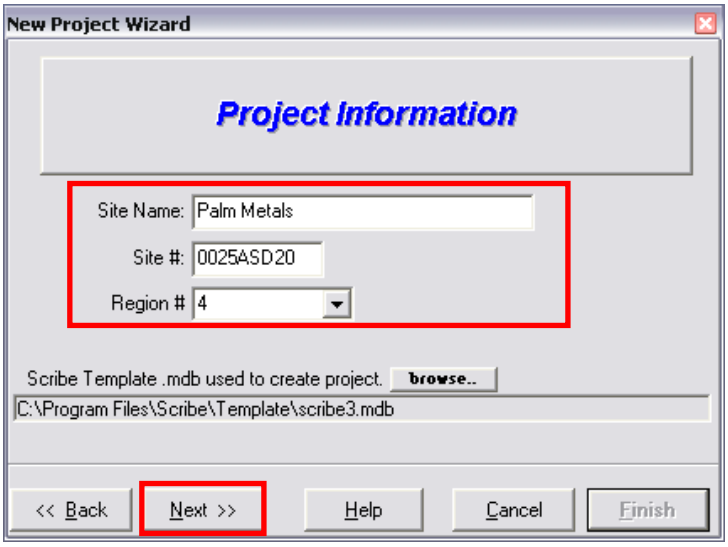
If you are starting Scribe for the first time after installation, the New Project Wizard will run automatically. Otherwise, to create a new project in Scribe:

1. Click on '**File'**.
2. Select '**New Project'**.
3. A New Project Wizard window is displayed.



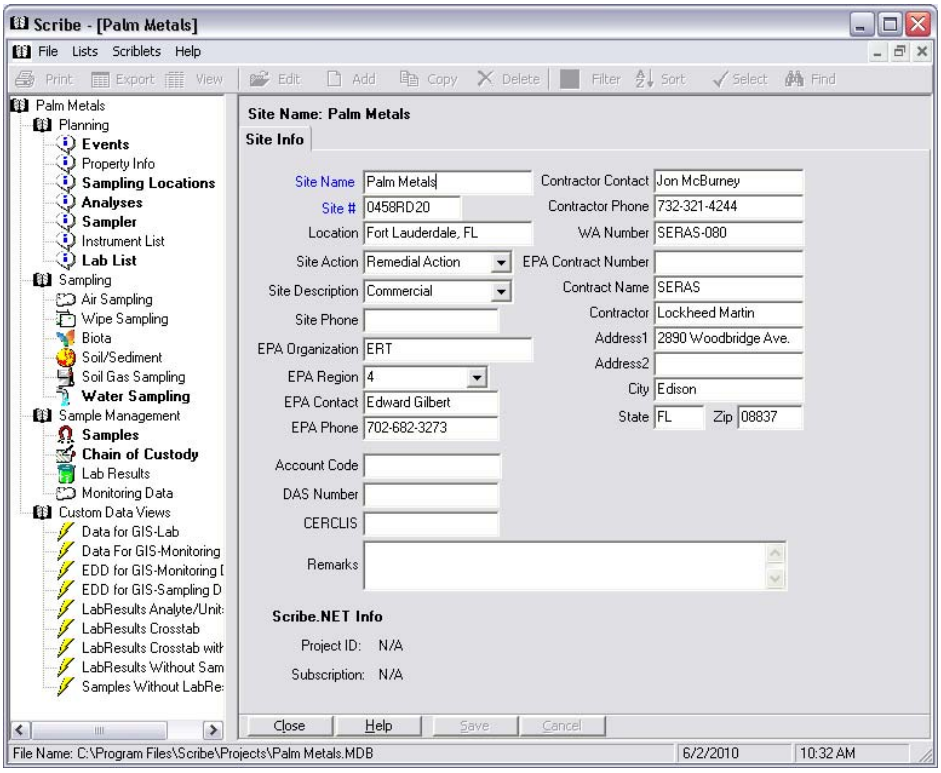
4. Click '**Next'** to continue.

5. Enter the Project Information.



6. Enter the **Site Name**, **Site #** and **EPA Region #**.

7. Click '**Next**' and then click '**Finish**' to create the new project.



The New Project Wizard closes and the "**Site Info**" screen displays. ONLY the field names in **BLUE** are required but we recommend completing as many fields as possible.

CLP SAMPLING IN SCRIBE

CLP Samples

CLP Analyses

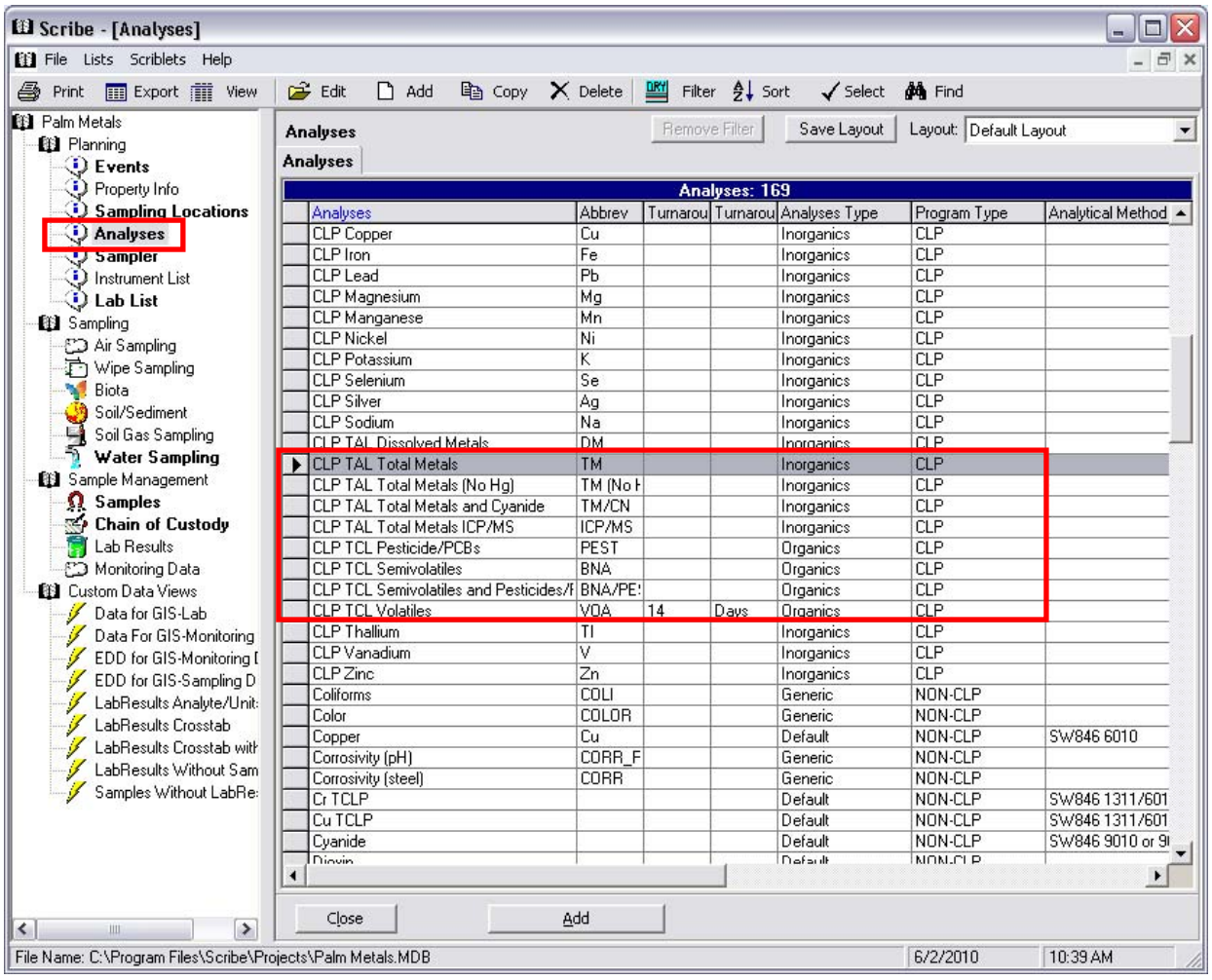
The Scribe Analyses List now includes CLP Analyses. To view or modify the list:

1. Click on "**Analyses**" in the left Navigation Pane. This section is used to manage a list of Analyses including the Program Type and Analysis Type. For example:

   Analysis: CLP TAL Total Metals

   Program Type: CLP

   Analyses Type: Inorganics



CLP/Tag Settings

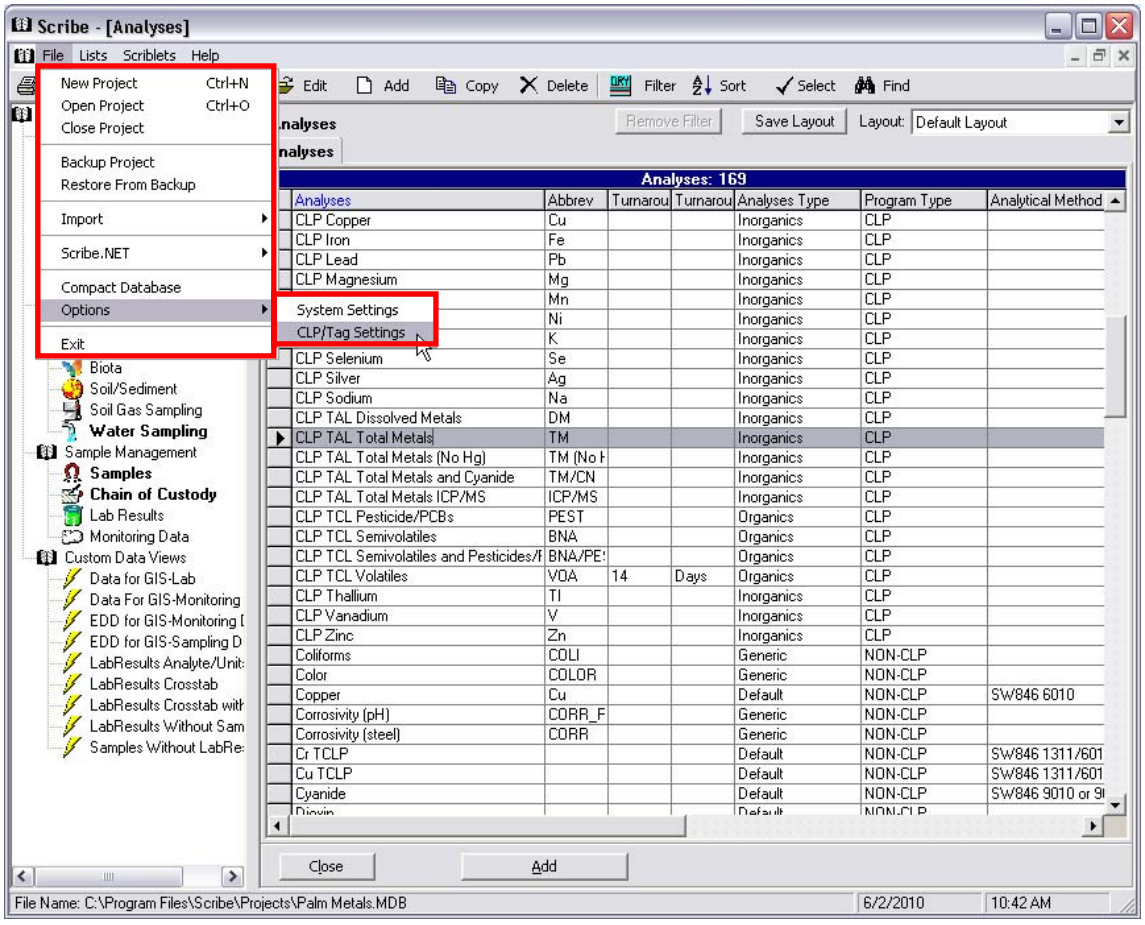
A new feature included with CLP Analyses is the ability to set defaults for the CLP Tags. When a CLP Analysis is selected for a sample, Scribe will assign a CLP Sample number. You can set the **Next CLP Sample number** and **Next Tag number** similar to a sample mask but not exactly.

The CLP Sample # and the Tag # is a field that will update as Samples are added to Scribe. This number is a DISPLAY of the Next number to be assigned. It is editable so that you may customize the next CLP Sample Number that you would like Scribe to assign to your samples.

The numbers auto-increment as samples are added using the CLP business rules.

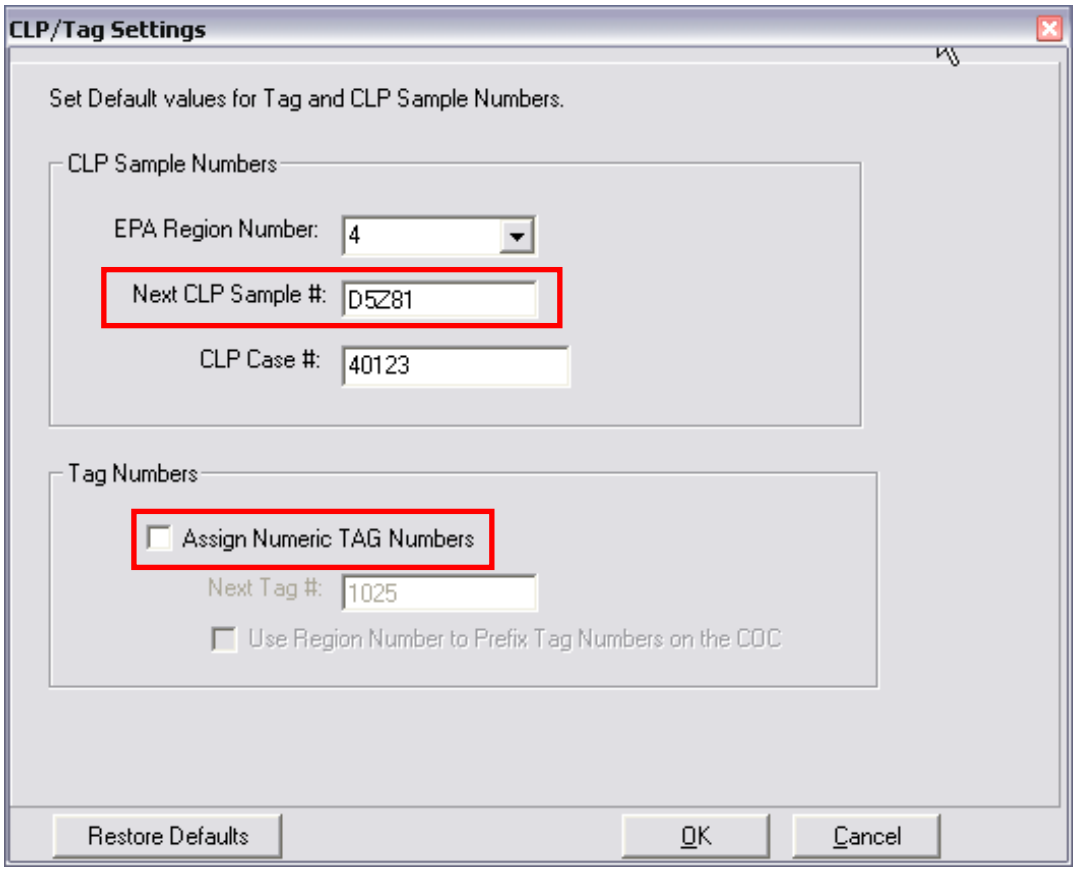
To modify the default settings:

1. Click on **File**.
2. Select **Options**.
3. Select **CLP/Tag Settings**.



4. The window for CLP/Tag Settings is displayed.

5. Input the appropriate information and click the '**OK**' button to Save and Close.



Adding CLP Samples and Assigning Analyses

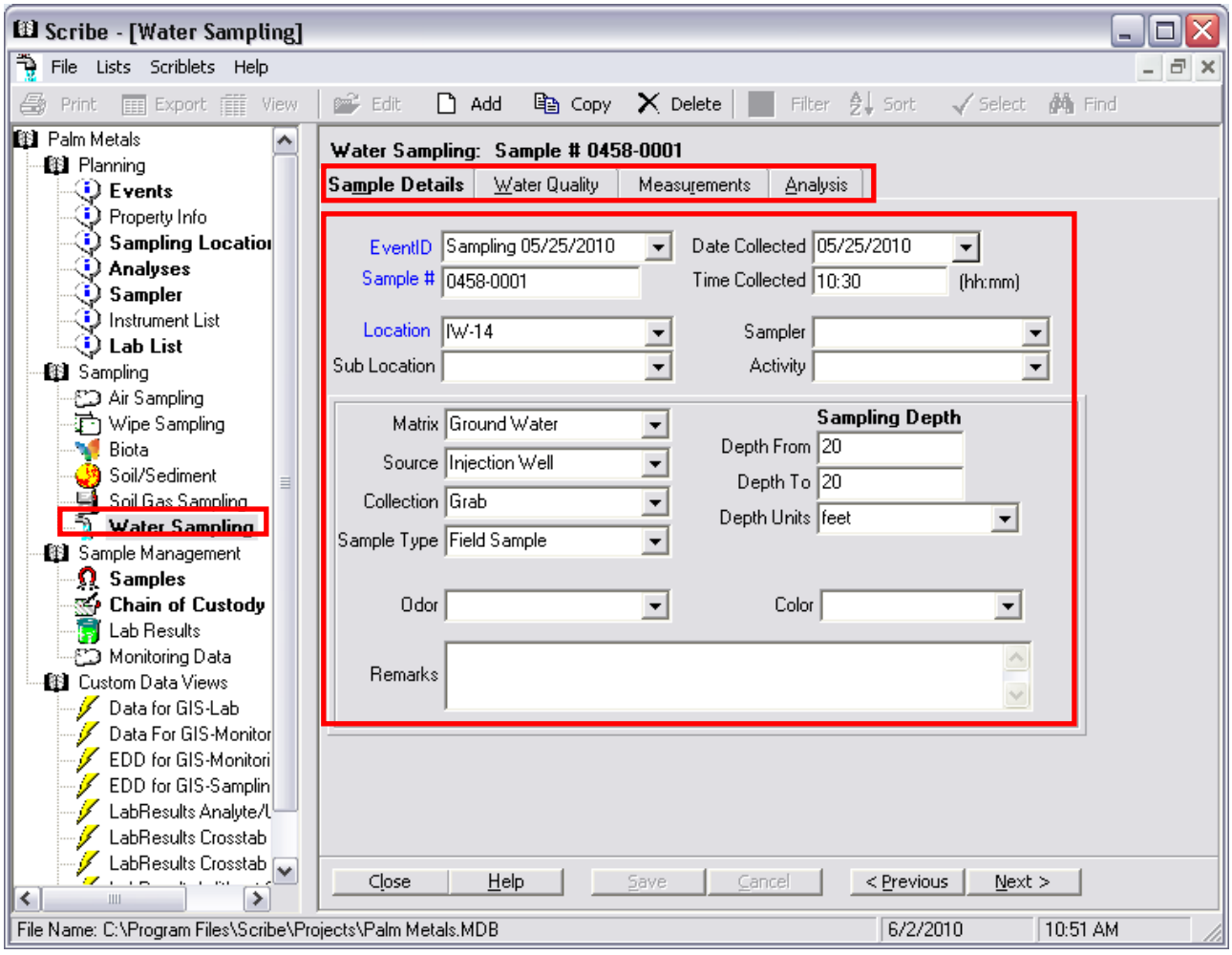
Depending on the type of sampling, click on the appropriate sampling task under Sampling in the left Navigation Pane. For example,

1. Click on '**Water Sampling'** in the left Navigation bar.

2. To add a Water Sample, click the '**Add**' button on the top menu.

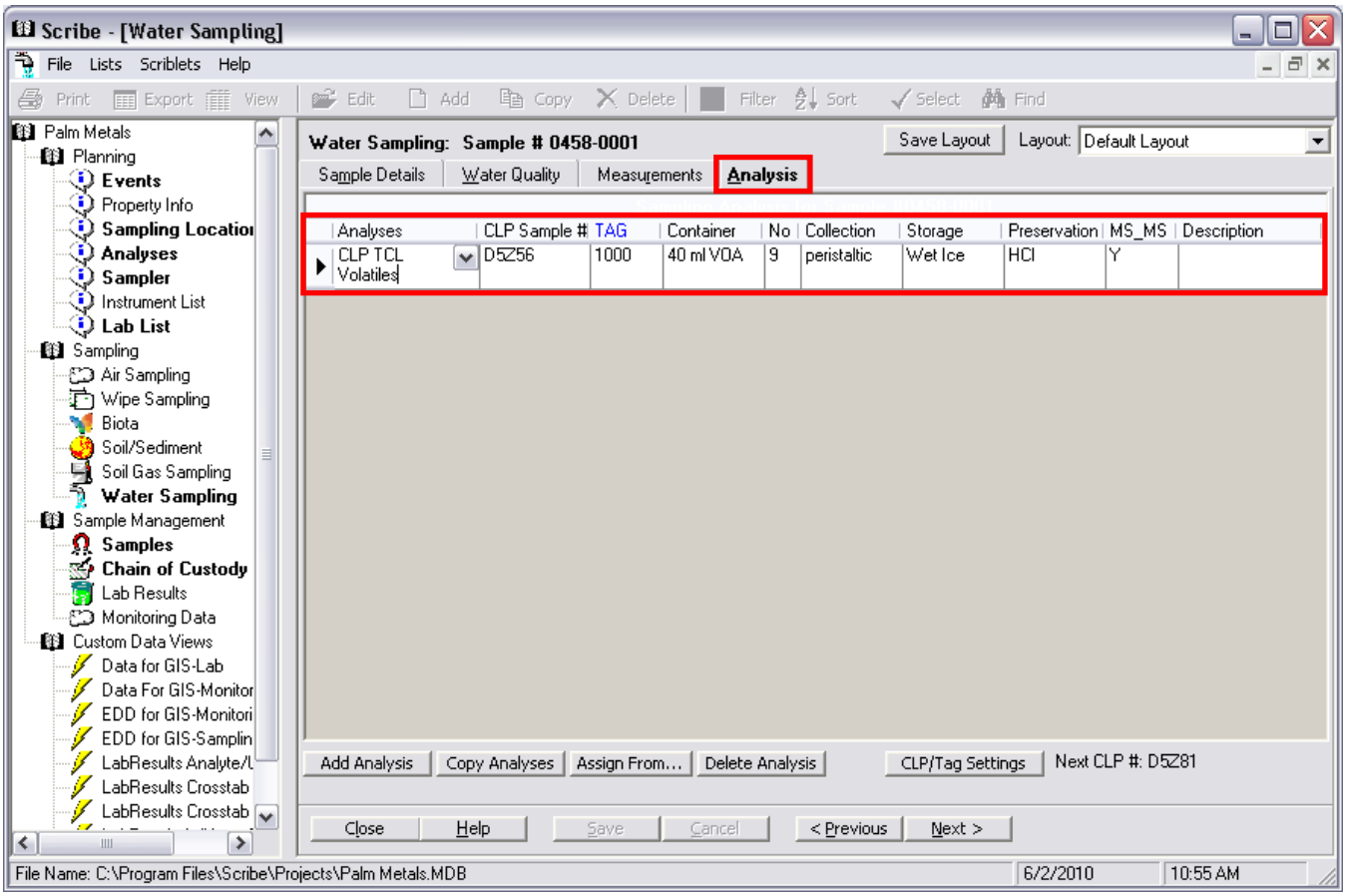
3. Enter sample information into the "**Sample Details"** screen.

