

SAMPLING AND ANALYSIS PLAN

Napa-Sonoma Marsh Restoration Project

This sampling and analysis plan (SAP) describes the procedures and rationale for the collection of samples and submittal of these samples for chemical and physical analysis. Four types of data results will be obtained from during this sampling event to assist in the modeling of the proposed flushing program including:

- Surface water field parameters;
- Water quality;
- Surface sediment quality; and
- Soil core physical characteristics.

The purpose of this SAP is to describe the sample location, sample collection procedures, sample preparation, analysis to be performed, and submittal procedures. Specific details for chemical analysis, quality control, and documentation are contained in the *Analysis Plan/Quality Assurance Project Plan* (QAPP) by the U.S. Army Corps of Engineers for this project.

1.0 SAMPLING LOCATIONS

A total of 40 sampling locations have been proposed as part of this feasibility study. Thirty-seven of these sites are located within the pond berm boundaries and three sample sites are within the receiving waters of the Site area. Figure 1 presents the general location of these sample points. Table 1 identifies the number of sites within each pond and type of samples to be collected per sample location.

The sample locations were established to best characterize and establish water and sediment conditions at the Site. Results from these samples should provide both chemical and physical attributes of the Site and receiving waters. Thus, impacts from the proposed flushing program will be evaluated via modeling programs using results from this sampling event.

TABLE 1 – Summary of Samples to be Collected

| Pond Number | Number of Monitoring Locations | Type of Sample at Each Monitoring Location | | | |
|-----------------|--------------------------------|--|---------------|----------|-----------|
| | | Field Water Tests | Water Quality | Sediment | Soil Core |
| 1 | 2 | X | X | X | X |
| 1A | 2 | X | X | X | X |
| 2 | 4 | X | X | X | X |
| 2A | 2 | X | X | X | X |
| 3 | 4 | X | X | X | X |
| 4 | 4 | X | X | X | X |
| 5 | 3 | X | X | X | X |
| 6 | 3 | X | X | X | X |
| 6A | 3 | X | X | X | X |
| 7 | 4 | X | X | X | X |
| 7A | 4 | X | X | X | X |
| 8 | 2 | X | X | X | X |
| Subtotal | 37 | | | | |
| Napa River | 1 | X | X | X | |
| Napa Slough | 1 | X | X | X | |
| San Pablo Bay | 1 | X | X | | |
| Total | 40 | | | | |

Sample Identification

As shown on Figure 1, each approximate sample location has been pre-identified with the pond number followed by a letter. This signification will be used in the sample ID. The sample ID will thus contain the pond number first and then an alphabet letter following a dash. Within each pond, the letter scheme started with “A” in the right corner and continued clockwise around the pond, where appropriate. Finally, either a “-W,” “-S,” or “-C” will complete the label sequence to signify media of sample collected (W-Water, S-Sediment, C-Soil Core). For example, a surface water sample, collected from Pond 5 at sampling point B, will be assigned a sample ID of: “5-B-W.” Table 3, Water and Sediment Sampling Stations & Analysis Requirement, of the QAPP details the sample ID for each water and sediment sample.

To maintain sampling ID distinction and numerical spacing, the receiving water monitoring locations will follow the same identification scheme for location and type of sample. In place of the pond number, the initials of the receiving water sample location will be used as follows:

- Napa River: NR
- Napa Slough: NS
- San Pablo Bay: SP

For example, a water sample collected at the proposed sample location in San Pablo Bay will be labeled SP-A-W.

Actual sampling locations will be field determined at the time samples are collected. Field notes will record the vertical and horizontal Universal Transverse Mercator (UTM) coordinates at each sampling point using a Global Positioning System (GPS). This location identifier will allow changes in locations to be noted for future sampling events and report preparation. The sample ID will correspond with all field notes, sample labels, and chain-of-custody (COC) documentation.