Note: There are additional detail screens on the Water Quality and Measurements tabs. These tabs vary by sampling task. The details on the **Analysis** tab must be completed to assign an analysis to your sample.



Enter Analysis information for the Sample and assign CLP Sample and Tag numbers.

4. Click on the **Analysis** tab.
5. Click in the **Analyses field**.
6. Click on the **down arrow** for a list of the CLP Analyses that we referred to earlier.
7. Select an Analysis.



8. For a CLP Analysis, a Tag number and a CLP Sample number is assigned based on the CLP/Tag Settings.
9. To assign additional Analyses to sample containers, click the '**Add Analysis'** button.
10. When all analyses have been added, click the '**Close**' button on the bottom of the window to save and close.

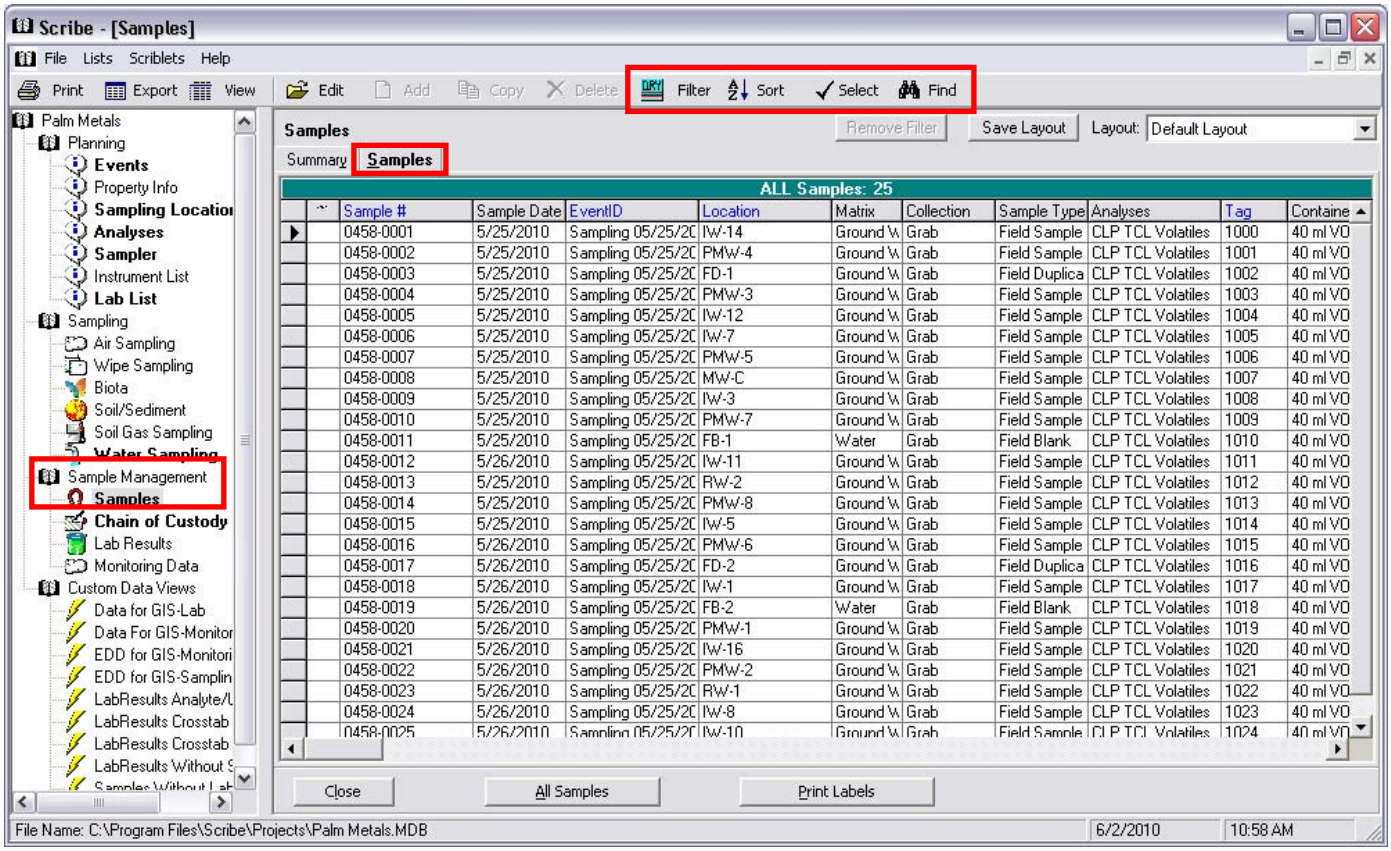
View Samples

Sample Management

Under Sample Management in the left Navigation Pane, you can view and manage all samples using Find, Filter and Sort. The options to Print labels and Chains of Custody are also available.

To view samples:

1. Click on '**Samples**' under Sample Management in the left Navigation Pane.

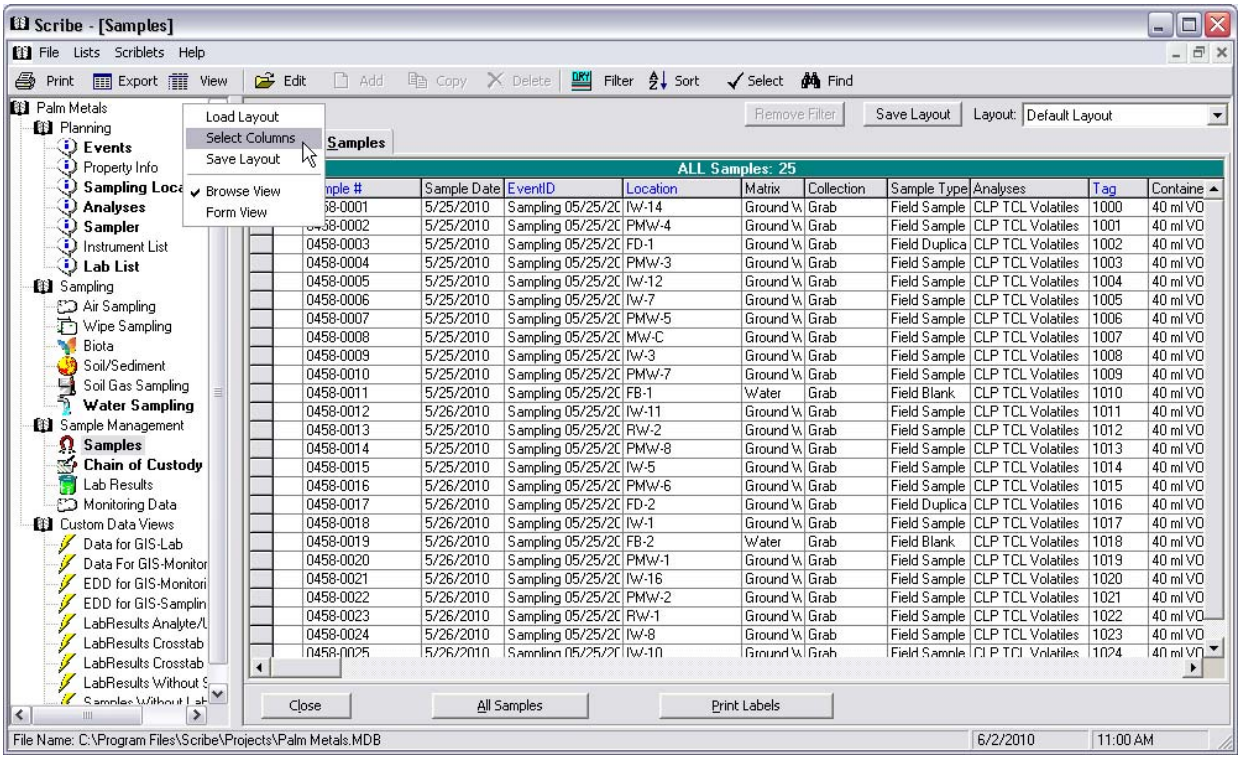


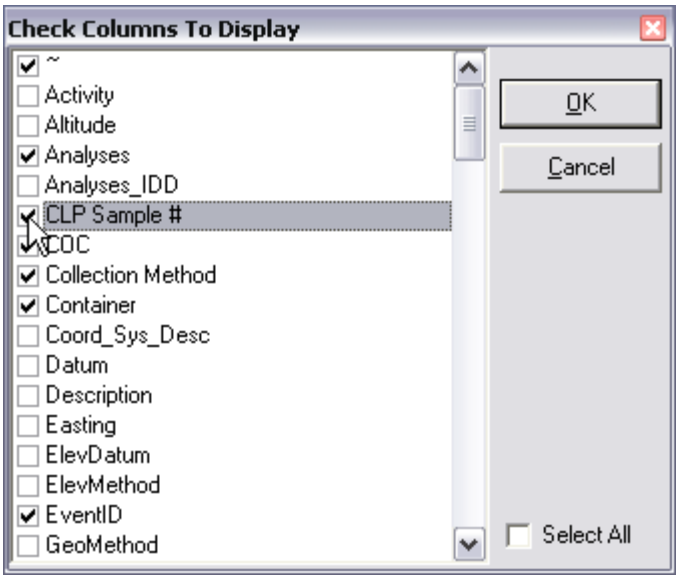
2. To filter your view of samples, RT-click on the field to filter on and select the '**Filter for…'** option. For multi-level filters, click the '**Filter'** button on the top menu bar.

3. To sort your view of samples, RT-click on the column heading and select a sort option. For advanced sort options, click on the '**Sort'** button on the top menu bar.

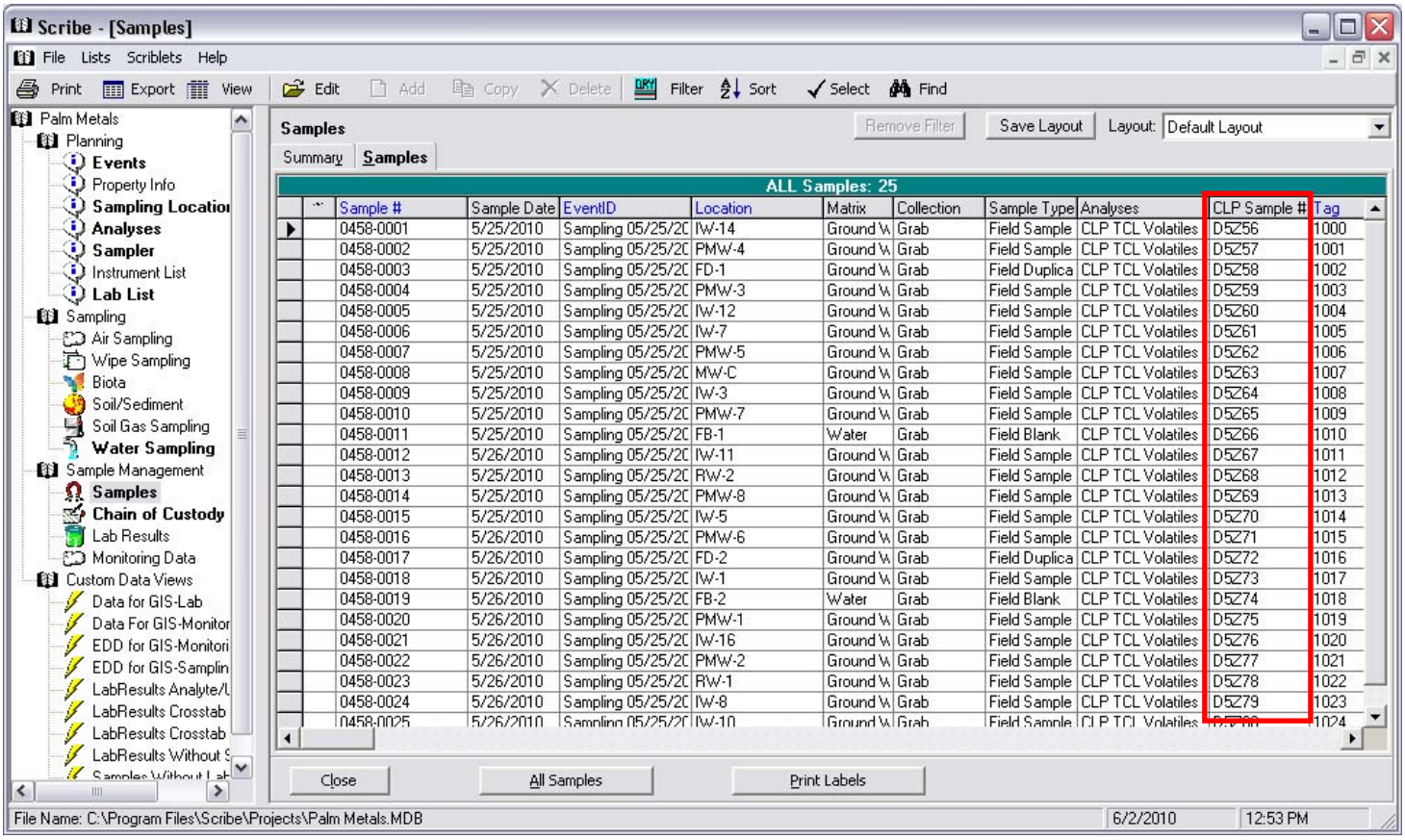
4. To find a particular sample(s), RT-click on the field and select the appropriate option. For multi-level finds, click the '**Find'** button on the top menu bar.

5. To see CLP Sample information including the **CLP Sample #,** click the drop-down menu for the Layout field on the top right corner of the window and select the '**CLP Layout**'.





6. The **CLP Sample #** column is now exposed.



LABELS AND CHAIN OF CUSTODY

CLP Sample Labels

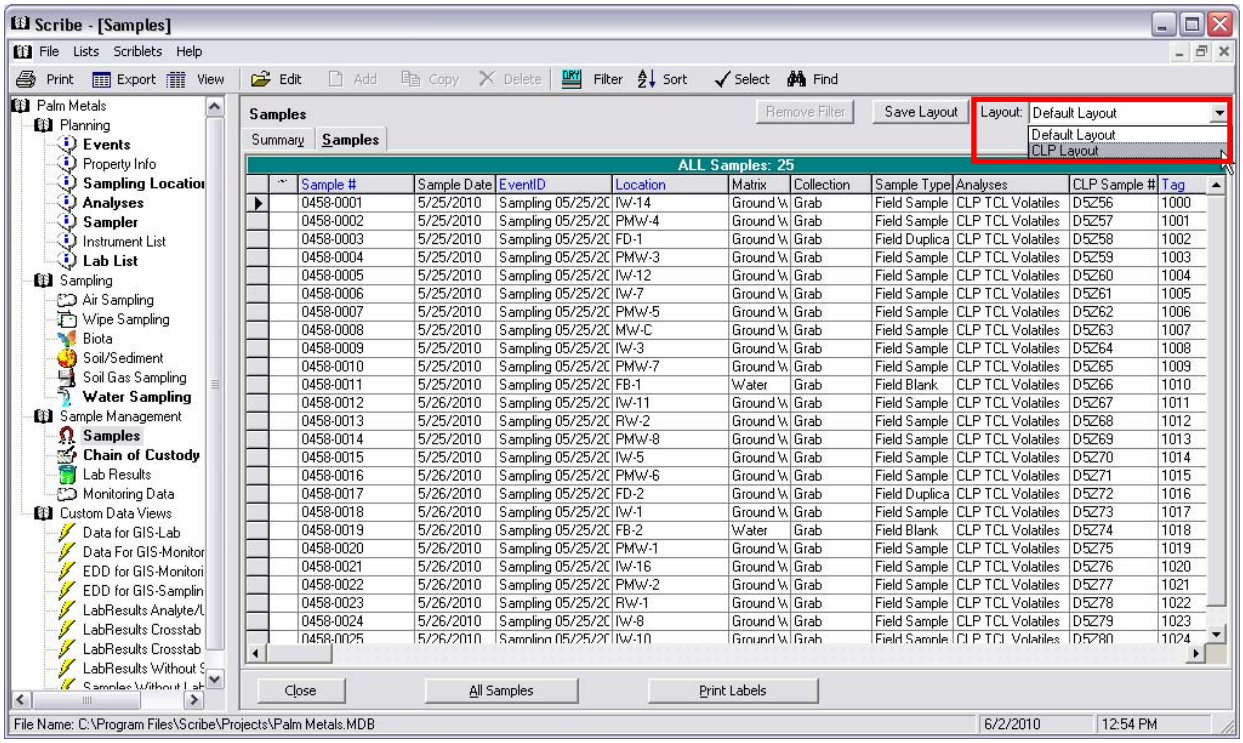
Print Sample Labels

Label options are available through the Samples View. Click on '**Samples**' under Sample Management in the left Navigation Pane. All samples shown on the screen are available to be printed on labels. You can apply Filters, Finds and Sorts to limit the display to the Samples you wish to see.

To configure your labels and print:

1. Click on **drop-down menu** for the Layout field on the top right corner.

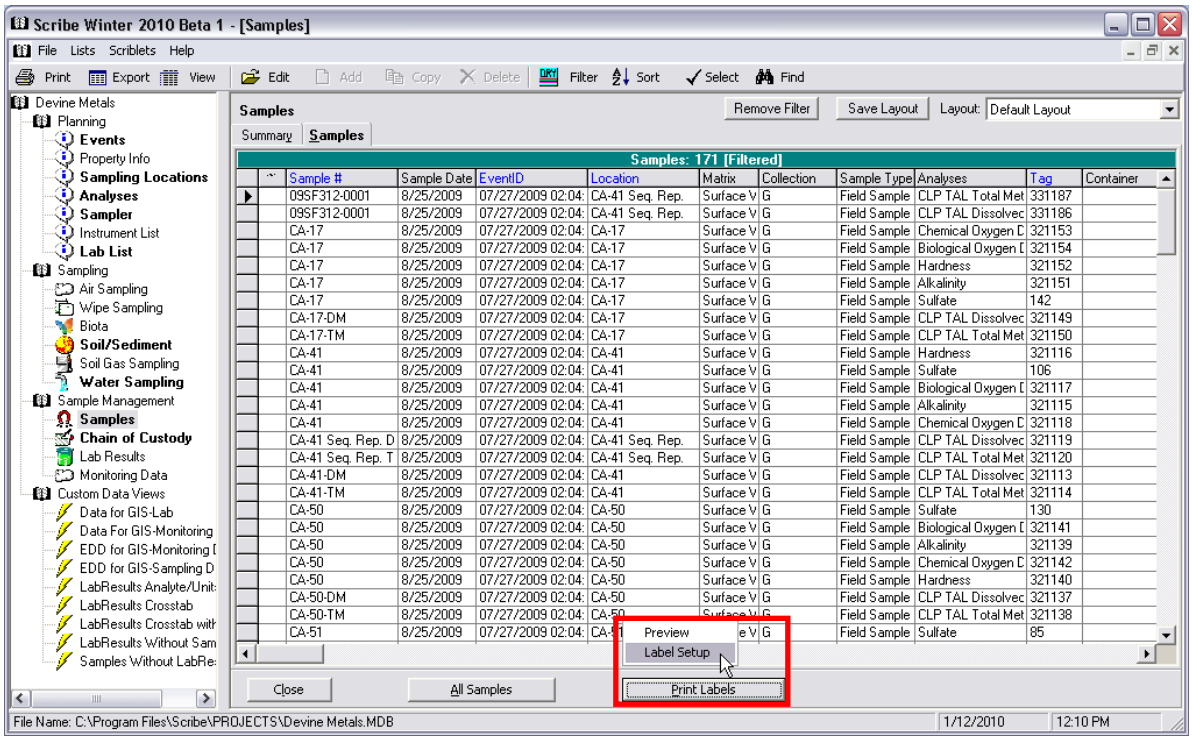
2. Select '**CLP Layout'**. This layout will replace the default Scribe Sample # with the CLP Sample # on the default label layout.

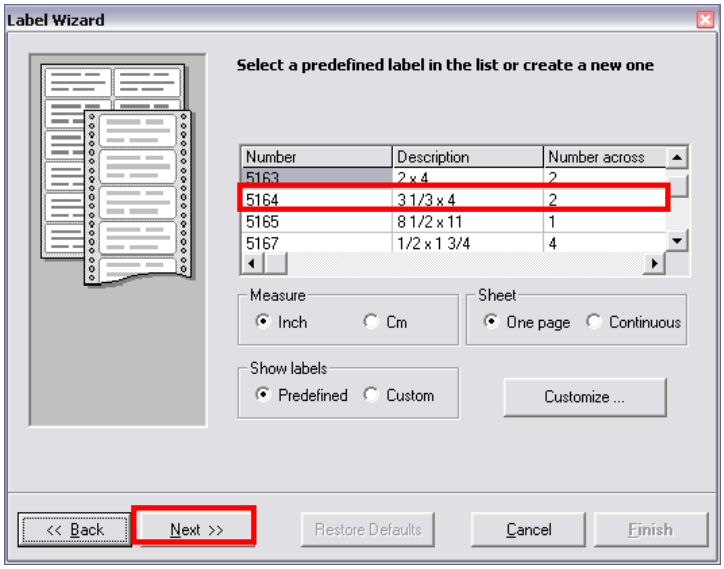


3. Click the '**Print Labels'** button on the bottom of the window.

4. Select '**Label Setup'** if it's the first time you are setting up a label.

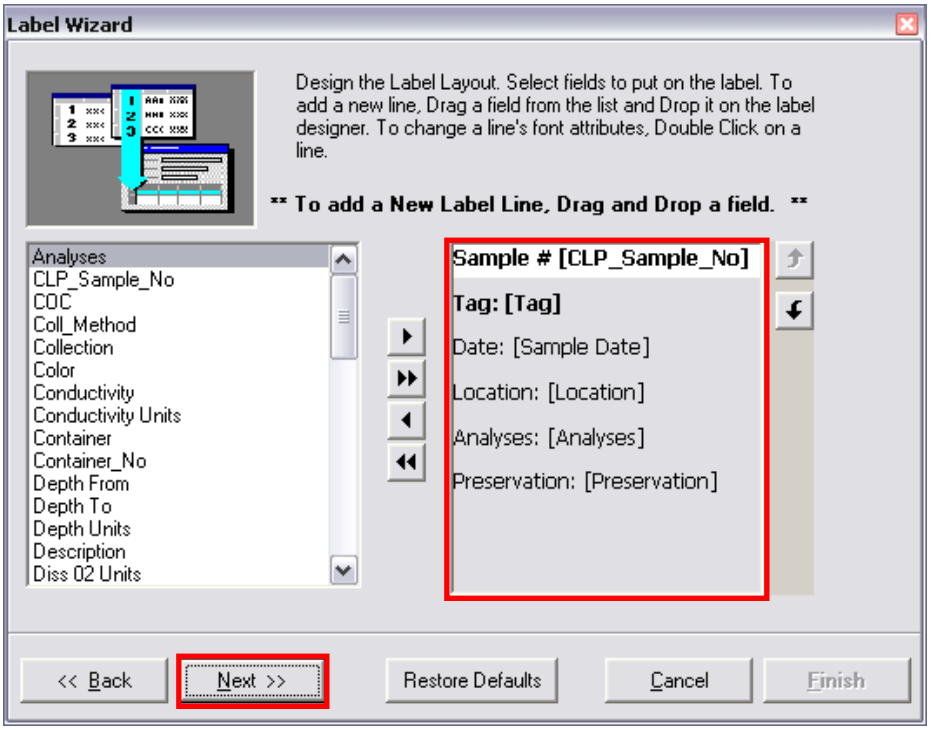
5. Select a pre-defined label format that matches your labels.





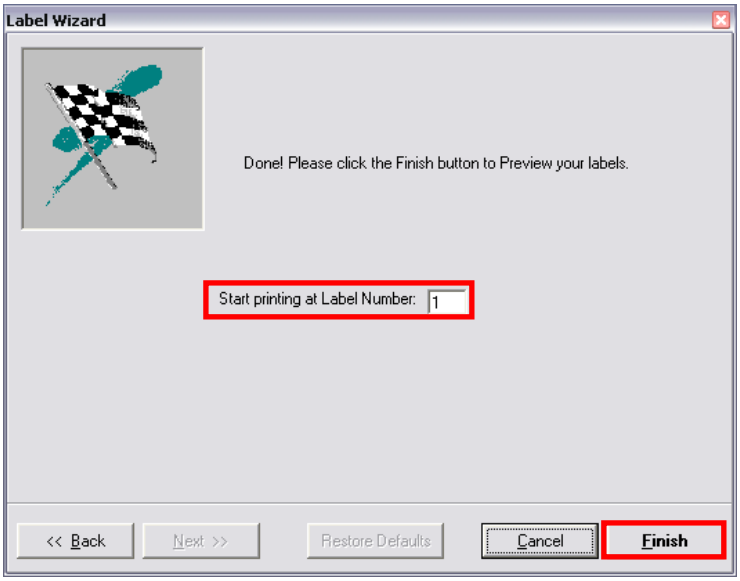
6. Click '**Next**' to continue.

7. Design your label by adding/removing fields to or use the default design. **Note:** The CLP Sample number instead of the Scribe Sample number will be printed on the label.

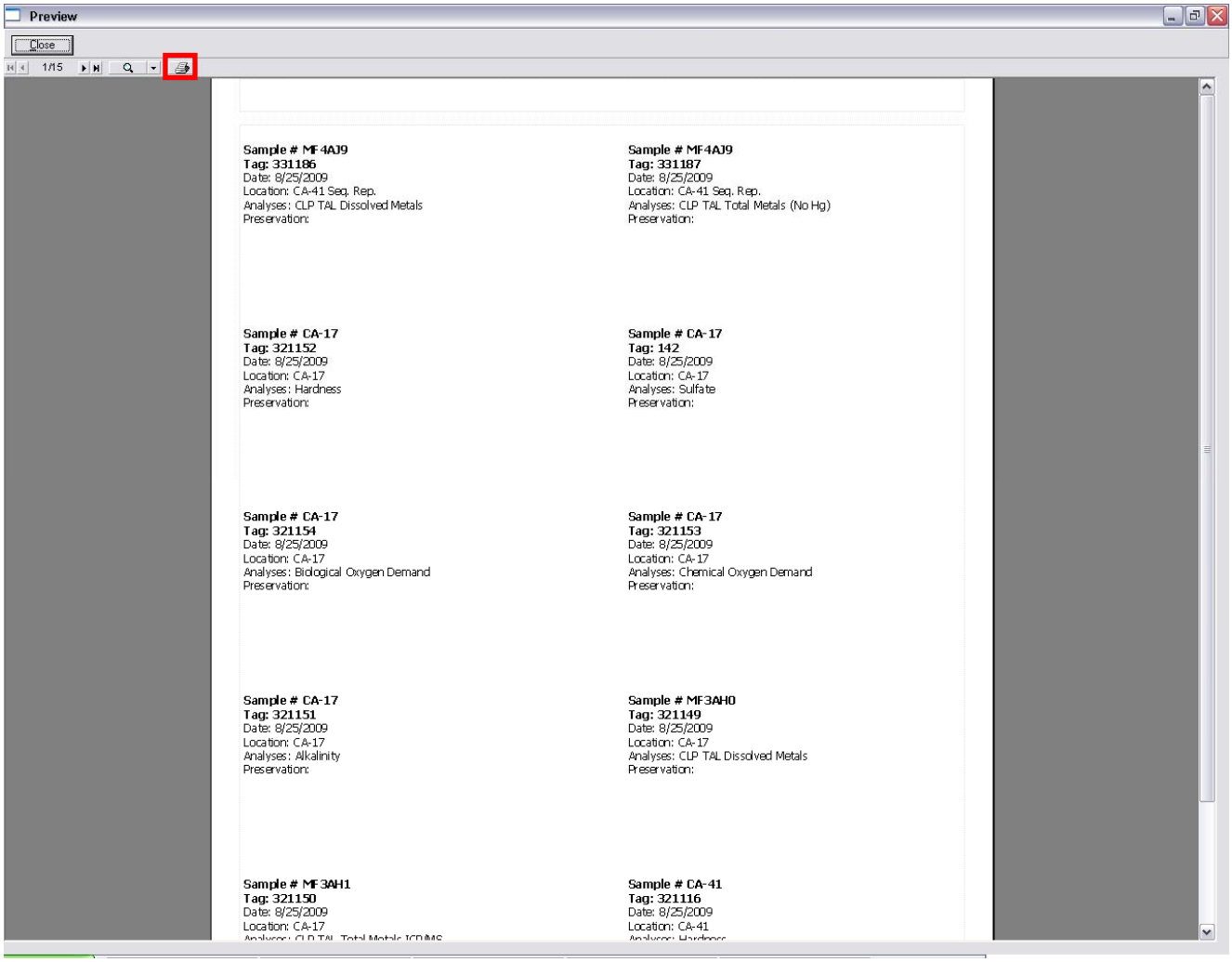


8. Click '**Next**' to continue.

9. If you need to print on half a sheet of labels, use this option to select which label to print on first. Otherwise, click '**Finish**' to continue.



10. A preview of the labels to be printed is displayed.



11. Click on the Printer icon on the top menu bar to print the labels.

Chain of Custody

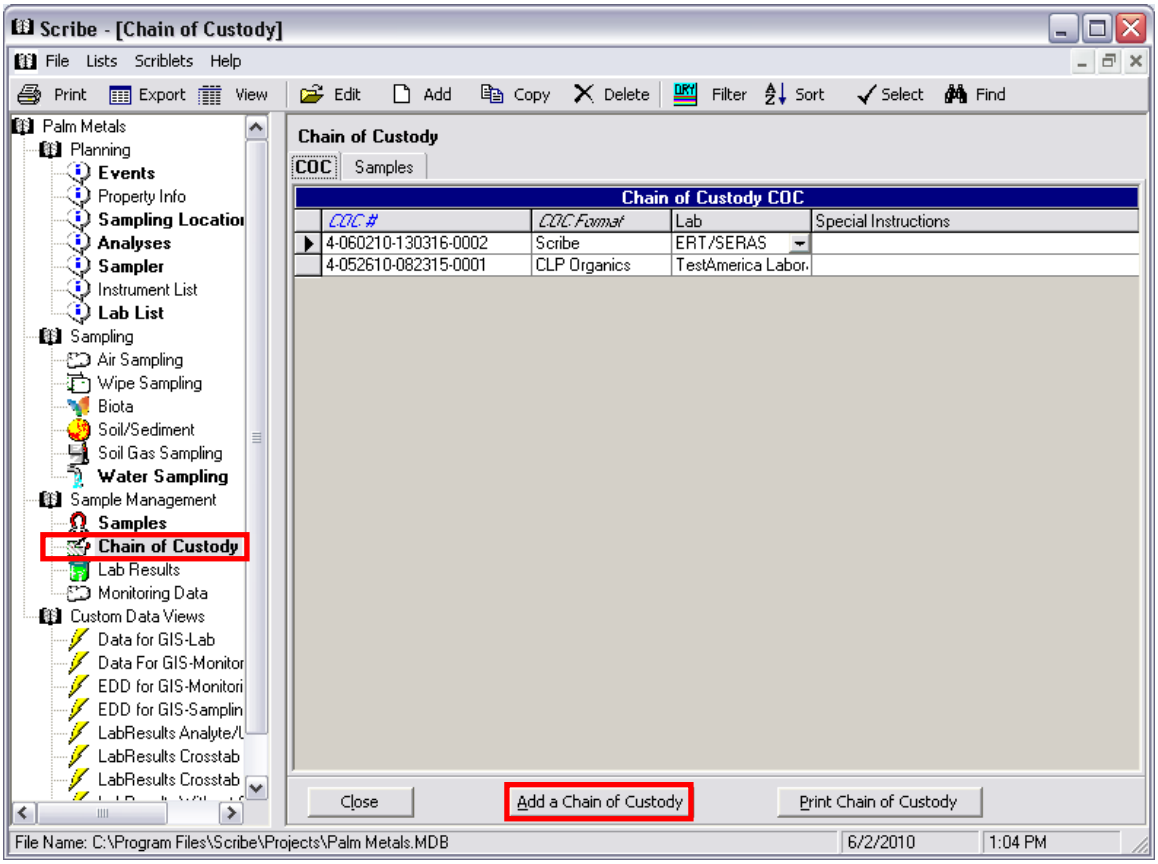
A new feature in Scribe to support CLP sampling is the COC Format for the Chain of Custody. The COC Format option modifies the COC form to adhere to COC standards and requirements. It also controls what samples can be assigned to the COC. For example, Samples with Inorganics analyses can only be assigned to the CLP Inorganics format on the COC.

Note: After submitting samples to the CLP labs, it is recommended that users request the labs to return lab results in electronic format i.e. a spreadsheet (.xls) or a comma-separated text (.csv). Scribe has a Custom Import feature that will import lab result data and marry them up with the sampling data. This effectively eliminates transcription errors and reduces data processing time. See the "Scribe Manual Advanced Part III" for importing details.

Create COC and Assign Samples

To manage and print a Chain of Custody (COC), a COC needs to be created and then samples have to be assigned to the COC:

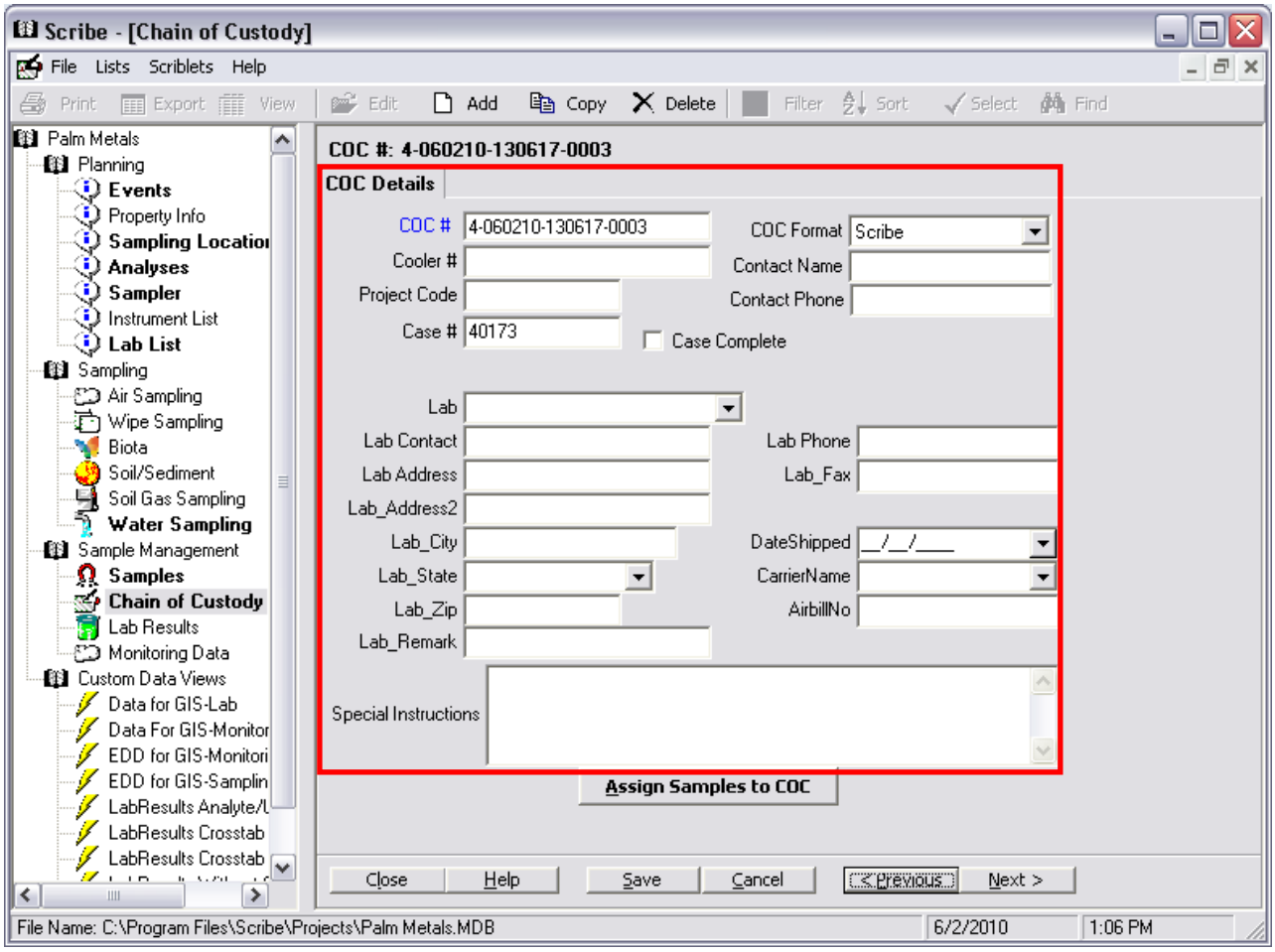
1. Select '**Chain of Custody**' under Sample Management in the left Navigation Pane.



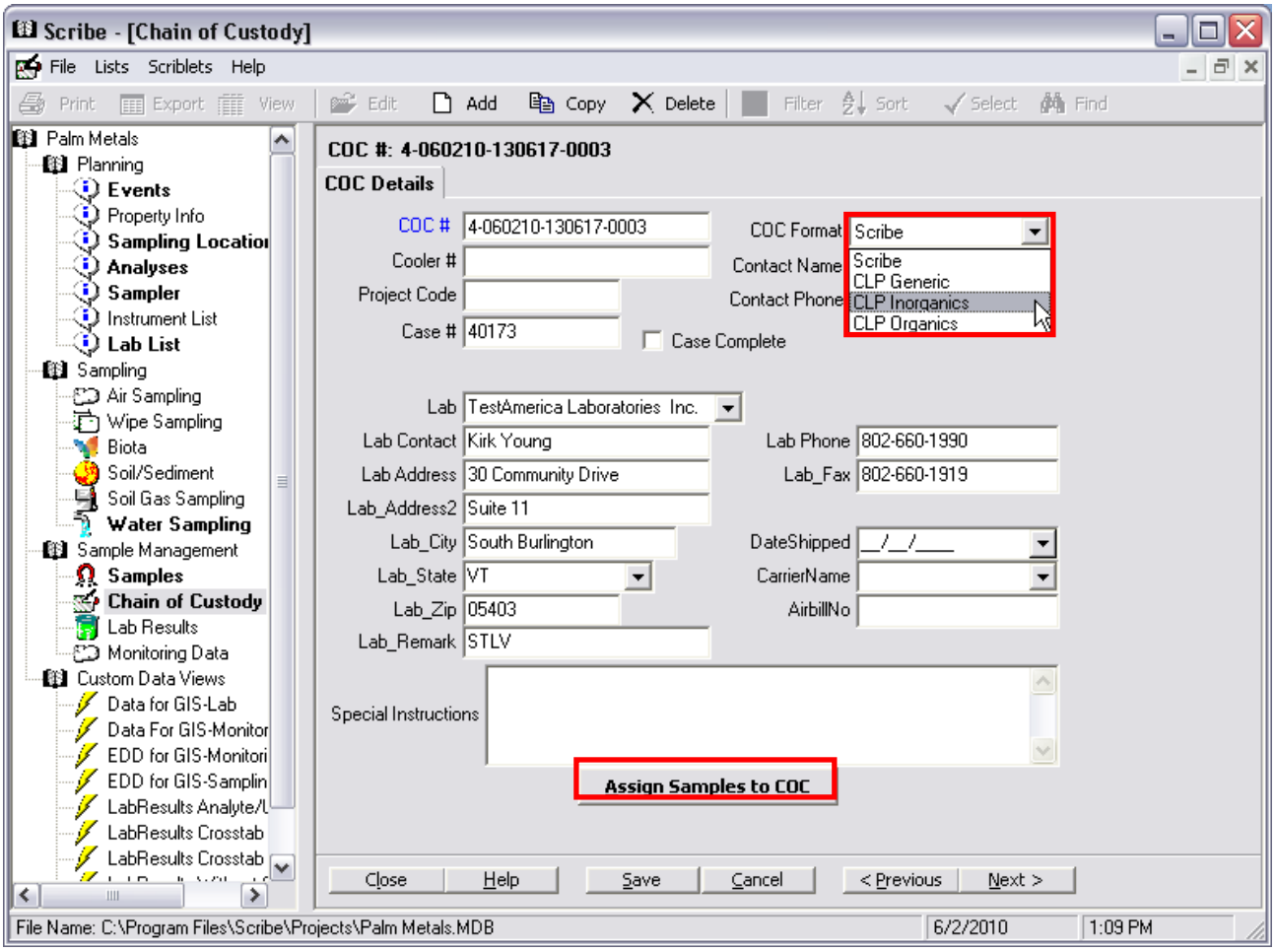
2. Click the '**Add a Chain of Custody**' button on the bottom of the window.

3. The "**COC Details**" screen is displayed.

4. Complete the form by entering other fields such as the **Case #, Cooler #, Lab, and Lab Phone**.

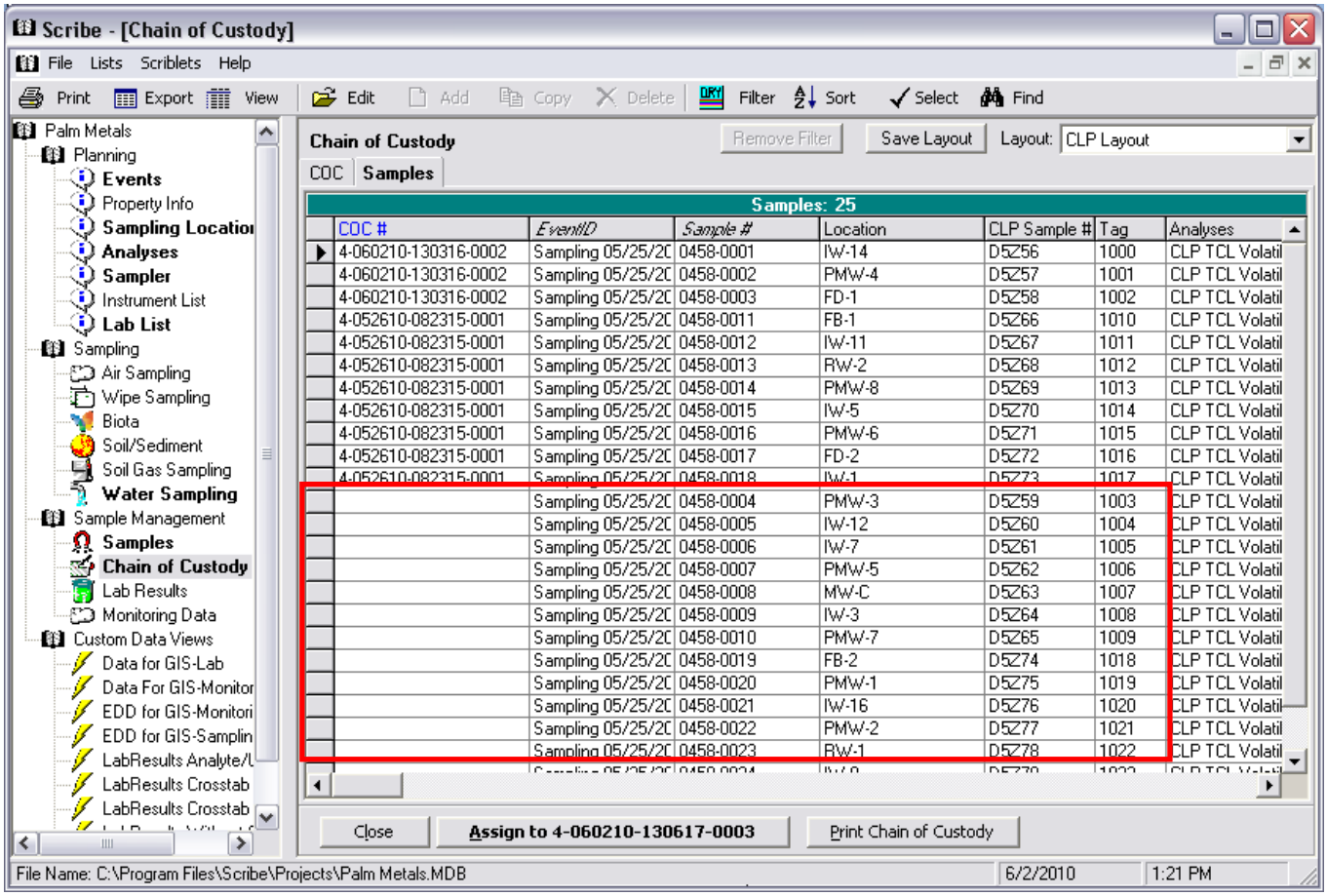


5. Select the appropriate **COC Format** based on the type of COC Samples you are packing. For example, if you are creating a COC for Inorganics, select COC Inorganics. The CLP Generic COC option should be used if you are submitting samples to a program other than CLP but one that requires a CLP/F2L type COC for generating CLP type XML files. Based on the format setting you select, the system will filter for only those types of samples that can be added to this COC.