2.0 DATA ASSURANCE AND QUALITY CONTROL

All data assurance and quality control for this SAP is covered under the QAPP. No field duplicates or trip blanks will be collected; however, sufficient volume of sample will be collected, per laboratory discretion, to accommodate laboratory quality control (i.e., Matrix Spike/Matrix Spike Duplicate) as required in the QAPP. This SAP was developed to assure the quality of samples collected and transport as well as the quality of data gathered in the field to attain the projects objectives accurately and efficiently.

3.0 GENERAL SAMPLE COLLECTION

Several practices will be conducted during this sampling event to maintain sample consistency between all of the sample locations and types of samples collected.

Due to the unknown nature of the existing project area, some modification of the sampling protocols contained herein may be required. Should a significant modification to these sampling procedures be required as a consequence of unforeseen field conditions, these modifications will be documented on field notes.

Sample Integrity and Decontamination

Precautions will be taken to protect the integrity of the samples. Sample technicians will wear nitrile gloves and change into a new pair prior to each sample location. Gloves will protect the sampler from potential impacts from the samples. In addition, the gloves will maintain sample integrity by preventing cross contamination between the sampler and actual sample collected and between each sample location.

Standard decontamination procedures will be followed between each sampling location. Decontamination of sampling equipment will prevent impacts from previous sampling points adversely affecting results at another sampling location. This SAP discusses the specific decontamination protocol as it pertains to the sample type in the following sections. These procedures have been pre-approved by the laboratory personnel performing the sample analysis.

Sampling Order

If water is present, field parameters will be measured first at the sampling location. Surface water samples will then be collected. After water quality parameters and samples have been recorded and collected, sediment and soil core samples will be collected. Soil samples must be collected after water quality has been measured and sampled to minimize turbidity disturbance in the water samples.

4.0 FIELD PARAMETER ASSESSMENT

At each sampling location, several parameters are required to be measured and observed. On each respective Field Record of Water and Soil Sampling log sheet (Log Sheet), the time, ambient temperature, approximate wind speed and direction, and other weather conditions (i.e., cloudy) will be recorded. A blank example of this log sheet is included as Appendix A.

If water is not present at the proposed location, the sampling point will be relocated to the nearest pooled water. If the pond is essentially dry, or within the vicinity of the sample location, the new sampling point will be moved to the nearest borrow ditch area. The borrow ditch transfers water between the drying beds and best represents the water quality from the adjacent pond. The sample location will only be relocated if standing water is not present. All sample location modification will be documented on the Log Sheet and field notes describing conditions for change.

The following field parameters for water will be collected approximately three inches below the surface:

- pH (standard units);
- Temperature (°F);
- Specific conductivity (us/cm);
- Salinity (mg/l);
- Dissolved oxygen (mg/l); and
- Turbidity (NTUs).

Sampling results from the field instruments will be recorded on the Log Sheet. Note that each measuring instrument/probe will be calibrated per the manufacture's specifications and protocols at the beginning of each sampling day. The calibration results will be recorded on the field notes.

5.0 WATER QUALITY SAMPLING

In conjunction with field water parameters, water samples will also be collected and submitted for chemical analysis as specified in the QAPP.

If water is not present at the predetermined sampling location, water may be sampled at the same location as that established for the field parameters. Section 4 details the protocol for sample point relocation.

Sample Analysis

As presented in Table 1, a total of 40 water sample locations have been proposed. The water samples will be analyzed as proposed in the QAPP. Four parameter lists were developed for the chemistry analysis of the water present in the ponds and receiving waters. The water quality analyses to be performed are as follows:

- Selected California Toxics Rule (CTR) Priority Pollutants – specific partial list of 126 parameters identified in the CTR
- Additional Toxics of Concern
- General Water Quality Parameters
- CTR Priority Pollutants – complete list

The QAPP fully discusses the parameter lists, analysis methods to be performed, and which samples are to be analyzed under which parameter list.