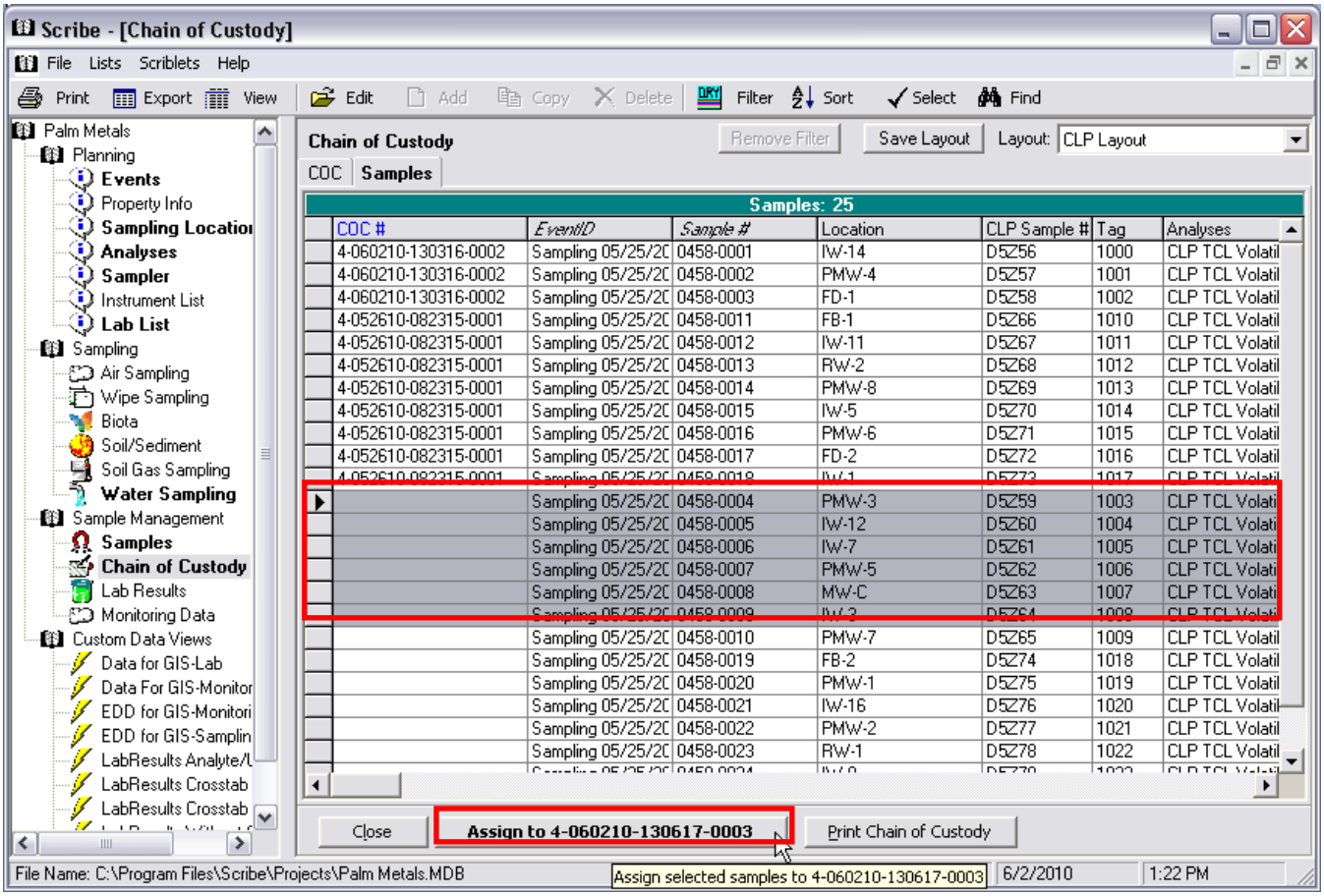
6. Click '**Assign Samples to the COC'** to continue.

7. The "**Chain of Custody Samples**" screen appears. Samples that have not been assigned to a chain are displayed at the bottom of the list.

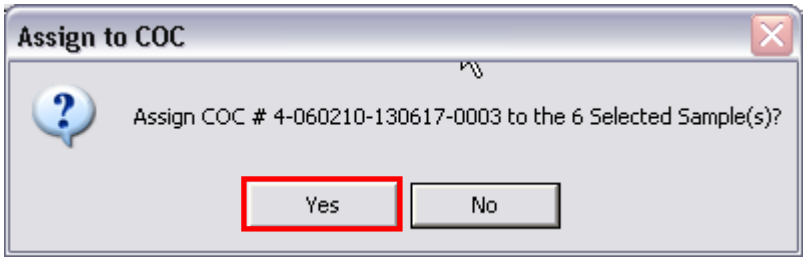


8. Highlight the samples to assign to the new Chain of Custody. Highlight multiple samples by holding down the Shift key or Ctrl key while clicking on the first column before COC# of the samples you wish to assign to the COC.

9. Click the '**Assign to...**' button on the bottom of the window to assign the samples to the Chain of Custody.



10. You will be prompted to confirm. Click '**Yes**' to assign the selected samples to the COC.

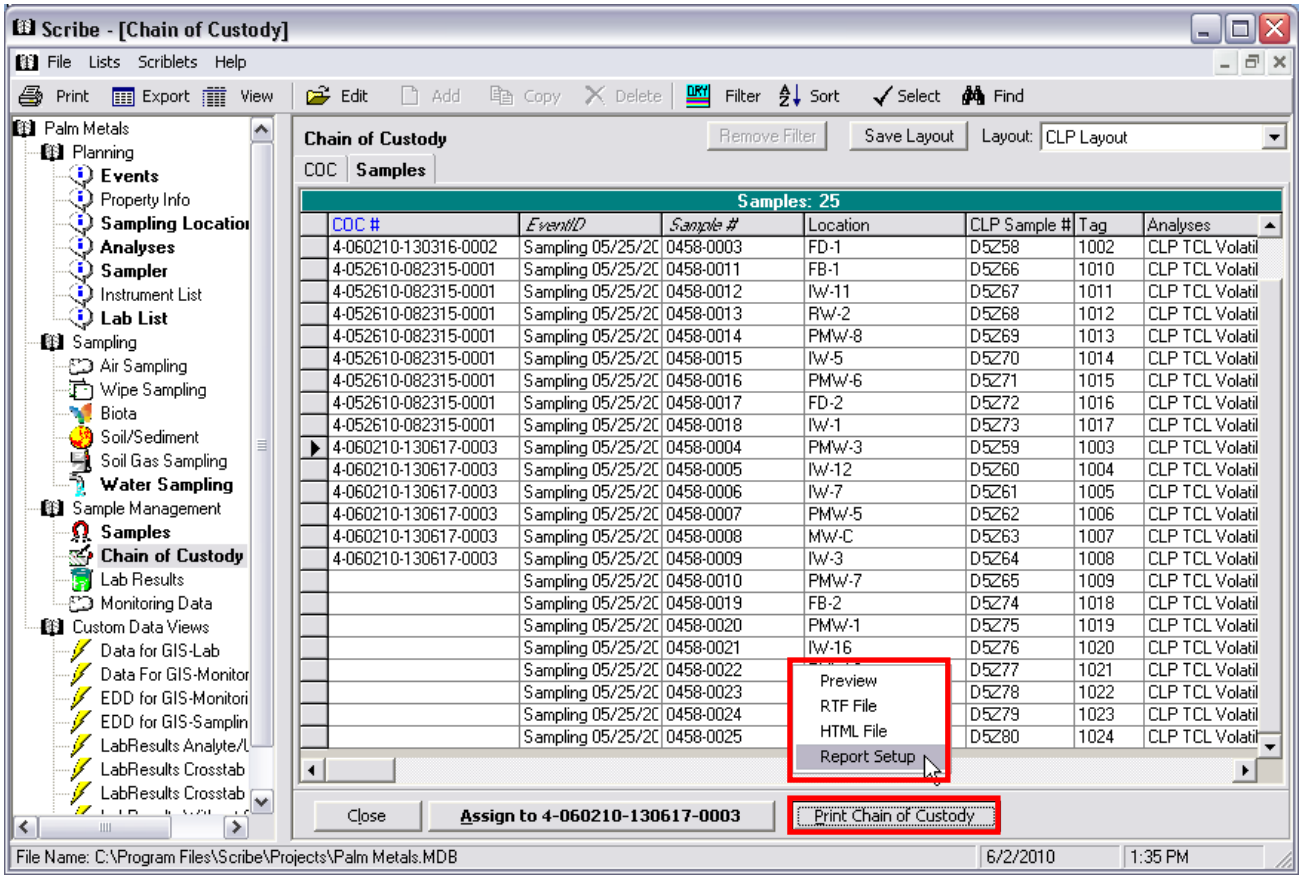


11. You are now ready to configure and print your COC.

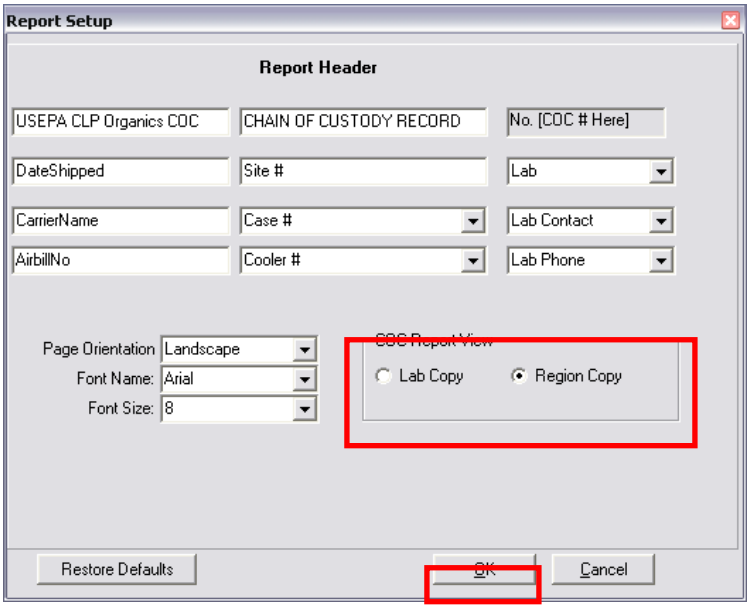
Configure and Print COC

To configure and print a COC:

1. Click the '**Print Chain of Custody**' button.
2. Then select '**Report Setup**'.

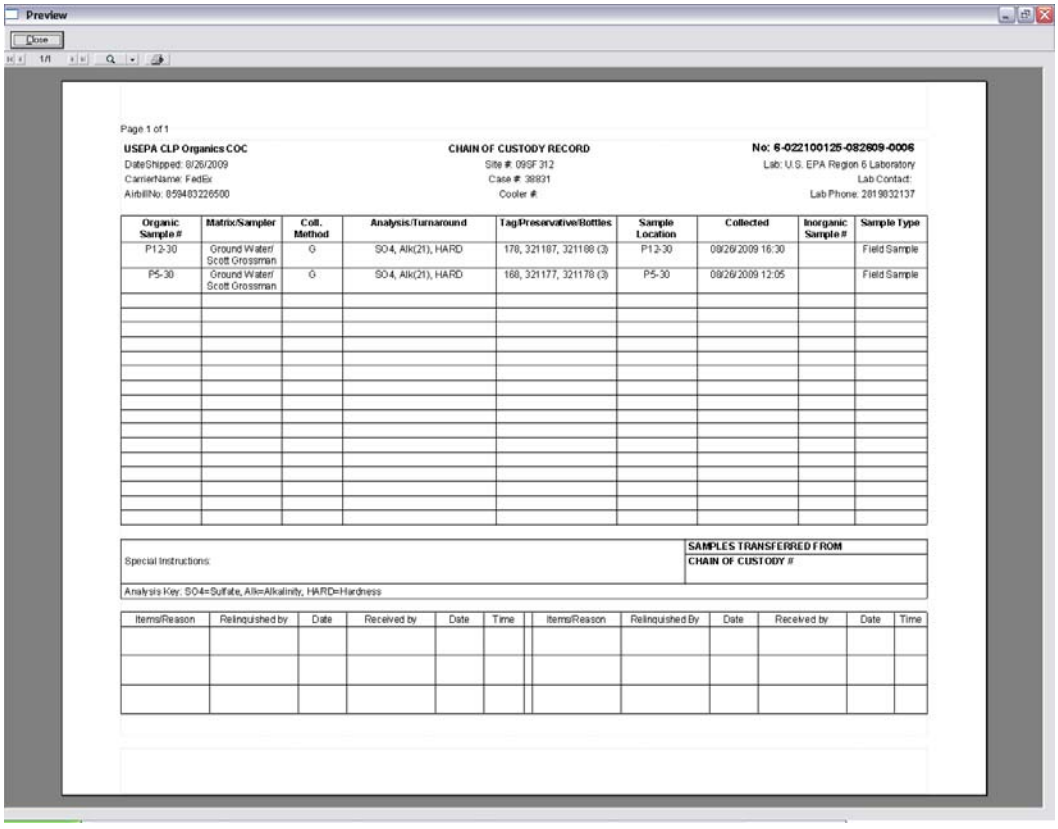


3. The Report Header settings are displayed.



4. The COC Report View (Lab or Region Copy) can also be selected.

5. Click '**OK**' to preview and print the Chain of Custody.

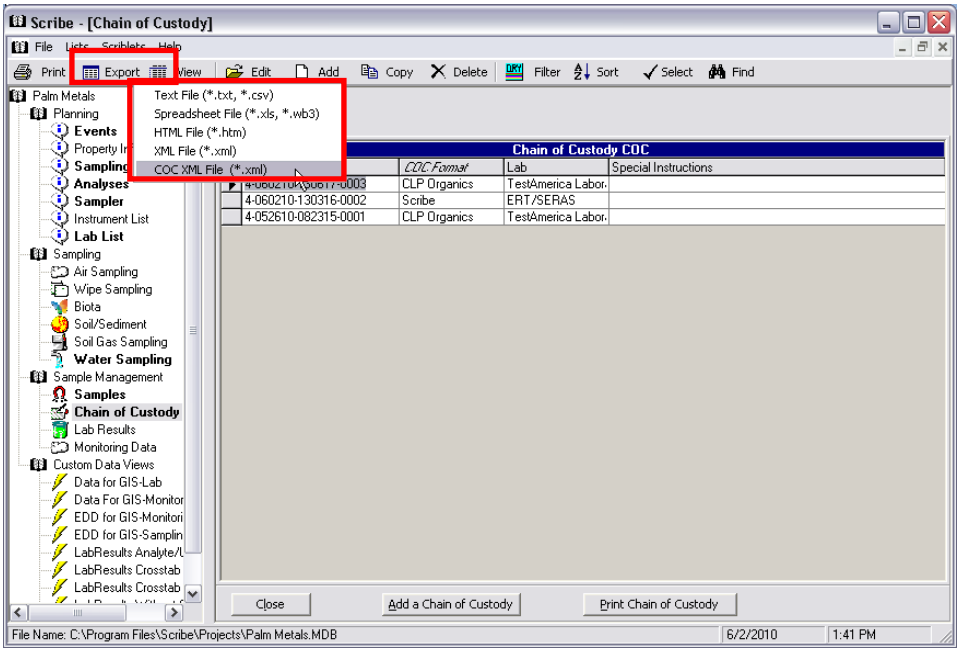


Export to XML File

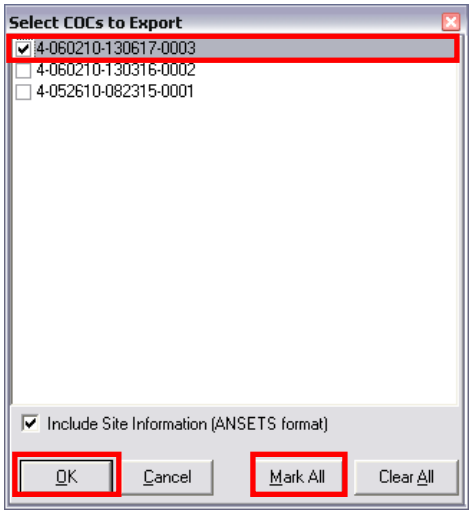
Export COC to XML

A new feature in Scribe is the ability to export the CLP COCs to an XML file. To export:

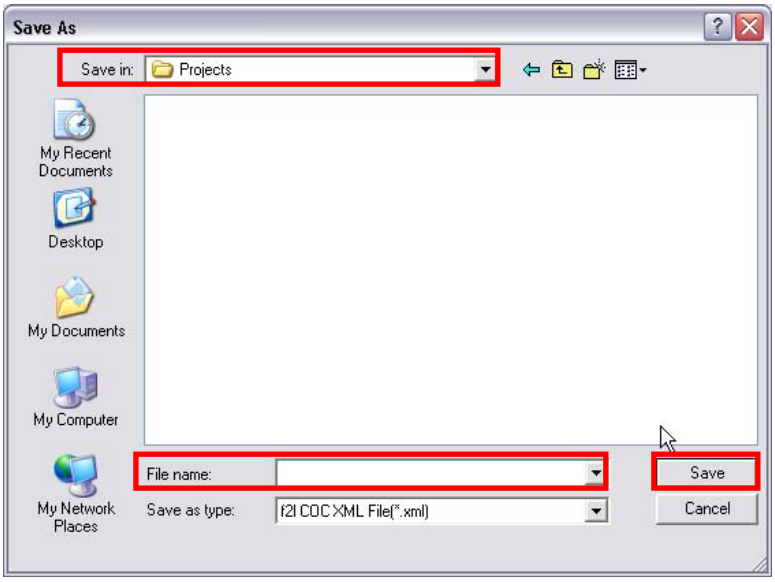
1. Click the '**Export'** button on the top menu bar.
2. Select '**COC XML File (*.xml)**' option.



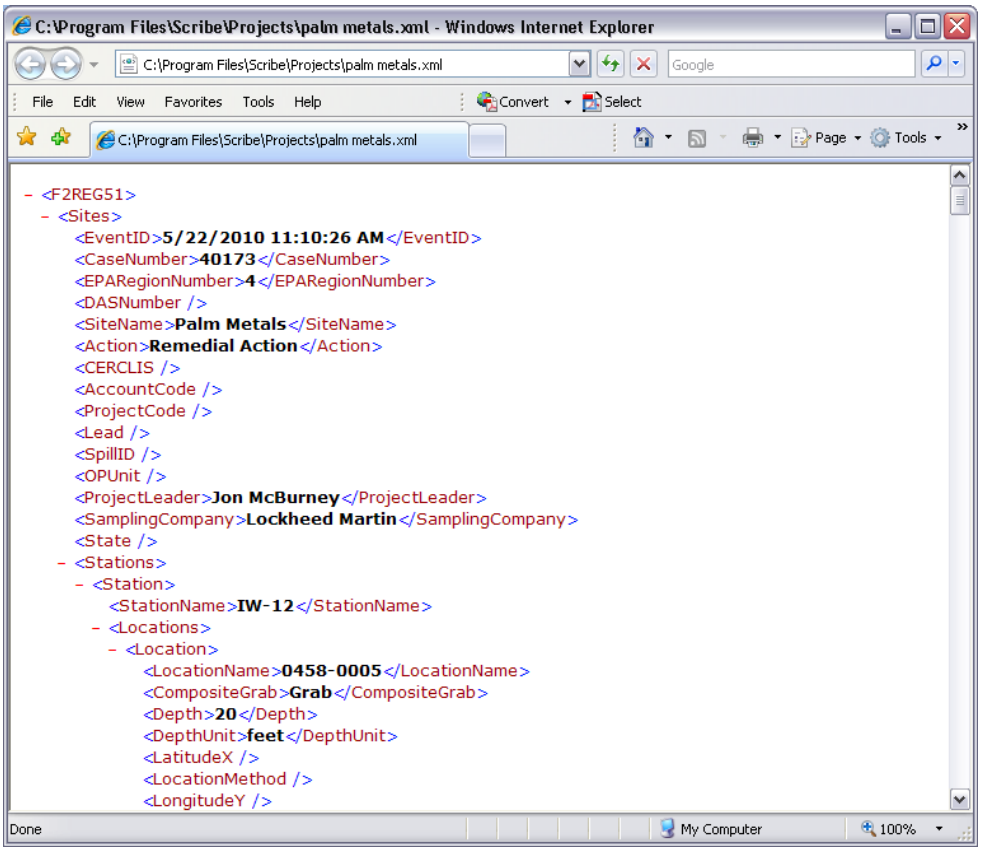
3. Select the Chain of Custody records to export by checking the individual records or click **'Mark All'** to select all COCs.



4. Select your location and provide a filename and click '**Save**'.



5. The XML file will open in Windows Internet Explorer while the file is created and saved.



REPORTING

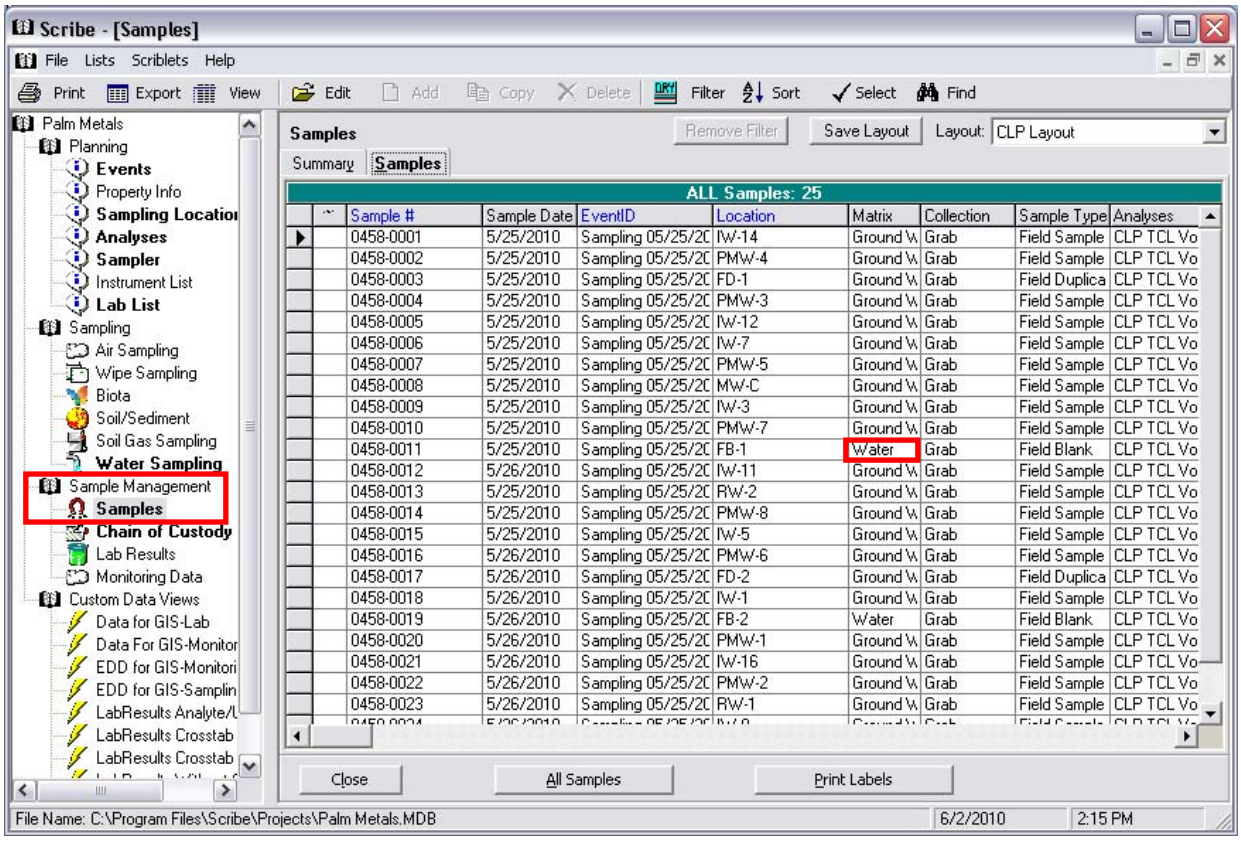
Scribe has flexible reporting options. The most popular way to report out from Scribe is to manipulate the grid view in the All Samples screen to display the data you wish to report. Then export the grid data to an file type that fits your reporting needs. File types include .txt, .csv, .xls, .htm, .xml, .kml, and .kmz.

Find, Filter and Sort

Scribe has built-in user-friendly querying functions such as Find, Filter and Sort. These functions are most useful when you are searching for a particular subset of data that meets one or more criteria.

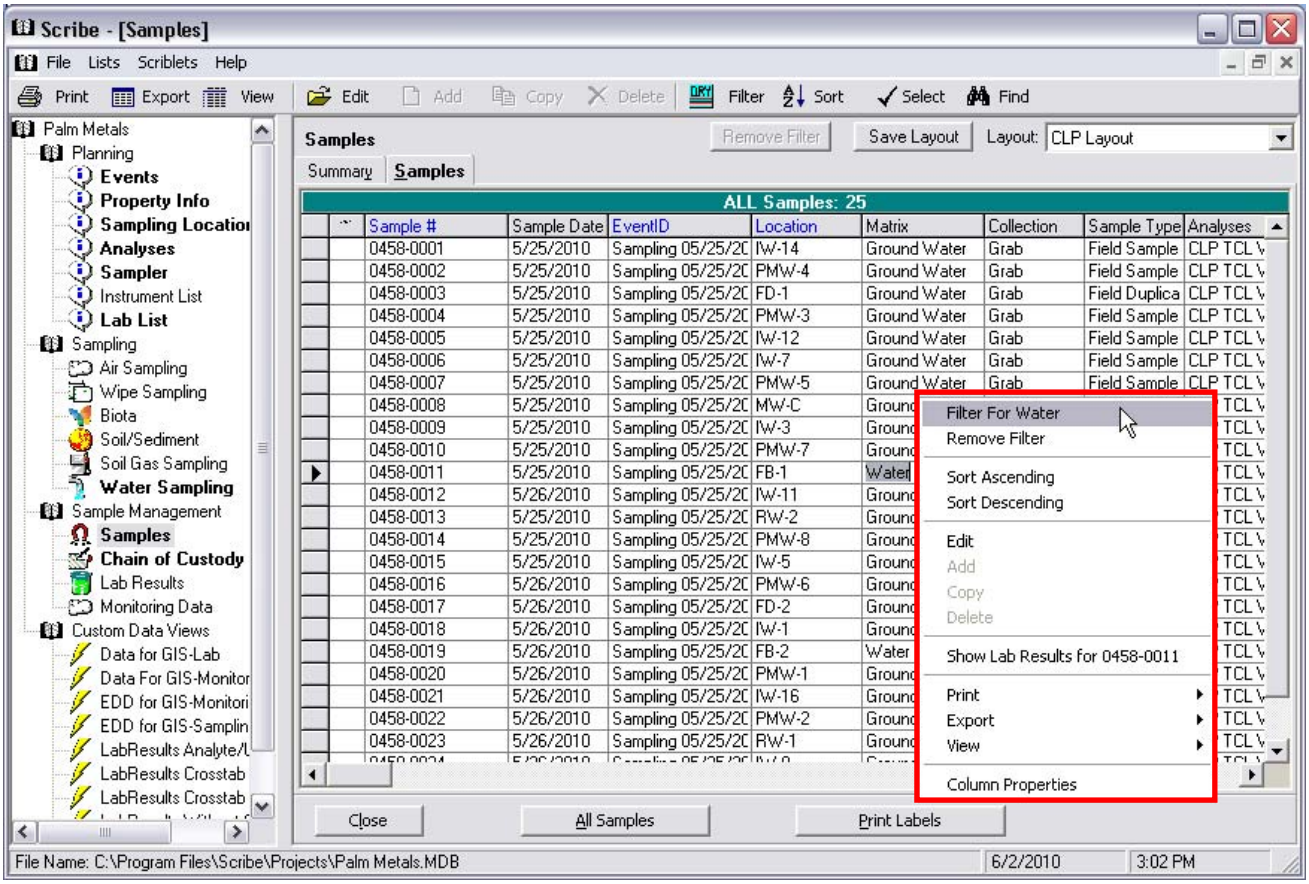
For example, to find and filter for all samples with a Water matrix or Sort ascending/descending:

1. Click on **'Samples'** under Sample Management in the left Navigation bar.



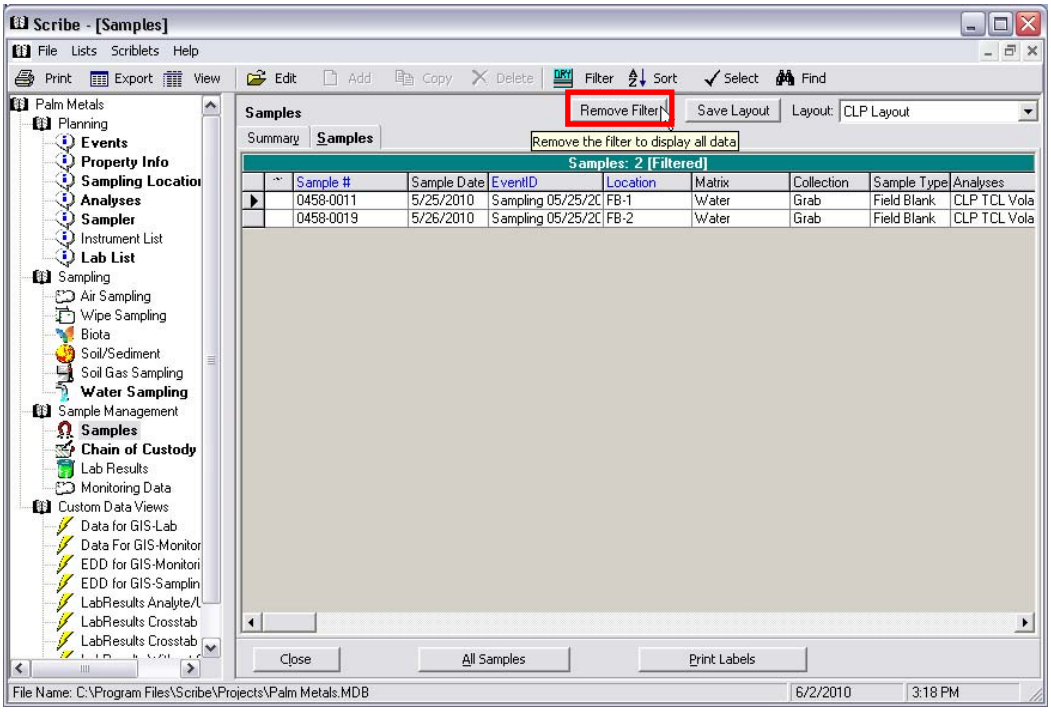
2. To filter or sort on ONE criteria, RT-click on Water value in the Matrix column.

3. Select '**Filter for Water'** in the pop-up menu or select Sort.

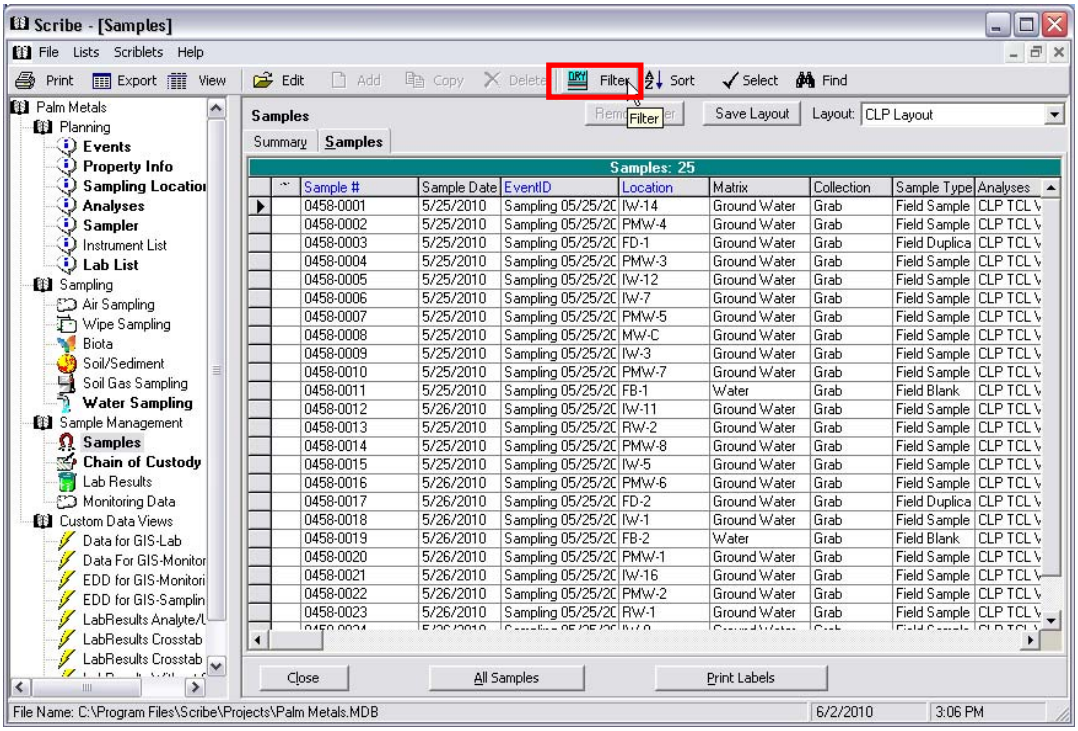


All records that have Water in the Matrix field are displayed.

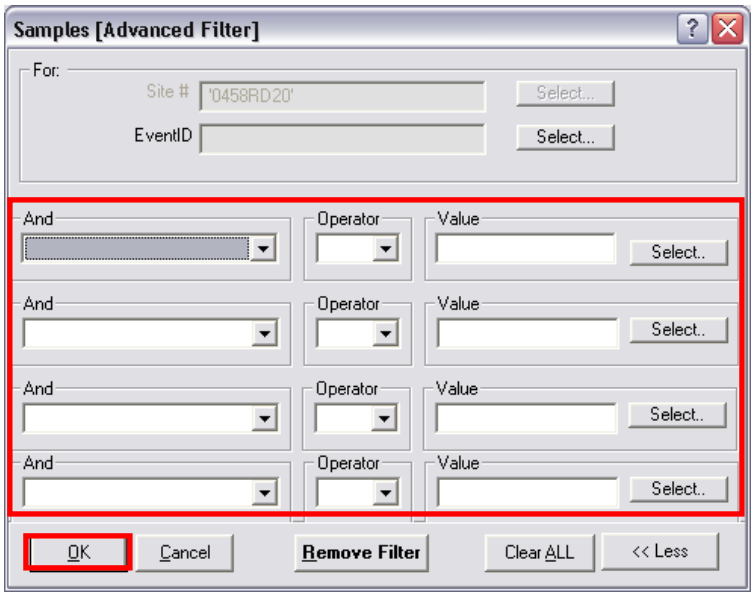
4. To remove the applied filter, click the **'Remove Filter'** button at the top of the screen.



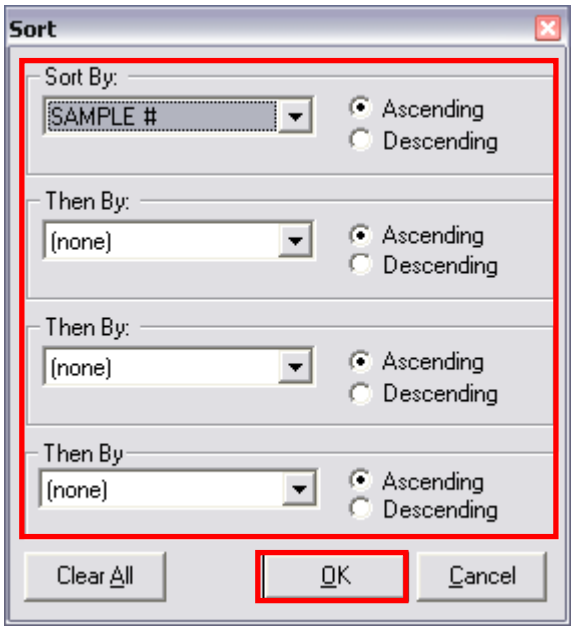
5. To filter on multiple criteria, select the **'Filter'** button on the top menu bar.



6. The Advanced Filter window is displayed. Input the criteria that for your search and click **'OK'** to apply the filter.



7. The Advanced **Sort** button also provides multi-tiered sorting options for sorting on more than one criteria.



Export

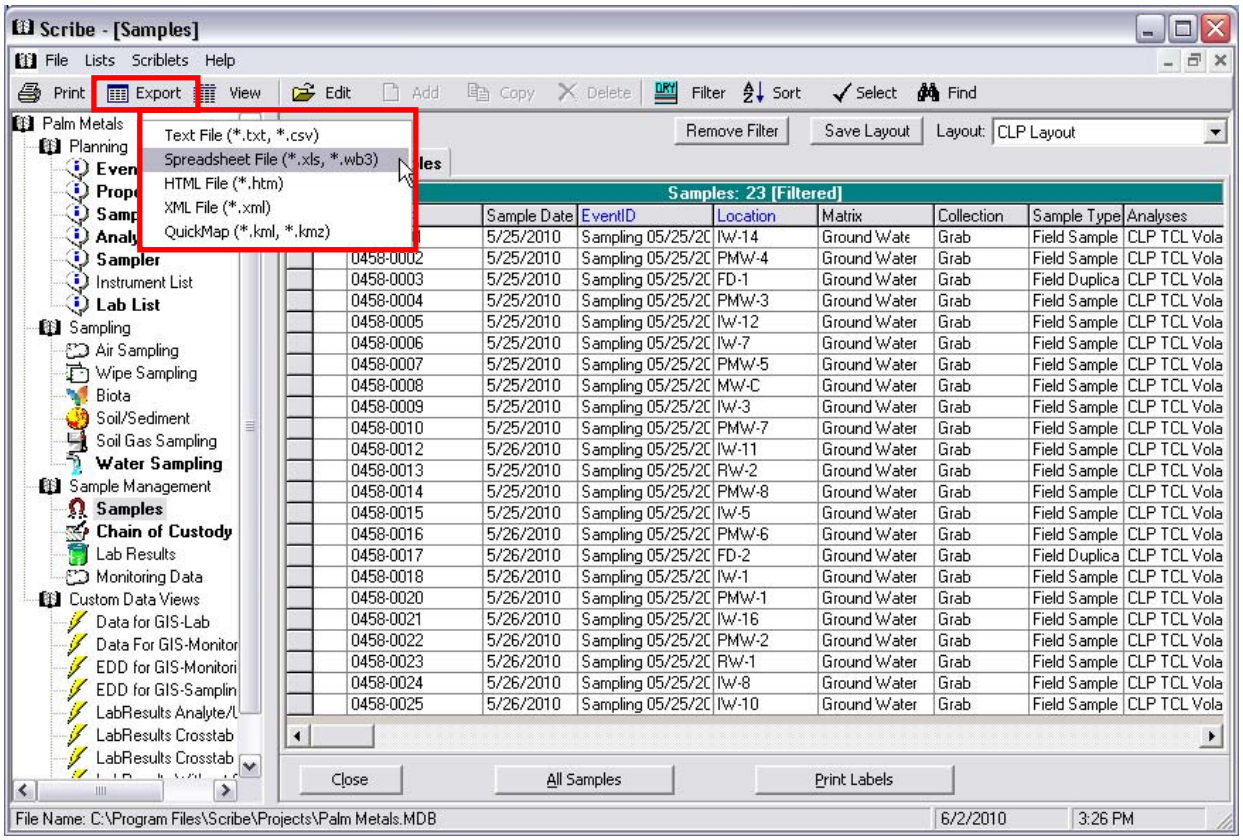
The Scribe grid view does not display every field in Scribe. Select fields are displayed by default and the user can turn on/off the columns. Turn on/off columns as described in the Sample Management section of this document to manipulate the data that is displayed.

After your grid view contains the data necessary for reporting purposes, the user can export the grid view to a third-party file type.

To export the grid view:

1. Click on **'Export'** button on the top menu bar.

2. Select the file type to which you wish to save the data. For example, Spreadsheet (.xls).



3. You will be prompted to select the destination and name the file.

4. The file will open in the external application if it is installed on your computer. For example, if you selected Spreadsheet, Excel will open with the grid data.

Worksheet Reports

Scribe provides a generic worksheet report that allows the user to customize the Header of the report to suit their needs. This option can be used to customize a Samples Report that could be used as a Receipt for Samples on residential sampling tasks.

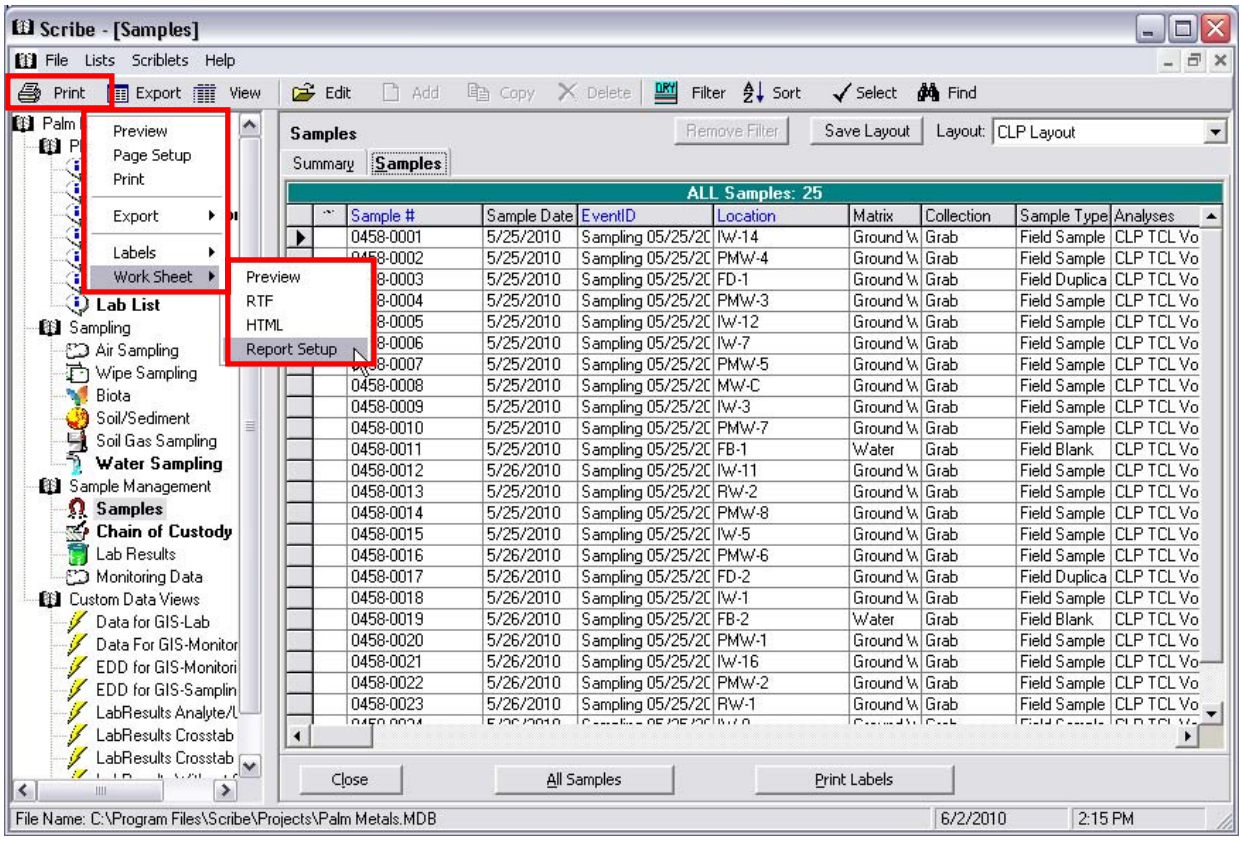
To generate the worksheet report:

1. Use the Find, Filter and Sort options and Column Views to display the data you want to report.

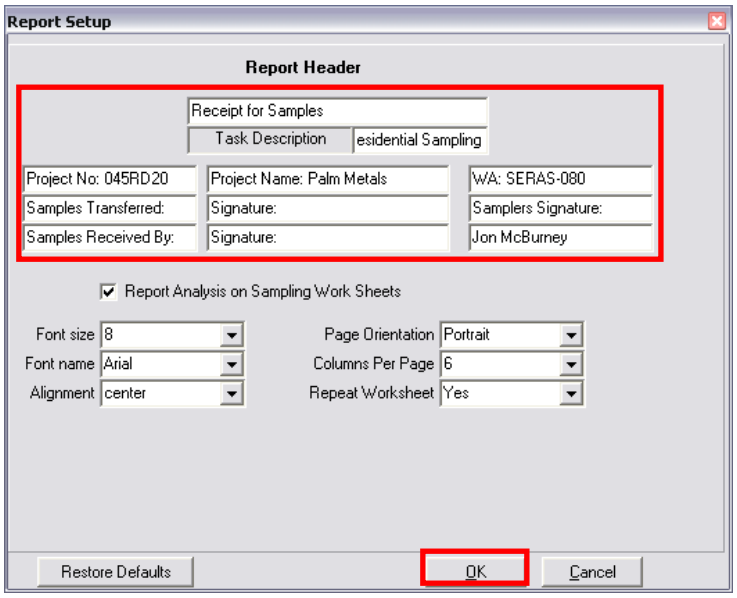
2. Click on the **'Print'** button on the top menu bar.