Due to the constraints in the field, the laboratory will be required to filter the sample prior to analysis for metals, if required. For dioxin and furan compounds, each sample will be split at the laboratory. The split will be composited with other splits from the same pond. For example, all three Pond 6A grab samples will form one composite sample to be analyzed by EPA Method 1613 for dioxin and furan. The other half of each split sample will be preserved for potential future analysis, depending on results from the composite split sample.

Sample Collection Procedure

After general water quality parameters have been measured, water samples will be collected from approximately six inches below the water surface at each of the identified monitoring locations. The samples will be collected at this depth to minimize intrusion of floating debris into the sample and obtain a representative sample of the water column. A chemical resistant 15 Liter (L) sampling bucket will be used to collect the sample. This bucket will allow one complete volume of sample to be collected. The samples will be transferred into laboratory-supplied containers. Each of these containers will contain the recommended preservative, if required. The collected samples will be immediately placed in an ice chest cooled to 4°C for storage and subsequent transportation. All samples will be labeled as described in Section 1.

Apparatus Decontamination Protocol

The 15 L Sample bucket will be brushed, washed in a biodegradable Liqui-Nox solution, and triple rinsed with de-ionized (DI) water. The bucket will be air-dried prior to use at the next sampling location.

6.0 SEDIMENT SAMPLING

To establish chemical impacts from the sediment base level of the ponds and receiving waters, sediment samples are required to be collected for analysis. These sediment samples include the material within the top 6-8 inches at the base of the pond or receiving water at each sample location.

Note that the sampling point for sediment and soil cores will remain as proposed if the sample location changes due to lack of standing water for sampling.

Sample Analysis

As shown in Table 1, a total of 38 sediment samples are proposed to be collected at the Site. Figure 1 presents the proposed sample locations for sediment samples. The sediment samples will be analyzed for the parameters as listed in Table 1 of the QAPP.

As with the water samples, sediment samples to be analyzed for dioxin and furan compounds, by EPA Method 1613, will be split at the laboratory. The split sample will be composited with other split samples from the same pond. The other half of each split sample will be preserved for potential future analysis, depending on results from the composite split sample.

Sample Collection

Sediment samples will be collected from the top six to eight inches of soil materials. Samples will be collected using a 2-1/4" diameter AMS sediment/sludge sampler. The sampler will be fitted with three-foot extension rods to allow access of the sampler below the water surface to the pond or river bottom and subsequent sediment retrieval. The sediment/sludge sampler will be fitted with a dedicated plastic sleeve in which the sample will be collected.

Upon reaching the required depth, the sediment sampler will be brought up to the surface and the plastic sleeve will be retrieved from the sampler. Each end of the plastic sleeve will be covered with Teflon sheets, capped and labeled as described in Section 1. The samples will be subsequently stored in an ice chest cooled to 4°C for sample preservation, storage, and transportation to the laboratory for analysis. Two samples will be collected at each sediment sample location. One sample will be submitted for chemical analysis to the lab and the other sample will be retained for visual evaluation. However, the second observation sample is not required to be collected in Ponds 1 through 3. Amount of sample collected will be recorded on the Log Sheet per sample location as inches recovered in the plastic sleeve.

If the sediment does not exhibit cohesive characteristics and sufficient sample is lost during sample retrieval, the sediment/sludge sampler will be fitted with a sludge butterfly valve. This valve closes the bottom of the core sampler when the sampler and rod are pulled back up through the sediment, thus preventing sample loss.

Apparatus Decontamination Protocol

All sediment samples will be collected into dedicated containers for which decontamination between sampling locations is not required. However, all of the sampling apparatuses will be brushed, cleaned, and rinsed with DI water after each sampling event. The apparatuses will then be allowed to air-dry. This decontamination procedure will further minimize potential for outside impacts to influence sample integrity.

7.0 SOIL CORE/PHYSICAL PROPERTIES SAMPLING

Soil Core samples will be collected to evaluate the physical characteristics of the ponds at the Site. Core samples will be collected from the top 12 inches of the pond base at all sample locations within the pond bermed area. Core samples will be collected adjacent to the sediment sample.