3. Select the **'Worksheet'** option.

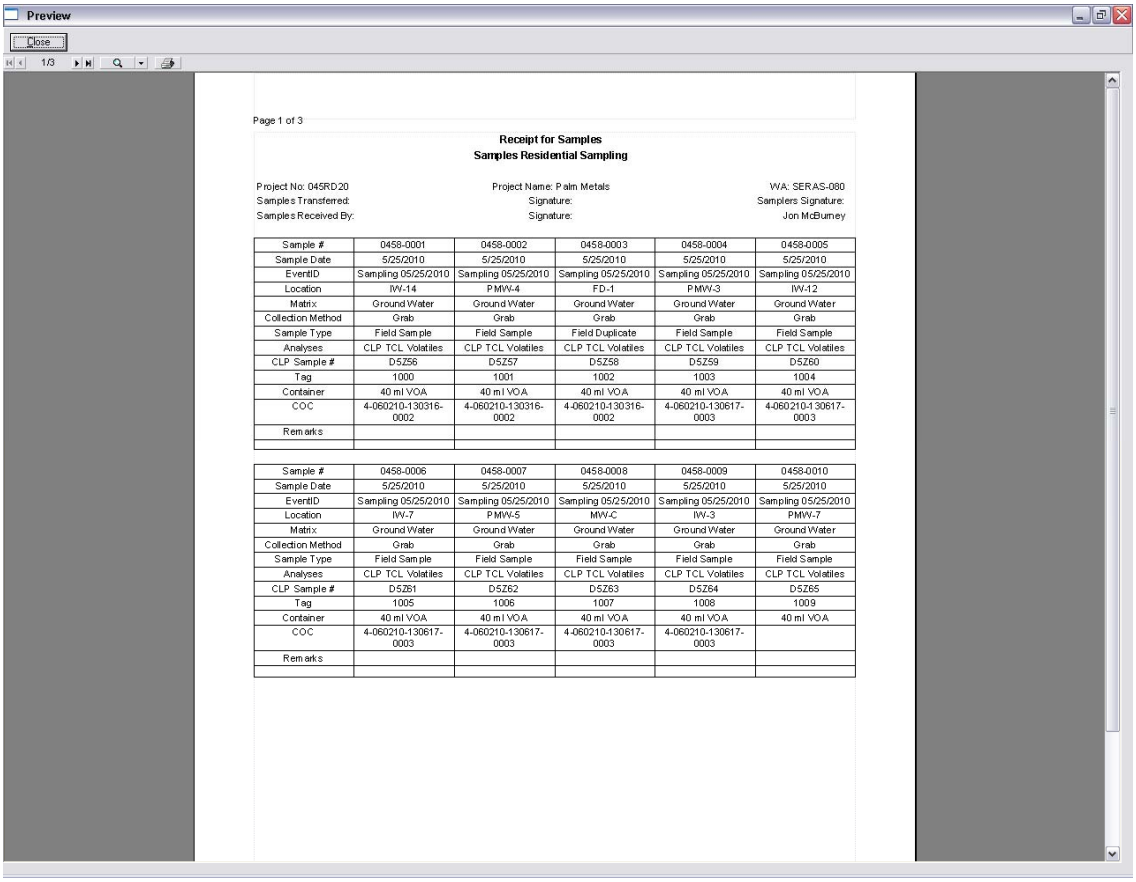
4. Select the **'Report Setup'** option to customize the Header. RTF and HTML will print the worksheet data to the selected format.



5. Configure the Report Header fields to reflect the information that will be displayed at the top of the report.



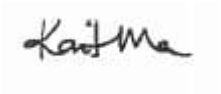
6. Click **'OK'** and the report is generated.



Sample #	0458-0001	0458-0002	0458-0003	0458-0004	0458-0005
Sample Date	5/25/2010	5/25/2010	5/25/2010	5/25/2010	5/25/2010
EventID	Sampling 05/25/2010	Sampling 05/25/2010	Sampling 05/25/2010	Sampling 05/25/2010	Sampling 05/25/2010
Location	IW-14	PMW-4	FD-1	PMW-3	IW-12
Matrix	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
Collection Method	Grab	Grab	Grab	Grab	Grab
Sample Type	Field Sample	Field Sample	Field Duplicate	Field Sample	Field Sample
Analyses	CLP TCL Volatiles	CLP TCL Volatiles	CLP TCL Volatiles	CLP TCL Volatiles	CLP TCL Volatiles
CLP Sample #	D5Z56	D5Z57	D5Z58	D5Z59	D5Z60
Tag	1000	1001	1002	1003	1004
Container	40 ml VOA	40 ml VOA	40 ml VOA	40 ml VOA	40 ml VOA
COC	4-060210-130316-0002	4-060210-130316-0002	4-060210-130316-0002	4-060210-130617-0003	4-060210-130617-0003
Remarks					

Sample #	0458-0006	0458-0007	0458-0008	0458-0009	0458-0010
Sample Date	5/25/2010	5/25/2010	5/25/2010	5/25/2010	5/25/2010
EventID	Sampling 05/25/2010	Sampling 05/25/2010	Sampling 05/25/2010	Sampling 05/25/2010	Sampling 05/25/2010
Location	IW-7	PMW-5	MW-C	IW-3	PMW-7
Matrix	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
Collection Method	Grab	Grab	Grab	Grab	Grab
Sample Type	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Analyses	CLP TCL Volatiles	CLP TCL Volatiles	CLP TCL Volatiles	CLP TCL Volatiles	CLP TCL Volatiles
CLP Sample #	D5Z61	D5Z62	D5Z63	D5Z64	D5Z65
Tag	1005	1006	1007	1008	1009
Container	40 ml VOA	40 ml VOA	40 ml VOA	40 ml VOA	40 ml VOA
COC	4-060210-130617-0003	4-060210-130617-0003	4-060210-130617-0003	4-060210-130617-0003	
Remarks					

Field Operating Procedure-08
Packing and Shipping of Environmental Samples

Author: Kaitlin Ma 5/4/2022 

Author

Approver: Kimberly Amley 5/4/2022 

Program Quality Manager

FIELD OPERATING PROCEDURE 08

Packing and Shipping of Environmental Samples

1.1 Purpose

This Field Operating Procedure (FOP) presents general guidelines for the packing and shipping of samples to the laboratory for analysis.

1.2 Scope

This is a general description of how to pack and ship samples collected and prepared for analysis at an offsite laboratory. Refer project-specific requirements for material or equipment substitutions, as applicable.

1.3 Equipment and Materials

- Waterproof hard plastic coolers
- Resealable plastic bags
- Plastic garbage bags
- Absorbent packing material (not vermiculite)
- Inert cushioning material (not vermiculite)
- Ice
- Scribe software
- Laptop and printer
- Adhesive labels (generated by Scribe software)
- Chain-of-custody forms (generated by Scribe software)
- EPA Regional custody seals, as applicable
- Air bills and shipping pouches (for example, FedEx)
- Clear tape
- Strapping tape
- Mailing labels

1.4 Procedures and Guidelines

1.4.1 Prepare Sample Bottles for Shipment

1. Arrange sample containers in groups by sample number.
2. Check that sample container lids are tight.
3. Arrange containers on ice in assigned coolers.
4. Affix appropriate adhesive labels to each container.
5. Enclose each sample in a clear, resealable plastic bag, making sure that sample labels are visible.

1.4.2 Prepare Evacuated Canisters Shipment

1. Arrange sample canisters in groups by sample number.
2. Check that the canisters were fully closed upon completion of sampling.
3. Secure laboratory-provided sample tags on canister with string or wire, if applicable
4. Arrange canisters in assigned boxes for shipment. Note that canisters are not shipped with ice.
5. Place flow controllers used for sampling within the box for shipment.
6. Affix appropriate adhesive labels to each box.

1.4.3 Prepare Coolers or Boxes (Evacuated Canisters only) for Shipment

1. Tape drains shut, inside and out.
2. Place inert cushioning material (for example, bubble wrap, preformed poly-foam liner) in the bottom of each package. Do not use vermiculite.
3. Put an absorbent pad in the bottom of the cooler and fill the cooler with enough packing material to prevent breakage of the sample bottles and to absorb the entire volume of the liquid being shipped (offsite sample shipment only). Absorbent material is not required for shipment of evacuated canisters.
4. Double-bag and seal loose ice in resealable, plastic, zip-top bags to prevent melting ice from leaking and soaking the packing material. Place the ice outside the garbage bags containing the samples. Place sufficient ice in cooler to maintain the internal temperature at 4±2 degrees Celsius during transport. Evacuated canisters are not shipped on ice.
5. Place appropriate chain-of-custody records with corresponding custody seals on top of each package.
6. Record the EPA Regional custody seal numbers, as applicable, on the chain-of-custody forms if package is being shipped. Sign each chain-of-custody form (or obtain signature) and indicate the time and date the cooler was custody sealed.
7. Seal the laboratory copies of the chain-of-custody forms in a large resealable plastic bag and tape to the inside lid of the package. Retain copies of the chain-of-custody forms for return to EPA, if requested (required for Region 5). Each cooler must contain a chain-of-custody form (or forms) that corresponds to the contents of the package.
8. Close lid and latch.
9. Peel custody seals carefully from backings and place intact over lid openings (right front and left back) for shipping. Cover seals with clear protection tape. When shipping evacuated canisters, verify that custody seals are placed so that if the box was opened they would break.
10. Place mailing label with laboratory address on top of each package.
11. Affix applicable laboratory-provided shipping labels on the outside of the package being shipped.
12. Tape package shut on both ends, making several complete revolutions with strapping tape for shipping. Do not cover custody seals with strapping tape.
13. Relinquish to carrier (for example, Federal Express). Place air bill receipt inside the mailing envelope and send to sample documentation coordinator, along with the other documentation.

1.5 Records Retention and Management

Project records will be managed in accordance with the DES CLIN 3 Quality Management Plan. Project documents and records will be retained for 10 years after the closing date of the prime contract. All information generated under this program is considered to be confidential and shall not be released to others without the written consent of the Contract Officer.

1.6 Quality Control and Quality Assurance

- Verify each cooler contains a chain-of-custody form (or forms) that corresponds to the contents of the package.
- Verify forms are complete before sealing inside the cooler.
- Verify EPA Regional copies of the chain-of-custody forms are retained for return to EPA, as applicable.
- Inspect the cooler for leaks prior to relinquishing to the carrier.

1.7 Attachments

None.

1.8 References

CH2M HILL, INC. *Quality Management Plan for U.S. Environmental Protection Agency Remedial Acquisition Framework (RAF) Design and Engineering Services (DES) Contract CLIN 3*. May 2022.

Field Operating Procedure-10
Investigation and Remediation-derived Waste Management

Author: Steve Chumney	5/4/2022	
	Date	Project Manager
Approver: Kimberly Amley	5/4/2022	
		Program Quality Manager

FIELD OPERATING PROCEDURE-10

Investigation and Remediation-derived Waste Management

1.1 Purpose

The purpose of this field operating procedure (FOP) is to provide general guidelines for the handling and disposal of investigation-derived waste (IDW) or remediation-derived waste (RDW). Refer to the project-specific Waste Management Plan (WMP) for additional details.

1.2 Scope

This FOP covers the handling and disposal of IDW/RDW, which are the waste materials generated during a field investigation and remediation activities, respectively. Some of the waste materials may be classified as hazardous waste. All IDW/RDW must be disposed of in accordance with local, state, and federal regulations.

1.3 Equipment and Materials

- Log book
- Indelible pen
- Container labels
- Approved waste container

1.4 Procedures and Guidelines

All IDW/RDW will be handled in accordance with federal and state regulations, as well as any site-specific requirements. If IDW/RDW is identified as potentially hazardous waste based on analytical data, it must be segregated from IDW/RDW that will be treated as nonhazardous for further characterization.

The following IDW/RDW will be placed in United Nations (UN)-approved 55-gallon steel drums or other container approved by the project-specific Environmental Manager:

- Disposable equipment, such as plastic ground and equipment covers, aluminum foil, Teflon tubing, broken or unused sample containers, sample container boxes, and tape
- Used personal protective equipment (PPE), such as disposable coveralls, gloves, booties, and respirator canisters identified as potentially hazardous waste
- Excessive soil brought to the surface during sampling activities not used for laboratory analysis Groundwater obtained through well development, purging, and/or sampling
- Development water
- Decontamination fluids

IDW/RDW not identified as potentially hazardous waste will be managed as follows:

- Used PPE will be placed in a UN-approved 55-gallon drum, trash bag, or project-specific approved container and disposed of as a solid waste in an appropriate licensed landfill.

1.4.1 Labeling

All IDW/RDW containers will be labeled to identify their waste status.

- Type of waste (for example, groundwater or decontamination fluids)
- Location from which the waste was generated
- Accumulation start date
- Generator point of contact (POC)

Containers used to accumulate waste will include one of the following labels:

- "Analysis Pending" – This is a temporary label used until analytical results are received and reviewed, and the waste characterized as hazardous or nonhazardous. Once the waste is characterized, this label will be replaced with one of the following labels. Include the accumulation start date on this label.
- "Hazardous Waste" labels with the following information:
  - Accumulation start date
  - Generator name, address, contact, and phone number
  - U.S. Environmental Protection Agency (EPA) identification (ID) number
  - Why the waste is hazardous (toxic, ignitable, corrosive, reactive)
  - RCRA waste code(s)
  - Proper Department of Transportation shipping name
  - Prior to transport, the manifest number must be added (for containers of less than 110-gallon capacity)
  - Manifest tracking number will be entered when pickup occurs
- "Nonhazardous Waste" labels with the following information:
  - Generator name
  - POC name and phone number
  - Waste-specific information (for example, petroleum-contaminated soil or petroleum-contaminated water)

For hazardous waste, the DOT labels (for example, flammable or oxidizer) will be included on the container prior to shipment.

1.4.2 Waste Accumulation Area Management

All IDW/RDW identified as potentially hazardous will be transferred as soon as practical to a temporary storage area identified by the field team leader. The following requirements apply to the waste storage areas:

- Hazardous wastes and waste awaiting designation will be stored separately in the waste accumulation area.
- Store containers in rows based on the waste stream designators.
- When possible, store UN-approved 55-gallon drums with solids on concrete, wooden pallets, or project-specific secondary containment system.
- Drums or other containers containing liquid waste will be placed in secondary containment.
- Drums will remain completely closed with lids, covers, bolts, and locking mechanisms engaged, as though ready for immediate transport, except when removing or adding waste to the drum.
- No waste container will be placed within 50 feet of a water course or storm drain.

1.4.3 Offsite Disposal

Arrangements will be made immediately upon completion of sampling activities to have the contracted waste handling firm remove the waste from the site. The need for waste disposal analysis will be determined as discussed with the contract waste handler before the onset of field events. IDW/RDW sampling, if required, will be completed in accordance with project-specific requirements.

1.5 Records Management

Project records will be managed in accordance with the DES CLIN 3 Quality Management Plan. Project documents and records will be retained for 10 years after the closing date of the prime contract. All information generated under this program is considered to be confidential and shall not be released to others without the written consent of the Contract Officer.

1.6 Quality Control and Quality Assurance

The field notes will be reviewed by the Site Quality Control Manager at the end of each work day performed.

1.7 Attachments

None.

1.8 References

CH2M HILL, INC. *Quality Management Plan for U.S. Environmental Protection Agency Remedial Acquisition Framework (RAF) Design and Engineering Services (DES) Contract CLIN 3*. May 2022.

Field Operating Procedure-16
GPS Coordinate Data Collection Procedures

Author: Ryan Sleeper 5/4/2022 

Author

Approver: Kimberly Amley 5/4/2022 

Program Quality Manager

FIELD OPERATING PROCEDURE-16

GPS Coordinate Data Collection Procedures

1.1 Purpose

This field operating procedure (FOP) provides guidelines for the collection of horizontal coordinates during field activities using a Global Positioning System (GPS) unit.

1.2 Scope

This method described for the collection of horizontal coordinates is applicable to a Trimble® Pathfinder Pro XR, Pro XRS, or comparable GPS receivers. The level of accuracy following this procedure is submeter. Refer to specific requirements of the project in the Uniform Federal Policy for Quality Assurance Project Plan (UFP-QAPP) or project plan(s) when using this FOP during field activities.

1.3 Equipment and Materials

- Trimble® Pathfinder Pro XR, Pro XRS, or comparable GPS receiver and compatible data-logger
- Field Logbook
- Pin Flags
- Aerial Photograph or map of Sampling Area
- Measuring Wheel

1.4 Procedures and Guidelines

- Assemble and turn on the unit in accordance to manufacturer's instructions.
- Verify that GPS readouts are in the units specified in the UFP-QAPP or project plan(s).
- Place the GPS antenna over the location where coordinates are to be collected, and record coordinates in field logbook, the GPS receiver, or both. If locations are to be logged into the receiver, readings must be collected every 5 seconds for a period of 1 minute (see manufacturer instructions on position logging). The data files recorded for each position must be named including both the sample location identification and date recorded.
- The data from the GPS unit must be downloaded to a personal computer every 2 hours or at each new sampling site. If neither option for downloading data is available (i.e., collecting samples from a boat), then a real-time reading of coordinates must also be recorded in the field log book or appropriate field form.
- The program precision and accuracy requirements for location coordinates are ± 1 meter (3.3 feet). To achieve real-time data with a submeter accuracy level with no post-processing of data using GPS Pathfinder Office, the following criteria must be met:
    - Minimum number of satellites = 4
    - Maximum Position Dilution of Precision (PDOP) = 6

  - Minimum (Signal to Noise Ration) SNR = 4
  - Minimum elevation = 15 degrees

- If any of the above criteria cannot be met due to weather conditions, time of day, or obstructions of the sky, such as buildings or foliage resulting in a less than submeter accuracy:
  - Mark the location using a pin flag and measure the distance from two known points for future triangulation calculations. Come back and take a reading when conditions are optimal, if the location coordinate accuracy requirements cannot be met because of either weather conditions or time of day.
  - Mark the location on an applicable aerial photograph or map for coordinate extrapolation in GIS and measure the distance from two known points if the location coordinate accuracy requirements cannot be met because of heavy foliage or other physical obstruction.
  - Mark the location on the applicable aerial photograph or map if the location cannot be marked using a pin flag (over water), no matter the obstruction. Also, estimate the distance from two known locations and note in the field logbook so that, at a minimum, a general location position can be obtained.

1.5 Records Retention and Management

Project records will be managed in accordance with the DES CLIN 3 Quality Management Plan. Project documents and records will be retained for 10 years after the closing date of the prime contract. All information generated under this program is considered to be confidential and shall not be released to others without the written consent of the Contract Officer.

1.6 Quality Control and Quality Assurance

- Verify the coordinate units meet the project plan(s).
- Charge battery to GPS unit when not in use.
- The field notes will be reviewed by the Site Quality Control Manager at the end of each work day performed.

1.7 Attachments

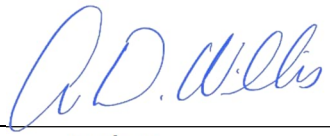
None.

1.8 References

CH2M HILL, INC. *Quality Management Plan for U.S. Environmental Protection Agency Remedial Acquisition Framework (RAF) Design and Engineering Services (DES) Contract CLIN 3*. May 2022.

Field Operating Procedure-47
Global Navigation Satellite System Survey Procedures

Author: Aaron Willis, PLS 6/14/2023



Author

Approver: Kimberly Amley 6/14/2023

Program Quality Manager

FIELD OPERATING PROCEDURE-47

Global Navigation Satellite System Survey Procedures

1.1 Purpose

This field operating procedure (FOP) provides general guidelines for conducting land surveying using Global Navigation Satellite System (GNSS) equipment.

1.2 Scope

The FOP covers the topic of GNSS survey and ensures consistency, accuracy, and safety during GNSS surveys. This document should be reviewed by the field project team prior to working in the field.

1.3 Equipment and Materials

- Log book and indelible pen.
- GNSS Receiver: Use a high-precision GNSS receiver capable of tracking multiple satellite constellations (e.g., GPS, GLONASS, Galileo, BeiDou).
- Surveying Rod: Use a surveying rod with precise height markings for accurate measurements.
- Data Collector: Utilize a data collector device or tablet equipped with software capable of recording GNSS data.

1.4 Procedures and Guidelines

1.4.1 Pre-survey Preparation

- Review Project Requirements: Understand the project scope, objectives, and client requirements for the GNSS survey.
- Check Equipment: Ensure the GNSS receiver, surveying rod, and data collector are in good working condition. Calibrate and update the firmware, if necessary.
- Verify Control Points and/or Reference Stations: Confirm the availability and suitability of control points or reference stations for real-time corrections or post-processing.
- Check Satellite Visibility: Check the satellite visibility int eh area of interest to ensure sufficient satellite coverage for accurate positioning.

1.4.2 Field Survey Procedure

- Establish Control Points: Establish or locate existing control points in the survey area with known coordinates. Ensure that these control points are marked clearly and can be easily identified.

- Set-up the GNSS Receiver: Set up the GNSS receiver on a stable tripod mount. Ensure it is level and provide clear sky visibility.
- Connect to Reference Station: Connect the GNSS receiver to the available reference station for real-time corrections, if applicable. Follow the manufacturer's instructions for establishing a reliable connection.
- Check Control Points: Move the GNSS receiver to each control point and occupy it for a sufficient duration to collect accurate GNSS data. Maintain stability and avoid disturbances during data collection.
- Field Checks: Perform field checks to identify and address potential errors.
- Document Field Observations: Using a field logbook, document field observations, environmental conditions, equipment issues, equipment calibration, or other factors that may impact data quality.

1.4.3 Post Processing

- Data Transfer: Transfer the collected GNSS data from the data collector to a secure storage medium for further processing.
- Quality Control: Perform quality control checks on the collected data, including validating data integrity, signal quality, and positional accuracy.
- Post-Processing Software: Utilize post-processing software to process the raw GNSS data. If required, apply appropriate correction models, such as differential correction, to enhance accuracy.
- Adjustments and Georeferencing: Using Computer-Aided Drafting (CAD) Software, generate the required maps, reports, and digital datasets, according to project specifications.

1.5 Records Management

Project records will be managed in accordance with the DES CLIN 3 Quality Management Plan. Project documents and records will be retained for 10 years after the closing date of the prime contract. All information generated under this program is considered to be confidential and shall not be released to others without the written consent of the Contract Officer.

1.6 Quality Control and Quality Assurance

- Conduct quality control checks as outlined in the procedural steps in Section 1.4.
- Implement Safety Precautions outlined in the project-specific safety plan, including but not limited to:
    - Personal Safety: Prioritize personal safety during the survey. Follow local safety guidelines and wear appropriate personal protective equipment (PPE), such as hard hats, high-visibility vests, and safety boots.
    - Hazard Identification: Identify and assess potential hazards in the survey area, such as uneven terrain, traffic, underground utilities, or environmental risks. Take necessary precautions to mitigate risks and ensure the safety of survey personnel and others in the vicinity.

- Environmental Awareness: Be aware of the surroundings, including potential hazards such as uneven terrain, traffic, wildlife, or inclement weather conditions. Take necessary precautions and adapt surveying procedures accordingly.
- Traffic Control: Implement appropriate traffic control measures if the survey involves working near roadways or areas with vehicular traffic. Comply with local regulations and ensure the safety of survey personnel and motorists.
- Communication: Maintain clear communication among survey team members to coordinate activities, share information, and address any safety concerns that may arise during the survey.
- Equipment Safety: Handle the GNSS receiver and associated equipment with care to prevent damage. Secure equipment during transportation and store properly when not in use. Equipment should be checked by a manufacturer-approved vendor, as needed.
- Emergency Preparedness: Be prepared for emergencies by carrying necessary safety equipment, such as first aid kits, communication devices, and emergency contact information.
- Site Access and Permissions: Obtain permissions and access permits before conducting surveys on private property, government land, or restricted areas. Respect property boundaries and comply with applicable regulations.
- Data Privacy and Confidentiality: All information generated under this program is considered to be confidential and shall not be released to others without the written consent of the Contract Officer. Protect the privacy and confidentiality of collected survey data, adhering to legal and ethical obligations. Store and handle data securely to prevent unauthorized access or disclosure.

1.7 Attachments

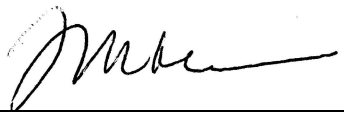
None.

1.8 References

CH2M HILL, INC. *Quality Management Plan for U.S. Environmental Protection Agency Remedial Acquisition Framework (RAF) Design and Engineering Services (DES) Contract CLIN 3*. May 2022.

Field Operating Procedure-50
Sediment Sampling Procedures

Author: Theresa Himmer 09/18/2023



Author

Approver: Kimberly Amley 09/18/2023

Program Quality Manager

FIELD OPERATING PROCEDURE 50

Sediment Sampling Procedures

1.1 Purpose

The purpose of this field operating procedure (FOP) is to describe general and specific procedures, methods, and considerations to be used and observed when collecting sediment samples for field screening or laboratory analysis.

1.2 Scope

The procedures contained in this document are to be used by field investigators when collecting and handling sediment samples in the field. On the occasion that field investigators determine that any of the procedures described herein are inappropriate, inadequate, or impractical and that another procedure must be used to obtain a sediment sample, the variant procedure will be documented in the field logbook, along with a description of the circumstances requiring its use. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

1.3 Equipment and Materials

The physical characteristics of the sediment sampling location and surface water body depth may dictate the equipment to be used. Wading may be a viable method for reaching the sampling location if that can be safely performed. The samples shall be collected facing upstream because wading may disrupt sediments and bias results. If the stream is too deep to wade, the sediment sample may be collected from a vessel or platform such as bridge.

- Global Positioning System (GPS) (tablet, mobile device, etc. with accuracy specified in the site-specific plan(s))
- Preassembled sampling containers
- Field logbook and pens with indelible ink
- Stainless-steel bowl(s)
- Stainless-steel spatula/spoon(s)
- Spade or shovel
- Sediment sampler (e.g., Ponar or Ekman grab)
- Sediment coring device (outer tubes, drive head, drop hammer, check valve devices, catchers, and core liners)
- Nylon rope or steel cable
- Bucket auger
- Large plastic tub or disposable food-grade aluminum pans
- Peristaltic pump
- Camera

- Dry erase board and marker
- Personal protective equipment identified in the project-specific plan(s) (disposable gloves, boots, hip/chest waders, etc.)
- Decontamination solution and equipment, as specified in project-specific plan(s)

Special considerations for projects that involve per- and polyfluoroalkyl substances (PFAS) shall be implemented in accordance with the project-specific plan(s).

1.4 Procedures and Guidelines

The sediment sampling techniques and equipment described in this procedure are designed to minimize effects on the chemical and physical integrity of the sample. If the procedures in this section are followed, a representative sample of the sediment should be obtained. The field team will determine which of the following procedures will be used to collect the sediment samples given the various site conditions including sediment depth to refusal. Operator manuals, if available, should be consulted for specific details.

1.4.1 Sample Collection

Suites of sample bottles will be preassembled. The volatile organic compound (VOC) bottles will be the first samples collected to minimize the loss of volatile compounds from the sample.

Surface sediment is to be collected either using a hand-held device such as a shovel or trowel or using a grab sampling device (such as Eckman, Ponar, VanVeen, etc). The surface interval can vary in thickness and will be defined in the project plan(s). Following collection, the sediment sample is placed into a decontaminated container such as a stainless-steel bowl or food grade aluminum pan, homogenized, and placed into appropriate sample containers. Sediment samples should be homogenized only after the portion for VOC analysis has been collected to avoid the loss of VOC contaminants during the homogenization process.

Before sub-samples of the surficial sediments are taken, the overlying water must be removed. The preferred method of removing this water is by slowly siphoning it off near one side of the sampler. This can be done using a peristaltic pump or similar siphoning or suction device (for example, turkey basters or large disposable plastic syringes). Methods such as decanting the water or slightly cracking the grab to let the water run out are not recommended, as they may result in unacceptable disturbance or loss of fine-grained surficial sediment and organic matter.

1.4.2 Hand Trowel, Shovel, Scoops, and/or Spoons

If the stream is dry, the sediment is accessed directly and is collected using either the hand trowel, shovel, stainless steel scoop or spoon.

- If the surface water body is a wade-able, wade into the surface water body and while facing upstream (into the current).
- If the surface water body is too deep to wade, the sediment sample will be collected from the bank, if the surface water body is narrow, or bridge or vessel. Attach a stainless-steel scoop or spoon to a piece of conduit or a handle.
- Remove the desired thickness of the sample along the bottom of the surface water body in the upstream direction.

- Remove/drain excess water from the scoop or spoon. However, this may result in the loss of some fine-grained particle size material associated with the substrate being sampled. Care should be taken to minimize the loss of fine-grained material.
- Collect VOC and gasoline range organics (GRO) samples if specified in the project plan(s). For VOCs and GRO, a dedicated micro-coring device (such as the laboratory provided plunger) should be used to transfer a predetermined amount of sediment into a pre-weighed sample container containing preservative, if possible. If pre-preserved vials are not provided, sediment should be placed in a small jar with no headspace for the VOC aliquot. After the VOC fraction of sediment is collected, place the remaining sediment sample in a stainless-steel bowl and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. A dedicated sampling scoop or trowel will be used to collect the sample material and place it into the appropriate sample container. Where possible, dedicated scoops or trowels are used to prevent the possibility of cross-contamination between sample stations as well as eliminating the need for any decontamination procedures between samples. The container cap will then be secured, and the sample will be preserved by immediately placing containers in a cooler with ice.

1.4.3 Grabs or Dredges

Grab samplers (also known as dredges) provide a means of collecting sediment from surface water bodies that are too deep to access by wading or too deep to collect from shore. This technique consists of lowering a sampling device to the sediment by use of a rope, cable, or extended handle. The mechanism is triggered, and the device entraps sediment in spring-loaded jaws, or within lever-operated jaws. The following procedures are used for collecting sediment samples with a sediment sampler such as an Ekman Bottom Grab Sampler or Ponar Grab:

- Attach a sturdy nylon or steel cable to the hook provided on top of the dredge or grab sampler.
- Arrange sampler in the open position.
- Lower the sampler to a point just above the sediment surface.
- Drop the sampler sharply onto the sediment.
- Trigger the release mechanism to close the sampler.
- Raise the sampler and slowly remove any free liquid through the top of the sampler. Be careful to retain fine sediments.
- Inspect the grab for acceptability. If the surface shows signs of disturbance (channeling, loss of surface integrity), discard the sample. Sediment samples are considered acceptable if they meet the following criteria:
    - Sampler is not overfilled with sediment; the jaws are fully closed and the top of the sediment is below the level of the opening doors.
    - Overlying water is present and not excessively turbid.
    - In certain locations slight over-penetration may be accepted at the discretion of the field team leader. Mild over-penetration may be accepted according to the following standards:
        - Sediment surface is intact on at least one side of the grab
        - Little or no evidence of surface sediment pushing through the grid surface of the grab (i.e., no visible imprint from the screening outside of that grid).

- Illustrations of acceptable grabs are shown on Figure 1.

- Gently siphon off overlying water, taking care to not disturb the sediment sample.
- Upon removal of the overlying water, take a photograph of the grab, so that the sediment type is observable. A dry erase board should be utilized to include the Station ID, grab number, and date in the photo. The description of the sediment should be recorded in the field logbook.
- Transfer the sediment into a stainless steel or high-density polyethylene bucket or a single use aluminum pan. Sediment in contact with the sides of the grab sampler should not be included in analytical samples. Continue to collect additional sediment until sufficient material has been obtained.
- Collect samples for VOC and GRO samples by inserting the coring device directly into undisturbed sediment in the central part of the grab. The remaining sample will then be placed into a stainless-steel bowl (or disposable pan) and homogenized using a dedicated stainless-steel scoop. Any extraneous material not considered to be relevant for analysis (for example, large debris or rocks) may be removed from the sample during homogenization and any water present will be decanted. The sample is then placed into the appropriate size, pre-labeled sample containers for each analysis to be performed. The container lid(s) will then be secured, and the samples will be preserved by immediately placing the containers in a cooler on ice.

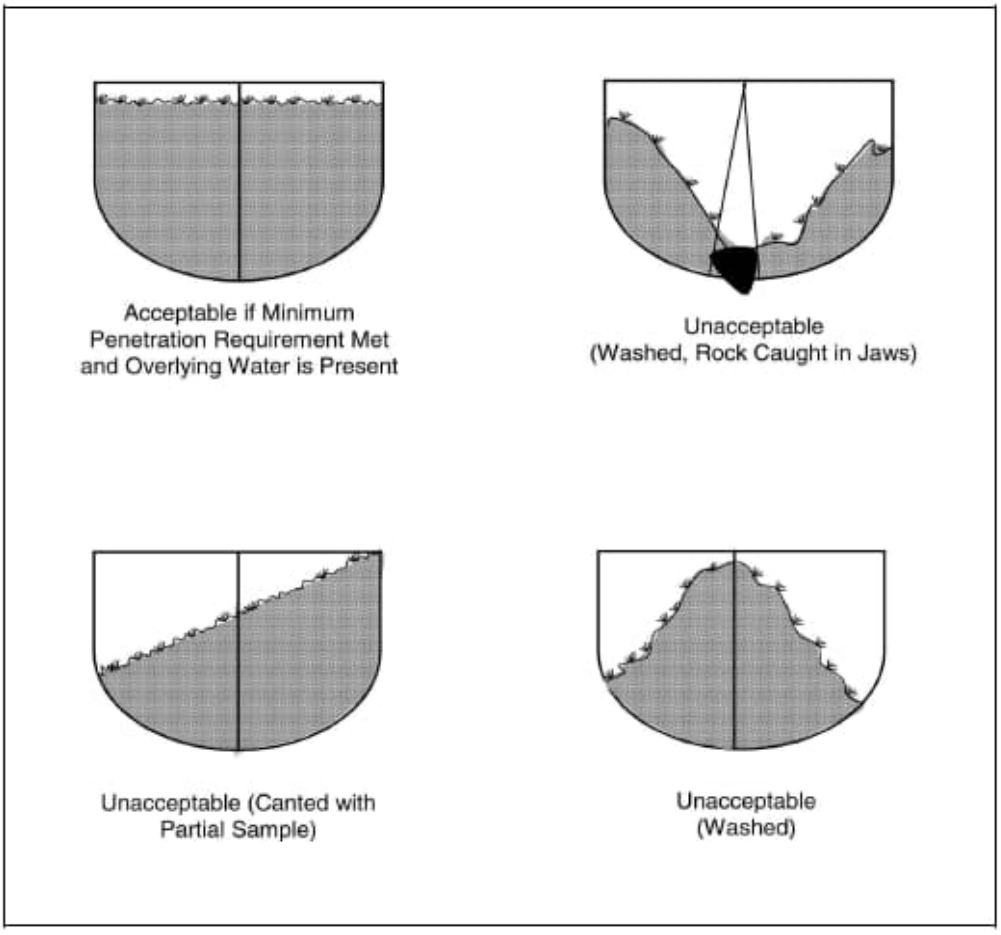


Figure 1. Depictions of Acceptable and Unacceptable Sediment Grab Samples

1.4.4 Hand Coring Device

A hand coring device consists of a coring device, handle, and core tub (which may be acetate, polycarbonate, or other material appropriate for the chemical testing planned). The following procedures are used for collecting sediment samples with a hand coring device. Field personnel will start downstream and work upstream to prevent contamination of unsampled areas.

- Assemble the coring device by inserting the core liner into the sampling tube.
- Insert the "eggshell" core catcher into the leading end of the sampling tube with the convex surface positioned inside the core liner; if a water check valve is part of the device, verify that it moves freely.
- Screw the handle onto the upper end of the sampling tube and add extension rods as needed.
- Place the sampler in a perpendicular position on the material to be sampled.
- This sampler may be used with either a drive hammer for firm consolidated sediments, or a "T" handle for soft sediments. If the "T" handle is used, place downward pressure on the device until the desired depth is reached. Rotate the sampler to help release the sediment at the bottom of the core tube and retrieve the device.
- Slide the core liner out of the sampler tube and either process the sample immediately or seal the core tube for storage and transport..
- Cores may be processed by extruding the sediment or splitting the core liner longitudinally and bisecting the core for characterization. VOC and GRO samples should be collected immediately upon opening the core; the project plan(s) will specify how the location for VOC or GRO aliquot will be selected (for example, the mid-point of an interval, based on visual observations, or informed by PID readings). . The remaining sample that was not in contact with the core liner will then be placed into a stainless-steel bowl (or disposable pan) and homogenized using a dedicated stainless-steel or high density polyethylene scoop (the project plan(s) will specify what materials may or may not be used for sample processing). Any extraneous material not considered to be relevant for analysis (for example, large debris or rocks) is removed from the sample during homogenization and any water present will be decanted. The sample is then placed into the pre-labeled sample containers for each analysis to be performed. The container lid(s) will then be secured, and the samples will be preserved by immediately placing the containers in a cooler on ice.

1.4.5 Drive Hammer

If the drive hammer is selected, use the following procedures for collecting a sediment sample:

- Insert the tapered handle (drive head) of the drive hammer through the drive head.
- With left hand holding the tube, drive the sampler into the material to the desired depth. Do not drive the tube further than the tip of the hammer's guide.
- Record the length of the tube that penetrated the sample material, and the number of blows required to obtain this depth.
- Remove the drive hammer and fit the keyhole-like opening on the flat side of the hammer onto the drive head. In this position, the hammer serves as a handle for the sampler.

- Rotate the sampler at least two revolutions to shear off the sample at the bottom.
- Lower the sampler handle (hammer) until it just clears the two ear-like protrusions on the drive head and rotate about 90-degrees.
- Withdraw the sampler by pulling the handle (hammer) upwards and dislodging the hammer from the sampler.
- Slide the core liner out of the sampler tube and either process the sample immediately or seal the core tube for storage and transport.Cores may be processed by extruding the sediment or splitting the core liner longitudinally and bisecting the core for characterization. VOC and GRO samples should be collected immediately upon opening the core; the project plan(s) will specify how the location for VOC or GRO aliquot will be selected (for example, the mid-point of an interval, based on visual observations, or informed by PID readings). . The remaining sample that was not in contact with the core liner will then be placed into a stainless-steel bowl (or disposable pan) and homogenized using a dedicated stainless-steel or high density polyethylene scoop (the project plan(s) will specify what materials may or may not be used for sample processing). Any extraneous material not considered to be relevant for analysis (for example, large debris or rocks) is removed from the sample during homogenization and any water present will be decanted. The sample is then placed into the pre-labeled sample containers for each analysis to be performed. The container lid(s) will then be secured, and the samples will be preserved by immediately placing the containers in a cooler on ice.
-

1.4.6 Sediment Characterization

This section provides the typical process followed for sediment characterization; the project plan(s) may specify additional observations that must be recorded to meet specific objectives. The sediment will be visually characterized for sediment type, color, moisture content, texture, grain size and shape, consistency, visible evidence of staining, and any other observations. The observations recorded must not contain any subjective conclusions about product type (i.e., nonaqueous phase liquid [NAPL] observations will consist of a description of the physical properties of the material including a description of odor as standardized below).

The sediment will be described using the Unified Soil Classification System (modified slightly for sediment characterization) based visual-manual identification in accordance with) ASTM-2488 standard practice.

The colors will be designated using a Munsell color chart. The information will be recorded in a field logbook or on a field form.

- Odor: Olfactory observations (odors) or positive responses to an organic vapor detector will be recorded on the sediment core log.
- Use the descriptors *none, strong, moderate, or faint to characterize odor.*
- Examples of odors may include, but not be limited to sulfur/sulfide, petroleum, and fuel type odors.
- Evidence of contamination: The following descriptors should be used to characterize any visible evidence of NAPL impact:
    - None Visible – Visible NAPL is not observed in the sediment sample.
    - Odor – Petroleum odor or positive response to an organic vapor detector

  - NAPL Sheen – NAPL is not visible but a distinct film is evident
  - NAPL Impregnated – NAPL is visible in the spaces between the sediment grains by NAPL does not flow from the sample.
  - Free NAPL – Sediment is NAPL impregnated and NAPL flows from the soil grains to the surface of the sample.
- Viscosity of Free-Phase Product – If free-phase product is present, a qualitative description of viscosity should be made. The following descriptors should be used:
  - Highly viscous (e.g., taffy-like)
  - Viscous (e.g., No. 6 fuel oil or bunker crude like)
  - Low viscosity (e.g., No. 2 fuel oil like)

1.4.7 Sediment Sample Documentation

Information to be recorded specific to this procedure includes the following:

- Sample location and number
- Date and time of collection
- Station coordinates (as-sampled)
- Water depth
- Make note of any debris in area
- Any other information (i.e., odor or sheen produced when grab brought to surface or sectioned).
- Grab penetration
- Collection method used
- Sediment color, texture, odor, organic content, and grain size distribution
- Photoionization detector readings, if required by project
- Number of attempts needed or other issues with sediment recovery
- Sample Identification and analytical samples collected
- Designation of quality control samples, including any blanks, duplicates, or laboratory matrix spikes/matrix spike duplicates
- Any other pertinent observations

1.5 Records Retention and Management

Project records will be managed in accordance with the DES CLIN 3 Quality Management Plan. Project documents and records will be retained for 10 years after the closing date of the prime contract. All information generated under this program is considered to be confidential and shall not be released to others without the written consent of the Contract Officer.

1.6 Quality Control and Quality Assurance

- Wear personal protective equipment outlined in the site-specific plan(s), including gloves.
- Start at downstream locations and work upstream to the extent practicable.
- Beware of hidden stream hazards.
- Make sure the samples are kept at a temperature of 4°C before and after they are processed for delivery to the laboratory.
- Determine if a QC sample will be required at a sampling location. If a MS/MSD or duplicate sample will be needed, then additional sample volume will be required. Additional sample volume may be acquired by collection of additional samples using the procedures outlined in this FOP.
- Ensure that all tools that may come in contact with the sample are properly decontaminated.
- The field notes will be reviewed by the Site Quality Control Manager at the end of each work day performed.

1.7 Attachments

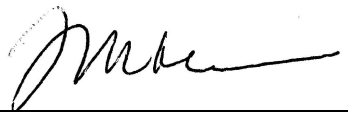
None.

1.8 References

CH2M HILL, INC. *Quality Management Plan for U.S. Environmental Protection Agency Remedial Acquisition Framework (RAF) Design and Engineering Services (DES) Contract CLIN 3*. May 2022.

Field Operating Procedure-58
Vibracore Sediment Sample Collection

Author: Theresa Himmer 7/09/2024



Author

Approver: Kimberly Amley 7/09/2024

Quality Assurance Manager

FIELD OPERATING PROCEDURE 58

Vibracore Sediment Sample Collection

1.1 Purpose

The purpose of this field operating procedure (FOP) is to describe the collection and handling of sediment samples using a vibracore over water during field operations.

1.2 Scope

This procedure is applicable for the collection of representative sediment from a vibracore sample over water.

1.3 Equipment and Materials

- Verify the sampling vessel is appropriate for anticipated sampling conditions (mooring, core deployment and recovery system, vessel draft)
- Nautical charts and tide tables
- Marine very high frequency radio and cellular telephone
- US Coast Guard required vessel safety device, including personal flotation device
- Appropriate vessel navigation and position recording equipment, including shore side reference station beacon and tide staff gauge installed onsite
- Fathometer and bar gauge or equivalents for recording depth to sediment
- Vibratory core barrel of appropriate sampling length, and polycarbonate core liner material, if required
- Decontaminated core cutter (nose cone) and sample retainer (catcher) assemblies
- Decontaminated core cutting and sample processing equipment
- Decontamination supplies, including wash down pump and hoses
- Steel tape measure
- Sample coolers and ice
- Logbook
- Personal protective equipment (nitrile gloves, rubber boots, rain gear, etc.)

1.4 Procedures and Guidelines

1. Inspect decontaminated core cutter and core retainer assemblies prior to vessel departure.
2. Review day's planned sampling activities to ensure that all required equipment is onboard the vessel, and that the planned sampling order is appropriate. Program sample location

coordinates into onboard navigation system and confirm that they were determined in the proper coordinate system and datum for the site.

3. Sampling will begin downstream and work upstream to prevent contamination of unsampled areas. For tidally influenced sites, sampling will be scheduled to coincide with low tide and under low flow conditions, when possible, to minimize the dilution of possible contaminants.
4. Confirm that land-based reference beacon (if used) and differential global positioning system (DGPS) links have been established, global positioning system (GPS) antenna is over sample location, and antenna offsets have been measured to correct for the actual sampling location.
5. Inspect tide staff gauge and record water surface level to the nearest 0.1 foot.
6. Navigate to sampling location and anchor in position, securing the mooring to minimize the effects of current and wind. Follow all vessel crew instructions, remaining clear of equipment and moorage rigging.
7. Once vessel is in position; at the direction of the vessel crew, record sampling station ID, depth to sediment from the vessel decking using a bar gauge and fathometer, depth to water from vessel deck, position coordinates, position relative to fixed reference points, weather, and water surface conditions.
8. Prior to the advancement of the core, ensure that winch cable, push rod, or vibracore barrel have been measured and clearly marked in order to record penetration depth and note changes in drilling advancement or effort.
9. Lower the Core assembly or push until penetrative depth or refusal is encountered. Record depth of penetration, vessel position, time, and apparent sampling conditions. As soon as is practicable following sampling, record water surface level reading from the staff gauge. In the event of sample refusal relocate within 5 feet and repeat procedure from Step 6.
10. Observe vessel crew instructions and clear the sampling portal or boom area as core is retrieved. Perform breathing zone monitoring in accordance with the site-specific plan(s).
11. Once vessel crew has secured the core barrel inspect the barrel cutter head. Provide qualitative description of cutter head catch condition, or soil if retained.
12. Ensure that external sampling equipment is decontaminated using site water and a decontaminated brush, while not disturbing the open end of the core barrel.
13. Label sample end cap for base of sample, remove cutter head assembly, affix end cap, and decontaminate cutter head assembly.
14. Once suspended sediment has had adequate time to settle following sample staging (15-30 minutes), measure total recovery, using a decontaminated tape, calculate and record recovered percentage.
15. Cut or drill a small drain slit above the water-sediment interface, above the depth of recovered sediment and decant supernatant water. Once water has been decanted cut excess sample barrel or liner approximately 1” above the water-sediment interface, label end cap and affix to barrel. Dry barrel and label with an indelible marker. Sample labeling should include up and down designations with the sample number on the end caps, and directional arrows on the barrel or liner body. Cut barrel sections to fit staging coolers, transfer labeled samples to coolers immediately post-processing.

1.5 Records Retention and Management

Project records will be managed in accordance with the DES CLIN 3 Quality Management Plan. Project documents and records will be retained for 10 years after the closing date of the prime contract. All information generated under this program is considered to be confidential and shall not be released to others without the written consent of the Contract Officer.

1.6 Quality Control and Quality Assurance

- Start downstream, work upstream.
- Log exact locations using permanent features.
- Beware of hidden hazards.

1.7 Attachments

None.

1.8 References

CH2M HILL, INC. *Quality Management Plan for U.S. Environmental Protection Agency Remedial Acquisition Framework (RAF) Design and Engineering Services (DES) Contract CLIN 3*. May 2022.

Standard Operating Procedure (SOP) 2.1.1.3

By Revital Katznelson and Arleen Feng

Construction and use of a syringe pump apparatus for water sampling

1.0 Application:

Collection of water samples at defined depths below the water surface without contact with air, for analyses of dissolved oxygen, sulfides, or any other water quality parameter. This apparatus can be used to monitor depth profiles in lakes, to sample groundwater monitoring wells, to sample pools in creeks, etc. The apparatus as specified below is useful for depths/heads of up to 3 meters. It is recommended to use shorter tubing where appropriate.