Sample Analysis

Soil Sample Cores are proposed to be collected at all of the sample locations within the ponds (Table 1). Soil Core samples are not required to be collected from the receiving waters.

The Soil Core Samples will be submitted to the lab to be analyzed for soil physical characteristics. Following is a list of parameters that are to be tested:

- Dry density
- Grain size
- Porosity
- *In-Situ* Shear Test (Field Test)

The sample analysis for physical characteristics will be separated into two phases – Phase I and Phase II. Phase I will only evaluate and analyze a limited number of samples. Table 2 indicates the number of samples per pond which are to be analyzed under Phase I. If results from Phase I warrant additional sample evaluation, Phase II will be implemented. Selected samples will then be analyzed for the same physical characteristics listed above.

TABLE 2 - Soil Physical Analysis

| Pond Number | Number of Samples Collected | Number of Samples Analyzed – Phase I |
|--------------------|------------------------------------|---|
| 1 | 2 | 1 |
| 1A | 2 | 1 |
| 2 | 4 | 1 |
| 2A | 2 | 1 |
| 3 | 4 | 2 |
| 4 | 4 | 2 |
| 5 | 3 | 1 |
| 6 | 3 | 1 |
| 6A | 3 | 1 |
| 7 | 4 | 2 |
| 7A | 4 | 2 |
| 8 | 2 | 1 |
| Total | 37 | 17 |

Sample Collection

Soil Core samples will be collected from the top 12 inches of soil materials. Due to the type of analysis to be conducted, representative samples must be collected in undisturbed material. The samples will be collected into dedicated 20-inch Brass thin walled core tubes. The 2-1/2" diameter tubes extend approximately 17 inches beyond the Shelby head allowing a complete virgin core sample to be extracted. The Shelby head is also fitted with a ball check valve on the top. This valve allows air and water to escape as the tube is being driven into the sediment, yet provides an air/water tight seal during extraction. This valve will thus allow a complete sample to be extracted without loss, even if the sample is not cohesive. The Shelby head will be fitted with extension rods to allow the technician to collect representative samples below water surface.

The sample will be collected within an undisturbed area of the sampling location. The core tubes will be driven into the sediment approximately one foot horizontally and plumb straight. Care will be taken during sampling to prevent the core tube from being over driving and compacting the sample. The depth of sample recovered in the brass core tube will be recorded on the Log Sheet.

When the core has been collected, the core tube will be extracted and immediately capped on both ends. Careful management of the cores will be taken to assure that each core sample remains upright. Each sample will be labeled as described in Section 1.0 and, in addition, each sample will have an arrow drawn to visually verify the orientation of the sample. All of the samples will be stored in a box and propped to assure that the tubes are not disturbed or tipped during transportation.

In addition, an *in-situ* shear strength test will be conducted in the field at each soil core sampling location. The results from this field parameter test will be recorded on the Log Sheet. PWA laboratory personnel will conduct this test.

Apparatus Decontamination Protocol

All soil core samples will be collected into dedicated containers for which decontamination between sampling locations is not required. However, all of the sampling apparatuses will be brushed, cleaned, and rinsed with DI water after each sampling event. The apparatuses will then be allowed to air-dry. This decontamination procedure will further minimize potential for outside impacts to influence sample integrity.

8.0 SAMPLE TRANSPORTATION

All water quality samples and sediment samples collected for chemical analysis are to be immediately stored at 4°C in ice chests at the time of sampling. Each sample must be recorded on the chain-of-custody (COC) form during the sampling event. These samples will be hand delivered under COC procedures to MEC Analytical, Inc. in Tiburon, California. Soil Core samples will be carefully placed upright and hand delivered to PWA of Sacramento, California under COC procedures. All events of delivery (i.e., time) will be recorded on field notes along with copies of the COCs.