2.0 Components:

Disclaimer: The information provided below does not construe endorsement of these products by the Clean Water Team or the SWRCB. The list below contains information from 1998. Readers are encouraged to check the latest information with vendors.

Item C1. 60 ml disposable syringe with Luer-Lok* tip (without needle):
Fisher Catalog Number: 14-823-2D (30 pack) $30.66 (Becton-Dickinson No.309663)

Item C2. Three-way stopcock with male Luer lock:
Cole-Parmer Catalog Number: E-30600-02 (10 pack) $16.25

Item C3. Plastic tubing for the “long tubing” (diameter 1/8" (3.2 mm) inside, 1/4" (6.4 mm) outside) should be flexible, but rigid enough to resist collapsing under vacuum or kinking under water. Clear PVC Nalgene* 180 works well; here are the Fisher Catalog Numbers:

14-176-12 (50 ft pack) $31.80 (Nalge Nunc No.8000-0020)
14-176-12 (10 ft pack) $7.99 (Nalge Nunc No.8000-1020)

Item C4. One ml disposable syringe with Luer slip tip (Tuberculin without needle):
Fisher Catalog Number: 14-823-2F (100 pack) $15 (Becton-Dickinson No.309602)

Item C5. Plastic tubing for the “side tube” (diameter 3/32" (2.4 mm) inside, 5/32" (4 mm) outside) should be flexible but does not have to be rigid.

Fisher Catalog Numbers: 14-176-192 (50 ft pack) $20 (Nalge Nunc No.8000-0006)

Fisher and other vendors have their own brands of PVC tubing in the same sizes, but we have not tested performance or compatibility.

3.0 Assembly notes: (see diagram)

Step 1: Push the top (wide fitting end) of the three-way stopcock, Item C2, onto the 60 ml syringe (Item C1) tip and screw into lock.

Step 2: Prepare 9-10 ft length of "long tubing" (Item C3) and push onto the bottom, narrow tip ("male lock") of the three-way stopcock (Item C2). For more strength, wrap joint with Parafilm or tape..

Step 3: Prepare 1 foot length of "side tube" (Item C5). Insert into the 1 ml syringe (Item C4) without the plunger; you may first cut this syringe about 1/2" from the tip if needed. Then push the tip of the 1 ml syringe into the side arm of the three-way stopcock. **Options**: Items C4 and C5 may be replaced by any other creative way to connect the side tube. Example: Prepare 1 ft tube (Item C3), cutting the end squarely; fit an insert piece (e.g. cut-off spare syringe tip, maybe aquarium connectors or a piece of ball-point pen tube?) into joint with side arm of stopcock, then wrap joint with Parafilm or tape (point 3 in the diagram).

4.0 Deployment Options:

Option 1: hold the end of the long tubing (farthest from the stopcock) in the creek or other sample source. Collect the sample as instructed below.

Option 2: Mark long tubing at 10 cm intervals, beginning from furthest end; attach a small weight to that end, deploy from above and collect sample. Caution: tubing will stretch, depth measurements may be inaccurate.

Option 3: Attach a non-stretching rope to a medium or heavy weight. Mark the rope at 10 cm intervals, beginning near the weight. Attach the end of the long tubing of the syringe apparatus to the weight or the rope, with the opening at zero cm, deploy from above and collect samples.

Option 4: Mark a "sampling pole" at 10 cm intervals, beginning from bottom tip, attach end of long tubing of the apparatus to tip of sampling pole with the opening at zero cm (see point 4 on the diagram), deploy from above or from the side (e.g. the bank of a creek). If the intake point of the syringe sampling apparatus is deployed at an angle, record the angle and the depth mark on the pole to calculate/estimate sampling depth.

5.0 Sample Collection: Preparation and priming

1. Assemble the apparatus: Connect the stopcock attached to the long tube to the 60-ml syringe. Connect the short tube to the side arm of the three-way stopcock. **(Be sure to hold the three-way stopcock in its center when you turn the selector. It is not strong enough to be held only by the syringe and will break if you attempt to turn the selector without support)**

2. Attach the end of the long tube to a rope or pole and dip in lake (or creek, or monitoring well) water.

3. Hold the stopcock and turn the selector so the "OFF" lever is in the direction of the short tube, and pull the plunger backwards slowly. This will fill the syringe with lake water (The volume of air in the tube should be about 30 ml, and then water will start coming in).

4. Hold the stopcock and turn the selector so the "OFF" lever is in the direction of the long tube, and push the plunger forward; this will push the water out through the short tube.

5. Hold the stopcock and turn the selector so the "OFF" lever is in the direction of the short tube, and pull the plunger backwards slowly. This will refill the syringe with lake water.

6. Hold the stopcock and turn the selector so the "OFF" lever is in the direction of the long tube, and push the plunger forward; this will push the water out through the short tube.

For most Water Quality parameters: After flushing 2-3 syringe-volumes through the system, take your sample for pH (and/or other water quality parameters) by placing the end of the short tube inside the sample container. Repeat steps 5 and 6 until the sample volume, in increments of 60 ml, is sufficient.

For Dissolved Oxygen (DO) or Sulfide: Make sure there are no air bubbles in the entire apparatus after step 6. Then place the short tube inside the DO bottle, and repeat steps 5 and 6 several times, flushing several bottle-volumes with sample water without contact with air. Then take the short tube out of the DO bottle and add to the bottle the reagents for the Winkler titration as instructed by the kit manufacturers.

6.0 Maintenance and Storage:

To clean the syringe and tubes, repeat steps 5 and 6 twice with tap water or deionized water. Clean the system immediately, or as soon as possible, after sampling. **Avoid drying of unwashed tubes.** Store syringe in partially opened position so you can push it forward in case rubber plunger sticks to the shaft. Store in a ziplock bag.

7.0 Sources and Resources

This SOP, as provided in the clean Water Team (CWT) Guidance Compendium, is identical to the following document (with slight revisions) and should be referenced as follows:

"Katznelson, R, and A. Feng 1998 Application, purchasing information, and use instruction of a syringe pump apparatus. Standard Operating Procedure submitted to the Alameda Countywide Clean Water Program, Hayward, CA. "

For an electronic copy, to find many more CWT guidance documents, or to find the contact information for your Regional CWT Coordinator, visit the CWT website at
www.swrcb.ca.gov/nps/volunteer.html

SYRINGE-PUMP APPARATUS

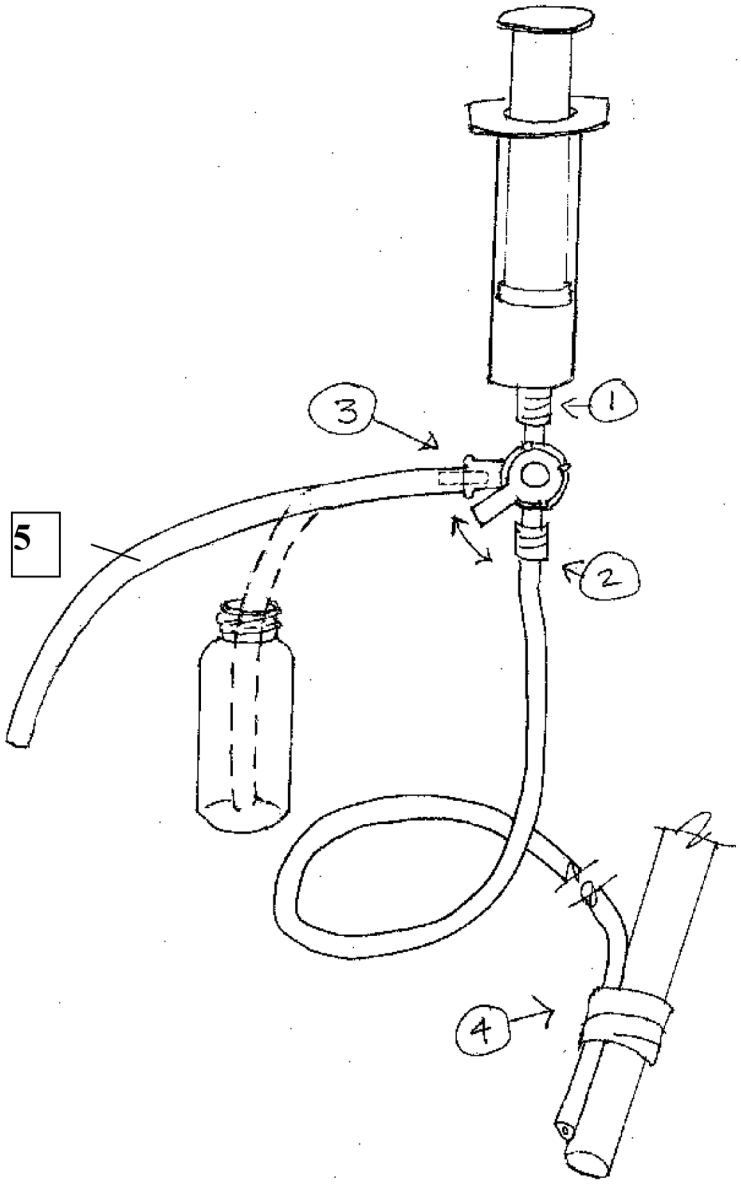


Diagram by Arleen Feng, Alameda County FCWCD, April 1998

Appendix B
Field Forms and Checklists

Appendix B
Field Forms and Checklists

Site Name:
Project Number:
Project Location:
Survey Duration:

Station ID: _____ **Latitude:** _____

Sampling _____ **Longitude:** _____

Crew _____ **Datum:** _____

_____ **Water Depth (ft):** _____

_____ **Water Depth Time:** _____

_____ **St. Arrival:** _____

Vessel: _____ **St. Depart:** _____

Coring Method: _____ **Logged by:** _____

Collector Information:

	Attempt 1	Refusal?	Attempt 2	Refusal?
Penetration (ft):				
Recovery (ft)				
Date/Time:				

	Attempt 3	Refusal?
Penetration (ft):		
Recovery (ft)		
Date/Time:		

	Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency	Cementation	Structure	Moisture Content	Maximum particle size	Odor	% gravel	% sand	% fines	PID Reading (ppm)	Sample IDs	Evidence of Contamination	Comments
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

Additional Notes/Comments:

Sample Summary (check boxes for analysis):

Sample ID	Sample Type (N/FD/MSD)	Sample Date/Time	Depth Interval (ft)															

Reviewed by: Date:

Sediment Core Log Key

MAJOR DIVISIONS			GRAPHIC SYMBOL	GROUP SYMBOL	DESCRIPTION
COARSE-GRAINED MATERIAL	GRAVELS	CLEAN GRAVELS		GW	Well-graded gravel Well-graded gravel with sand
				GP	Poorly graded gravel Poorly graded gravel with sand
		GRAVELS WITH FINES		GW-GM	Well-graded gravel with silt Well-graded gravel with silt and sand
				GW-GC	Well-graded gravel with clay Well graded gravel with clay and sand
				GP-GM	Poorly graded gravel with silt Poorly graded gravel with silt and sand
				GP-GC	Poorly graded gravel with clay Poorly graded gravel with clay and sand
				GM	Silty gravel Silty gravel with sand
				GC	Clayey gravel Clayey gravel with sand
	SANDS	CLEAN SANDS		SW	Well-graded sands Well-graded sand and gravel
				SP	Poorly-graded sands Poorly graded sand with gravel
		SANDS WITH FINES		SW-SM	Well-graded sand with silt Well-graded sand with silt and gravel
				SW-SC	Well-graded sand with clay Well-graded sand with clay and gravel
				SP-SM	Poorly-graded sand with silt Poorly-graded sand with silt and gravel
				SP-SC	Poorly-graded sand with clay Poorly-graded sand with clay and gravel
				SM	Silty sand Silty sand and with gravel
				SC	Clayey sand Clayey sand and with gravel
FINE-GRAINED MATERIALS	SILTS AND CLAYS			CL	Lean clay * Lean clay with sand or gravel * Sandy lean clay * Sandy lean clay with gravel * Gravelly lean clay * Gravelly lean clay with sand
				ML	Silt * Silty with sand or gravel * Sandy silt * Sandy silt with gravel * Gravelly silt * Gravelly silt with sand
				CH	Fat clay * Fat clay with sand or gravel * Sandy fat clay * Gravelly fat clay * Gravelly fat clay with sand
				MH	Elastic silt * Elastic silt with sand or gravel * Sandy elastic silt * Sandy elastic silt with gravel * Gravelly elastic silt * Gravelly elastic silt with sand
				OL/OH	Organic silt * Organic silt with sand or gravel * Sandy organic silt * Sandy organic soil with gravel * Gravelly organic soil * Gravelly organic soil with sand

Well Graded (Engineering) = Poorly Sorted (Geological) = grains of all different sizes mixed together

Poorly Graded (Engineering) = Well Sorted (Geological) = grains are all same size

∩ Shell hash

λλλλ Peat/organic matter

CONSISTENCY
Penetration of thumb:
<0.25 cm = hard (H)
0.25 - 2.0 cm = firm (F)
2.0 - 4.0 cm = soft (S)
>4.0 cm = very soft (VS)

CEMENTATION
N = not cemented
W = weakly cemented
M = Moderately cemented
S = Strongly cemented

STRUCTURE
H = Homogeneous
S = Stratified
L = Laminated
M = Mottled

COLOR
from Munsell chart

MAXIMUM PARTICLE SIZE
SC = Small Cobble
CP = Coarse Pebble
MP = Medium Pebble
SP = Small Pebble
CS = Coarse Sand
MS = Medium Sand
FS = Fine Sand
VFS = Very Fine Sand
Z = Silt

SA = Sub-angular
VA = Very angular

ODOR
N = None
UNC = Unclassified
S = Sulfur-like
T = Tar-like
PHC = Petroleum hydrocarbon-like

Quantifying Descriptors
Strong
Moderate
Faint

Moisture Content
Wet
Moist
Dry

VISIBLE CONTAMINATION DESCRIPTORS

Sheen - iridescent petroleum-like sheen. Free product is not present but a distinct film is evident. Not to be used to describe a “bacterial sheen” which can be distinguished by its tendency to break up on the water surface at angles whereas petroleum sheen will be continuous and will not break up.
Stained - used w/ color (i.e. black or brown stained) to indicate that the soil matrix is stained a color other than the natural (unimpacted) color of the soil.

Coated - soil grains are coated with free product – there is not sufficient free-phase material present to saturate the pore spaces.

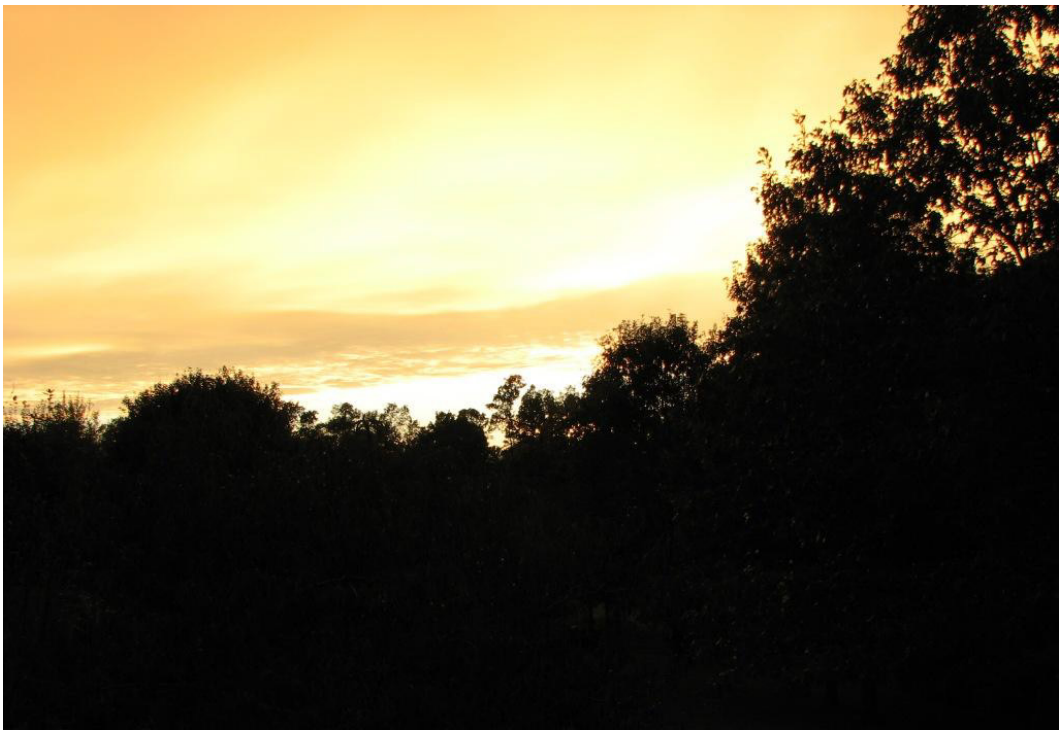
Blebs - observed discrete sphericals of tar/free product - but for the most part the soil matrix was not visibly contaminated or saturated. Typically this is residual product.

Saturated - the entirety of the pore space for a sample is saturated with NAPL. Care should be taken to ensure that you’re not observing water saturating the pore spaces if you use this term. Depending on viscosity, free-phase saturated materials may freely drain from a soil sample.

Project Title	**Operable Unit 6 – Asarco Sediments Commencement Bay Nearshore/Tideflats Superfund Site**
Location	Tacoma, Washington
Date	July 2024

Field Sampling Photolog

Photograph 1: Title/Description (sequence is auto numbered; just need to right click on the number and click "Update Field")



Photograph 2: Lizard on back step

Memorandum

Commencement Bay Nearshore/Tideflats
Operable Unit 06 – Asarco Sediments
Daily Report

Daily Field Report

Asarco OU6 – Title	
MM/DD/YYYY	
CH2M Staff	Name & Position
Subcontractors	Organization, Name, & Position
EPA Staff	Name & Position
Other	Organization, Name, & Position
Health & Safety	*Tailgate topics, observations, H&S controls/changes, etc.* Incidents: None
Weather	*Example Sunny; 50°F - 68°F; S winds at 1-6 mph. Gusts up to 10 mph.*
Tides/Water Levels	*Example High tide: 0227 (+11.68 ft), low tide: 0943 (-0.24 ft), high tide: 1738 (+10.86 ft)*
Daily Tasks	1. *Task Description & List of Daily Tasks*
Deviations from the UFP-QAPP	*Captures any approved adjustments or deviations from the approved UFP-QAPP.*

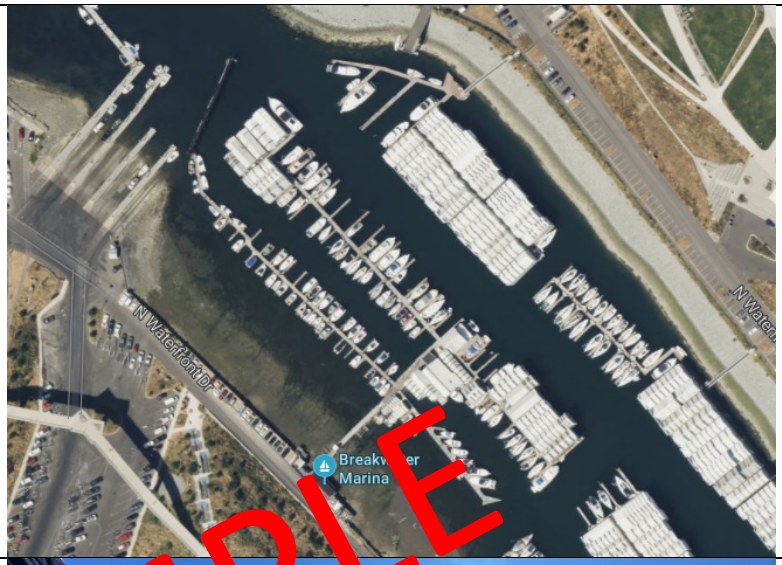
Daily Progress Summary by Task

Task Description	Summary of activities completed – reference to more detailed survey forms if needed.
Other	N/A

Next Steps

1. Action Items or activities for the following day.

Photographs

Location: Breakwater Marina, Tacoma WA. **Description:** Red outline shows Breakwater Marina footprint. **Photo Direction:** N/A **Date:** 6/18/2024	
Location: Breakwater Marina, Tacoma WA. **Description:** Southeastern boundary of Breakwater Marina and the TYC. **Photo Direction:** East **Date:** 6/18/2024	

Location: … **Description:** … **Photo Direction:** .. **Date:** …	*Insert Photo*
Location: … **Description:** … **Photo Direction:** .. **Date:** …	*Insert Photo*

Location: … **Description:** … **Photo Direction:** .. **Date:** …	*Insert Photo*
Location: … **Description:** … **Photo Direction:** .. **Date:** …	*Insert Photo*

Site Name:
Project Number:
Project Location:

Station ID: _____ Datum: _____

Sample Date: _____ Water Depth: _____

Sampling Crew: _____ Water Depth Time: _____

_____ Station Arrival: _____

_____ Station Depart: _____

_____ Logged by: _____

_____ Collection method: _____

Vessel:

Attempt #	Distance from Target (ft)	Time	As-Sampled Coordinates		Water Depth (ft)	Time	Recovery (cm)	Sample Interval (cm)
			Easting	Northing				
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Sediment description (grain size, odor, color) for each grab:

Sample ID:

Analytical Suite:

Reviewed by: _____ Date: _____

Seep Sampling Field Form

Client: _____ **Project Number:** _____ **Page:** _____ **of** _____

Location: _____ **Location ID:** _____

Event: _____ **Sample ID:** _____

Date: _____ **Sampling Team:** _____

Weather: _____

Total Depth: _____ FT.(BTODP)

Depth to water: (-) _____ FT.(BTODP) **Measuring Devices:** **Air:** _____

Water Column: _____ FT. **WLI:** _____

(x) _____ GAL/FT. **WQP:** _____

Drive Point Volume: _____ GAL.

Total Purge Vol.: _____ GAL.

Purge Device: _____

FIELD PARAMETERS

Note: Purge 1 x Drive Point volumn prior to sampling.

Time	Purge Vol. (gal)	Temp. °C	pH SU	ORP mV	Cond. mS/cm	Turbidity NTU	DO mg/L	DTW ft BTODP	Color / Odor / Comments

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers

Observations/Notes:

Air Monitoring: **N/A**

Time:

VOC (ppm) =

H2S (ppm) =

LEL (%) =

Pump Start Time: **CO (ppm) =**

O2 (%) =

Bladder **Initial Fill Time(FT; sec):** **Final Fill Time:**

Bladder **Initial Discharge Time(DT; sec):** **Final Discharge Time:**

Time:

Submersible **Initial Control Setting(Hz):** **Final Control Setting(Hz):** **VOC (ppm) =**

H2S (ppm) =

Initial Purge Rate: **LEL (%) =**

Pump Depth: **Final Purge Rate:** **CO (ppm) =**

Sample Time: **O2 (%) =**

End Sample Time:

MS/MSD (Y / N): Field Duplicate (Y / N):

Signature(s): Duplicate Time: