FINAL
PHASE I FIELD SAMPLING PLAN
FOR GROUNDWATER, SURFACE WATER, AND SEDIMENT
AREA IV RADIOLOGICAL STUDY
SANTA SUSANA FIELD LABORATORY
VENTURA COUNTY, CALIFORNIA

U.S. EPA Contract Number: EP-S7-05-05
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Prepared for:

U.S. Environmental Protection Agency Region 9
75 Hawthorne Street
San Francisco, California 94105

July 28, 2010

HGL
HydroGeoLogic, Inc

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Appendix C	Responses to Comments Received on Draft Final Field Sampling Plan Dated April 2010.

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LIST OF ACRONYMS AND ABBREVIATIONS

Ag PRG	agricultural preliminary remediation goal
Am-241	americium-241
C-14	carbon-14
Cm	curium
Co-60	cobalt-60
Cs	cesium
DO	dissolved oxygen
DOE	Department of Energy
EC	electrical conductivity
ETEC	Energy Technology Engineering Center
FLUTe	Flexible Liner Underground Technologies
FSP	Field Sampling Plan
GPS	global positioning system
H-3	tritium
HGL	HydroGeoLogic, Inc.
HSA	Historical Site Assessment
I-129	iodine-129
IDW	investigation-derived waste
MCL	maximum contaminant level
mL/min	milliliter per minute
MWH	Montgomery Watson Harza
NAA	North American Aviation
NBZ	Northern Buffer Zone
Np-237	neptunium-237
NTU	nephelometric turbidity unit
ORP	oxidation-reduction potential
pCi/L	picocuries per liter
Pu	plutonium
QA	quality assurance

QAPP	Quality Assurance Project Plan
QC	quality control
Ra-226	radium-226
ROI	radionuclides of interest
SOP	standard operating procedure
Sr-90	strontium-90
SSFL	Santa Susana Field Laboratory
SSHP	Site Safety and Health Plan
Tc-99	technetium-99
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey

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1.0 INTRODUCTION

HydroGeoLogic, Inc. (HGL) has been tasked by the U.S. Environmental Protection Agency (USEPA) to conduct an extensive radiological characterization study of the Santa Susana Field Laboratory (SSFL) at Area IV and the Northern Buffer Zone (NBZ) located in Ventura County, California. This work is being executed under USEPA Region 7 Architect and Engineering Services Contract EP-S7-05-05, Task Order 038. The technical lead on the project is USEPA Region 9. This Phase I Field Sampling Plan (FSP) describes the site characterization activities to be performed at Area IV and adjacent NBZ, hereafter collectively referred to as the Area IV Study Area. The location of the Area IV Study Area is illustrated on Figure 1.1.

This FSP describes collection of surface water, spring and seep, sediment, and groundwater samples in the Area IV Study Area. As described in Section 1.1, the scope of work for Phase I sampling was developed to provide high quality data for an extended suite of radionuclides and information that may aid in the development of the scope of work for additional phases of site characterization. To achieve these goals, the Phase I sampling regime was designed to acquire a limited number of samples for initial evaluation. Once this data has been obtained and evaluated, the Phase II sampling will be designed to target information gaps and further delineation of radionuclides reported during Phase I.

Phase I sampling includes collecting 34 surface water samples, 10 spring and seep samples, 35 sediment samples, and 70 onsite groundwater samples. No sampling will be conducted outside the boundaries of the Area IV Study Area during the Phase I sampling event. All media, with the exception of groundwater, will be analyzed for a complete suite of radionuclides. As described in Section 3.1, a targeted list of radionuclides has been selected for groundwater due to budget constraints placed on the Phase I laboratory procurement. These budget constraints will not be a factor for Phase II work. Analytical results of the Phase I sampling effort will be evaluated to determine additional sampling to be conducted under Phase II. A Phase II FSP will be prepared to describe additional surface water, spring and seep, sediment, and groundwater samples (on and off site), that will be collected to better define the nature and extent of radionuclides detected during Phase I. New data from other components of the Area IV Radiological Study, including the surface gamma radiation scanning, soil sampling, and Historical Site Assessment (HSA), will also be used to determine sampling locations for the Phase II sampling program. This approach will allow for optimization of sampling locations over the course of the project and will allow Stakeholders the opportunity to provide input to the Phase II sampling. Characterization of areas outside the Area IV Study Area maybe be considered by the USEPA based on the Phase I results.

This FSP describes procedures to be used for sampling surface water, springs and seeps, sediment, and groundwater during the Phase I sampling event. The Phase I and Phase II FSPs, together with the requirements of the Quality Assurance Project Plan (QAPP), represent the complete sampling and analysis requirements for the media addressed in this document. The QAPP is being prepared as a stand-alone planning document and submitted under separate cover.

1.1 PROJECT OBJECTIVES

The primary project objective is to provide data to characterize radiological conditions resulting from historical activities in the Area IV Study Area. This FSP describes examination of, surface water, springs, and seeps, sediment, and groundwater within the Area IV Study Area. Specifically, the sampling and analysis of these media are designed to:

- Provide high quality data for comparison to data reported by others;
- Provide data on radionuclides not previously assessed, and;
- Provide data for areas that may require additional assessment.

The data collected during the activities described in this plan are not intended to be comprehensive; however, the data may be useful to support human health and ecological risk assessments and to evaluate remedial alternatives.

1.2 SCOPE OF WORK

The scope of work presented in the Task Order Proposal submitted by HGL under Contract Number EP-S7-05-05, Task Order 038 (HGL, 2009a) has been refined to include the following Phase I activities:

- Collect surface water samples from approximately 34 locations from drainages before exiting the Area IV Study Area after a rain event.
- Collect spring and seep samples from approximately 10 locations during Phase I. The locations will be determined through field observations generally after significant rain events. The Phase I seep and spring sampling event will be conducted in November or December 2010.
- Sample and analysis of sediment from the major drainages within the Area IV Study Area. The objective of Phase I is to identify radionuclides in sediment and to determine the general extent of radiological contamination in sediments.
- Collect groundwater samples from available onsite groundwater wells.

The strategy employed for determination of sample quantities and distribution of samples for Phase I was to acquire data from areas and wells of known or potential concern; this will allow for optimization of the Phase II effort. The quantities and locations of samples that will be collected during Phase II will be based on the Phase I data, Stakeholder input and other considerations.

1.3 ORGANIZATION OF THE FIELD SAMPLING PLAN

This FSP consists of the following sections:

Section 1 – Introduction
Section 2 – Site Background
Section 3 – Sampling Program
Section 4 – Field Activity Methods and Procedures
Section 5 – Field Operations Documentation
Section 6 – Surveying
Section 7 – Investigation-Derived Waste Management
Section 8 – References

Appendix A Standard Operating Procedures
Appendix B Field Forms
Appendix C Responses to Comments Received on Draft Final Field Sampling Plan Dated April 2010.

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2.0 SITE BACKGROUND

This section describes the physical attributes of the SSFL site and provides a brief overview of the site history obtained from documents describing previous investigations. The site history will be further refined in an HSA currently being completed by USEPA.

2.1 SITE LOCATION AND DESCRIPTION

The SSFL is located in southeastern Ventura County, California, near Simi Valley (Figure 1.1). The 2,850-acre site is approximately 30 miles northwest of downtown Los Angeles between the Simi and San Fernando valleys in the Simi Hills. Residential areas are near the southern, northern, and eastern boundaries of the site.

2.2 SITE HISTORY

Before development, the area comprising the SSFL Site was used for ranching. In approximately 1948, North American Aviation, Inc. (NAA) began developing over 1,600 acres in the northeast section of the site, and constructed facilities to design, develop, and test liquid propellant rocket engines. NAA initially supported the U.S. Air Force facilities at the SSFL Site and supported nearly every major space program from the earliest satellite launches to the Space Shuttle. Area I of the SSFL Site contains administrative and laboratory facilities and has been used for rocket engine testing. Area II included additional rocket engine test facilities known as the Alfa, Bravo, Coca, and Delta facilities. This area also included facilities for small jet engine testing. Area III, located in the northwest portion of the SSFL Site, included facilities for small engine testing using propellants that were developed on site (Thielking, et al., 1987). The Rocketdyne Division of NAA operated these portions of the SSFL Site until approximately 1996 when Rocketdyne merged into The Boeing Company (Rumerman, 1960). Since approximately 1996, operations at the site have been conducted by The Boeing Company (Energy Technology Engineering Center [ETEC], 2010).

While some portions of SSFL outside Area IV supported rocket engine static testing for development and improvement of military missiles, on-going historical research is incomplete concerning potential Department of Defense activities in Area IV.

In addition to rocket and small engine testing facilities, NAA also had facilities at Area IV for researching, developing, and constructing equipment for harnessing nuclear energy through its Atomics International Division. According to a 1959 company brochure, Atomics International maintained a nuclear field test area covering approximately 300 acres at the SSFL Site (Atomics International, 1959). Under contract to the Department of Energy (DOE), Atomics International supported the development of civilian nuclear power, as well as the testing of non-nuclear components related to liquid metals within 90 acres of Area IV of the SSFL Site. The facilities within these 90 acres would later be referred as the ETEC (ETEC, 2010).

Nuclear operations facilities at ETEC included 10 nuclear research reactors. These ten nuclear reactors included the Sodium Reactor Experiment, the Space Nuclear Auxiliary Power liquid-metal reactors, and seven critical facilities (that is, facilities housing operations involving masses of fissionable material capable of sustaining a nuclear chain reaction) (Atomics International, 1959).

Other operations that handled radiological material within Area IV included the Radioactive Materials Disposal Facility and the Hot Laboratory, as well as the Sodium Disposal Facility, or Area IV burn pit. The operational history of each of these facilities will be addressed in the HSA.

According to the DOE ETEC web site, most nuclear research related programs and operations ceased in 1988 and were replaced with decontamination and decommissioning operations (ETEC, 2010).

2.3 PHYSICAL SITE SETTING

The physical setting of the site in terms of localized topography, earth materials, and hydrogeological setting are discussed in the following subsections.

2.3.1 Topography and Drainage

The SSFL is located on a ridge within the Transverse Ranges physiographic province. The facility is about 850 feet above the valleys to the north and south. While the laboratories and other facilities within Area IV are generally located on relatively flat ground, local relief can be up to 600 feet. In the Area IV Study Area, the highest elevation (2,150 feet above mean sea level) is along the southern boundary (Figure 2.1). Along the northwest boundary, the land slopes steeply away to undeveloped land. The relatively flat area in the southern part of Area IV is called "Burro Flats."

Surface water drainage in the northern portion of the Area IV Study Area flows north into Meier Canyon and north-northwest into Runkle Canyon, which are tributaries to the Arroyo Simi, flowing westward and terminating in the Pacific Ocean. Drainage of the majority of Area IV leads to the southeast into the Bell Creek drainage system as suggested by the location of the northeast-southwest trending drainage divide on Figure 2.1. Bell Creek is the headwater and tributary of the Los Angeles River which flows south and eastward terminating in the Pacific Ocean. Given the topographic divide and topographical rises to the east and west of Area IV, there is no drainage directly to the west or east from Area IV (U.S. Geological Survey [USGS], 1952). The northern portion of Area IV drains generally to the north into the NBZ, which itself drains generally to the north.

Surface drainage within Area IV Study Area is through man-made and natural ditches and swales that lead to natural streambeds. The drainage from some operational areas is directed through various settling and process ponds. The locations of surface drainage features are presented on Figure 2.1.

2.3.2 Soils

The parent material of the soil in the Area IV Study Area consists of weathered bedrock, colluviums and alluvium derived from the Chatsworth Formation. According to the Natural Resources Conservation Service, approximately 40 percent of the Area IV Study Area is classified as sedimentary rock outcrop. The two predominant soil types in Area IV are a sandy loam of the Saugus series and a loam of the Zamora series. The Saugus series soils consists of deep, well drained soils that usually form on dissected terraces and foothills and are moderately permeable. The sandy loam of the Saugus series usually has slopes of 5 to 30 percent. The Zamora series soils are typically well drained loam that form on nearly level grade or on strongly sloping fans and terraces. The Zamora series in Area IV has slopes that range from 2 to 15 percent (U. S. Department of Agriculture, 2003).

2.3.3 Geology

The SSFL is located within the Transverse Ranges physiographic province, approximately 30 miles north of downtown Los Angeles (Baily and Jahns, 1954). Two geologic formations underlie Area IV within the SSFL: the Cretaceous Chatsworth Formation and the Tertiary Santa Susana Formation. The Chatsworth Formation underlies approximately 80 percent of Area IV. The descriptions in the following sections are derived from the Preliminary Geologic Map of the Los Angeles 30 feet by 60 feet Quadrangle, Southern California (Yerkes and Campbell, 2005). A geologic map of the area is presented as Figure 2.2.

2.3.3.1 <u>Chatsworth Formation</u>

The Chatsworth Formation consists of three unnamed members. The members were deposited by turbidity currents in the deep ocean at depths ranging from 4,000 to 5,000 feet. Turbidity currents cause massive submarine landslides from the continental shelf into submarine canyons which are generally more than a half-mile wide and greater than ten miles in length. During periods without turbidity currents, silt and clay particles from runoff filtered to the ocean floor and formed the siltstone strata found in the formation.

Deposited in the late Cretaceous era, the Chatsworth Formation is in excess of 6,000 feet thick. The uppermost member is a thick strata of light gray to brown sandstone, which is hard, coherent, arkosic, micaceous, primarily medium grained separated by thin partings of siltstone. The middle member is a gray conglomerate of cobbles of rounded, polished clasts of quartzite, porphyry and granitic rocks in hard sandstone matrix. The lower member is gray clay shale, crumbly with ellipsoidal fracture where weathered, and may include sandstone strata.

2.3.3.2 <u>Santa Susana Formation</u>

The Burro Flats Fault places the Chatsworth Formation in structural contact with the Santa Susana Formation in the Area IV Study Area. The Santa Susana Formation underlies the southwestern most portion of the Area IV Study (Figure 2.2) and consists of four members. The unnamed uppermost layer of the Santa Susana Formation consists of gray micaceous claystone and siltstone with a limited number of thin sandstone beds. Below the uppermost layer lies a second unnamed layer that is made up of tan coherent fine grained sandstone, which locally contains thin shell-beds and calcareous concretions. Underlying this layer is the Las Virgenes Sandstone Member, which is composed of tan semi-friable bedded sandstone and is locally pebbly. The oldest member is the Simi Conglomerate Member. This member contains gray to brown cobble conglomerate with smooth cobbles of quartzite, metavolcanic and granitic rocks in sandstone matrix that locally includes thin lenses of red clay. The Santa Susana Formation was also formed by turbidity currents.

2.3.3.3 Geologic Structures at the Santa Susana Field Laboratory

The SSFL is located on the south flank of an approximately east-west striking, westward plunging syncline. There are three categories of geologic structures present in the SSFL faults/fault zones, deformation bands, and structures (Montgomery Watson Harza [MWH], 2007a). The fault zones and deformation features displace primary geologic features, the former showing displacement of at least five feet and the later with minimal observed displacement (less than 6 inches). Mapped faults in the SSFL are presented on Figure 2.2. The Burro Flats Fault places the Chatsworth Formation in structural contact with the Santa Susana Formation in the southwest portion of the Area IV Study Area.

2.4 HYDROGEOLOGY

The groundwater system in the vicinity of SSFL is recharged by precipitation. Recharge occurs throughout the Simi Hills and rates vary with the type of geologic material, local topography, vegetation, and precipitation. The elevation of groundwater at the SSFL is up to 900 feet higher than the groundwater levels in the surrounding alluvial valleys (Simi and San Fernando valleys), suggesting that groundwater flows from the higher elevations toward the topographically lower areas.

In the Area IV Study Area, groundwater occurs in the overburden and weathered bedrock and in consolidated bedrock. Historical documents commonly refer to the saturated overburden as near-surface groundwater. Groundwater that occurs in the fractured Chatsworth Formation is referred to as the Chatsworth Formation groundwater. Numerous monitoring wells are located in Area IV. Approximately 44 of these wells are screened in the near-surface groundwater, with depth-to-water occurring from 5 feet to 50 feet below ground surface. Approximately 47 wells are screened in the deeper Chatsworth Formation groundwater, with depth-to-water ranging from approximately 16 feet to 320 feet below ground surface. In some areas of the SSFL the groundwater in the overburden is perched, and in other areas groundwater within the overburden is in direct communication with groundwater in the Chatsworth Formation.

Groundwater flow at SSFL has been the subject of numerous studies by The Boeing Company and the DOE. MWH discusses results of recent flow characterization efforts including horizontal and vertical flow (MWH, 2009). A groundwater divide occurs near the center of the Area IV Study Area (Figure 2.1). Downward and upward vertical gradients have been reported at SSFL. Groundwater flow through fractures in the hydrogeologic units at SSFL is also discussed in the Draft Site-Wide Groundwater Remedial Investigation Report (MWH, 2009). The hydrogeologic investigation and agreement concerning the conceptual model is on-going.

2.5 HYDROLOGY

The mean annual rainfall from 1960 to 2008, as measured at a U.S. weather station located in the northeastern part of the SSFL, averaged 18.5 inches per year with a record low of 6.15 inches in 2007 and a record high of 41.24 inches in 1998 (MWH, 2009). Although normally in the form of rain, precipitation at SSFL can also be in the form of snow during the winter months. The majority of annual precipitation falls between the months of November and March (wet season). The locations of surface drainage features are presented on Figure 2.1.

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3.0 SAMPLING PROGRAM

The investigation activities for this FSP consist of sampling and analysis of surface water, springs and seeps, sediment, and groundwater. The sampling regime has been designed to meet the project objectives described in Section 1.1. A discussion of the radionuclides to be tested is presented in this section followed by discussions of the Phase I sampling for each media.

3.1 RADIOLOGICAL CONTAMINANTS OF INTEREST

As part of the Final FSP for the Radiological Background Study, Santa Susana Field Laboratory (HGL, 2009b), the USEPA developed a radionuclides of interest (ROI) list for laboratory analyses of soil. This list of ROIs for soil was developed evaluating available historical information, information from the DOE Hanford Site in Richland, Washington, State of California Department of Public Health suggestions, and a document commissioned by DOE titled "Radionuclides Related to Historical Operations at the Santa Susana Field Laboratory Area IV" (Rucker, 2009). Findings of the HSA currently being executed for the site were not considered. The ROI list was refined in consideration of the following criteria which were reviewed by SSFL Technical Stakeholder Group on March 23, 2009.

1. Radionuclide was used or produced at SSFL.
2. The physical state of the radionuclide was not a gas. An exception to this criterion is if the radionuclide is a gas and its parent was not removed from the list, then it would not be proposed for removal.
3. Radionuclide has a half-life greater than one year. An exception to this criterion is if the radionuclide has a half-life of less than one year and its parent was not removed from the list, then it would not be proposed to remove the ROI from the list.
4. The SSFL Technical Stakeholder Group elected to retain a specific radionuclide on the list of ROIs.

Table 3.1 summarizes the analyte list for all media being sampled under this FSP: surface water (including springs and seeps) and sediment samples will be analyzed for the complete list of ROIs, and groundwater samples will be analyzed for a targeted list of ROIs. The following subsections describe the prioritization of analytes for groundwater sampling.

3.1.1 Prioritization of Radionuclides of Interest for Phase I Sampling

During Phase I, surface water and sediment samples will be analyzed for the radionuclides presented in Table 3.1. Due to budget limitations imposed for Phase I only, groundwater samples will be analyzed for a targeted group of ROIs, identified as Priority 1 and Priority 2 analytes. Groundwater samples will be analyzed for a subset of ROIs selected from the complete list of soil ROIs. This approach provides the data necessary to meet the data quality objectives of the project while optimizing costs. The approach described below was applied during selection of the targeted list of groundwater ROIs to balance the radionuclide information that will be obtained from different analytical methods and the need to provide adequate sampling coverage. The following prioritization was developed to achieve this cost/benefit balance.

- Priority 1 - analyses will be performed on all groundwater samples.
- Priority 2 - analyses will be performed on a select number of groundwater samples due to budget limitations.
- Other - analyses will not be performed on Phase I samples but may be considered for Phase II.

3.1.1.1 Priority 1 Groundwater Radionuclides

Priority 1 analytes provide the most direct benefit to the project dataset relative to the cost to obtain the data. Analysis of the Priority 1 list will utilize most of the available budget for the Phase I groundwater sampling. The following radionuclides were selected for Priority 1 groundwater analysis.

- Tritium (H-3) was selected because it is a specific ROI, and has been detected onsite in previous investigations.
- Strontium-90 (Sr-90) was selected because it has been detected onsite in previous investigations.
- Gamma spectroscopy analytes are included in the Priority 1 list because a large number of ROI at SSFL will be analyzed non-destructively at low cost.
- Uranium isotopes were selected because they tend to be relatively mobile in water and have been previously reported in SSFL soil and water samples.
- Gross alpha and beta radiation analyses were selected because they can be used as a screening tool to indicate the presence of radionuclides other than those specifically tested. In addition, maximum contaminant levels (MCL) are promulgated for gross alpha and beta radiation.

The Priority 1 list includes specific gamma spectroscopy analytes of interest such as cesium (Cs)-134, Cs-137, and cobalt (Co-60), which have been reported in water. The Priority 1 list also contains certain gamma emitting radioisotopes which have not been previously detected in SSFL water samples. This group of analytes is included because they may be detected and reported through cost-effective gamma spectroscopy.

Gross alpha and beta radiation results can be used to infer that radionuclides may be present in addition to those radionuclides measured using different analytical methods. For example, many beta emitting radionuclides also emit gamma radiation, therefore those beta-emitting radionuclides measured via gamma spectrometry and specific methods (e.g. Sr-90, H-3, etc.) can be summed and compared to the gross beta result or a particular sample. If the gross beta result is significantly greater than the summed value, then it is possible that the sample contains beta activity from a radionuclide that had not been measured or detected. Gross alpha data can be similarly inspected.

The gross alpha and beta results can be compared to the Federal MCL for gross alpha activity (15 picocuries per liter [pCi/L]) or the California MCL of 50 pCi/L for gross beta activity. The Federal gross alpha MCL excludes uranium and radon so activities associated with these radionuclides should be used to calculate an adjusted gross alpha value for comparison to the MCL. Similarly, naturally occurring potassium-40 activity should be subtracted from gross beta activity to provide a value to compare to the MCL (Federal Register, 2000).

3.1.1.2 Priority 2 Groundwater Radionuclides

Priority 2 radionuclides represent potentially important analytes that, because of cost, can only be analyzed for a limited number of groundwater samples for the Phase I work. These analytes are:

- carbon-14 (C-14),
- technetium (Tc-99),
- iodine-129 (I-129),
- radium-226 (Ra-226),
- neptunium-237 (Np-237),
- plutonium (Pu)-238,
- Pu-239,
- Pu-240,
- Pu-242,
- americium-241 (Am-241),
- curium (Cm)-243,
- Cm-244,
- Cm-245, and
- Cm- 246.

These isotopes were selected based on a combined consideration of health risks, mobility in water, and the total information gained or inferred from the analysis. Tc-99, I-129 and Np-237 are relatively mobile but are not the highest priorities. The isotopes Pu-238, Pu-239, Pu-240, Pu-242 are generally highly immobile. Am-241 was previously reported in groundwater at SSFL and is retained in the Priority 2 list together with the Cm radionuclides which are analyzed together with Am-241. Ra-226 is a naturally occurring radioisotope which has a relatively high health risk and has been detected on site.

3.1.2 Analytical Priority Based on Available Sample Volume

Although a priority list of radionuclides has been developed, it is important to note that each water analysis requires a minimum volume of water. Certain wells, particularly shallow wells, are likely to become dry during sampling before a sufficient volume of water can be acquired for all analyses. Therefore, a priority list of analyses has been developed as listed below. If the volume of water that can be collected is limited, the laboratory will be instructed to subsample the gamma spectroscopy volume for analysis of the remaining analytes where practical.

Following is the order in which sample volumes should be collected for analysis:

- H-3
- Gamma spectroscopy analytes (with one exception for Sr-90, see below)
- Uranium isotopes
- Sr-90 (this radionuclide will be given second priority at well RD-98 where it has been reported before).
- Gross alpha and beta radiation.
- Priority 2 analyses in the following sets:
    - Am-241, Cm-243, Cu-244, Cm-245, Cm-246
    - Pu-238, Pu-239, Pu-240, Pu-242
    - Np-237
    - Ra-226
    - I-129
    - Tc-99
    - C-14

Note that the Priority 2 analytes will be analyzed only at a few wells. These wells are listed in Section 3.5

3.1.3 Action Levels and Minimum Quantifiable Concentrations

The data quality objectives are discussed in detail in the QAPP. For sediment, the data quality objective for each ROI is the action level established as the agricultural preliminary remediation goal (AgPRG) for soil. AgPRGs have not been established for the groundwater or surface water matrices. Where an MCL in drinking water has been promulgated for an ROI, the action level for aqueous matrices will be set at the MCL. In all other cases, the PRGs for tap water established by USEPA have been selected as the comparison criterion for aqueous matrices.

Determination of the minimum quantifiable action levels for the ROIs listed in Table 3.1 will occur subsequent to laboratory award; however, the laboratories will be required to meet the following criteria:

- The required relative method uncertainty for each ROI must be no more than 10 percent, when the measured activity is at or above the action level.
- For sample activity less than the action level, the required absolute method uncertainty is not to exceed 10 percent of the action level.
- In cases where the ROI action levels are below the quantification capabilities of available analytical technology, the laboratory will be required to propose alternate activity levels at which the requirements for the relative and absolute uncertainties can be achieved.
- Alternate activity levels, which may be considered practical limits to the action levels, must be approved by USEPA before acceptance.

3.2 SURFACE WATER SAMPLING

The objective of the Phase I surface water sampling program is to provide a preliminary characterization of radiological contamination in surface water that could be attributed to previous activities in the Area IV Study Area. Generally, surface water is very limited and intermittent due to the arid conditions and because the SSFL site is located near a topographic high. There are no natural ponds in Area IV. Surface water is present only during and immediately following periods of heavy rain. Therefore, surface water sampling will occur only immediately following significant precipitation events.

In March 2010 HGL performed a reconnaissance to identify potential surface water sampling locations within the Area IV Study Area. Criteria for selection included:

- whether the location appeared to be in a major drainage leading from Area IV;
- the presence of observed or known surface water that enters an outcrop and exists a bedrock fracture;
- observation of standing water with access for sampling, and;
- SSFL Technical Stakeholder Group input.

The locations of surface water samples identified are depicted on Figure 3.1. Each location is included in Table 3.2 together with the name of the drainage feature described in the Draft Gap Analysis Report published by Camp, Dresser, and McKee (Camp, Dresser, and McKee, 2008). HGL will verify each of these locations for sampling feasibility one additional time subsequent to a significant rain event.

During the Phase I sampling event, approximately 34 surface water samples will be collected. Samples obtained at each location will be laboratory-filtered, as described in Section 4.1.4, which differs from procedures previously used. Total and filtered results will be reported by the laboratory.

Table 3.1 lists the ROIs to be tested for surface water. The proposed sampling methodology for collection of surface water samples is presented in Section 4.3.

3.3 SPRING AND SEEP SAMPLING

The objective of the spring and seep sampling is to characterize radiological contamination that may be associated with previous operations in the Area IV Study Area. In addition, because of the generally arid conditions at the site, the characterization will be biased to:

- those areas where flowing water is observed and where there has been previous sampling and indications of chemical contamination;
- locations that have been sampled previously that have shown contamination;
- locations requested to be sampled by the SSFL Technical Stakeholder Group, and;
- other opportunistic sampling locations.

Springs and seeps are areas where groundwater naturally flows to the land surface where it either ponds, flows into a drainage, or evaporates rapidly without additional flow. Flowing springs and seeps will be identified during or immediately after significant rainfall events (generally events with greater than 1 inch of rainfall) during the wet season and dry season. Since HGL has full-time staff located at SSFL, HGL can quickly mobilize to make these observations. Because of the limited number of samples proposed (10 locations) samples will be focused on the NBZ area for Phase I work.

Spring and seep samples will be analyzed for the ROIs listed for surface water in Table 3.1. Sampling will be based on the availability of flowing locations; however, Phase I sampling is expected to occur during the wet season (November through March). Samples obtained at each location will be laboratory-filtered as described in Section 4.1.4. Total and filtered results will be reported by the laboratory. The methodology to be used for spring and seep sampling is presented in Section 4.4.

3.4 SEDIMENT SAMPLING

The objective of the sediment sampling activities is to provide a general understanding of the nature and localized extent of radionuclide contamination in sediment. The transport mechanisms through which radionuclides from potential sources in Area IV may have been deposited in sediments are through airborne deposition, transported while sorbed onto soil particles, or precipitated out of solution (surface water). The sampling regime for this study has been developed to provide broad coverage of sediment conditions in the primary drainages leaving the Area IV Study.

Sediment samples will be collected at 35 locations along the major drainage features that flow from the Area IV Study Area. Sediment sampling will target the portions of the drainage features where sediment is accumulating (such as the low-velocity zones inside of meanders and overbank deposits where finer-grained materials are present). An approximately 65-foot deep excavation into bedrock that is filled with water is present at Building 4056. One sediment sample will be collected from the bottom of this excavation (Figure 3.2).

The proposed sediment sampling locations are depicted on Figure 3.2. These locations may be slightly adjusted due to access limitations. Table 3.4 lists the proposed sediment sampling locations.

Sediment samples will be analyzed for the ROIs listed for sediment in Table 3.1. The required sample volumes and containers for sediment samples will be clarified in an addendum to this FSP. The proposed methodology that will be used for sediment sampling is presented in Section 4.5.

3.5 GROUNDWATER SAMPLING

During the Phase I groundwater sampling program, samples will be collected from the existing monitoring well network to provide high-quality data for comparison to data reported by others at the Area IV Study Area and provide data for radionuclides not previously tested. It is estimated that up to 70 monitoring well locations will be sampled during the Phase I sampling event scheduled for summer 2010 (dry season). The Phase II groundwater sampling is expected to occur in winter 2011 and will be described in a Phase II FSP to be issued at a later date.

A database search identified 97 groundwater monitoring wells and piezometers in the Study Area: 51 deep monitoring wells, 10 shallow monitoring wells, and 36 piezometers. During a monitoring well gauging conducted in July 2010, it was determined that the following 12 of these 97 wells and piezometers were either damaged or abandoned and therefore cannot be sampled.

Damaged or Abandoned Well Locations

Well/Piezometer Number	Well/Piezometer Number
PZ-115	PZ-099
PZ-051	PZ-097
PZ-107	PZ-104
RD-89	RD-28
RD-25	RS-28
RD-30	RD-74

In addition, during the July monitoring well gauging event, the following 18 locations were found to be dry.

Dry Locations

Well/Piezometer Number	Well/Piezometer Number
PZ-073	PZ-111
PZ-143	PZ-055
RS-24	PZ-114
RS-11	RS-23
PZ-056	PZ-116
RS-16	PZ-101
RD-97	PZ-102
RS-27	PZ-113
PZ-110	PZ-124

The resulting number of wells that are not dry, damaged, or abandoned and can potentially be sampled is 67 and are depicted on Figure 3.3. The well/piezometer designations and construction information are presented in Table 3.5. All these locations are planned to be sampled; however, 10 of these locations are multi-level installations where the number of samples collected needs to be limited. The elevations (ports) selected to be sampled from multi-level wells are described below.

Ten wells are completed as multi-level Flexible Liner Underground Technologies (FLUTe) wells in Area IV. Though there are multiple ports at each multi-level location, only one port from each location has been selected for sampling due to Phase I budget. The criteria used to select each port, in order of priority, are presented below:

- The port with the highest level of reported tritium was selected for sampling.
- If no tritium data exists for the multi-level well, the well port with the highest reported hydraulic conductivity was selected.
- In cases where there is no port-specific tritium data or hydraulic conductivity data, a port within the first 100 feet of saturated bedrock was selected.

Table 3.6 presents the ports to be sampled based on these criteria.

As described in Section 3.1.1, all locations are to be sampled for Priority 1 analytes listed in Table 3.1. The radiological data from groundwater in the Area IV Study Area were examined and assessed for the selection of wells for sampling and analyses of Priority 2 groundwater analytes. Those wells selected for Priority 2 analytical list sampling (budget permitting) for the Phase I work are:

- RS-18,
- RD-19,
- RD-29,
- RD-33B,
- RD-34B,
- RD-97, and
- RD-98.

The proposed methodology that will be used to sample the existing groundwater wells is presented in Section 4.6.

4.0 FIELD ACTIVITY METHODS AND PROCEDURES

This FSP provides the rationale and procedures that will be used to conduct the Phase I surface water, spring and seep, sediment, and groundwater sampling portion of the radiological investigation of the Area IV Study Area. The following subsections describe the field investigation methods and procedures that will be employed to meet the project objectives, and ensure that data of sufficient quantity and known quality are obtained to support decision making. The following field activity tasks are planned:

- mobilization,
- surface water sampling,
- spring and seep sampling,
- sediment sampling, and
- groundwater sampling.

Investigation-derived waste (IDW) generated during the execution of field tasks will be managed as described in Section 7.0 and in accordance with the Site Management Plan, Santa Susana Field Laboratory, Area IV Radiological Study (HGL, 2010a) and applicable federal and state regulations.

The following discussion references standard operating procedures (SOP) for each activity, where applicable. Referenced SOPs are included in Appendix A. Referenced field forms are included in Appendix B.

4.1 MOBILIZATION ACTIVITIES

Before implementation of the field work, several mobilization activities will be necessary including setting up an onsite field office as the base of operations, establishing site security measures, preparing the site, and procuring all necessary equipment and supplies. These activities and general site management procedures are described in HGL's Site Management Plan (HGL, 2010a). Key mobilization activities required for execution of the work are described in the following sections.

4.1.1 Operations and Site Security

The onsite field office is located in Building 204 located in Administrative Area II. The field office provides office space and field operations support. HGL personnel, equipment, and subcontractor resources will mobilize to this central location before sampling activities begin.

Site security is managed by The Boeing Company. HGL will coordinate with The Boeing Company to maintain current security requirements and implement additional measures to assure that equipment and property in Building 204 are secure. A lockable room within Building 204 will be designated for sample storage. Access to this room will be strictly controlled and only a limited number of HGL employees (field personnel) will be issued a key for entry. Samples under proper chain-of-custody will be stored in this room after they have been collected and will be held until they are shipped to the laboratory for analysis.

4.1.2 Site Preparation

The sample custody room in Building 204 will be cleaned and configured for sample handling. This room will be stocked with sample bottles, coolers, laboratory-grade water, and other required materials before sampling activities begin.

Site preparation at the sampling locations is described in the following subsections and the SOPs included in Appendix A.

4.1.3 Equipment, Supplies, and Containers

Within Building 204, lockable storage facilities will provide access control for sampling equipment and sample containers. Certain aspects of the groundwater purging will be performed by The Boeing Company under the direct supervision of HGL as described in Section 4.6.3; therefore, storage locations for groundwater purging equipment will be determined by The Boeing Company. A designated work space to charge, calibrate, and repair sampling and monitoring equipment is also present. Since sampling equipment will be rented, it will be inspected upon arrival at the site to make sure it is functioning properly. To ensure that analytical data and field measurements generated during field activities are reliable, all equipment and instruments will have an established routine testing, inspection, and maintenance schedule. Preventative maintenance will be performed and documented by field personnel. Equipment maintenance procedures will be presented in Section 5.4 and 5.5. In addition, all non-disposable sampling equipment will be decontaminated before sampling activities begin.

Disposable sampling supplies, such as nitrile gloves, paper towels, permanent markers, and labels, will be purchased and stocked in the sample custody room.

Unless otherwise stated, the laboratory will provide sample containers and preservatives for samples designated for analysis. All sample containers will be pre-cleaned and traceable to the facility that performed the cleaning. Sample containers will not be cleaned or rinsed in the field. Sample bottles will be stored in the sample custody room.

Coolers will be used to ship samples from the site to the laboratory. Coolers will be supplied by the laboratory and will be stored in the sample custody room along with the sample bottles.

The SOPs provided in Appendix A, list the equipment and supplies necessary to support the field activities.

4.1.4 Analysis of Total Activity and Activity of Filtered Water Samples

As described in the following sections, field filtering and preservation will not be performed for water samples. All water samples collected will be passed through a 0.45 micron filter at the laboratory and preserved. Both the activity of the filtered water and the activity of the residue collected on the filter will be measured. The activity of the filter residue will be converted to a volumetric activity. Total activity will be derived through summation of the filtered water activity and the activity of the filter residue. The groundwater, surface water, and sediment sampling QAPP for this project describes the laboratory procedures in detail.

4.1.5 Health and Safety

A Site Safety and Health Officer has been assigned to ensure that field activities are conducted in accordance with the safe work practices detailed in the Site Safety and Health Plan (SSHP), Santa Susana Field Laboratory, Area IV Radiological Study (HGL, 2010b). The SSHP outlines safety and health practices that will be employed throughout the duration of the project. The SSHP is provided under separate cover.

4.2 IDENTIFICATION OF SAMPLING LOCATIONS

A site reconnaissance was conducted in March 2010 to identify potential sampling locations with the Area IV Study Area. The results of this reconnaissance, discussions with the SSFL Technical Stakeholders Group, and evaluation of potential sampling locations within USEPA have resulted in selection of preliminary sampling locations as described in Sections 3.2, 3.3, 3.4, and 3.5. Sampling of the locations described in those sections is contingent on:

- Availability of water in wells,
- Availability of surface water, and
- New information that may require selecting new locations over others.

Some additional tasks are required to evaluate seeps before sampling. Those tasks are described below.

4.2.1 Identification of Potential Onsite Spring and Seep Sampling Locations

To identify spring and seep sample locations, HGL will conduct surveys of rock faces in each drainage basin after major rain events (generally events generating over 1 inch of total rainfall). The study area will be broken into manageable subareas so that over time, a high-level of coverage is obtained. In addition, USEPA will solicit additional input from the Technical Stakeholders Group to identify locations of particular concern. The identified springs and seeps will be numbered. A database search will also be completed to include identification of seep locations onsite that have had detections of radionuclides or chemical contaminants. Seeps with detectable concentrations will be given priority for sampling. In addition, those locations in the NBZ will be given priority. Because only 10 locations are to be sampled during Phase I, the coverage of the area is expected to be low but will provide a check on previously generated data. Spring and seep sample locations will be identified with a permanent sign or other acceptable permanent marking. The locations will be surveyed using a global positioning system (GPS) unit. Photographs will be taken of the locations and the surrounding area.

4.3 SURFACE WATER SAMPLING PROCEDURES

Four types of sampling methods will be utilized to collect surface water samples, depending on site conditions:

- dipping the sample container directly in the water;
- using a stainless steel scoop to collect water and then filling the sample container;
- using a Kemmerer sampler, and
- using a peristaltic pump.

Specific sampling procedures associated with these four methods are included in SOP 2.16.

4.3.1 Direct Dip Method

The direct dip method of collecting surface water samples is the most desirable. This method consists of collecting a single grab sample by immersing the sample bottle directly under the surface of the water as close to the center of the channel as possible. This method reduces the potential for cross contamination as it does not require using equipment that requires decontamination. If the channel is wide enough that field personnel have to wade into the stream to collect the sample, the sample must be collected while facing upstream to avoid collecting sediment re-suspended in the water column by the sampler entering the water.

4.3.2 Stainless Steel Scoop

If the stream is too deep to wade, then a stainless steel scoop affixed to a telescoping aluminum pole will be used to collect the sample from near the center of the channel. The scoop will be decontaminated after each use in accordance with SOP 2.01 and Section 3.2.4 of the QAPP. Clean scoops will be wrapped securely in aluminum foil and stored when not in use.

4.3.3 Kemmerer Sampler

A Kemmerer discrete depth water sampler will be used to sample the water at the bottom of the Building 4056 excavation. The Kemmerer sampler is a brass cylinder with rubber stoppers that are open while being lowered in a vertical position, thus allowing free passage of water through the cylinder. A messenger is sent down a rope when the sampler is at the designated depth which causes the stoppers to close. After closing the cylinder, it is then raised and water poured through a valve into sample containers.

4.3.4 Peristaltic Pump

A peristaltic pump will be used to collect samples from storm water pipes or other areas where access is restricted. Disposable Tygon tubing will be used in the pump drive. Disposable polyethylene tubing will be attached to the Tygon tubing and extended to the length needed. New Tygon and polyethylene tubing will be used for each sample to avoid cross contamination.

Water quality parameters for temperature, pH, electrical conductivity (EC), dissolved oxygen (DO), oxidation-reduction potential (ORP), and turbidity will be collected directly at the sampling location, if possible. If direct measurement of these parameters is not possible an additional grab sample from each location will be collected and a measurement acquired from that sample. This sample will not be submitted for laboratory analysis. Odors, color, flow estimates, site conditions, and other notable characteristics will also be documented on the field sampling sheet and in the field logbook.

A detailed protocol for collecting surface water samples is presented in SOP 2.16 (Appendix A).

4.4 SPRING AND SEEP SAMPLING PROCEDURES

The point of emergence of a spring or seep may be a fracture in a near-vertical rock face, a hillside, the side of a natural drainage, or other such non-horizontal surface. Under these conditions, the water emerging from the spring may flow across the surface downward toward a pool that accumulates beneath the point of emergence, or there may be no pool at all.

The spring and seep samples will be collected as close to the emergence point as possible rather than sampling from the pooled area (if one is present). If the emergence of the water is within the pool, the sample will be collected as close to the emergence point as possible.

If the spring or seep is an area of moist sediment without a pool of standing water, a clean hand trowel will be used to dig out a depression in the sediment, creating a pool in which the spring water can accumulate. A sample will be collected from the pool. The sampler will take detailed field notes at each spring sampling location. Observations such as the size of the hole created and the rate at which groundwater flows will be documented.

Four sampling methods will be employed to collect water samples from the majority of the springs and seeps. These methods are identical to those described for surface water sampling in Section 4.3.

A detailed protocol for collecting spring water samples is presented in SOP 2.16 (Appendix A).

4.5 SEDIMENT SAMPLING PROCEDURES

The streams and surface water bodies at SSFL are largely ephemeral; therefore, sediment samples will be collected along dry water courses or ponds. Sediment samples will be collected using a stainless steel trowel or hand auger. The sediment will be collected within the top 6 inches of material. The sampling will target the fine-grained sediment that has been deposited within the drainage (low velocity zones such as inside meanders) and associated stream bank (if any). The fine sediment will be placed into a stainless steel bowl and stirred to create a homogeneous mixture before placing the sample into the appropriate sample container.

One sediment sample will be collected from the Building 4056 excavation. An Ekman sampler will be used to collect a sediment sample from the bottom of that excavation. The Ekman sampler is a box-style sediment sampler which includes a messenger-operated release device. The sampler has overlapping cover plates, loosely hinged at the top of the box, that permit an outflow of water during descent, and close tightly to prevent wash out of sediment during ascent.

Specific procedures for sediment sampling are included in SOP 2.15 in Appendix A.

4.6 GROUNDWATER WELL SAMPLING PROCEDURES

Groundwater monitoring wells installed in the Area IV Study Area consist of a combination of traditional shallow screened wells, open hole bedrock wells, artesian wells, and FLUTe multilevel systems. Each different type of well requires different methods for purging and collecting groundwater samples. The proposed procedures are discussed in the following subsections and SOPs contained in Appendix A.

4.6.1 Area IV Site-Wide Water Level Measurement Event

Comprehensive water-level gauging events will be conducted prior to each groundwater monitoring event. All wells that are a part of the Area IV groundwater sampling program will be gauged.

An electronic water level meter will be used to gauge each well included in the gauging event. The tape and probe that entered the well will be decontaminated in accordance with SOP 2.01 before the first gauging and between wells. The wells will be gauged in the order of increasing expected contamination. Depth-to-water and depth-to-bottom measurements will be recorded. All depth-to-water measurements will be recorded from the established measuring point or from the top, north side of the inner well casing. Information such as depth-to-water, depth-to-bottom, general well condition, and any other pertinent observations will be documented on the Well Gauging Data Form presented in Appendix B.

4.6.2 Groundwater Monitoring Well Sampling

Previous groundwater sampling events at SSFL have generally followed the “well-volume” approach that is included as SOP 2.23 of Appendix A. The well sampling for this project will employ three methods of groundwater sampling as follows:

- Low-flow techniques are to be employed for screened wells with short screens (10 feet or less in length, SOP 2.02).
- Open-hole bedrock wells will be sampled using a well-volume purge approach (SOP 2.23).
- Multi-level systems will be sampled using the manufacturer’s procedures. A description of the low-flow technique and well-volume technique is provided herein.

One additional special-case purging and sampling procedure will be used for those wells that are expected to go dry during purging and not recover over a period of at least seven days. In these cases USEPA will attempt to collect water-screening samples before attempting collection of actual groundwater samples. Water-screening samples are samples of water from a well that have not been purged as described in SOPs 2.02 and 2.23. These water-screening samples will therefore not be considered to be representative of groundwater and will be flagged and segregated from groundwater results during reporting. Further detail of purging wells that are expected to go dry is provided in Section 4.6.2.1.2.

Multi-level and open-hole bedrock well purging procedures, as described below, are similar to procedures that have been employed during previously sampling by others at SSFL.

Most of the wells with short screens in the Area IV Study Area are screened within the unconsolidated overburden. Shallow overburden wells are generally more prone to development of artificial turbidity during the purging process. To limit artificial turbidity low-flow sampling techniques will be used to sample wells with short screens. As described in Section 4.1.4, the activity of radionuclides contained in the turbidity of all water samples will be measured to provide for a total activity when summed with the activity of the water itself.

4.6.2.1 Low-Flow Purging

Low-flow purging and sampling will be performed in wells with short screens (10 feet or less in length) and water column lengths equal to or greater than 3 feet, to obtain representative samples of formation groundwater. The low-flow purging method is based on the premise that low-flow pumping, with little or no drawdown, will rapidly establish laminar flow and withdraw formation water without significantly mixing or dewatering the stagnant water in the well and without mobilizing material not naturally occurring within the aquifer. In addition, due to exceptionally low-flow rates, turbidity is generally reduced. The low-flow method therefore minimizes purge volumes and IDW volumes while providing more representative aquifer samples. A detailed description of the low-flow purging and sampling procedure that will be used is presented in SOP 2.02 (Appendix A). The following is a general description of the low-flow purging and sampling process.

Before purging, the water column length must be calculated. To minimize agitation of the sediment present at the base of the well, the water column length will be calculated using the depth-to-water subtracted from the total well depth measurement obtained from the well construction details or data collected during the pre-sampling gauging event.

In wells where the water level is above the well screen, the pump inlet will be positioned at the highest hydraulic conductivity elevation (if known) or approximately in the center to slightly above the center of the well screen. In wells where the water level is below the top of the well screen, the pump will be placed at the highest hydraulic conductivity in the saturated zone (if known) or near the center of the water column.

Wells will be purged at a rate of approximately 200 to 500 milliliters per minute (mL/min). A graduated container will be used to accurately measure the flow rate. Water levels will be continuously recorded to monitor drawdown in the well and to allow for flow rate adjustment before the maximum drawdown is exceeded. The goal is to purge the well at a rate that does not draw down the static water level more than 0.33 feet. Water quality readings temperature, pH, EC, DO, ORP, and turbidity will be measured continuously during purging. During the purging, a minimum of one tubing volume (including the volume of water in the pump and flow cell) must be purged before recording the water quality indicator parameters. Flow rate measurements, water level measurements, and water quality readings will be recorded at five minute intervals.

A groundwater sample will not be collected until the water level has stabilized and then there are three consecutive water quality readings that meet the following criteria:

- pH ± 0.1 units
- EC ± 3 percent
- DO ± 10 percent
- ORP ± 10 millivolts, and
- Turbidity ± 10 percent (when turbidity is greater than 10 nephelometric turbidity units [NTU]).

Turbidity readings below 50 NTUs are desired. If turbidity drops below 10 NTUs, the water will be considered stabilized for that parameter. When turbidity is high, the purge time will be extended in order for turbidity to reach a value below 50 NTUs; however, if turbidity stabilizes above 50 NTUs for 15 to 30 minutes, then turbidity will be considered stable as defined above.

If water quality parameters do not stabilize as prescribed in SOP 2.02, professional judgment will be exercised to determine whether stabilization sampling can occur. Justification for the associated decision must be documented on the groundwater field sampling data sheet.

Groundwater samples will be collected using the pump used in the purging procedure at a flow rate of 200 mL/min to 500 mL/min. If the parameters do not stabilize with less than 0.33 feet of drawdown, a subset (pH, EC, and turbidity or DO) will be used as the stabilization parameters. If subset parameters do not stabilize, then the sample will be collected when a maximum number of parameters stabilize, and the anomalous parameters will noted on the sampling form and brought to the Field Manager's attention. In cases where maintaining 0.33 feet or less of drawdown is not possible at minimum flow rates, the drawdown will be allowed to continue until water level stabilization is achieved. This deviation from the SOP will be noted on the field sampling data sheet and brought to the attention of the Field Operations Manager.

All associated discharge tubing and water quality meters will be kept in shaded areas to limit the tubing and equipment from heating the groundwater. IDW generated during groundwater sampling activities will be managed in accordance with Section 7.0 of this FSP and the Site Management Plan (HGL, 2010a).

4.6.2.1.1 Slow Recharging Well or a Water Column Less Than 3 Feet

In the case of an extremely slow-recharging well or a well with a water column 3 feet or less, a Teflon, disposable bailer will be employed to purge the well. The bailer will be slowly lowered to the top of the water column and allowed to fill. The water-filled bailer will then be brought to the surface, its contents emptied into properly labeled sampling containers in the order specified in Section 3.1.2, and placed on ice in a cooler. These samples are designated as water-screening samples that will only be subject to analysis in cases where the well does not recover as described in Section 4.6.2.1.2. The bailer will then be placed back down the well. During the purging process, water quality parameters (DO, pH, EC, turbidity, ORP, and temperature) will be measured at least once per gallon purged. This purging process will continue until three well volumes have been removed, stabilization of the water quality parameters has occurred, or the well is purged dry.

For wells with slow recharge, water level stabilization will not be a requirement. As with wells with water columns greater than 3 feet, professional judgment will be allowed to determine whether stabilization has been achieved. At a minimum, at least one well casing volume should be purged from the well. Once water quality parameters have stabilized and the minimum purge volume removed, groundwater samples can be collected.

4.6.2.1.2 Screening Water Sampling of Wells that Remain Dry

As discussed in Section 4.6.2.1.1, screening-water samples are to be collected for wells that recharge very slowly. These samples are to be labeled and sent to the laboratory. Wells that go dry will be inspected within 24 hours to see whether there has been recharge. If recharge is 85 percent within 24 hours, groundwater samples may be collected as in Section 4.6.2.2. If recharge is 75 percent groundwater samples may be collected as described in Section 4.6.2.3. If after seven days of water level monitoring, neither of the above criteria are met, the laboratory will be directed to analyze the original water-screening samples. These water-screening samples will be flagged and segregated from results for groundwater samples acquired using low-flow or well-volume approach sampling during reporting. It is important to note that the laboratory has five days from the date of sampling to filter and preserve the water samples. Therefore, it may be necessary to direct the laboratory to filter and preserve the water-screening samples even if they are ultimately not analyzed.

4.6.2.2 Low Flow Groundwater Sampling

After well purging has been completed, a groundwater sample will be collected. The equipment used to purge the well will also be used to collect a groundwater sample. For example, if a bladder pump was used to purge the well, then the bladder pump will be used to collect the groundwater sample.

If sampling is conducted using a pump, the sample pumping rate will range between 100 mL/min to 500 mL/min. Therefore, if a well has been purged at a rate greater than 500 mL/min, then the pumping rate must be reduced to 500 mL/min to begin sampling. Under no condition will a water sample be collected on the effluent end of a flow through cell of a water quality meter.

If a disposable bailer has been utilized to purge a well, the water level within the well will be allowed to recover to within 85 percent of its initial static water level before sampling. However, the well must be sampled within 24 hours from completing well purging. Sampling will consist of slowly lowering the disposable bailer used for purging the well into the water column. Care will be taken to minimize agitation of the water column and the sediments that may be present at the bottom of the well. Once the bailer is full, the bailer will be retrieved from the well and direct-pour methods will be employed to fill the necessary sample containers. Upon approval by the Field Operations Manager, minimum sample volumes may be collected if the well yield is insufficient to provide a full sample volume.

Samples should be collected in the order described in Section 3.1.2. Sample containers will be labeled with the appropriate identifying information (location, date, time, condition, added preservatives, etc.). Each sample will be logged on a groundwater sample collection data sheet at the time of collection. A copy of a Groundwater Field Sampling Data Sheet is included in SOP 2.02 and Appendix B. Sample containers of appropriate volume and composition will be prepared in advanced to ensure the collection of sufficient volumes for all specified analyses including quality assurance (QA)/quality control (QC) samples (duplicates, splits, matrix spike/matrix spike duplicate samples).

The following QA procedures will be followed when collecting groundwater samples from all monitoring wells:

- Samples will be collected using direct-pouring techniques. While filling the appropriate sample containers, care will be taken not to overfill sample containers.
- Field duplicates should be collected from monitoring wells located in contaminated areas of various concentrations. Matrix spike/matrix spike duplicate samples should be collected from monitoring wells located in uncontaminated areas. All QA/QC samples will be collected from monitoring wells that have a sufficient recharge rate to supply the additional volume of water needed within a reasonable time frame.
- All sample containers will be transferred immediately upon collection to an iced cooler and delivered to the laboratory in a timely manner. Samples must be delivered to the laboratory to comply with holding times specified in Table 3.3. Sample handling, packing, and shipping are discussed below in Section 5.3.

4.6.2.3 Well-Volume Approach-Open-Hole Bedrock Well Sampling

The well-volume procedure for sampling is described in SOP 2.23. This procedure differs from the low-flow approach in that drawdown and pumping rate are not necessarily limited; however, the objectives are, if possible, to limit full evacuation of the water column and to achieve parameter stabilization, as described for low-flow techniques. In addition, a minimum of three, but no more than six, well volumes will be evacuated. In the event that the wells yield is so low that it goes dry during pumping at the lowest pumping rate, wells will be allowed to recover to 75 percent of the original well volume or will be sampled within 24 hours at any recovery percentage before samples are acquired. In cases where the well goes dry, pH, EC, DO, ORP, temperature, and turbidity must be monitored during collection of the sample from the recovered volume.

4.6.2.4 Sampling FLUTe Multi-Level Wells

Representatives of The Boeing Company will collect samples from FLUTe multi-level wells for USEPA; however, USEPA will oversee the sampling operations. Procedures for sampling those systems therefore will not be incorporated into this FSP.

4.6.3 Sampling Coordination with The Boeing Company

The Boeing Company will perform all activities that require well access with the exception of actually collecting samples into laboratory containers. The Boeing Company will procure, maintain, and calibrate the sampling equipment. The Boeing Company has also agreed to follow the procedures for groundwater sampling described in this FSP and will be continuously monitored by USEPA for compliance with the FSP requirements. Samples will always remain in the custody of USEPA before being shipped to the laboratory. Should any instances of nonconformance be observed, USEPA will coordinate with The Boeing Company for resolution. USEPA will provide documentation of the procedures used by The Boeing Company during sampling

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5.0 FIELD OPERATIONS DOCUMENTATION

5.1 DAILY FIELD REPORTS

Daily Field Reports will be prepared as described in SOP 4.01 included in Appendix A. An example Daily Field Report is included in Appendix B. The following items will be recorded on the Daily Field Report:

- Work performed each day, location of work, and description of work.
- Submittals reviewed, specifications referenced, and persons responsible for actions.
- Inspections performed, including results of inspections, problems encountered, and completed corrective action.
- Test and/or control activities performed, deficiencies noted with completed corrective action.
- Daily site safety inspection results and completed corrective actions.
- Instructions given/received and conflicts encountered in plans and/or specifications.
- Deliveries received of any equipment or materials.
- Number of subcontractors/trade personnel working on project.
- Weather conditions.
- General comments.

Daily Field Reports will be assembled and provided to the Field Operations Manager.

5.2 FIELD LOGBOOK

A bound field logbook will be used to document field operations and will contain sufficient data and information to reconstruct field activities for a specific day. SOP 4.07 for field logbooks is presented in Appendix A.

5.3 PHOTOGRAPHIC RECORDS

Color photographs obtained using a digital camera may be taken to record important features of the site before the commencement of work, during project activities, and after work is complete. Photographs will be stored electronically by site. Pertinent information will be added to the field logbook as described in SOP 4.07.

5.4 SAMPLE DOCUMENTATION

In addition to the documentation required in the following sections, a Supplemental Database Information Sheet shall be filled out for each sample collected and each water level measurement. These sheets are presented in Appendix B. The Field Operations Manager will provide the teams with the list of valid data elements for each field in the Supplemental Database Information Sheet.

5.4.1 Sample Numbering System

The sample numbering system is outlined in Table 5.1. This numbering system will assist in tracking samples from collection through reporting and give the internal data reviewer and/or data validator a general understanding of the sample origin and type.

A sample label will be attached to each sample container and completed legibly with indelible ink. The sample labels will be affixed to the sample bottle and covered with clear tape. The labels will identify the following:

- Name/initials of the collector;
- Date and time of sample collection;
- Place of collection;
- Sample number;
- Analysis required;
- Preservatives added; and
- Designation between "grab" and "composite" samples.

Often the sample labels will be preprinted from one of the environmental sampler's computers. Below is an example sample label.

Example Sample Label	
Client: *HydroGeoLogic, Inc.*	Environmental Sample Type: *Grab*
Site: *SSFL*	Date: *11/27/2008*
Sample ID: *SMPZ-099-112708Q*	
Analyses: *Tritium*	
Time: *13:15*	

5.4.2 Chain-of-custody Records

The chain-of-custody record identifying its contents will accompany all sample shipments. This record will be used to document sample custody transfer from the sampler to other sampling team members (if necessary), to the courier (if necessary), and finally to the analytical laboratory. The chain-of-custody record ensures that samples can be traced from the time of field collection until samples are received and analyzed by the analytical laboratory. The original custody record will be shipped along with the samples, and the initiator of the record retains a copy. An example chain-of-custody is included in Appendix B. The information required for the chain-of-custody record includes the following items:

- Type of sample (grab or composite) and matrix.
- Analytical method numbers and parameter names.
- Sample number.
- Signature of sampler.
- Date and time of sample collection.
- Project name, location, and address.
- Signatures of persons involved in the chain of possession.

When custody for a group of samples changes, each custodian will not be required to retain a copy of the chain-of-custody record as long as the original custody record indicates that each person accepting the samples has subsequently relinquished custody appropriately.

Chain-of-custody forms will be completed according to the following protocol:

- The originator will fill in all requested information from the sample labels.
- The originator will sign the "Relinquished by" box and keep the copy.
- The original record sheet will be shipped with the samples, in a plastic shipping envelope taped to the inside of the cooler top, and the remaining two copies of the chain-of-custody record will be filed with the representative sampling documents.
- The person receiving custody will check the sample label information against the custody record, check sample condition, and note anything unusual under "Remarks" on the custody form.
- The person receiving custody will sign in the adjacent "Received by" box and keep the original.
- The date and time will be the same for both signatures because custody must be transferred between two individuals; however, when samples are shipped via common carrier (e.g., Federal Express), the date and time will not be the same for both signatures.
- When samples are shipped via common carrier, the original custody form will be shipped with the samples and the shipper (e.g., Field Sample Custodian) keeps the copy, as well as all shipping paper, bills of lading, etc.
- In all cases, it must be readily seen that the person receiving custody has relinquished it to the next custodian.
- If samples are left unattended or a person refuses to sign, this must be documented and explained on the chain-of-custody record.

5.5 SAMPLE MANAGEMENT

Samples will be picked up or delivered to the designated laboratory by trained laboratory representatives, local courier, or by a common carrier such as Federal Express. Sample log-in procedures at the laboratory are included in the subcontract laboratory QA/QC manual included in the QAPP. During the field effort, the field team leader or sample coordinator will coordinate laboratory shipments. Clean hard-plastic coolers will be used for shipping samples. Coolers may require decontamination before storage on site or shipping, as described in Section 5.6. Coolers must be able to withstand a 4-foot drop on solid concrete in the position most likely to cause damage. Samples inside the cooler must be cushioned to result in the least amount of damage if such a fall were to occur. After packing is complete, the cooler will be taped shut with custody seals affixed across the top and bottom joints. Each container must be clearly marked with a sticker containing the originator's address.

The following procedures must be used when transferring samples for shipment:

- A chain-of-custody form must accompany samples. When transferring possession of samples, the individuals relinquishing and receiving must sign, date, and note the time on the record. This record documents transfer of custody of samples from the field sampler to another person or to the laboratory. When used, overnight carriers will be treated as a single entity, and a single signature will be required when samples are delivered to the laboratory.
- Samples must be properly packaged for shipment and dispatched to the appropriate laboratory for analysis with a separate signed chain of custody form enclosed in each sample box or cooler.

A chain-of-custody form identifying the contents must accompany all packages. The original record will accompany the shipment, and a copy will be retained at the site.

5.6 EQUIPMENT TESTING, INSPECTION AND MAINTENANCE

Preventive maintenance for most field equipment will be performed in accordance with procedures and schedules recommended in the equipment manufacturer's operating manual. However, more stringent testing, inspection, and maintenance procedures and schedules may be required when field equipment is used to make critical measurements. A field instrument that is out of order will be segregated, clearly marked, and not used until it is repaired. The field team leader will be notified of equipment malfunctions so that service can be completed quickly or substitute equipment can be obtained. When the condition of equipment is suspect, unscheduled testing, inspection, and maintenance should be conducted. Any significant problems with field equipment will be reported in the Daily Field Report.

5.7 CALIBRATION OF FIELD EQUIPMENT

Field equipment will be calibrated at the beginning of the field effort and at intervals recommended by the manufacturer or specified in the SOPs provided in Appendix A. The calibration frequency depends on the type and stability of equipment, the intended use of the equipment, and the recommendations of the manufacturer. Detailed calibration procedures for field equipment are available from the specific manufacturers' instruction manuals. All calibration information will be recorded in a field logbook or on field forms. A photoionization detector will be used to measure concentrations of volatile organic chemicals which are known to be present at the site. The photoionization detector will be calibrated and maintained in accordance with the manufacturer's specifications. It will be calibrated at the beginning of each day, at a minimum, and will be recalibrated if readings become suspect or if the ambient temperature changes more than 20 degrees Fahrenheit during the day of operation. All calibrations will be recorded in the daily field report.

5.8 EQUIPMENT DECONTAMINATION

Equipment will be decontaminated in accordance with procedures presented in Appendix O of the Site Management Plan (HGL, 2010a) and SOP 2.01 in Appendix A. Personnel shall use the procedures that apply to decontamination of sampling devices used for the collection of samples for trace metals analyses where applicable. A summary of the procedures is provided below.

Sampling equipment will be decontaminated using the following procedures:

- Clean with tap water and laboratory detergent solution. Use phosphate-free detergent, such as Liquinox, or equivalent. Use a brush to remove particulate matter and surface film.
- Rinse thoroughly with organic-free water.
- Rinse with 10 percent nitric acid.
- Rinse thoroughly with organic-free water.
- Rinse twice with solvent (pesticide-grade methanol).
- Allow to air dry for 24 hours, if possible.
- If it is not possible to air dry for 24 hours, then rinse twice with organic-free water and allow to air dry as long as possible.
- Wrap sampling devices with aluminum foil (with shiny side facing outward). This is when a sampling device is used to collect samples that contain oil, grease, or other hard to remove materials, it may be necessary to rinse the device several times with an approved solvent (one which meets the requirements of SOP 2.01) before initiating decontamination. In extreme cases it may be necessary to steam clean, brush, or sandblast the sampling device prior to using this decontamination method. If the sampling device cannot be adequately cleaned utilizing the above means, it must be discarded.

Teflon implements used to collect samples for metals analysis will require the following decontamination procedure:

- Clean water rinse immediately after use.
- Detergent scrub with brushes (Alconox, Liquinox or equivalent detergent will be used if nutrients are analytes).
- Clean water rinse (with a steam cleaner for drilling equipment).
- Double deionized water rinse.
- Air dry.
- Cover with aluminum foil (if not to be used immediately).

Submersible pumps and interior and exterior surfaces of pump hoses for all pumps used to purge groundwater wells will be decontaminated using the following procedure:

- Clean water rinse immediately after use.
- Detergent and tap water wash and flush.
- Clean water rinse and flush.
- Deionized water rinse and flush.
- Air dry.

Coolers will be scanned for radiation using protocols outlined in the equipment release procedures described in the SSHP (HGL, 2010b). In addition, coolers will be inspected for visible contamination. Visible contamination will be removed using the procedure specified below:

- Alconox, Liquinox or equivalent detergent scrub with brushes.
- Clean water rinse.
- Deionized water rinse.
- Wipe dry with paper towels.

Equipment that cannot be adequately cleaned will be properly disposed.

5.9 INSPECTION AND ACCEPTANCE OF SUPPLIES AND CONSUMABLES

When supplies are received, the Field Operations Manager or designee will check packing slips against purchase orders, and inspect the condition of all supplies before they are accepted for use on a project. If an item does not meet the acceptance criteria, deficiencies will be noted on the packing slip and purchase order, and the item will then be returned to the vendor for replacement or repair.

6.0 SURVEYING

Surveying will be performed for all surface water, sediment, spring and seep sample locations using a GPS. SOP 2.33 describes use of a Trimble PRO XRS GPS. If alternative GPS units are to be used they will be operated in accordance with the manufacturer's instructions. Existing well locations do not require additional surveying. All survey data will be reported in North American Datum 1983, California State Plane Zone V, in feet.

In the event that it becomes necessary to achieve higher accuracy surveying than that which can be obtained using a GPS (generally sub-meter horizontal and vertical) a State of California licensed surveyor will perform the surveys. In these situations horizontal survey coordinates will be measured to the nearest 0.1 foot and vertical survey elevations will be measured to the nearest 0.01 foot and referenced to the 1988 North American Vertical Datum.

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7.0 INVESTIGATION-DERIVED WASTE MANAGEMENT

IDW will consist largely of monitoring well purge water, personal protective equipment (such as nitrile gloves and coveralls), paper towels, polyethylene sheeting, and decontamination fluids. IDW is to be stored on site while awaiting final disposal. The water is expected to be disposed off site under proper manifest and at a properly licensed facility. Monitoring well purge water with historically elevated levels of tritium (above 20,000 pCi/L) will be stored onsite pending determination of the preferred disposition alternative. The California Department of Toxic Substances Control has indicated to USEPA that they currently will not allow evaporation of this water on site. Alternatives for disposal of tritium-contaminated water include, but are not limited to, off site solidification and proper disposal, and disposal through a licensed facility without solidification. Protocols for the management and disposal of IDW are presented in Appendix J of the Site Management Plan (HGL, 2010a).

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TABLES

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Table 3.1
Proposed Radionuclides for Analysis

Symbol	Radionuclide	Half-Life	Units	Analyze in Sediment/ Surface Water	Priority 1 Groundwater Analytes*	Priority 2 Groundwater Analytes*
Ac-227	actinium-227	21.772	Years	●	●	
Ac-228	actinium-228	6.15	Hours	●	●	
Ag-108	silver-108	2.37	Minutes	●	●	
Ag-108m	silver 108m	418	Years	●	●	
Am-241	americium-241	432.6	Years	●		●
Am-243	americium-243	7,370	Years	●		
Ba-133	barium-133	10.5	Years	●	●	
Ba-137m	barium-137m	2.552	Minutes	●	●	
Bi-210	bismuth-210	5.012	Days	●		
Bi-212	bismuth-212	60.55	Minutes	●	●	
Bi-214	bismuth-214	19.9	Minutes	●	●	
C-14	carbon-14	5,700	Years	●		●
Cd-113m	cadmium-113m	14.1	Years	●	●	
Cf-249	californium-249	351	Years	●	●	
Cl-36	chlorine-36	3.01E+05	Years	●		
Cm-243	curium-243	29.1	Years	●		●
Cm-244	curium-244	18.1	Years	●		●
Cm-245	curium-245	8,500	Years	●		●
Cm-246	curium-246	4,760	Years	●		●
Cm-248	curium-248	348,000	Years	●		
Co-60	cobalt-60	5.275	Years	●	●	
Cs-134	cesium-134	2.0652	Years	●	●	
Cs-137	cesium-137	30.08	Years	●	●	
Eu-152	europium-152	13.537	Years	●	●	
Eu-154	europium-154	8.593	Years	●	●	
Eu-155	europium-155	4.753	Years	●	●	
Fe-55	iron-55	2.737	Years	●		
H-3	tritium (hydrogen-3), organic	12.32	Years	●	●	
Ho-166m	holmium-166m	1,230	Years	●	●	
I-129	iodine-129	1.57E+07	Years	●		●
K-40	potassium-40	1.25E+09	Years	●	●	
Na-22	sodium-22	2.6027	Years	●	●	
Nb-94	niobium-94	2.03E+04	Years	●	●	
Ni-59	nickel-59	76,000	Years	●		
Ni-63	nickel-63	100.1	Years	●		
Np-236a	neptunium-236a	1.53E+05	Years	●	●	
Np-237	neptunium-237	2.14E+06	Years	●		●
Np-239	neptunium-239	2.356	Days	●	●	
Pa-231	protactinium-231	32,760	Years	●	●	
Pb-210	lead-210+D	22.2	Years	●		
Pb-212	lead-212	10.64	Days	●	●	
Pb-214	lead-214	26.8	Minutes	●	●	
Pm-147	promethium-147	2.6234	Years	●		

Table 3.1
Proposed Radionuclides for Analysis

Symbol	Radionuclide	Half-Life	Units	Analyze in Sediment/ Surface Water	Priority 1 Groundwater Analytes*	Priority 2 Groundwater Analytes*
Po-210	polonium-210	138.376	Days	●		
Pu-236	plutonium-236	2.585	Years	●		
Pu-238	plutonium-238	87.7	Years	●		●
Pu-239	plutonium-239	24,110	Years	●		●
Pu-240	plutonium-240	6,563	Years	●		●
Pu-241	plutonium-241	14.29	Years	●		
Pu-242	plutonium-242	375,000	Years	●		●
Pu-244	plutonium-244	8.00E+07	Years	●		
Ra-226	radium-226	1,600	Years	●		●
Ra-228	radium-228	5.75	Years	●		
Rn-220	radon-220	55.6	Seconds	●		
Rn-222	radon-222	3.8235	Days	●		
Sb-125	antimony-125	2.7586	Years	●	●	
Se-79	selenium-79	2.95E+05	Years	●		
Sn-126	tin-126	2.30E+05	Years	●	●	
Sr-90	strontium-90	28.8	Years	●	●	
Tc-99	technetium-99	211,100	Years	●		●
Te-125m	tellurium-125m	57.4	Days	●	●	
Th-228	thorium-228	1.9116	Years	●		
Th-229	thorium-229	7,880	Years	●		
Th-230	thorium-230	75,400	Years	●		
Th-231	thorium-231	25.52	Hours	●	●	
Th-232	thorium-232	1.41E+10	Years	●		
Th-234	thorium-234	24.1	Days	●	●	
Tl-208	thallium-208	3.053	Minutes	●	●	
Tm-171	thulium-171	1.92	Years	●	●	
U-232	uranium-232	68.9	Years	●		
U-233	uranium-233	1.59E+05	Years	●	●	
U-234	uranium-234	245,500	Years	●	●	
U-235	uranium-235	7.04E+08	Years	●	●	
U-236	uranium-236	2.34E+07	Years	●	●	
U-238	uranium-238	4.47E+09	Years	●	●	
U-240	uranium-240	14.1	Hours	●		
Y-90	yttrium-90	64.053	Hours	●		
Gross Alpha Radiation	N/A	N/A	N/A	●	●	
Gross Beta Radiation	N/A	N/A	N/A	●	●	

Notes:

* Suite may change. See Section 2.2 of the Field Sampling Plan for a discussion.

N/A - not applicable

Table 3.2
Preliminary Surface Water Sampling Locations

New Location ID	Drainage Name	Surveyed*	Comment
EPASW01	N/A	X	Surface water originating from the top of the outcrop and exiting a fracture.
EPASW02	N/A	X	Surface water originating from the top of the outcrop and exiting a fracture.
EPASW03	N/A	X	Surface water originating from the top of the outcrop and exiting a fracture.
EPASW04	Area IV 7	X	Surface water originating from the top of the outcrop and exiting a fracture.
EPASW05	Bell-CC Bell 1.4	X	Surface water collection point at the culvert running under G street near the intersection of 17th.
EPASW06	Bell 1	X	During reconnaissance there was standing water and easy access.
EPASW07	Area IV 7	X	Surface water originating from the top of the outcrop and exiting a fracture.
EPASW08	Area IV 7	X	Apparent fill material in the drainage. Location is the lowest point that can be access from Area IV.
EPASW09	N/A	X	Furthest point downgradient accessible from Area IV.
EPASW10	North 1.15 - OB	X	Furthest point downgradient accessible from Area IV.
EPASW11	Area IV 1	X	Downgradient from Outfall 5.
EPASW12	Area IV 2	X	Downgradient from Outfall 6.
EPASW13	Area IV 6	X	Downgradient from Outfall 3.
EPASW14	Area IV 6	X	Upgradient of Outfall 3 and downgradient from the Radiation Materials Handling Facility.
EPASW15	Area IV 7	X	Downgradient of Outfall 4.
EPASW16	N/A	X	Downgradient of Outfall 10.
EPASW17	North 1 - OB	X	Downgradient of Outfall 9.
EPASW18	N/A		Furthest point downgradient accessible from Area IV.
EPASW19	Area IV 7		Furthest point downgradient of Outfall 4 accessible from Area IV.
EPASW20	Area IV 5		Furthest point downgradient in drainage Area IV 5 accessible from Area IV.
EPASW21	Area IV 4		Furthest point downgradient of Outfall 5 accessible from Area IV.
EPASW22	Area IV 3		Furthest point downgradient in drainage Area IV 3 accessible from Area IV.
EPASW23	Area IV 8		Furthest point downgradient in drainage Area IV 8 accessible from Area IV.
EPASW24	Bell 1		Furthest point downgradient in drainage Bell 1 accessible from Area IV.
EPASW25	Bell 1.4.2		Furthest point downgradient in drainage Bell 1.4.2 accessible from Area IV.
EPASW26	Bell CC Bell 1.4.3		Furthest point downgradient in drainage Bell CC Bell 1.4.3 accessible from Area IV.
EPASW27	Bell CC Bell 1.4		Furthest point downgradient in drainage Bell CC Bell 1.4 accessible from Area IV.
EPASW28	Bell 1		Furthest point downgradient in drainage Bell 1.4 accessible from Area IV.
EPASW29	Area IV 2		Primary Drainage leaving Area IV

Table 3.2
Preliminary Surface Water Sampling Locations

New Location ID	Drainage Name	Surveyed*	Comment
EPASW30	Area IV 3		Primary Drainage leaving Area IV
EPASW31	Building 4056		Water sample from bottom of standing water in excavation.
EPASW32	Bell 1.4 - ditch		Location requested by Stakeholders
EPASW33	Drainage 8		Location requested by Stakeholders before lined channel.
EPASW34	Drainage West		Location requested by Stakeholders - Potential drainage to west

Notes:

* Surveyed locations have been field verified. An additional reconnaissance of all locations will be performed before sampling.

Drainage designations derived from: Area IV SSFL Environmental Impact Statement, prepared by CDM, a Joint Venture with SAIC & DSO for the U.S. DOE, 1 June 2008.

N/A - not applicable

NPDES - National Pollutant Discharge Elimination System

Table 3.3
Summary of Sample Containers, Preservatives, Sample Volumes, and Holding Time Requirements

Analyte Group	Container	Minimum Sample Size	Preservative	Holding Time
C-14, H-3, Cl-36, I-129, and Tc-99 (soil)	One 4-oz jar	4 oz [(1)]	None	None
Other radiological Parameters (soil)	Two 1-gal freezer bags (half filled)	2 L [(1)]	None	None
C-14, H-3, Cl-36, I-129, and Tc-99 (water and water QC)	Glass bottle	1 L [(1)]	None	None
Gross alpha radiation (water and water QC)	Plastic container	TBD[(2)]	None	None
Gross beta radiation (water and water QC)	Plastic container	TBD[(2)]	None	None
Other Radiological Parameters (water and water QC)	Plastic container	TBD[(2)]	None	None

Notes:
[(1)] The sample size provided is sufficient to process a single sample for all analyses; generally, an additional aliquot of equal size must be collected for each archive sample associated with the original sample.
[(2)]Volumes required for analysis will be presented in an addendum to this FSP.
L - liter
oz - ounce
QC – quality control
TBD – to be determined

Table 3.4
Proposed Sediment Sampling Locations

Location ID	Drainage Name	Surveyed*	Comments
EPASED 01	Area IV 1	X	Downgradient of Outfall 5
EPASED 02	NA	X	Associated with EPASW02
EPASED 03	Area IV 2	X	Downgradient of Outfall 5 & 6
EPASED 04	Area IV 2		Characterize the sediment within the drainage.
EPASED 05	SDF Drainage		Characterize the sediment within the drainage.
EPASED 06	B009 Drainage		Characterize the sediment within the drainage.
EPASED 07	Area IV 4		Downgradient of Outfall 7.
EPASED 08	Area IV 3		Characterize the sediment within the drainage.
EPASED 09	Area IV 4		Downgradient of Outfall 7, and on the boundary of the Northern Buffer Zone.
EPASED 10	Area IV 5		Characterize the sediment within the drainage at the boundary of the Northern Buffer Zone.
EPASED 11	Area IV 6		Downgradient from Outfall 3.
EPASED 12	Area IV 5		Characterize the sediment within the drainage.
EPASED 13	Area IV 6	X	Downgradient from Outfall 3.
EPASED 14	Area IV 6	X	Upgradient of Outfall 3 and downgradient from the RMHF Building.
EPASED 15	NA		Characterize the sediment within the drainage at the border of the Northern Buffer Zone.
EPASED 16	Area IV 7	X	Associated with EPASW05.
EPASED 17	Area IV 7	X	Characterize sediment below fill material noted at EPASW09.
EPASED 18	Area IV 7	X	Characterize sediment below EPASW08.
EPASED 19	Area IV 7	X	Downgradient of Outfall 4. Sediment from pond.
EPASED 20	Area IV 7		Downgradient of Outfall 4 and accessible from Area IV.
EPASED 21	Area IV 7		Downgradient of Outfall 4, mid way down the drainage and accessible from Area IV.
EPASED 22	Area IV 7		Downgradient of Outfall 4 and at the boundary of the Northern Buffer Zone.
EPASED 23	NA		Characterize the sediment within the drainage at the boundary of the Northern Buffer Zone.
EPASED 24	NA		Characterize the sediment within the drainage.
EPASED 25	NA		Characterize the sediment within the drainage.
EPASED 26	NA	X	Downgradient of Outfall 4 Characterize the sediment within the drainage.

Table 3.4
Proposed Sediment Sampling Locations

Location ID	Drainage Name	Surveyed*	Comments
EPASED 27	NA	X	Downgradient of Outfall 4 Characterize the sediment within the drainage.
EPASED 28	NA		Downgradient of Outfall 4, at the border of the Northern Buffer Zone.
EPASED 29	North 1.15 - OB		Characterize the sediment within the drainage.
EPASED 30	North 1.15 - OB		Characterize the sediment within the drainage.
EPASED 31	North 1.15 - OB	X	Characterize the sediment within the drainage at the border of the Northern Buffer Zone.
EPASED 32	North 1 - OB		Characterize the sediment within the drainage at the border of the Northern Buffer Zone.
EPASED 33	North 1 - OB	X	Characterize the sediment downgradient of Outfall 9 at the northern boundary of the Northern Buffer Zone.
EPASED 34	Bell CC Bell 1.4	X	Characterize the sediment within the corrugated culverts under G Street near the intersection of 17th.
EPASED 35	Building 4056	X	Characterize the sediment within the pond located within the Building 4056 excavation.

Notes:

* Surveyed locations have been field verified. An additional reconnaissance of all locations will be performed before sampling.

Drainage designations derived from: Area IV SSFL Environmental Impact Statement, prepared by CDM, a Joint Venture with SAIC & DSO for the U.S. DOE, 1 June 2008.

N/A - not applicable

NPDES - National Pollutant Discharge Elimination System

Table 3.5
Proposed Onsite Well Sampling Locations

Well ID	Northing	Easting	Casing interval (feet)	Casing diameter (in)	Total well depth (feet bgs)	Measuring point elevation	Date of last DTW	Last DTW elevation	Last DTW	Screened interval	Formation	Comments
PZ-041	267315.813	1785662	--	--	29.6	1809.1	07/21/10	1796.93	12.17	19-29	Shallow Piezometer	
PZ-110	267204	1786209.6	--	--	20.1	1818.9	07/21/10	Dry		7-17	Shallow Piezometer	Well condition good.
PZ-111	266948.4	1786433.9	--	--	20.3	1794.9	07/21/10	Dry		7.5-17.5	Shallow Piezometer	Well condition good.
PZ-112	267435.9	1786720.8	--	--	37.06	1829.14	07/21/10	1800.94	28.2	24-34	Shallow Piezometer	Well condition moderate. Well casing is slightly bent. May not be able to insert pump.
RD-16	267211.2326	1786783.4799	0-30	8.25	220	1808.99	07/21/10	1761.57	47.42	Open hole	Chatsworth	
RD-17	267668.0995	1786003.546	0-30	8.25	125	1836.3	07/21/10	1807.4	28.9	Open hole	Chatsworth	
RS-24	267218.8165	1786806.2372	0-8.5	4	8.5	1809.24	07/21/10	Dry		4-8.5	Shallow well	Well condition good.
ES-31	266692.4034	1785729.46	0-25	6	25	1787.01	07/21/10	1771.11	15.9	11.6-25	Shallow well	
PZ-051	266485.8	1785857	--	--	27	1770.87	03/24/10	1765.8	5.07	5-15	Shallow Piezometer	Well casing is bent. Will not be able to insert pump or bailer. Transducer stuck in well.
PZ-052	266742.1	1786103.7	--	--	31.34	1790.72	07/21/10	1766.69	24.03	18.9-28.9	Shallow Piezometer	Well condition good. DTB on 3/24/2010 was 31.37 feet.
PZ-106	266411.9	1785469.6	--	--	35	1784.17	07/21/10	1767.07	17.1	18-28	Shallow Piezometer	
PZ-107	266876.4	1785822	--	--	11	1793.62	03/24/10	Dry		5-10	Shallow Piezometer	Well casing is bent. Will not be able to insert pump or bailer.
PZ-108	267332.4	1785248.2	--	--	30	1763.01	07/21/10	1750.88	12.13	16-26	Shallow Piezometer	
PZ-120	267230.1	1785009.7	--	--	26	1810.96	07/21/10	1794.06	16.9	15-25	Shallow Piezometer	
PZ-121	267491.6	1785120.7	--	--	33	1808.98	07/21/10	1790.48	18.5	15-25	Shallow Piezometer	
PZ-122	267091.9	1785176.5	--	--	27.5	1810.8	07/21/10	1794.49	16.31	15.5-25.5	Shallow Piezometer	
RD-24	267283.0054	1784708.5514	0-30	8.25	150	1809.93	07/21/10	1770.8	39.13	Open hole	Chatsworth	
RD-29	266949.2566	1785123.266	0-30	8.25	100	1806.29	07/21/10	1790.96	15.33	Open hole	Chatsworth	
RD-93	267564.05	1785023.25	0-20	8	60	1810.48	07/21/10	1775.9	34.58	Open hole	Chatsworth	
RD-95	267499.85	1784758	0-50	8	80	1811.36	07/21/10	1758.65	52.71	Open hole	Chatsworth	
RS-11	266864.3123	1785819.457	0-17.5	4	17.5	1790.39	07/21/10	1773.84	16.55	10-17.5	Shallow well	Only 0.95 feet of water 07/21/2010. Dry.
RS-27	266927.6252	1785133.218	0-9	4	9.87	1804.78	07/21/10	Dry		5-9	Shallow well	Well condition good.
PZ-005	266634.9	1784877.25	--	--	45	1800.97	07/21/10	1783.32	17.65	15-25	Shallow Piezometer	
PZ-104	266270.2	1784924.2	--	--	38.5	1797.47	03/24/10	1767.2	30.27	18-28	Shallow Piezometer	Well condition damaged. Casing is bent, cannot get pump or bailer down well.
PZ-109	267080.8	1784684.4	--	--	36.5	1809.51	07/21/10	1794.74	14.77	25-35	Shallow Piezometer	
RD-20	266605.3611	1784382.9182	0-30	8.25	127	1819.72	07/21/10	1776.06	43.66	Open hole	Chatsworth	
RD-25	--	--	--	--	--	--	1st Qtr 2004	1684.71	126.05	--	Chatsworth	Abandoned 4/2004 as part of Building 4059 demolition.
RD-28	--	--	--	--	--	--	1st Qtr 2004	1750.08	60.84	--	Chatsworth	Abandoned 4/2004 as part of Building 4059 demolition.
PZ-103	266281.2	1784400.9	--	--	37.65	1815.93	07/21/10	1789.71	26.22	28.5-38.5	Shallow Piezometer	
PZ-105	265935.5	1784787.9	--	--	30.33	1803.87	07/21/10	1785.75	18.12	17-27	Shallow Piezometer	
RD-13	265809.9021	1784083.675	0-30	8.25	160	1840.27	07/21/10	1777.18	63.09	Open hole	Chatsworth	
PZ-055	267253.6	1787421.3	--	--	32.35	1818.4	07/21/10	1786.33	32.07	19-29	Shallow Piezometer	Well condition good. Only 0.28 feet of water 07/21/2010. Dry.
PZ-056	268068.7	1788028	--	--	30.35	1805.86	07/21/10	1775.81	30.05	17-27	Shallow Piezometer	Only 0.30 feet of water 07/21/2010. Dry.
PZ-113	267682.9	1787367.8	--	--	17.02	1823.68	07/21/10	1806.96	16.72	7-15	Shallow Piezometer	Well condition good. Only 0.30 feet of water 07/21/2010. Dry.
PZ-114	268304	1787913.1	--	--	50.35	1818.19	07/21/10	1768.45	49.74	37-47	Shallow Piezometer	Only 0.61 feet of water 07/21/2010. Dry.
PZ-115	268006.8	1787536.5	--	--	40	1817.81	03/24/10	Dry		25.5-37.5	Shallow Piezometer	Damaged, casing melted from fire, cannot sample.
PZ-150 (SRE-NS-W)	268281.6538	1786086.776	--	--	30.48	1852.23	07/21/10	1826.51	25.72	--	Shallow Piezometer	Well condition good.
PZ-151	268743.1285	1787988.758	--	--	79.94		07/21/10		78.53	--	Shallow Piezometer	
PZ-160 (SRE-NS-E)	268345.0389	1786286.124	--	--	29.58	1851.41	07/21/10	1825.28	26.13	--	Shallow Piezometer	Well condition good.

Table 3.5
Proposed Onsite Well Sampling Locations

Well ID	Northing	Easting	Casing interval (feet)	Casing diameter (in)	Total well depth (feet bgs)	Measuring point elevation	Date of last DTW	Last DTW elevation	Last DTW	Screened interval	Formation	Comments
PZ-161 (SRE-NS-N)	268418.8061	1786132.353	--	4	30.07	1852.23	07/21/10	1827.16	25.07	--	Shallow Piezometer	Well condition good.
RD-14	268605.9016	1787467.911	0-30	8.25	125	1824.29	07/21/10	1741.71	82.58	Open hole	Chatsworth	
RD-15	268114.6024	1787805.607	0-30	8.25	152	1817.7	07/21/10	1767.92	49.78	Open hole	Chatsworth	
RD-18	268517.6059	1786851.878	0-30	8.25	240	1839.49	07/21/10	1748.34	91.15	Open hole	Chatsworth	
RD-85	268384.83	1786081.98	0-20	8	90	1849.09	07/21/10	1789.89	59.2	Open hole	Chatsworth	
RD-86	268480.42	1786522.79	0-20	8	80	1830.51	07/21/10	1794.7	35.81	Open hole	Chatsworth	
RD-92	267847.1	1787222.9	0-20	8	105	1833.74	07/21/10	1772.86	60.88	Open hole	Chatsworth	
WS-07	268493.2064	1787829.423	--	--	700	1826.19	07/21/10	1767.54	58.65	--	Chatsworth	
RD-19	268204.7221	1785783.853	0-30	8.25	135	1853.13	07/21/10	1776.73	76.4	Open hole	Chatsworth	
RD-27	267977.6842	1785610.541	0-30	8.25	150	1841.67	07/21/10	1789.23	52.44	Open hole	Chatsworth	
RD-30	268025.9501	1785319.753	0-30	8.25	75	1768.69	2nd Qtr 2009	Capped		Open hole	Chatsworth	Well capped.
RD-63	268029.7562	1785216.838	0-20	8.25	230	1764.85	07/21/10	1742.75	22.1	Open hole	Chatsworth	
RD-87	267800.3	1784860.53	0-20	8	60	1789.09	07/21/10	1742.39	46.7	Open hole	Chatsworth	
RD-88	267691.43	1784769.97	0-20	8	30	1774.62	07/21/10	1748.53	26.09	Open hole	Chatsworth	
RD-89	267732.21	1785204.3	0-30	8	50	1814.18	03/24/10	1770.35	43.05	Open hole	Chatsworth	Well condition damaged, bentonite on end of probe. DTB was 43.05 feet instead of 50 feet.
RD-90	267701.9	1784858.9	0-20	8	125	1784.75	07/21/10	1751.83	32.92	Open hole	Chatsworth	
RD-96	267385.1	1784343.7	0-20	8.625	90	1805.14	07/21/10	1745.19	59.95	Open hole	Chatsworth	
RD-98	268054.0732	1785566.961	--	--	65	1808.73	07/21/10	1769.32	39.41		Chatsworth	
RS-25	268226.7405	1785922.797	0-13.5	4	16	1862.71	07/21/10	1848.17	14.54	8.5-13.5	Shallow well	
RS-28	268030.0822	1785310.465	0-19	4	19	1786.59	2nd Qtr 2009	Capped		14-19	Shallow well	Well capped.
PZ-098	266788.9	1783488.8	--	--	37.5	1797.78	07/21/10	1770.73	27.05	24-34	Shallow Piezometer	Well condition good.
PZ-099	266508.7	1783141	--	--	33	1819.57	03/24/10	Not applicable		18-28	Shallow Piezometer	Well has been abandoned.
PZ-100	266078.3	1782962.2	--	--	19.32	1870.11	07/21/10	1857.99	12.12	5.67-15.67	Shallow Piezometer	Well condition good.
PZ-101	266057.5	1783090.6	--	--	23.21	1869.71	07/21/10	1847.37	22.34	10-20	Shallow Piezometer	Well condition good. Only 0.87 feet of water 07/21/2010. Dry.
PZ-102	266501.1	1783693	--	--	60.7	1827.78	07/21/10	1767.64	60.14	48.5-59.2	Shallow Piezometer	Well condition good. Only 0.56 feet of water 07/21/2010. Dry.
PZ-124	267166.7	1784015.9	--	--	28.33	1764.11	07/21/10	1736.17	27.94	14.7-24.7	Shallow Piezometer	Well condition good. Only 0.39 feet of water 07/21/2010. Dry.
RD-07	266937.9122	1784160.699	0-25	10.125	300	1812.82	07/21/10	Not Measured - FLUTe		Open hole	Chatsworth	
RD-21	266053.2732	1783079.77	0-30	8.25	175	1866.96	07/21/10	Not Measured - FLUTe		Open hole	Chatsworth	Well was converted to a FLUTe Well 01/14/2003.
RD-22	266277.8444	1782691.0728	0-30	8.25	440	1853.41	07/21/10	Not Measured - FLUTe		Open hole	Chatsworth	
RD-23	266390.8476	1783122.7935	0-30	8.25	440	1838.19	07/21/10	Not Measured - FLUTe		Open hole	Chatsworth	
RD-50	265713.7562	1783049.0335	0-18.5	8.25	195	1914.88	07/21/10	Not Measured - FLUTe		Open hole	Chatsworth	
RD-54A	266312.8	1783135.8	0-19	12.125	278	1841.72	07/21/10	Not Measured - FLUTe		Open hole	Chatsworth	
RD-54B	266350.2	1783087.3	0-19	12.125	437	1842.54	07/21/10	1596.51	246.03	Open hole	Chatsworth	
RD-54C	266313.8	1783106.8	0-20	12.125	638	1843.77	07/21/10	1614.32	229.45	Open hole	Chatsworth	
RD-64	266259.4	1782967.8	0-19	8.25	398	1857.04	07/21/10	Not Measured - FLUTe		Open hole	Chatsworth	
RD-65	266543.7153	1783268.561	0-19	8.25	397	1819.14	07/21/10	Not Measured - FLUTe		Open hole	Chatsworth	
RD-74	267112.63	1784112.94	0-30	12	101	1810.9	07/21/10	--		Open hole	Chatsworth	Well damaged will not be able to sample.
RD-91	266538.2	1783945.5	0-20	8	140	1818.04	07/21/10	1769.5	48.54	0-20	Chatsworth	
RS-16	266981.3024	1784220.674	0-20.5	4	19.11	1811.05	07/21/10	Dry		16.5-20.5	Shallow well	
RS-18	266661.7243	1783393.962	0-13	4	13.15	1802.86	07/21/10	1791.06	11.8	7.5-13	Shallow well	

Table 3.5
Proposed Onsite Well Sampling Locations

Well ID	Northing	Easting	Casing interval (feet)	Casing diameter (in)	Total well depth (feet bgs)	Measuring point elevation	Date of last DTW	Last DTW elevation	Last DTW	Screened interval	Formation	Comments
RS-23	265827.2544	1783082.839	0-13	4	14.62	1887.25	07/21/10	Dry		8-13	Shallow well	Well condition good. DTB on 3/24/2010 was 11.61 feet.
RS-54	266307.6	1783111.2	0-7	6.25	38	1846.66	07/21/10	1812.81	33.85	Open hole	Shallow well	
PZ-073	269435.8	1788107.5	--	--	55	1760.54	07/21/10	Dry		41-51	Shallow Piezometer	Condition of well is Good. DTB on 3/24/2010 was 53.32 feet. Bottom felt soft, may have sediment.
PZ-097	267048.9	1783400.3	--	--	44.5	1761.87	4th Qtr 2005	Dry		33-43	Shallow Piezometer	Well condition damaged. Casing is bent, cannot get pump or bailer down well.
PZ-116	268032.6	1785076.3	--	--	34	1827.78	07/21/10	Dry		22-32	Shallow Piezometer	
PZ-143	269399.543	1788800.747	--	2	67	1849.84	07/21/10	Dry		55-65	Shallow Piezometer	Condition of well is Good. DTB on 3/24/2010 was 67.51 feet.
RD-33A	266547.6283	1782597.595	0-11 0-100	12.125 6.25	320	1792.97	07/21/10	Not Measured - FLUTe		Open hole	Chatsworth	
RD-33B	266546.8907	1782616.763	0-20 0-360	12.125 6.25	415	1793.21	07/21/10	1510.34	282.87	Open hole	Chatsworth	
RD-33C	266547.6283	1782576.653	0-10 0-480	12.125 6.25	520	1793.54	07/21/10	1509.49	284.05	Open hole	Chatsworth	
RD-34A	268045.9992	1785103.296	0-16	8.25	60	1761.83	07/21/10	1722.17	39.66	Open hole	Chatsworth	
RD-34B	268058.2837	1785096.207	0-30 0-180	12.125 6.25	240	1762.51	07/21/10	1720	42.51	Open hole	Chatsworth	
RD-34C	268034.9873	1785086.828	0-30 0-380	12.125 6.25	450	1762.6	07/21/10	1751.87	10.73	Open hole	Chatsworth	
RD-56A	269425.0164	1788099.14	0-20.5	12.125	397.5	1758.62	07/21/10	1441.11	317.51	Open hole	Chatsworth	
RD-56B	269402.12	1788070.92	0-10 0-443	16 10	463	1761.83	07/21/10	1587.58	174.25	Open hole	Chatsworth	
RD-57	266916.1576	1782949.863	0-19.5	12.125	419	1774.15	07/21/10	Not Measured - FLUTe		Open hole	Chatsworth	
RD-70	269722.51	1789696.06	0-19	12	278	1732.26	07/21/10	1584.58	144.51	Open hole	Chatsworth	
RD-94	267743.28	1784559.82	0-20.5	8	35	1744.38	07/22/10	1727.27	17.11	Open hole	Chatsworth	
RD-97	267540.4	1784376.4	0-20	8.625	74.5	1792.22	07/21/10	Dry		Open hole	Chatsworth	

Notes:
RD-21 was converted to a FLUTe Well 01/14/2003.
Shaded rows were removed from sampling program.
Coordinates in NAD 1927 California V Plane.
bgs - below ground surface
DTW - depth to water
DTB - depth to bottom
FLUTe - Flexible Liner Underground Technologies
ID - identification
Qtr - quarter

Table 3.6
Proposed FLUTe Well Ports to be Sampled

Well Identification	Port Number	Port Top Elevation (btc)	Port Bottom Elevation (btc)	Port Midpoint elevation (ft msl)	Comments
RD-07	3	90	100	1717.82	
RD-21	2	105	115	1756.96	
RD-22	2	330	340	1518.41	
RD-23	3	271	281	1562.19	
RD-33A	2	231	241	1556.97	
RD-50	1	106	116	1803.88	Top Port Selected
RD-54A	2	170.5	180.5	1666.22	
RD-57	7	348	358	1421.15	
RD-64	6	270.5	280.5	1581.54	
RD-65	4	227	237	1587.14	Highest hydraulic conductivity

Notes:

Data from Haley & Aldrich, 2008, Report on Annual Groundwater Monitoring, 2007, Santa Susana Field Laboratory, Ventura, County, California.

btc - below top of casing

ft - feet

msl - mean sea level

Table 5.1
Field Sampling Naming Scheme

First Segment			Second Segment			Third Segment
Facility	**Area Designation**	**Site Number**	**Sample Type**	**Sample Number**	**Qualifier**	**Additional Qualifiers As Applicable**
A	*AN*	*AN*	*AA*	*NNN or NNNNNN*	*AN*	*NN*
Facility: S - SSFL **Area Designation:** M – SSFL property N – Northern buffer S – Southern buffer O – Off site **Site Number if Applicable*** i.e. PZ-099			**Sample Type:** GW - Groundwater sample SW - Surface water sample SP - Spring/Seep SS - Surface soil sample SB - Subsurface soil sample TB - Trip blank FB - Field blank EB - Equipment blank **Date:** 2. MMDDYY: month, day, and year of sampling event **Qualifier:** Q= duplicate sample MS = Matrix spike MSD = Matrix spike duplicate			**Qualifier:** NN = sample depth, enter depth of top of interval

Notes:
Segments are separated by a dash.
Use qualifier only if applicable.
*Site numbers given here are not inclusive of all the sites located at the facility. The naming scheme given above will be used as an example.

A – alphabetic
AN – alphanumeric
N - numeric

Example: A duplicate spring sample collected on November 27, 2008 at Area IV at designated location PZ-099 taken at a depth of 15 feet would be called SMP-099-GW1112708P-15. Similarly, a duplicate collected on November 27, 2008, associated with PZ-099 collected from Area IV would be called SMPZ-099-112708Q.

FIGURES

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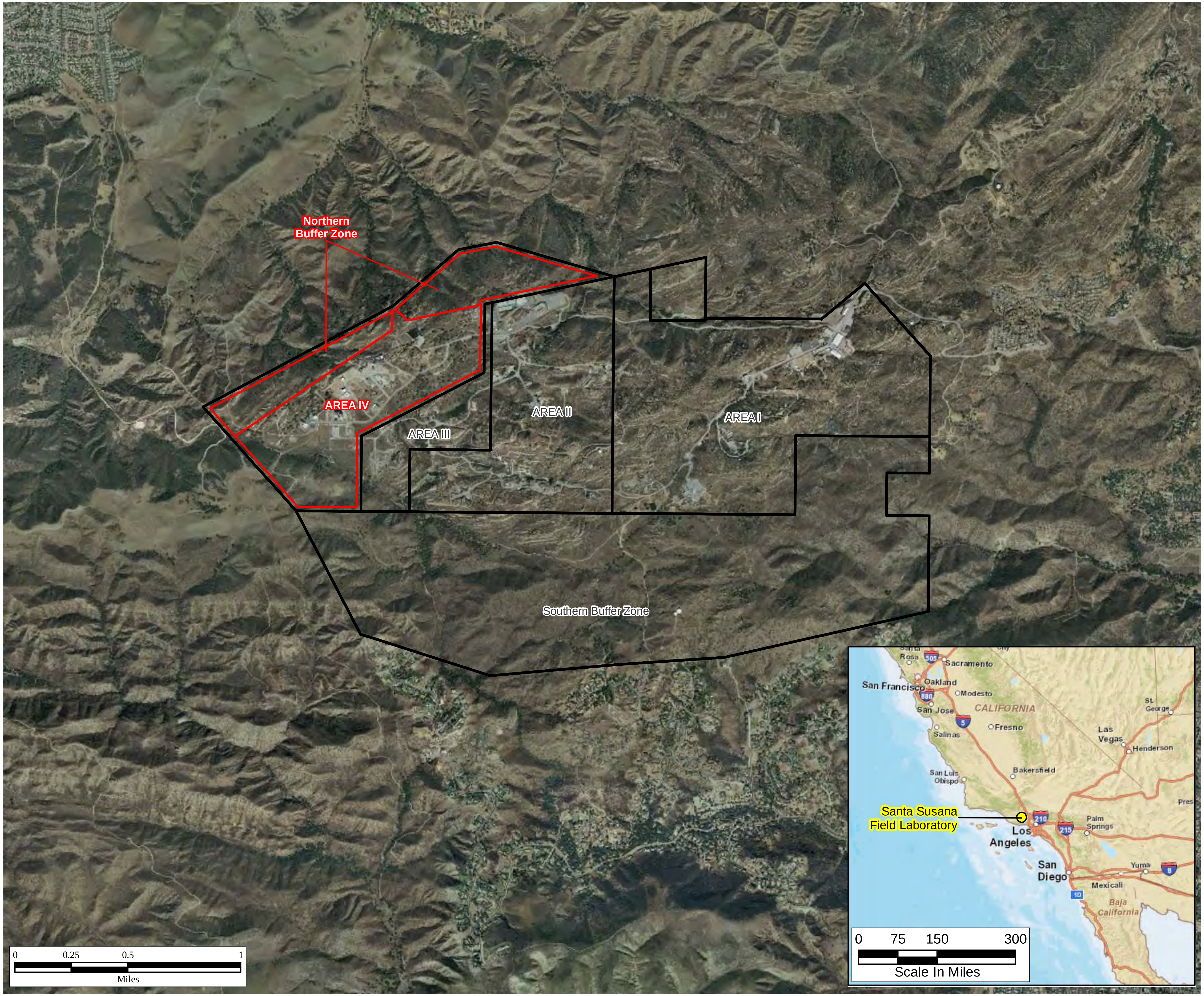


HGL—FSP for Groundwater, Surface Water, and Sediment Sampling, SSFL—Ventura County, CA

Figure 1.1
Site Location
Santa Susana Field Laboratory

U.S. EPA Region 9

Legend

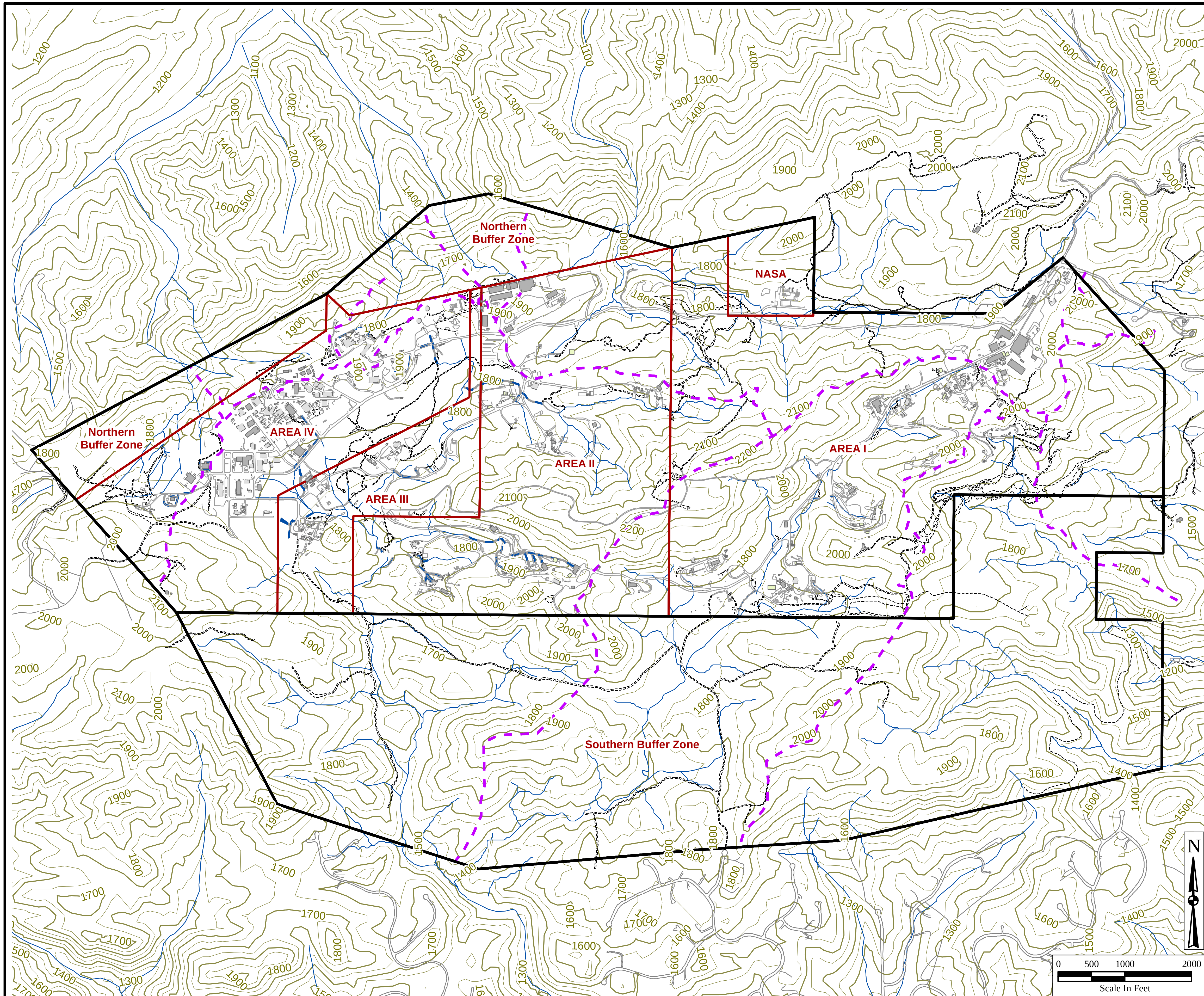
EPA Study Area Boundary; Area IV and Northern Buffer Zone

Santa Susana Field Laboratory Property Boundary

N

Filepath: Y:\Santa_Susana\EP9038\GW_SW_Sediment_FSP\(1-01) SiteMap_Updated.mxd
Project: EP9038
Created: CLimoges
Revised: 04/01/2010 CL
Source: CaSil, NAIP 2009; Boeing 2008

HGL HydroGeoLogic, Inc.



HGL—FSP for Groundwater, Surface Water, and Sediment Sampling, SSFL—Ventura County, CA

Figure 2.1
Santa Susana Field Laboratory Topographic Map

U.S. EPA Region 9

Legend

- Santa Susana Field Laboratory Property Boundary
- Santa Susana Field Laboratory Administrative Areas
- Drainage Divide

Buildings

- Demolished
- Existing
- Status Unknown

Hydrology

- Lined Channel
- Unlined Channel

Roads

- Off-site Roads
- Dirt Roads

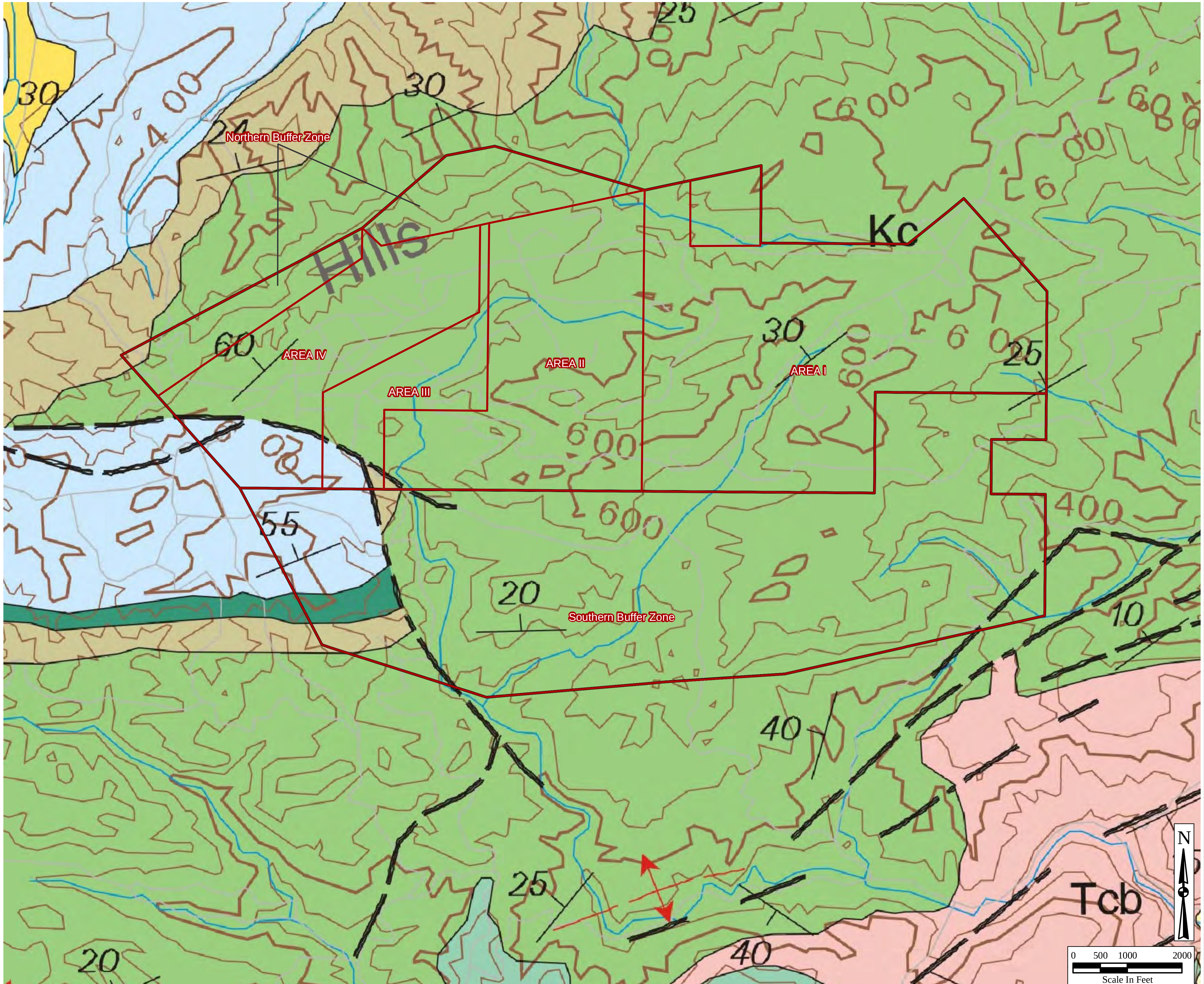
Elevation Contours

- 100' Division
- 50' Division

Filepath: Y/Santa_Susana/EP9038/GW_SW_Sediment_FSP/(2-1)_Topography.mxd
Project: E10024
Edited By: CLimoges 20100122
Source: CDM Inc. (2008). Draft Gap Analysis Report, Submitted on June 1, 2008. Prepared for the U.S. Department of Energy

Figure 2.2
Geologic Map
Santa Susana
Field Laboratory

U.S. EPA Region 9



Legend

- Santa Susana Field Laboratory Property Boundary
- Administrative Boundaries at the Santa Susana Field Laboratory

Geologic Formation

- Kc — Chatsworth Formation (late Cretaceous)
- Tss — Santa Susana Formation (early Eocene to late Paleocene)
- Tlv — Las Virgenes Formation (Paleocene)
- Tsi — Simi Conglomerate, Undivided (Paleocene)
- Tcb — Calabasas Formation, Undivided (early late Miocene and late middle Miocene)
- Tm — Modelo Formation Undivided (late Miocene)
- Qof — Old alluvial-fan deposits, Undivided (late to middle Pleistocene)

Filepath: Y/Santa_Susana/EP9038/GW_SW_Sediment_FSP/(2-2)_GeologicMap.mxd
Project: EP9038
Created: CLimoges 20091111
Revised: CLimoges 20100208
Source: Preliminary Geologic Map of the Los Angeles 30′ x 60′ Quadrangle, Southern California; Yerkes and Campbell; 2005

HGL HydroGeoLogic, Inc

HGL—FSP for Groundwater, Surface Water, and Sediment Sampling, SSFL—Ventura County, CA

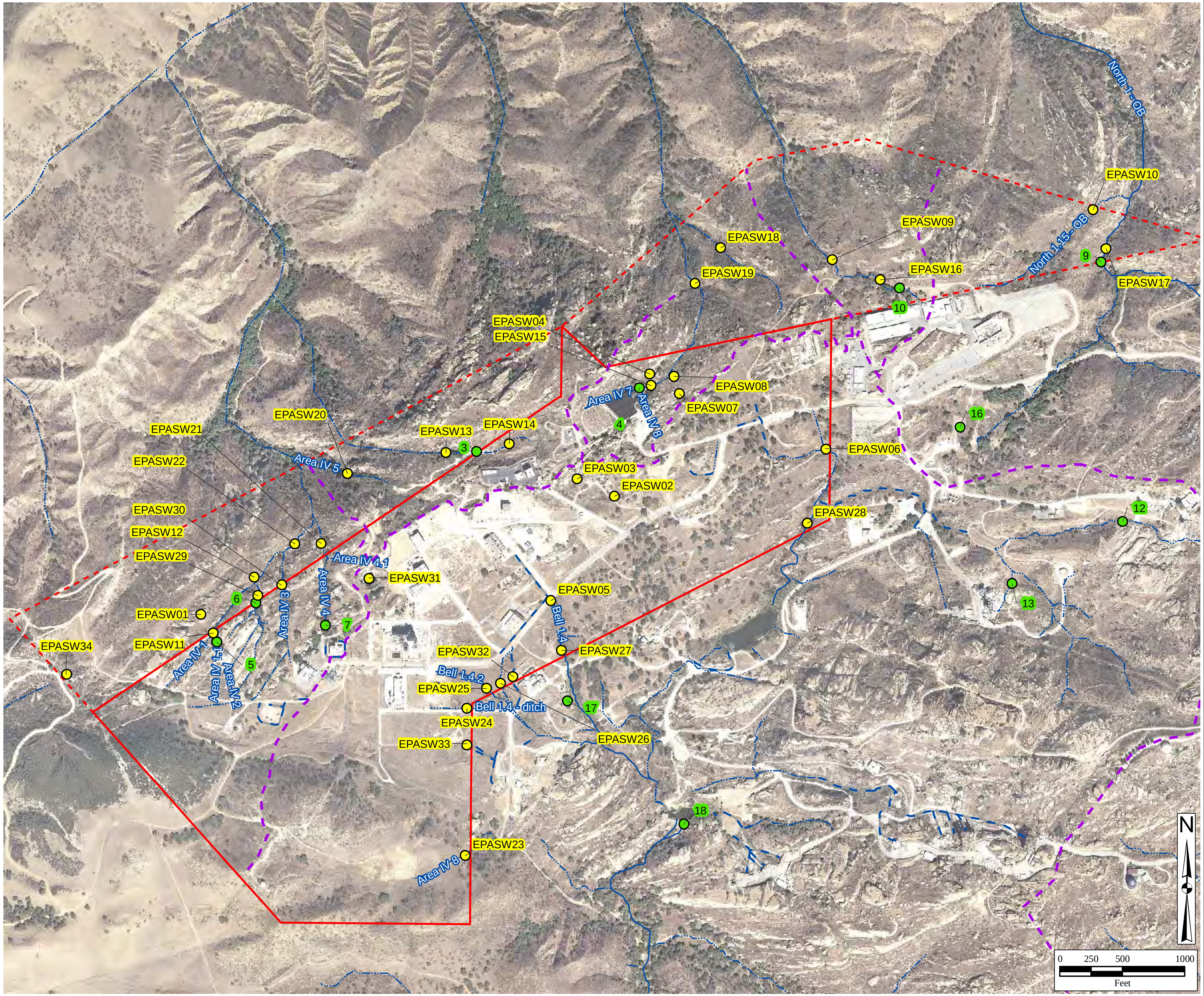


Figure 3.1
Proposed Surface Water Sampling Locations at Santa Susana Field Laboratory

U.S. EPA Region 9

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Legend

- Proposed Surface Water Sample
- NPDES Locations
- Santa Susana Field Laboratory Area IV Boundary
- Northern Buffer Zone Boundary
- Surface Water Drainage Divide
- Intermittent Stream
- Perennial Stream
- Lined Channel

Notes:
Surface water feature numbers were derived from:
Area IV Santa Susana Field Laboratory.
Environmental Impact Statement, Draft Gap Analysis Report.
Prepared by CDM. June 1, 2008

Filepath: Y:/Santa_Susana/EP9038/GW_SW_Sediment_FSP/(3-1)_AreaIV_Surface_Water_wNPDES.mxd
Project: EP9038
Edited: CLimoges 20100614
Source: Streams, SWMUs, and AOC Data. Boeing. 2009.
Aerial Imagery. Channel Islands Regional Geographic Information Systems 2007

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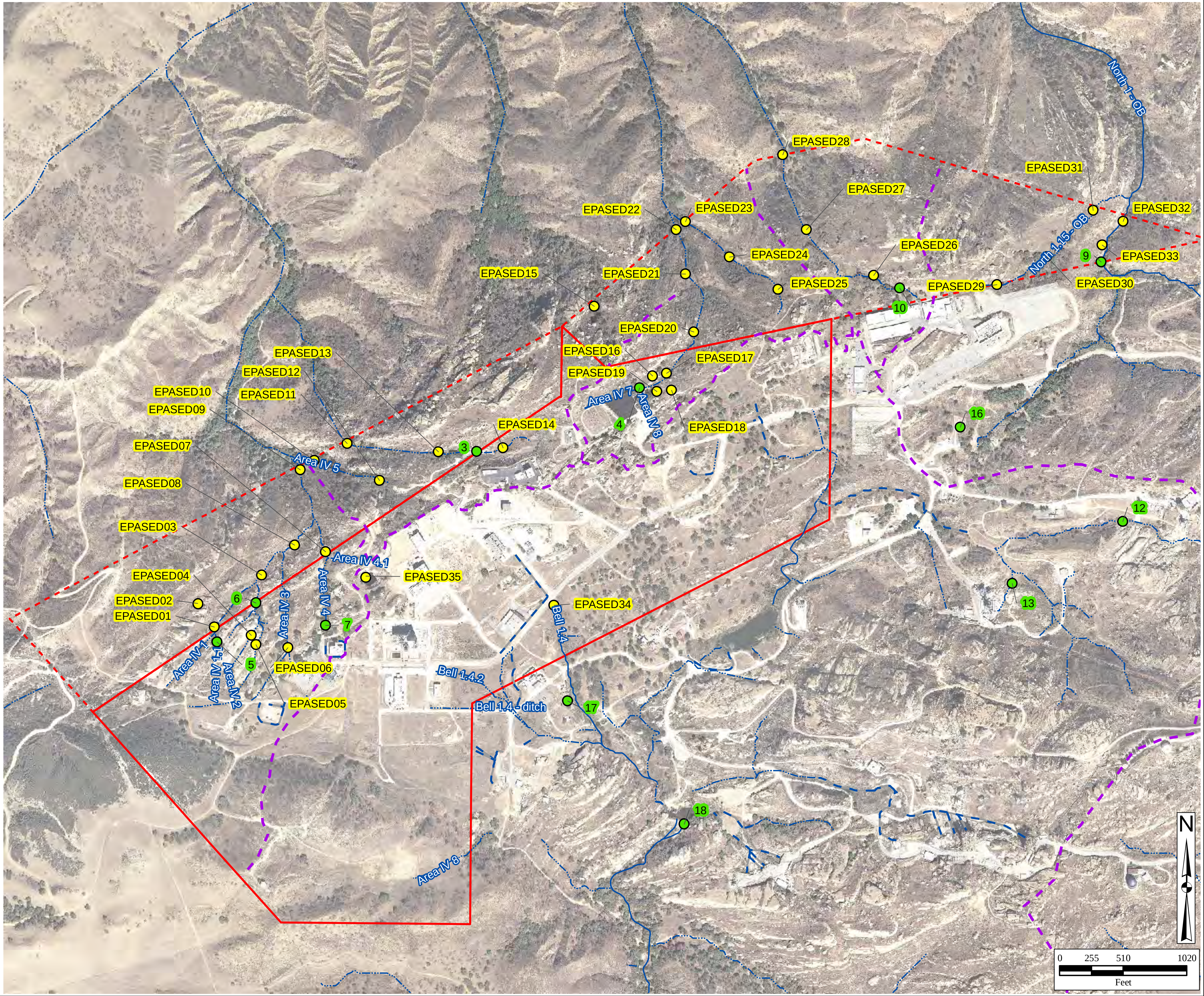
Figure 3.2
Proposed Sediment Sampling Locations at Santa Susana Field Laboratory

U.S. EPA Region 9



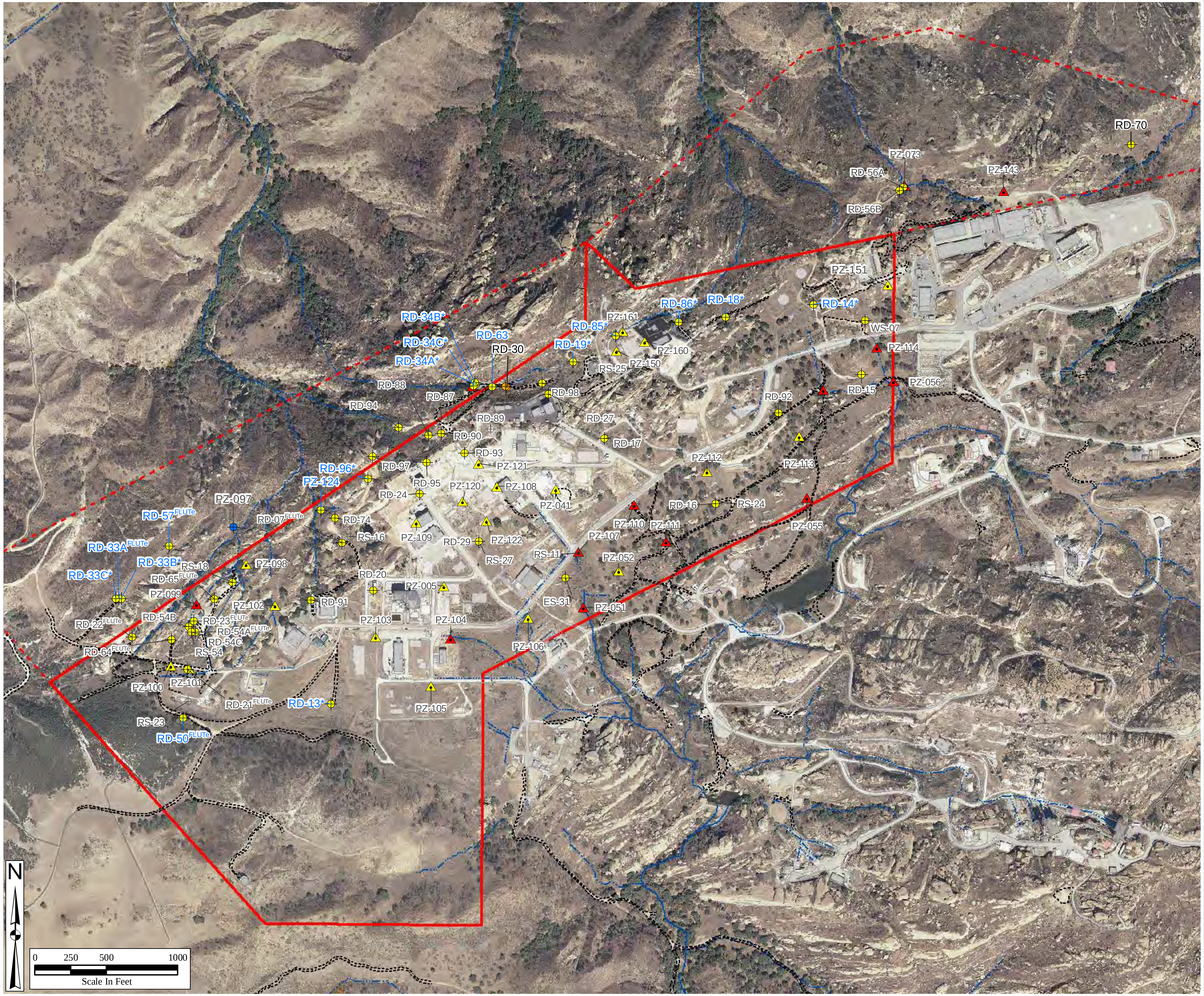
Legend

- Proposed Sediment Sample Locations
- NPDES Locations
- Santa Susana Field Laboratory Area IV Boundary
- Northern Buffer Zone Boundary
- Surface Water Drainage Divide
- Intermittent Stream
- Perennial Stream
- Lined Channel

Notes:
Surface water feature numbers were derived from:
Area IV Santa Susana Field Laboratory Environmental Impact Statement Draft Gap Analysis Report. Prepared by CDM. June 1, 2008.

Filepath: Y:/Santa_Susana/EP9038/GW_SW_Sediment_FSP/(3-2)_AreaIV_Sediment_wNPDES.mxd
Project: EP9038
Edited: CLimoges 20100614
Source: Streams, SWMUs, and AOC Data. Boeing. 2009.
Aerial Imagery. Channel Islands Regional Geographic Information Systems 2007

HGL HydroGeoLogic, Inc



HGL—FSP for Groundwater, Surface Water, and Sediment Sampling, SSFL—Ventura County, CA

Figure 3.3
Proposed On-Site Well Sampling Locations at Santa Susana Field Laboratory

U.S. EPA Region 9

Legend

- Santa Susana Field Laboratory Area IV Boundary
- Northern Buffer Zone Boundary
- Proposed Well Sampling Location
- Proposed Piezometer Sampling Location
- Existing Well
- Well Abandoned or Capped
- Piezometer
- Intermittent Stream
- Perennial Stream

Notes:
Well text in blue indicates location planned to be sampled by Boeing under Quarterly Sampling Program.

Well to be retrofit with new sampling equipment.
[FLUTe] Well is a "FLUTe" completion .

Filepath: Y:/Santa_Susana/EP9038/GW_SW_Sediment_FSP/ (3-3)_Area_IV_Onsite_SampleLocs.mxd
Project: EP9038
Edited: CLimoges 20100616
Source: Streams, SWMUs, and AOC Data. Boeing. 2009. Aerial Imagery. Channel Islands Regional Geographic Information Systems 2007

HGL HydroGeoLogic, Inc

APPENDIX A

STANDARD OPERATING PROCEDURES

SOP 2.01	*Cleaning & Decontaminating Sample Containers and Sampling Equipment*
SOP 2.02	*Low-Flow (Minimal Drawdown) Groundwater Sampling Procedures*
SOP 2.03	*Groundwater Level Measurement Procedures*
SOP 2.15	*Sediment Sampling*
SOP 2.16	*Surface Water and Spring/Seep Sampling*
SOP 2.23	*Groundwater Sampling Using Procedures Other Than Low Flow*
SOP 2.33	*Trimble GPS Unit Procedures*
SOP 4.01	*Documentation – Field Activity Reports*
SOP 4.07	*Use and Maintenance of Field Log Books*

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SOP 2.01
CLEANING AND DECONTAMINATING SAMPLE CONTAINERS AND SAMPLING EQUIPMENT
SANTA SUSANA FIELD LABORATORY
VENTURA COUNTY, CALIFORNIA

1.0 PURPOSE

The purpose of this procedure is to describe decontamination methods and related issues involving the physical removal of chemical and radioactive contaminants from sample containers and sampling equipment.

2.0 SCOPE AND APPLICATION

This procedure provides general guidelines for the decontamination of the surfaces of sample containers and equipment that come in direct contact with actual samples during sample collection and processing in order to prevent or reduce cross-contamination. The prevention or minimization of cross-contamination in sampled media is critical in avoiding the introduction of error into sampling results and for ensuring the health and safety of site personnel.

Eliminating or neutralizing contaminants that have accumulated on sampling equipment ensures protection of personnel from permeating substances, reduces or eliminates transfer of contaminants to clean areas, prevents the mixing of incompatible substances, and minimizes the likelihood of sample cross-contamination.

2.1 DEFINITIONS

Deionized Water: Tap water treated by passing through a standard deionizing resin column. The deionized water should contain no heavy metals or other inorganic compounds (i.e., at or above analytical detection limits) as defined by a standard Inductively Coupled Argon Plasma Spectrophotometer scan.

Equipment: Those items (variously referred to a "field equipment" or "sample equipment") necessary for sampling activities that do not directly contact the samples.

Laboratory Detergent: A standard brand of phosphate-free laboratory detergent, such as Liquinox, or the equivalent.

Organic-free Water: Tap water treated with activated carbon and deionizing units or water from a Milli-Q system (or equivalent). This water should not contain pesticides, herbicides, extractable organic compounds, and less than 50 micrograms per liter (μg/L) of purgeable organic compounds as measured by a low-level gas chromatography/mass spectrometry (GC/MS) scan. Organic-free water should be stored only in glass or Teflon containers and dispensed from only glass, Teflon, or stainless steel containers.

Sampling Devices: Utensils and other implements used for sample collection and processing that directly contact actual samples.

Solvent: Pesticide-grade methanol is the standard solvent used for decontamination in most instances. The use of any other solvent must be justified and approved by the responsible project personnel and documented on the Daily Field Report Forms or in the field logbooks.

Tap Water: This refers to tap water from a tested and approved water system.

3.0 GENERAL

- All work will be performed in a manner that is consistent with Occupational Safety and Health Administration (OSHA) established standards and requirements.
- Any deviations from specified requirements will be justified to and authorized by the Project Manager (PM) or the relevant Program Manager, and should be documented on the appropriate field change forms.
- Deviations from requirements will be sufficiently documented to allow re-creation of the modified process.
- Refer to the site- or project-specific HSP for relevant H&S requirements.
- Refer to the Field Sampling Plan (FSP) for project/task-specific sampling and analysis requirements.
- Personnel who use this procedure must provide documented evidence of having been trained in the procedure to the Program Manager or PM for transmittal to the Project File.
- The objectives of decontamination are: to remove contamination from contaminated surfaces; to minimize the spread of contamination to uncontaminated surfaces; to avoid any cross-contamination of samples; and to minimize personnel exposures. The intent is to accomplish the required level of decontamination while minimizing the generation of additional solid and liquid waste.
- As a minimum, nitrile or equivalent gloves will be worn while decontaminating equipment. Safety glasses or goggles, uncoated Tyvek coveralls, laboratory coat, or splash apron will be worn if justified by contaminant concentration and potential adverse effects. Face shield, heavy-duty polyvinyl chloride (PVC) or equivalent gloves, coated Tyvek or equivalent coveralls will be worn while cleaning with steam or high temperature water. Ground fault circuit interrupters will be used to supply power to any portable electrical equipment in the equipment decontamination area. Solvent rinsing will be conducted in an open, well-ventilated area or under a fume hood. No eating, smoking, drinking, chewing, or hand to mouth contact will be permitted during decontamination activities. A fifteen-minute eyewash will be available within 100 feet if corrosive (concentrated acids or bases) decontamination fluids are used.

- Refer to the FSP for project specific decontamination methods and schedules.
- Procedures for packaging and disposal of all waste generated during field activities will be described in the FSP.
- Decontamination of sampling devices will be performed in a designated decontamination area, removed from any sampling location. This designated area must also be in a location free of direct exposure to airborne and radiological surface contaminants.
- Decontamination activities will be conducted downwind of the location where clean field equipment, clean sample devices, and sample containers are stored.
- Contaminated or dirty sampling devices/sample containers are not stored with clean (decontaminated) sampling devices/sample containers.
- Sample containers and sampling devices are segregated from all other equipment and supplies.
- Paint or any other coatings must be removed from any part of a sampling device which may either contact a sample or which may otherwise affect sample integrity. After removal of such coatings, the sampling device will then require decontamination by the appropriate method.
- The brushes used to clean sampling devices must not be of the wire-wrapped type.
- For any of the specific decontamination methods that may be used, the substitution of higher-grade water is permitted (e.g., the use of organic-free water in place of deionized water). However, it must be noted that deionized water and organic-free water are less effective than tap water in rinsing away the detergent during the initial rinse.
- Decontaminated sampling devices and all filled and empty sample containers will be stored in locations that are protected from exposure to any contaminant.
- In reference to decontaminated sampling devices and sample containers, their release for unrestricted use is based on site-specific criteria. These site-specific criteria should be found in the project work plans.
- Rags used during decontamination may become a hazardous waste and require segregation. Refer to the project work plans for hazardous waste requirements.

4.0 INTERFERENCES AND POTENTIAL HAZARDS

- The use of distilled/deionized water commonly available from commercial vendors may be acceptable for decontamination of sampling equipment provided that it has been verified by laboratory analysis to be analyte free.
- An untreated potable water supply is not an acceptable substitute for tap water. Tap water may be used from any municipal water system for mixing of decontamination solutions.
- Acids and solvents utilized in the decontamination sequence pose the health and safety risks of inhalation or skin contact, and raise shipping concerns of permeation or degradation.
- The site work plan must address disposal of the spent decontamination solutions.

- Several procedures can be established to minimize contact with waste and the potential for contamination. For example:
  - Stress work practices that minimize contact with hazardous substances.
  - Use remote sampling, handling, and container-opening techniques when appropriate.
  - Cover monitoring and sampling equipment with protective material to minimize contamination.
  - Use disposable outer garments and disposable sampling equipment when appropriate.

5.0 EQUIPMENT/APPARATUS

- appropriate personal protective clothing
- non-phosphate detergent
- selected solvents
- long-handled brushes
- drop cloths/plastic sheeting
- trash container
- paper towels
- galvanized tubs or buckets
- tap water
- distilled/deionized water
- metal/plastic containers for storage and disposal of contaminated wash solutions
- pressurized sprayers for tap and deionized/distilled water
- sprayers for solvents
- trash bags
- aluminum foil
- safety glasses or splash shield
- emergency eyewash bottle

6.0 REAGENTS

- methanol (pesticide grade)
- 10% nitric acid

7.0 CALCULATIONS

This section is not applicable to this SOP

8.0 PROCEDURES

8.1 DECONTAMINATION SCHEDULES

- Sampling devices must be decontaminated prior to being used in the field, in order to prevent potential contamination of a sample.
- Sampling devices must be decontaminated between samples to prevent cross-contamination.
- Sampling devices must be decontaminated at the close of the sampling event prior to being taken off-site.
- All personnel leaving the contaminated area of a site must be decontaminated.
- An acceptable alternative to cleaning and decontaminating sampling devices is the use of items cleaned or sterilized by the manufacturer that are discarded after use. Care must be exercised to ensure such previously cleaned or sterilized items do not retain residues of chemical or radioactive sterilizing agents that might interfere with analytical techniques.
- Whenever visible dirt, droplets of liquid, stains, or other extraneous materials are detected on the exterior of a sample container, the exterior surfaces must be decontaminated. This should be done before placing in a sample cooler or shipping container.
- For sample containers used in controlled access areas, a more rigorous cleaning and/or radiation monitoring may be required before removal from the site. Refer to the project-specific work plan for details.

8.2 DECONTAMINATION METHODS

The following decontamination methods are examples of some of those most commonly used in field investigations. Note that the decontamination methods described in this section are for guidance only; the Field Operations Manager will adjust decontamination practices to fit the sampling situation and applicable requirements.

- Decontaminating the Exterior of Sample Containers in Use
  - Wipe the exterior surfaces of the sample container with disposable rags/ toweling, or rinse with deionized water.
  - If rinsing with deionized water, then the exterior of the sample container must be wiped dry with disposable rags/toweling, or allowed to air dry.
  - All visible dirt, droplets of liquid, or other extraneous materials must be removed.
  - For containers used in controlled access areas or where the sample media is difficult to remove (e.g., sludge), a more rigorous cleaning and/or radiation monitoring may be required. Refer to the project-, task-, or site-specific FSP for details.
  - This decontamination procedure will be performed at the sample location before placing the sample container in the sample cooler or shipping container.

- Decontaminating Stainless Steel, Teflon, or Metal Sampling Devices Used to Collect Samples for Trace Organic Compounds and /or Metals Analyses
  - Clean with a tap water and laboratory detergent solution. Use phosphate-free detergent, such as Liquinox®, or equivalent. Use a brush to remove particulate matter and surface film.
  - Rinse thoroughly with organic-free water.
  - Rinse with 10% nitric acid.
  - Rinse thoroughly with organic-free water.
  -
  - Rinse twice with solvent (pesticide-grade methanol).
  - Allow to air dry for 24 hours, if possible.
  - If it is not possible to air dry for 24 hours, then rinse twice with organic-free water and allow to air dry as long as possible.
  - Wrap sampling devices with aluminum foil (with shiny side facing outward). This is when a sampling device is used to collect samples that contain oil, grease, or other hard to remove materials, it may be necessary to rinse the device several times with an approved solvent (one which meets the requirements of the FSP) before initiating decontamination. In extreme cases it may be necessary to steam clean, brush, or sandblast the sampling device prior to using this decontamination method. If the sampling device cannot be adequately cleaned utilizing the above means, it must be discarded.
- Decontaminating Glass Sampling Devices Used for the Collection of Samples for Trace Organic Compounds and/or Metals Analyses
  - Glass sampling devices will be washed thoroughly with laboratory detergent and hot water using a brush to remove any particulate matter or surface film.
  - Rinse thoroughly with hot tap water.
  - Rinse thoroughly with tap water.
  - Rinse twice with solvent and allow to air dry for at least 24 hours, if possible.
  - Wrap with aluminum foil (with shiny side facing outward). This is done to prevent contamination during storage and/or transport to the field.

Note: When a sampling device is used to collect samples that contain oil, grease, or other hard to remove materials, it may be necessary to rinse the device several times with an approved solvent (one which meets the requirements of the FSP) before initiating decontamination. In extreme cases it may be necessary to steam clean, brush, or sandblast the sampling device prior to using this decontamination method. If the sampling device cannot be adequately cleaned utilizing the above means, it must be discarded.

8.3 QUALITY CONTROL

- The quality of the deionized and organic-free water used may be monitored by collecting samples in standard precleaned sample containers and submitting them to the laboratory for a standard inductively coupled plasma (ICP) scan. Organic-free water should be submitted for low-level pesticide, herbicide, extractable, or purgeable compounds analyses, as appropriate.
- Effectiveness of the decontamination procedures is monitored by submitting a rinseate blank to the laboratory for low-level analysis of the parameters of interest. A rinseate blank consists of a sample of analyte-free water which is passed over and through a field decontaminated sampling device and placed in a clean sample container. An attempt should be made to select different sampling devices, each time devices are washed, so that a representative sampling of all devices is obtained over the length of the project. Rinseate blanks should be run for all parameters at a rate of 1 per day for each parameter, even if samples are not shipped that day. Note on the Daily Field Report Forms or in the field logbooks the devices being used for the quality control (QC) rinsate.

9.0 DATA VALIDATION

This section is not applicable to this SOP

10.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA, and specific health and safety procedures.

Decontamination can pose hazards under certain circumstances even though performed to protect health and safety. Hazardous substances may be incompatible with decontamination methods. For example, the decontamination solution or solvent may react with contaminants to produce heat, explosion, or toxic products. Decontamination methods may be incompatible with clothing or equipment; some solvents can permeate or degrade protective clothing. Also, decontamination solutions and solvents may pose a direct health hazard to workers through inhalation or skin contact, or if they combust.

11.0 RECORDS

Documentation generated as a result of this procedure is collected and maintained in accordance with requirements specified in the FSP.

12.0 ATTACHMENTS

ATTACHMENT A
FIELD CHECKLIST

________ Daily Field Report Forms or Field Logbooks ________ Safety Glasses or Mono-goggles ________ Black, Indelible Pen ________ Decontamination Equipment ________ Work Plan ________ Appropriate Containers for Waste and Equipment	________ Gloves ________ Safety Shoes ________ Plastic Sheets ________ Health and Safety Plan ________ Monitoring Instruments

Table 1
Recommended Solvent Rinse for Soluble Contaminants

SOLVENT	SOLUBLE CONTAMINANTS

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SOP 2.02
LOW-FLOW (MINIMAL DRAWDOWN) GROUNDWATER SAMPLING PROCEDURES
SANTA SUSANA FIELD LABORATORY
VENTURA COUNTY, CALIFORNIA

1.0 PURPOSE

The purpose of this SOP is to describe the standard method and equipment used to perform low-flow (minimal drawdown) groundwater sampling using dedicated low-flow bladder pump, variable frequency drive (VSD) electrical pump or a non-dedicated pump. The general techniques described in this procedure are in general agreement with the procedures outlined in the United States Environmental Protection Agency (USEPA) publication entitled “Low-Flow (Minimal Drawdown) Ground Water Sampling Procedures” (USEPA, 1996).

2.0 SCOPE AND APPLICATION

The SOP emphasizes the need to minimize stress by low water-level drawdowns, and low pumping rates (usually less than 1 liter/min) in order to collect samples with minimal alterations to water chemistry. The low-flow (minimal drawdown) groundwater sampling procedures are used to facilitate the collection of depth-specific samples and offer the following advantages:

- The water column in the well experiences minimal disturbance during the purging and sampling procedure;
- The volume of purge water to achieve stabilization parameters is greatly reduced;
- The work effort associated with field decontamination of sampling equipment is greatly reduced.

The mid-point of the saturated screen length (which should not exceed 10 feet) is used by convention as the location of the pump intake. However, significant chemical or permeability contrast(s) within the screen may require additional field work to determine the optimum vertical location(s) for the intake, and appropriate pumping rate(s) for purging and sampling more localized target zone(s). Primary flow zones (high(er) permeability and/or high(er) chemical concentrations) should be identified in wells with screen lengths longer than 10 feet, or in wells with open boreholes in bedrock. Targeting these zones for water sampling will help insure that the low stress procedure will not underestimate contaminant concentrations.

Stabilization of indicator field parameters is used to indicate that conditions are suitable for sampling to begin. Achievement of turbidity levels of less than 10 NTU and stable drawdowns of less than 0.33 feet, while desirable, are not mandatory. Sample collection may still take place provided the remaining criteria in this procedure are met. If after 4 hours of purging indicator field parameters have not stabilized, one of 3 optional courses of action may be taken: a) continue purging until stabilization is achieved, b) discontinue purging, do not collect any samples, and record in log book that stabilization could not be achieved (documentation must describe attempts to achieve stabilization) c) discontinue purging, collect samples and provide full explanation of attempts to achieve stabilization (note: there is a risk that the analytical data obtained, especially metals and strongly hydrophobic organic analytes, may not meet the sampling objectives).

3.0 EQUIPMENT AND SUPPLIES

Pump with the capability to produce consistent, low flow rates ranging from 0.1 to 0.5 liters per minute (dedicated pumps should be equipped with Teflon tubing to reduce the contamination of the tubing over time, and non-dedicated pumps should either use Teflon tubing, with proper decontamination between wells, or disposable one-time-use polyethylene tubing; the use of 1/4 inch or 3/8 inch (inner diameter) tubing is preferred, as this will help ensure the tubing remains liquid filled when operating at very low pumping rates.)

- Pump controller and pump (bladder or VSD)
- Check valve for pump
- Portable air compressor or compressed gas
- Generator and gasoline for VSD pumps
- Tubing - Teflon® or Teflon® lined polyethylene tubing is preferred when sampling for organic compounds. Polyethylene tubing can be used when sampling inorganics.
- Water level meter capable of 0.01 foot accuracy
- Multi-parameter water quality analyzer (with flow-thru cell)
- Calibration fluids for Multi-parameter water quality analyzer
- Flow measurement supplies (e.g. graduated cylinder, stopwatch)
- Interface probe, if required
- Plastic sheeting
- Decontamination supplies
- Sample bottles (with labels and/or tags)
- Filtration equipment
- Sample preservation supplies
- Personal protective equipment (PPE), Nitrile gloves, Tyvek, over boots, etc.
- 55-gallon drum or equivalent container to collect purge water
- Well construction data, location map, field data from last event
- Well keys
- Tool box - All needed tools for all site equipment used

- Field log book
- PID or FID instrument (if appropriate) to detect VOCs for health and safety purposes, and to provide qualitative field evaluations.
- Groundwater field sampling data sheet
- Site specific Sample and Analysis Plan/Quality Assurance Project Plan

4.0 PROCEDURES

Sampling locations must begin at the monitoring well with the least contamination, generally up-gradient or furthest from the site or suspected source. Then proceed systematically to the monitoring wells with the most contaminated ground water.

4.1 WELL INSPECTION/GAUGING

Before groundwater sampling begins, wells shall be inspected for signs of tampering or other damage. If tampering is suspected (i.e., casing is damaged, lock or cap is missing), this shall be recorded in the field log book, and reported to the Field Operations Manager. Wells that display signs of tampering shall not be sampled until the Field Operations Manager has discussed the matter with the Project Manager (PM).

Before starting the sampling activities, all non-dedicated purging and sampling equipment will be decontaminated. Plastic sheeting shall be placed on the ground surrounding the well. Any water in the protective casing or in the vaults around the well casing shall be removed prior to venting and purging. Each time a casing cap is removed to measure water level or collect a sample, the air in the breathing zone and the air in the well casing shall be checked with a photoionization detector (PID). Procedures in the HSP shall be followed when high concentrations of organic vapors or explosive gases are detected. Air monitoring data shall be recorded in the field log book.

An interface probe shall be used if a nonconductive product layer is suspected in the well, or in newly constructed wells before the initial sampling event. The interface probe shall be used to determine the presence of floating product, if any, prior to measurement of the groundwater level. If none are encountered, subsequent check measurements with an interface probe are not needed unless analytical data or field head space information indicate a worsening situation. The groundwater level shall then be measured to the nearest 0.0l foot using an electric water level indicator. Water levels shall be measured from the notch or designated measuring point located at the top of the well casing and recorded. If well casings are not notched, measurements shall be taken from the north edge of the top of the well casing, and a notch shall be made using a decontaminated metal file.

The total depth of the well from the top of the casing shall be determined using an electric sounder and recorded, preferably the day before to allow for re-settling of any particulate in the water column. If the total depth of the well is previously known, avoid measuring the total depth until after sampling as to not disturb the water column. The screened interval should be known and the height of the water column present within the screened portion of the well (i.e., not above the top or below the bottom of the screen) shall be calculated. This is the saturated screened interval to be used in order to determine proper placement of the sampling pump. All water level and total depth measuring devices shall be routinely checked with a tape measure to ensure measurements are accurate.

4.2 PURGING

The monitoring wells should be purged and sampled in order of increasing expected contamination. This practice will help reduce the potential for cross contamination between wells by accessory sampling equipment.

Note: The dedicated VSD electrical or bladder pumps used will be pre-positioned at the desired depth (if not specified in the work or field sampling plans, in the middle of the saturated screened interval or slightly above the interval). A minimum of six inches will be maintained between the bottom of the pump and the bottom of the well. The pump inlet position is best determined using a calibrated sampling pump hose or measuring tape that has been clamped to the pump using a stainless steel hose clamp. A pump should not be positioned beyond the final placement depth, and raised back up. If this should occur, the well should be sampled 24 hours later to ensure that equilibrium has been achieved.

After water levels are measured in the well, the dedicated pump accessory equipment shall be attached according to manufacturer's instructions, or the non-dedicated pump lowered to the desired sampling depth. The groundwater discharge line shall be attached to an in-line flow-through cell to facilitate the collection of field parameters. Once accessory equipment is attached and operational, the purging procedure can commence at a rate of approximately 0.2 to 0.5 liters per minute (L/min). The purge water should be discharged into a suitable container of a known volume. Use a stop watch to record the discharge rate.

Water levels should be continuously recorded to monitor drawdown in the well and to allow for flow rate adjustment before the maximum drawdown is exceeded. When the placement of the pump inhibits the measurement of the water level in the well, purge rates from previous sample events will not be exceeded and the water discharge line and flow-through cell will be closely monitored for air bubbles. If air bubbles are detected at any point during purging, the bladder pump will be shut down and the validity of lowering the pump or adjusting the purge rate will be evaluated. The goal is to purge the well at a rate that does not draw down the static water level more than 0.33 feet. This goal may not be achievable in all wells based on geologic conditions. During pump start-up, drawdown may exceed the 0.33 feet target and then "recover" as pump flow adjustments are made. Purge volume calculations should utilize stabilized drawdown value, not the initial drawdown. Do not allow the water level to fall to the intake level (if the static water level is above the well screen, avoid lowering the water level into the screen). The final purge volume must be greater than the stabilized drawdown volume plus the extraction tubing volume.

Wells with low recharge rates may require the use of special pumps capable of attaining very low pumping rates (bladder, peristaltic), and/or the use of dedicated equipment. If the recharge rate of the well is lower than extraction rate capabilities of currently manufactured pumps and the well is essentially dewatered during purging, then the well should be sampled as soon as the water level has recovered sufficiently to collect the appropriate volume needed for all anticipated samples (ideally the intake should not be moved during this recovery period). Samples may then be collected even though the indicator field parameters have not stabilized.

Temperature, pH, electrical conductivity (EC), dissolved oxygen (DO), oxidation-reduction potential (ORP), and turbidity should be measured during purging and recorded. Measurements will be taken every three to five minutes when flow rates are in the 0.2 to 0.5 L/min range. Stabilization is achieved after all parameters, except temperature, have stabilized for three consecutive readings as outlined below (USEPA, 1996):

- pH ± 0.1 units
- EC ± 3 percent
- DO ± 10 percent
- ORP ± 10 millivolts (mV), and
- turbidity ± 10 percent (when turbidity is greater than 10 nephelometric turbidity units [NTUs]).

Turbidity readings below 50 NTUs are desired, especially when metal samples are to be collected. When turbidity is high, the purge time will be extended in order for turbidity to reach a value below 50 NTUs; however, if turbidity stabilizes above 50 NTUs for 15 to 30 minutes, then turbidity will be considered stable as defined above. Groundwater samples will be collected using the pump used in the purging procedure. If the parameters do not stabilize when the drawdown indicates a laminar flow, a subset (pH, EC, and turbidity or DO) will be used as the stabilization parameters. If subset parameters do not stabilize, then the sample will be collected when a maximum number of parameters stabilize, and the anomalous parameters will be brought to the Field Operations Manager's attention and recorded

All measurements, except turbidity, must be obtained using a flow-through cell. Transparent flow-through cells are preferred, because they allow field personnel to watch for particulate build-up within the cell. This build-up may affect indicator field parameter values measured within the cell and may also cause an underestimation of turbidity values measured after the cell. If the cell needs to be cleaned during purging operations, continue pumping and disconnect cell for cleaning, then reconnect after cleaning and continue monitoring activities.

If a particular well routinely produces turbid water (i.e., about 50 NTUs), then the contractor will consult with the client and the well may be redeveloped. For wells known to have a less than a 0.2 L/L/min flow rate, a flow rate of 0.05 to 0.2 L/min should be attempted. If the drawdown is nearing 0.33 feet and the water level is approaching the top of the screened interval, reduce the flow rate or turn the pump off (for 15 minutes) and allow for recovery. It should be noted whether or not the pump has a check valve. A check valve is required if the pump is shut off. Begin pumping at a lower flow rate, if the water draws-down to the top of the screened interval again turn pump off and allow for recovery. Continue iteratively until the lowest possible pumping rate is used (no less than 0.05 L/min). If under these minimal pumping conditions, drawdown continues then the low-flow technique is assumed to be invalid and should be discontinued because groundwater flow to the pump is no longer considered to be laminar across the screen within the aquifer. The flow in the vicinity of the pump now contains a vertical component from the stagnant water column in the filter pack and screened casing. In these cases procedures for sampling will be changed to those described in SOP 2.23 (Groundwater Sampling using Procedures other than Low Flow). This information should be noted in the field notebook or ground-water sampling log.

A maximum of five well volumes may be removed from any well before it is sampled. However, five well volumes need not be removed if the purge parameters have stabilized with less than 0.33 feet of drawdown. The well bore volume is defined as the volume of submerged casing, screen, and filter pack. One well volume can be calculated using the following equation:

$$V_w = HV_{ft}$$

where

V_w = Well volume (gal)
H = Well depth minus depth to water (feet)
V_{ft} = Volume of one-foot length of borehole (gal/feet)

$$V_{ft} = 7.481\pi\left(\frac{D}{2}\right)^2$$

and where

D = Inside diameter of well borehole (feet)

4.3 SAMPLE COLLECTION

Before sample collection, the flow-through cell used to measure parameters will be disconnected and the flow rate adjusted to maintain the established purge rate. Radionuclide samples will be filtered and preserved at the laboratory and not in the field.. The samples will be collected from the pump discharge line using a slow, controlled pour. If a bailer must be used, the sample shall be collected from the bailer using a slow, controlled pour.

All samples should be properly labeled prior to sample collection and immediately stored (inverted) on ice until receipt at laboratory.

Water samples should be collected immediately after parameter stabilization using the same pump used in purging. Field equipment should be calibrated every morning and if erroneous readings appear during the day. (No negative DO values should be obtained.) After sampling, the lock on the well casing should be replaced and secured.

5.0 DECONTAMINATION

Decontamination is addressed in the SOP titled Cleaning and Decontaminating Sample Containers and Sampling Equipment.

6.0 FIELD QUALITY CONTROL

Quality control samples are required to verify that the sample collection and handling process has not compromised the quality of the ground water samples. All field quality control samples must be prepared the same as regular investigation samples with regard to sample volume, containers, and preservation. The following quality control samples shall be collected for each batch of samples (a batch may not exceed 20 samples).

- Field duplicate.
- Matrix spike.
- Matrix spike duplicate.
- Equipment blank.
- Temperature blank (one per sample cooler).

The equipment blank shall include the pump and associated tubing. If tubing is dedicated to the well, the equipment blank will only include the pump in subsequent sampling rounds. Collect equipment blanks after sampling from contaminated wells and not after background wells.

Field duplicates are collected to determine precision of sampling procedure.

If split samples are to be collected, collect the split for each analyte group in consecutive order. Split sample should be as identical as possible to original sample.

All monitoring instrumentation shall be operated in accordance with EPA analytical methods and manufacturer's operating instructions. EPA analytical methods are listed in 40 CFR 136, 40 CFR 141, and SW- 846 with exception of Eh, for which the manufacturer's instructions are to be followed. Instruments shall be calibrated at the beginning of each day. If a measurement falls outside the calibration range, the instrument should be re-calibrated so that all measurements fall within the calibration range. At the end of each day, check calibration to verify that instruments remained in calibration. Temperature measuring equipment, thermometers and thermistors, need not be calibrated to the above frequency. They should be checked for accuracy prior to field use according to EPA Methods and the manufacturer's instructions.

7.0 FIELD LOGBOOK

A field log shall be kept to document all ground water field monitoring activities (see attached example matrix), and record all of the following:

- Well identification.

- Well depth, and measurement technique.
- Static water level depth, date, time and measurement technique.
- Presence and thickness of immiscible liquid (NAPL) layers and detection method.
- Pumping rate, drawdown, indicator parameters values, and clock time, at the appropriate time intervals; calculated or measured total volume pumped.
- Well sampling sequence and time of each sample collection.
- Types of sample bottles used and sample identification numbers.
- Preservatives used.
- Parameters requested for analysis.
- Field observations during sampling event.
- Name of sample collector(s).
- Weather conditions.
- QA/QC data for field instruments.
- Any problems encountered should be highlighted.
- Description of all sampling equipment used, including trade names, model number, diameters, material composition, etc.

8.0 RECORDS

Complete the Groundwater Field Sampling Data Sheet, (measurement times, parameter values, purge volume, water levels, etc.).

Record purge information in field log book.

9.0 QUALITY CONTROL

The project quality assurance (QA)/quality control (QC) Officer is responsible for ensuring that all equipment is calibrated daily prior to use and recording the calibration results on the Calibration Log. The QA Coordinator is responsible for periodically reviewing these results.

10.0 REFERENCES

U.S. Environmental Protection Agency, 1996. Low-Flow (Minimal Drawdown) Ground Water Sampling Procedures, EPA/540/S-95/504. April 1996.

11.0 ATTACHMENTS

Attachment 1 – Groundwater Field Sampling Data Sheet
Attachment 2 – Calibration Log

ATTACHMENT 1

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GROUNDWATER FIELD SAMPLING DATA SHEET

Well No.:		Site:	
Sampler(s):		Project No.:	
Well Depth:		Date:	Time:
DTW (ft):	DTP (ft):	Courier: ___UPS ___Hand ___Other	
MP Ht. Above/Below Ground Surface:		Sampling Method (G=grab, B=bailer, SP=submersible pump	
Condition of Bottom of Well:		Type of Pump:	
Screen Interval (ft):		Weather (sun/clear, overcast/rain, wind direction, ambient temperature):	
Well Diameter (in):			
Placement of Pump (ft):			

TIME	DEPTH TO WATER (FT)	FLOW RATE (GPM)	TOTAL VOLUME (GAL)	PH	TEMP. (°C)	COND. (UMHOS/ CM)	ORP	D.O. (MG/L)	TURB (N.T.U.)	COMMENTS

OBSERVATIONS

Color: Clear Other (describe):
Odor: None Low Medium High Very strong H2S Fuel-like
Notes:
PURGE VOLUME CALCULATIONS For: well casing volume = J (Rc)^2 (well depth - static H_2O depth) x (conversion 7.48 gal/ft3)
Signed/Sampler(s):

ATTACHMENT 2
CALIBRATION LOG

Page __ of ____

Project Name:______________________________

Project No.______________________________

Date/Time	Calibrated by	Instrument	Standard/ Manufacturer Lot #	Standard Concentration	Instrument Reading	Comments

SOP 2.03
GROUNDWATER LEVEL MEASUREMENT PROCEDURES
SANTA SUSANA FIELD LABORATORY
VENTURA COUNTY, CALIFORNIA

1.0 PURPOSE

The purpose of this SOP is to describe the standard method and equipment used to perform groundwater level measurements in groundwater monitoring and piezometer wells using an electric water-level indicator. The general techniques described in this procedure are in general agreement with the procedures outlined in the United States Environmental Protection Agency (USEPA) publication entitled "Low-Flow (Minimal Drawdown) Ground Water Sampling Procedures" (USEPA, 1996) and HGL SOP 2.02 Low-Flow (Minimal Drawdown) Groundwater Sampling Procedures (HGL, 2010).

2.0 SCOPE AND APPLICATION

The SOP emphasizes the need to collect accurate and precise groundwater level measurements in order to produce reliable data that will be used to calculate groundwater elevations, determine hydraulic gradients and construct groundwater elevation contour maps.

Before the groundwater monitor well sampling program begins, there will be a site-wide groundwater gauging event conducted at Area IV. This information will be used to evaluate the pieziometric surface including the height of the piezometric surface and the general groundwater flow direction during the time period of the sampling event. All wells that are a part of the Area IV groundwater sampling program will be gauged, as well as any additional wells identified in the SRR.

3.0 EQUIPMENT AND SUPPLIES

- Electronic water-level meter capable of 0.01 foot accuracy
- Interface probe, if required
- Decontamination supplies
- Personal protective equipment (PPE), Nitrile gloves, Tyvek, over boots, etc.
- Well construction data, location map, field data from last event
- Well keys
- Field log book
- PID or FID instrument (if appropriate) to detect VOCs for health and safety purposes, and to provide qualitative field evaluations
- Groundwater field sampling data sheet

- Site specific Health and Safety Plan, the Groundwater Field Sampling Plan (FSP), and Site Reconnaissance Report (SRR).

4.0 PROCEDURES

Pre-gauging Procedure

- Before starting the gauging event field personnel will review the project Health and Safety Plan (HSP). The HSP will be with the field crew during the gauging event.
- Make copies of the FSP and SRR for each gauging team.
- Obtain the equipment and supplies listed in Section 3 of this SOP.
- Obtain previous water level monitoring data, if available.
- Obtain necessary well keys or well wrenches.
- Make sure the electronic water-level meter is in proper working order.
- Decontaminate the water-level meter.

Gauging Procedure

- Before the gauging activities begin and the well is opened, inspect the well for signs of tampering or other damage. Record any damage in the field log book, on the Groundwater Field Sampling Data Sheet, and report the damage to the Field Operations Manager.
- Before venting or removing the well cap, remove any water in the protective casing or in the vaults around the well casing.
- Open the well and check the breathing zone and the air in the well casing with a photoionization detector (PID). Record air monitoring data on the Groundwater Field Sampling Data Sheet and in the field log book.
- Locate the established reference point on the top of the well casing. If there is no established reference point, the measurement will be taken from the north edge of the top of the well casing. If there is no established reference point then record where the measurement was taken in the field log book and on the Groundwater Field Sampling Data Sheet.
- Turn on the water-level and adjust the sensitivity of the meter, if necessary.

- Lower the water-level meter probe into the well until the audible or visual signal indicates that probe has contacted water.
- Measure the depth to water (DTW) level to the nearest 0.0l foot. Record the data on the Groundwater Field Sampling Data Sheet and in the field log book.
- Remove the water-level meter from the well.
- Decontaminate the water-level meter tape, using Deionized (DI) water and paper towels, as it is withdrawn from the well.
- Place the cap back on the well casing and lock the well vault.

5.0 DECONTAMINATION

Decontamination of the water-level meter is critical. The meter tape and probe will be lowered in numerous wells and cross contamination of the wells is a concern. The wells will be gauged in the order of increasing expected contamination. Depth-to-water and depth-to-bottom measurements will be recorded. The water-level meter tape will be decontaminated using the decontamination procedures presented in SOP 2.01.

6.0 FIELD LOGBOOK

A field log shall be kept to document all groundwater field monitoring activities (see attached example matrix), and record all of the following:

- Well identification.
- Static water level depth, date, time and measurement technique.
- Presence and thickness of immiscible liquid (NAPL) layers and detection method.
- Field observations during gauging event.
- Name of gauger(s).
- Weather conditions.
- Any problems encountered should be highlighted.
- Description of water level meter used, including rental number, trade name, model number, diameter, etc.

7.0 RECORDS

Record the gauging data information in field log book and on the Groundwater Field Sampling Data Sheet.

8.0 QUALITY CONTROL

The project quality assurance (QA)/quality control (QC) Officer is responsible for ensuring that all equipment is calibrated daily prior to use and recording the calibration results on the Calibration Log. The QA Coordinator is responsible for periodically reviewing these results.

9.0 REFERENCES

U.S. Environmental Protection Agency, 1996. Low-Flow (Minimal Drawdown) Ground Water Sampling Procedures, EPA/540/S-95/504. April 1996.

10.0 ATTACHMENTS

Attachment 1 – Groundwater Field Sampling Data Sheet

ATTACHMENT 1

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GROUNDWATER FIELD SAMPLING DATA SHEET

Well No.:	Site:	
Sampler(s):	Project No.:	
Well Depth:	Date:	Time:
DTW (ft): DTP (ft):	Courier: ___UPS ___Hand ___Other	
MP Ht. Above/Below Ground Surface:	Sampling Method (G=grab, B=bailer, SP=submersible pump	
Condition of Bottom of Well:	Type of Pump:	
Screen Interval (ft):	Weather (sun/clear, overcast/rain, wind direction, ambient temperature):	
Well Diameter (in):		
Placement of Pump (ft):		

TIME	DEPTH TO WATER (FT)	FLOW RATE (GPM)	TOTAL VOLUME (GAL)	PH	TEMP. (ºC)	COND. (UMHOS/ CM)	ORP	D.O. (MG/L)	TURB (NTU)	COMMENTS

OBSERVATIONS

Color: Clear Other (describe):
Odor: None Low Medium High Very strong H2S Fuel-like
Notes:
PURGE VOLUME CALCULATIONS For: well casing volume = J $(Rc)^2$ (well depth - static H_2O depth) x (conversion 7.48 gal/ft3)
Signed/Sampler(s):

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SOP 2.15
SEDIMENT SAMPLING
SANTA SUSANA FIELD LABORATORY
VENTURA COUNTY, CALIFORNIA

1.0 PURPOSE

This procedure establishes the guidelines for sediment sampling using a variety of sampling devices. Methods for preventing sample and equipment cross-contamination are included. Proper sediment sampling ensures that any evaluations of sediment contamination are based on actual contaminant levels and are not based on improper sampling techniques.

This procedure provides guidance for routine field operations on environmental projects. Site-specific deviations from the methods presented herein must be approved by the HydroGeoLogic, Inc. (HGL) Project Manager.

2.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) is applicable to the collection of representative sediment samples. Analysis of sediment may determine whether concentrations of specific contaminants exceed established threshold action levels, or if the concentrations present a risk to public health, welfare, or the environment.

The methodologies discussed in this procedure are applicable to the sampling of sediment in both flowing and standing water. They are generic in nature and may be modified in whole or part to meet the handling and analytical requirements of the contaminants of concern, as well as the constraints presented by the sampling area. However, if modifications occur, they should be documented in the site logbook or report summarizing field activities.

For the purposes of this procedure, sediments are those mineral and organic materials which were deposited beneath an aqueous layer. The aqueous layer may be either static, as in lakes, ponds, or other impoundments or flowing, as in rivers and streams, or dry as in intermittent or ephemeral streams.

3.0 DEFINITIONS AND ABBREVIATIONS

3.1 DEFINITIONS

Not applicable.

3.2 ABBREVIATIONS

cm	centimeter
FSP	Field Sampling Plan

ft/sec	foot per second
HGL	HydroGeoLogic, Inc.
QAPP	Quality Assurance Project Plan
SOP	Standard Operating Procedure
VOC	Volatile Organic Compounds

4.0 RESPONSIBILITIES

Field personnel collecting sediment samples are responsible for performing the applicable tasks outlined in this procedure when conducting work related to environmental projects.

The Project Manager or an approved designee is responsible for checking all work performance and verifying that the work satisfies the applicable tasks required by this procedure. This will be accomplished by reviewing all documents (Attachments) and data produced during work performance.

5.0 INTERFERENCES AND POTENTIAL PROBLEMS

Substrate particle size and organic content are directly related to water velocity and flow characteristics of a body of water. Contaminants are more likely to be concentrated in sediments typified by fine particle size and a high organic content. This type of sediment is most likely to be collected from depositional zones. In contrast, coarse sediments with low organic content do not typically concentrate pollutants and are found in erosion zones. The selection of a sampling location can, therefore, greatly influence the analytical results.

6.0 EQUIPMENT/APPARATUS

Equipment needed for collection of sediment samples includes:

- maps/plot plan
- safety equipment
- compass
- tape measure
- survey stakes, flags, or buoys and anchors
- camera and film
- stainless steel, plastic, or other appropriate composition bucket
- 4-oz, 8-oz, and one-quart, wide-mouth jars w/Teflon-lined lids
- Ziploc plastic bags
- logbook
- sample jar labels
- chain of custody forms, field data sheets
- cooler(s)
- ice
- decontamination supplies/equipment

- spade or shovel
- spatula
- scoop
- trowel
- bucket auger
- thin-walled auger
- extension rods
- T-handle
- sampling trier
- sediment coring device (tubes, points, drive head, drop hammer, "eggshell" check valve devices, acetate cores)
- Ponar dredge
- Eckman dredge
- nylon rope

7.0 PROCEDURES

7.1 NON-SUBAQUEOUS SEDIMENT SAMPLING

Non-subaqueous sediment sampling will consist of the following:

- Field personnel will record all data in the field log books in accordance with Standard Operating Procedure (SOP) 4.07: *Use and Maintenance of Field Log Books*;
- Insert a decontaminated Teflon7 or stainless steel spoon, scoop or trowel into the sediment to the desired depth and remove the collected sample; or rotate and push down a decontaminated auger into the sediment to the desired depth and remove collected sample; a disposable scoop may be used for specified media and analytical parameters, in accordance with the site specific Field Sampling Plan (FSP).
- Collect samples for volatile organic compounds (VOC) analysis from the sampling device or from unmixed sediment placed into a stainless steel bowl;
- Place the sample in a decontaminated stainless steel bowl. Stir sample thoroughly (non-VOC samples only) with a decontaminated stainless steel spoon or spatula; or with a dedicated disposable scoop, to provide a homogeneous mixture prior to filling sampling containers;
- Aliquot size (i.e., mass), container type, storage conditions, and holding times will follow guidelines as specified in the site specific FSP and Quality Assurance Project Plan (QAPP). Fill the appropriate sample containers as specified in the site specific FSP. Identify or label samples carefully and clearly, addressing all the categories or parameters;
- After labeling the sample containers, place the filled sample containers on ice immediately;
- Decontaminate the sampling equipment in accordance with SOP 2.01: *Cleaning & Decontaminating Sample Containers and Sampling Equipment*, after use and between sampling if dedicated disposable scoops are not used. Field crew members handling the sampling

equipment and/or samples shall don new clean gloves prior to beginning sampling activities and at each sampling point.

- Complete all chain of custody documents and record information in the field logbook (see the project specific QAPP for sample custody procedures).

7.2 SUBAQUEOUS SEDIMENT SAMPLING

Subaqueous sediment sampling from lakes, ponds, lagoons, and surface impoundments will consist of the following

- Specific sediment sampling devices are described in Exhibit A, Sampling Equipment and Techniques;
- Decontaminate all sampling equipment in accordance with SOP 2.01: *Cleaning & Decontaminating Sample Containers and Sampling Equipment*;
- If sampling from a boat equipped with an engine, attempt to collect the sample with the boat engine off or attempt to ensure that all exhaust fumes are directed away from the sample collection area until the sample has been collected;
- Lower the sampler at a controlled descent of approximately one foot per second (ft/sec.), until the sampler reaches the bottom as indicated by a slackening of the cable. Slowly retrieve the sampler and raise it at a controlled speed. When the sampler is at the water surface, attach a tag line(s) to steady and pull the sampler back into the boat. If large samplers are used, a motorized winch will be required for retrieval;
- Open and tie back any vent flaps on the sampler and carefully siphon off any overlying water over the side of the boat;
- Visually inspect the sample for acceptability (e.g., determine if an undisturbed surface layer is evident, the overlying water is not excessively turbid, and adequate penetration is achieved); if the sample is not acceptable, discard it and collect another sample from an adjacent location;
- Carefully extrude the sediment from the sampler by slowly lifting on the winch cable and sliding the sample out the bottom of the sampler. If using core liners, remove the front face of the core liner to expose the side of the core;
- Visually inspect the side of the sample to identify any obvious stratification (e.g., different sediment types, sizes or colors), and if no patterns are evident, collect a sample from the surface and mid-core depth. During some investigations, it may be necessary to collect separate samples from the surface and mid-core depths. This may best be accomplished by gently scraping the side of the core with a decontaminated stainless steel scraper or knife. Scrape from the bottom to the top of the core only. If the sediment is unconsolidated, do not scrape;
- Remove a sample from the upper two centimeters (cm) of the sample using a decontaminated Teflon7 or stainless steel scoop, or dedicated disposable scoop, and place it in the sample container. From an undisturbed area of the sample surface, scoop a two-cm sample only if grain size analysis is required. After grain size analysis samples are collected, scrape off the

upper sediment layer and discard overboard. Collect samples from the mid-section of the sediment. Sediment must be removed with caution to avoid contaminating the sample (i.e., from exposure to engine exhaust, rust, or grease);

- Nonrepresentative materials such as twigs or debris should not be included in the sample. Sediments contacting the side of the sampler or core liner should not be included for analysis;
- Aliquot size (i.e., mass), container type, storage conditions, and holding times will follow guidelines as specified in the site specific FSP and QAPP. Fill the appropriate sample containers as specified in the site specific FSP. Identify or label samples carefully and clearly, addressing all the categories or parameters;
- Decontaminate the sampling equipment in accordance with SOP 2.01: *Cleaning & Decontaminating Sample Containers and Sampling Equipment*, after use and between sampling if dedicated disposable scoops are not used. Field crew members handling the sampling equipment and/or samples shall don new clean gloves prior to beginning sampling activities and at each sampling point;
- Complete all chain of custody documents and record information in the field logbook (see the project specific QAPP for sample custody procedures).

7.3 STREAM SEDIMENT SAMPLING

Stream sediment sampling will include the following:

- The sample should be collected in an area of sediment accumulation, such as the inside of stream meanders, quiet shallow areas, and low velocity zones. Avoid areas of net erosion, such as high velocity, turbulent flow zones;
- If possible, remain on the stream bank. If the sample cannot be obtained from the bank, enter the stream from a point downstream of the sediment sampling location. Entering a river may be hazardous, consult the Site Health and Safety Plan for specific safety procedures. Collect the sediment sample by reaching into the stream with a decontaminated stainless steel spoon or Teflon7 scoop and scooping a sample in an upstream direction. Attempt to minimize the loss of fine material. A disposable scoop may be used for specified media and analytical parameters, in accordance with the site specific FSP;
- Place sample in a stainless steel bowl and gently mix with a stainless steel spoon or dedicated disposable scoop (non VOC samples only). Transfer the sediment samples to the appropriate sample containers using the stainless steel spoon or dedicated disposable scoop. Do not mix samples for volatile organic analysis;
- Aliquot size (i.e., mass), container type, storage conditions, and holding times will follow guidelines as specified in the site specific FSP and QAPP. Fill the appropriate sample containers as specified in the site specific FSP. Identify or label samples carefully and clearly, addressing all the categories or parameters;
- Decontaminate the sampling equipment in accordance with SOP 2.01: *Cleaning & Decontaminating Sample Containers and Sampling Equipment*, after use and between sampling

if dedicated disposable scoops are not used. Field crew members handling the sampling equipment and/or samples shall don new clean gloves prior to beginning sampling activities and at each sampling point;

- Complete all chain of custody documents and record information in the field logbook (see the project specific QAPP for sample custody procedures).

8.0 QUALITY ASSURANCE/QUALITY CONTROL

There are no specific quality assurance activities which apply to the implementation of these procedures. However, the following QA/QC procedures apply:

- All data must be documented on field data sheets or within site logbooks.

- All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and they must be documented.

9.0 RECORDS

Documentation generated as a result of this procedure is collected and maintained in accordance with requirements specified in the site specific FSP.

- Document all daily field activities on a Field Activity Report.
- Document the sampling on a Field Sampling Report.
- Complete the field logbook in accordance with procedures listed in SOP 4.07: *Use and Maintenance of Field Log Books*.

10.0 REFERENCES

U.S. EPA Region 9, 1999. *Sediment Sampling*, SOP No. 1215, Revision 1. September.

U.S. Army Corps of Engineers, 2001. *Requirements for the Preparation of Sampling and Analysis Plans* (EM200-1-3). Appendix C.5.

11.0 ATTACHMENTS

Attachment A Sampling Equipment and Techniques

ATTACHMENT A
SAMPLING EQUIPMENT AND TECHNIQUES

Sediment samples may be obtained using on-shore or off-shore techniques. Sediment sampling equipment and techniques must be designed to minimize the risk of dilution or loss of material as the sample is moved through the water column. For situations where boats are required for sampling, extra precautionary measures must be employed. At a minimum, life preservers must be provided and two individuals will undertake the sampling and an additional person will remain in visual contact on-shore to observe the operations. If sampling from a commercial vessel, the Captain must have all appropriate licenses to operate the vessel. The additional person to observe operations is not needed if sampling from a commercial vessel, if the vessel is equipped with a marine radio to contact the Coast Guard or another vessel if case of emergency.

Sediment sampling is described below.

Dip Sampler

A dip sampler consists of a pole with a jar or scoop attached. The pole may be made of bamboo, wood, Teflon7, or aluminum and be either telescoping or of fixed length. The scoop or jar at the end of the pole is attached by a clamp.

The dip sampler is operated by submerging the jar or scoop and pulling it through the sediments to be sampled. The samples retrieved are then transferred into the appropriate sample container after decanting the liquid. Further decanting can occur while the sample is present in the sample jar. Avoid contact with sampler's gloves. Transferring the sample may require the use of a stainless steel or Teflon7 spoon/spatula.

Hand Operated Core Samplers

Hand operated sediment core samplers are used to obtain sediment samples in shallow water (less than three feet). These samplers operate in a manner similar to soil core samplers. However because of the saturated conditions of most sediments, provisions must be made to retain the sample within the core. Core samplers are generally constructed of a rigid metal outer tube into which a two-inch plastic core sleeve fits with minimum clearance. The cutting edge of the core sampler has a recessed lip on which the plastic sleeve rests and which accommodates a core retainer. This retainer is oriented such that when the sampler is pressed into the sediment, the core is free to move past the retainer. Due to construction of the retainer, the core will not fall through the retainer upon removal of the sampler from the sediment.

When the sampler is removed from the sediment, the plastic sleeve is removed. The sediment is removed from the sleeve and placed in the appropriate sample container. Chlorinated organics will not be collected using core samplers because core sleeves and retainers are generally made of plastic. The hand operated core sampler will not be useful for obtaining samples of gravelly, stony or consolidated sediments

Gravity Core Samplers

Gravity core samplers are used to obtain sediment samples in water bodies or lagoons with depths of greater than three to five feet. These types of samplers can be used for collecting one- to two-foot cores of surface sediments at depths of up to 100 feet beneath the water surface.

As with all core type samplers, gravity core samplers are not suitable for obtaining samples of coarse, gravelly, stony, or consolidated deposits. They are, however, useful for fine grained inorganic sediment sampling.

The gravity core sampler operates in a manner similar to the hand operated core in that a two-inch plastic sleeve fits within a metal core housing fitted with a cutting edge. Plastic nests are used to retain the core within the plastic sleeve. An opening exists above the core sleeve to allow free flow of water into and through the core as it moves vertically downward to the sediment. The sampler has a messenger-activated valve assembly which seals the opening above the plastic sleeve following sediment penetration. This valve is activated by the messenger creating a partial vacuum to assist in sample retention during retrieval.

Samples are obtained by allowing the sampler, which is attached to approximately 100 feet of aircraft cable, to drop to the benthic deposits. The weight of the sampler drives the core into the sediment to varying depths depending on the characteristics of the sediments. The messenger is then dropped on the taut aircraft cable to seal the opening above the plastic sleeve. The sampler is then carefully retrieved.

Upon retrieval of the sampler, the plastic core sleeve is removed and the sample placed in the appropriate sample container. Care should be exercised in labeling in order to properly identify sample orientation.

Dredges

Dredges are generally used to sample sediments which cannot easily be obtained using coring devices or when large quantities of materials are required. Various dredge designs are available for sampling in deep or turbulent waters and for obtaining samples from gravelly, stony or dense deposits.

Dredges generally consist of a clam shell arrangement of two buckets. The buckets may either close upon impact or be activated by use of a messenger. Dredges are commonly quite heavy and may require use of a winch and crane assembly for sample retrieval.

Upon retrieval of the dredge, the sample can either be sieved or transferred directly to a sample container for labeling and storage. Dredge types which could be used for sampling include Ponar, Petersen and Ekman dredges.

Hand Auger

Sediment samples may be collected using a hand auger. When using a hand auger, provisions must be made to ensure that sediment samples remain in the auger. Hand augers are best utilized when sampling non-subaqueous sediments.

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SOP 2.16
SURFACE WATER AND SPRING/SEEP SAMPLING
SANTA SUSANA FIELD LABORATORY
VENTURA COUNTY, CALIFORNIA

1.0 PURPOSE

The purpose of this procedure is to describe the methods for surface water sampling (including springs and seeps). It describes the procedures and equipment to be used to obtain representative surface water samples that are capable of producing accurate quantification of water quality.

This procedure provides guidance for routine field operations on environmental projects. Site-specific deviations from the methods presented herein must be approved by the HydroGeoLogic, Inc. (HGL) Project Manager and discussed in the approved project plans.

2.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) is applicable to the collection of representative liquid samples, both aqueous and non-aqueous from streams, rivers, lakes, ponds, lagoons, embayments, seeps, springs and surface impoundments. It includes samples collected from depth, as well as samples collected at the surface. This SOP was reviewed for general consistency with "Standard Operating Procedure for Spring and Seep Sampling", obtained from the web site http://www.dtsc-sfl.com/files/lib_rcra_groundwater/seeps_springs/samplingplan/3596_SOP%20-%20Seeps%20and%20Springs%20Sampling,%20Oct-2008.pdf.

3.0 DEFINITIONS AND ABBREVIATIONS

3.1 DEFINITIONS

Aliquot: Fractional amount.

Composite Samples: Samples composed of more than one aliquot collected at various sampling sites and/or at different times.

Epilimnetic zone: The uppermost layer of water in a lake, characterized by an essentially uniform temperature that is generally warmer than elsewhere in the lake and by a relatively uniform mixing caused by wind and wave action. Specifically, the epilimnetic zone is the light (less dense), oxygen-rich layer of water in a thermally stratified lake.

Grab Samples: Samples that are collected at one particular point and time.

Hypolimnetic zone: The lowermost layer of water in a lake, characterized by an essentially uniform temperature (except during turnover) that is generally colder than elsewhere in the lake and is often characterized by relatively stagnant or oxygen-deficient water.

Rinsate: Waste water generated as a result of rinsing sampling equipment during decontamination procedures.

Spring/Seep Samples: Samples of water collected from a source consisting of groundwater emerging at the land surface.

Surface water samples: Samples of water collected from streams, ponds, rivers, lakes, or other impoundments open to the atmosphere.

3.2 ABBREVIATIONS

HGL	HydroGeoLogic, Inc.
FSP	Field Sampling Plan
ml	milliliter
QAPP	Quality Assurance Project Plan
SOP	Standard Operating Procedures

4.0 RESPONSIBILITIES

Field personnel are responsible for performing the applicable tasks in accordance with this procedure when conducting work related to environmental projects.

The Project Manager or an approved designee is responsible for checking all work performed and verifying that the work satisfies the applicable tasks required by this procedure. This will be accomplished by reviewing all documents (Attachments) and data produced during work performance.

5.0 PROCEDURE FOR SAMPLING SURFACE WATERS, SPRINGS AND SEEPS

5.1 INTRODUCTION

The objectives of surface, spring, and seep sampling include evaluation of the water quality entering and/or leaving a site. It is also used to obtain data on waste loads, water quality and characteristics that will permit prediction or modeling of the water system (to describe probable water quality), and effects on uses under a variety of conditions.

5.2 SAMPLING EQUIPMENT

Sampling equipment includes all sampling devices and containers that are used to collect or contain a sample prior to final sample analysis. All surface water sampling equipment shall have a design that will maintain sample integrity and to provide the desired level of quality in achieving desired analytical results. There is a variety of equipment available for surface water sampling. The appropriate sampling device must be of a proper composition. Samplers constructed of glass, stainless steel, polyvinyl chloride of PFTE (Teflon®) should be used based upon the analyses to be performed. For example, devices which are free of metal surfaces should be used for collecting samples for metal analyses. Because each site may contain varied surface water conditions, collection of a representative sample may be difficult. In general, a sampling device will include the following characteristics:

- Be constructed of disposable or non-reactive material (Teflon7 or stainless steel); and
- Have a minimum capacity of 500 milliliters (ml) to minimize sample disturbance.

Sampling situations vary widely, and, therefore, no universal sampling procedure can be recommended. However, sampling of both aqueous and non-aqueous liquids from the above mentioned sources is generally accomplished through the use of one of the following samplers or techniques:

- Dip sampler
- Direct method
- Discrete depth samplers
- Peristaltic pumps
- Stormwater collection devices

Equipment needed for collection of surface water samples includes:

- Dip sampler
- Kemmerer or Van Dorn bottles
- Line and messengers
- Peristaltic pumps
- Stormwater samplers
- Sample collection bottles
- Sample bottle preservatives
- Ziploc bags
- Ice
- Cooler(s)
- Chain-of-custody forms, field data sheets
- Custody seals
- Decontamination equipment
- Maps/plot plan
- Safety equipment
- Compass
- Tape measure
- Survey stakes, flags, or buoys and anchors
- Camera and film
- Global positioning system unit
- Logbook/waterproof pen
- Sample bottle labels

Additional equipment needed for collection of samples from seeps, and springs includes:

- 60 ml disposable syringe (1 per sample)
- Metal trowel

Reagents will be utilized for preservation of samples and for decontamination of sampling equipment. Required preservatives are specified by the analysis to be performed. Decontamination solutions are specified in SOP 2.01, *Cleaning and Decontaminating Sample Containers and Sampling Equipment*.

5.3 INTERFERENCES AND POTENTIAL PROBLEMS

There are two primary interferences or potential problems with surface water, spring, and seep sampling. These include cross-contamination of samples and improper sample collection.

Cross-contamination problems can be eliminated or minimized through the use of dedicated sampling equipment. Another suitable method can be to work collecting samples from low to high concentration, should this information be available. If this is not possible or practical, then decontamination of sampling equipment is necessary. Refer to SOP 2.01, *Cleaning and Decontaminating Sample Containers and Sampling Equipment*.

Improper sample collection can involve using contaminated equipment, disturbance of the stream or impoundment substrate, and sampling in an obviously disturbed area.

Following proper decontamination procedures and minimizing disturbance of the sample site will eliminate these problems.

5.4 DECONTAMINATION

Decontaminate the sampling equipment in accordance with SOP 2.01: *Cleaning & Decontaminating Sample Containers and Sampling Equipment*, after use and between sampling if dedicated disposable equipment is not used.

5.5 SAMPLING LOCATION/SITE SELECTION

Prior to sampling, consideration must be given to the specific sampling locations in order to provide a representative sample. This and other considerations are detailed in the project specific Field Sampling Plan (FSP).

The physical location of the investigator when collecting a sample may dictate the equipment to be used. If surface water samples are required, direct dipping of the sample container into the stream is desirable. This is possible, however, only from a small boat, a pier, etc., or by wading in the stream. Wading, however, may cause the re-suspension of bottom deposits and bias the sample. Wading is acceptable if the stream has a noticeable current (is not impounded), and the samples are collected while facing upstream. If the stream is too deep to wade, or if the sample must be collected from more than one water depth, or the sample must be collected from a bridge, etc., supplemental sampling equipment must be used.

The general determining factors in the selection of a sampling device for sampling liquids in lakes, ponds, lagoons, and surface impoundments are listed below:

- Accessibility:
- Boat: If the water is navigable, any sampling location is accessible by boat.
- Bridges: Provide ready access, are readily identifiable, and permit water sampling at any point across the width of the water body.
- Wading: Personnel safety must be paramount. Wading is not recommended in areas where bottom deposits are easily disturbed, thereby increasing the possibility of increased sediment in the samples.

Rivers, streams, and creeks:

- Sampling stations will be located wherever a marked physical change occurs in the stream channel. For example, between rapids/deep water transitions, as well as at both ends of a reach.
- Sampling stations will be located short distances above and below dams and weirs, to determine the artificial increase in dissolved oxygen.
- A minimum of three sampling locations will be established between any two points of major change in a stream.
- Sampling stations will be located upstream and downstream of any waste discharge site. Since the inflow frequently hugs the stream bank with very little lateral mixing, care must be taken to establish the sampling station after complete mixing with the main stream.
- A tributary sampling station will be established near the mouth and upstream of any effects from the main stream. The station on the main stream will be just upstream from the confluence.
- Sample as close as is practical to areas or points of important water uses.
- At stations where wastes and tributary waters are well-mixed, one sampling point near mid-channel is usually adequate. At stations where mixing is inadequate, the station will be sampled at quarter points across the width of the station.

Lakes, ponds, lagoons, and impoundments:

- A single station at the deepest point may be sufficient for naturally-formed ponds (near the center) and for impoundments (near the dam or spillway).
- A sampling grid is the most representative for lakes and large impoundments.

- In lakes with irregular shapes and with several bays and coves that are protected from the wind, sampling stations should be established in these areas.
- A control station above a waste source is usually necessary to compare background water quality. It should be carefully selected and it may be necessary to have two or three control stations to establish the rate at which unstable material is changing. The time of travel between stations should be sufficient to permit accurate measurement of the change in the constituents under consideration.

Springs and Seeps:

- Sampling locations are generally taken as close as possible to an observed emergence point.

5.6 SAMPLING METHODS

5.6.1 Surface Water General

The specific sampling method utilized will depend on the accessibility to, the size, and the depth of the water body, as well as the type of samples being collected.

In most ambient water quality studies, grab samples will be collected. However, the objectives of the study will dictate the sampling method and will be specified in the project specific FSP.

For rivers, streams and creeks, the type of samples collected will be dependent upon the size and the amount of turbulence in the water body. Approximate the depth and location of samples in order to assure consistency.

- With small streams less than 20 feet wide, a single grab sample collected at mid-depth in the center of the channel is usually adequate to represent the entire cross-section. In small streams and creeks less than 10 feet wide, a single grab sample can be collected by immersing the bottle directly under the surface of the water as close to the center of the channel as possible.
- For slightly larger streams, a vertical composite sample in the center of the channel may be required. The composite sample consists of samples taken just below the surface, at mid-depth and just above the bottom.
- For rivers, several vertical composite samples are collected across the water body. The vertical composite samples will be collected at points in the cross-section approximately proportional to flow. The number of vertical composites required and the number of depths sampled for each are usually determined in the field. This determination is based on a reasonable balance between two considerations:
- The larger the number of subsamples, the more nearly the composite sample will represent the water body; but
- Taking many subsamples is time-consuming and increases the chance of cross-contamination.

For lakes, ponds, lagoons, and impoundments, the greater tendency to stratify and the relative lack of adequate mixing usually requires that more subsamples be collected. The flow rate of impoundments will be measured in accordance with SOP 2.08: Stream Flow Measurements.

- In ponds, lagoons, and small impoundments, a single vertical composite sample at the deepest point is usually adequate.
- In lakes and larger impoundments, several vertical composites should be combined into a single sample. In some cases, it may be useful to form several composites of the epilimnetic and hypolimnetic zones. Normally, however, a composite consists of several verticals with subsamples collected at various depths.

For springs and seeps generally the depth of water is not enough to need stratification sampling. Detailed observations should be recorded on field forms throughout the sampling event. The sampler should assess things like the spatial extent of the seep pool (i.e. length, width, depth); the approximate rate of flow from the seep or spring; and water flow into the pool from sources other than the spring or seep.

- Ideally the sample is drawn into a syringe from approximately one to two inches below the surface of the pool associated with a spring or seep.

- If there is no pool to draw water from, as when a seep may emerge from a fracture in a near vertical rock face, a hillside, the side of a natural drainage, or other such non-horizontal surface, it is best to collect the sample directly from as close as possible to the discharge point, from within the fracture itself.

- A spring or seep may also present itself as an area of moist sediment without a pool of standing water. In these circumstances, it is permissible to use a clean hand trowel to dig out a depression in the sediment in which groundwater can accumulate and from which a sample can be collected. The sampler should take notes on the size of the hole created and the rate at which groundwater flows into it.

5.6.2 Surface Water Direct Method

Collecting a representative sample from small streams and creeks less than 10 feet wide, a single grab sample can be collected by immersing the sample bottle directly under the surface of the water as close to the center of the channel as possible. This method reduces the potential for cross contamination as it does not require the decontamination of equipment. The following procedures will be followed when sampling with a sample bottle:

- If sampling from within the stream, always sample from the furthest down stream location and work up stream;
- When wading to location, try to move slowly to minimize the amount of sediment stirred up from the bottom:

- Stand facing up stream;
- A single grab sample can be collected by immersing the bottle directly under the surface of the water as close to the center of the channel as possible ensuring the sample is collected up stream of the sampler.
- If preservatives are required for sample preservation, add preservative after samples have been collected. If pre-preserved bottleware is to be used, first collect the sample in an unpreserved bottle and decant the water to the pre-preserved bottle.
- Raise the sampler, seal, wipe clean, label or identify and prepare the bottle for transport in accordance with project guidelines;
- Identify or label samples carefully and clearly, addressing all the categories or parameters;
- After labeling of the sample bottles has been completed, place the filled sample containers on ice immediately;
- All field crew members handling the sampling equipment and/or sample bottles shall don new clean gloves prior to beginning sampling activities and between each successive sample point.
- Complete all chain-of-custody documents and record information in the field logbook (see the project specific Quality Assurance Project Plan [QAPP] for sample custody procedures).
- Mark sample location and approximate depth, if possible, and note on maps and in field log book.

One additional grab sample from each location will be collected and a water quality probe will be used to collect pH, conductivity, temperature, turbidity, and salinity (where applicable) data. This sample will not be submitted for laboratory analysis. Other odors and significant characteristics will also be documented on the field sampling sheet and in the field log book.

5.6.3 Surface Water Weighted Bottle Sampler

Collecting a representative sample from a larger body of water requires the gathering of samples from various depths and locations. A weighted bottle sampler is typically utilized for this type of sampling. The sampler consists of a Teflon 7 bottle, a weighted sinker, a bottle stopper and a wire cord used to raise, lower and open the samples. This type of sampler can be fabricated or purchased. The following procedures will be followed when sampling with a weighted bottle sampler (Attachment A, Weighted Bottle Sampler):

- Decontaminate the sampling equipment in accordance with SOP 2.01: *Cleaning & Decontaminating Sample Containers and Sampling Equipment*;
- Assemble the weighted bottle sampler in accordance with the sampler instruction manual;
- Gently lower the sampler to the desired depth so as not to remove the stopper prematurely. Do not let sampler disturb bottom sediments;
- Pull out the stopper with a sharp jerk of the sampler line;
- Allow the bottle to fill completely, as evidenced by the cessation of air bubbles;

- Raise the sampler, seal, wipe clean, label or identify and prepare the bottle for transport in accordance with project guidelines;
- Identify or label samples carefully and clearly, addressing all the categories or parameters;
- After labeling of the sample bottles has been completed, place the filled sample containers on ice immediately;
- Decontaminate the sampling equipment in accordance with SOP 2.01: *Cleaning & Decontaminating Sample Containers and Sampling Equipment*;
- All field crew members handling the sampling equipment and/or sample bottles shall don new clean gloves prior to beginning sampling activities and between each successive sample point.
- Complete all chain-of-custody documents and record information in the field logbook (see the project specific QAPP for sample custody procedures).
- Mark sample location and approximate depth, if possible, and note on maps and in field log book.

One additional grab sample from each location will be collected and a water quality probe will be used to collect pH, conductivity, temperature, turbidity, and salinity (where applicable) data. This sample will not be submitted for laboratory analysis. Other odors and significant characteristics will also be documented on the field sampling sheet and in the field log book.

5.6.4 Pond Sampler

The pond or dip sampler (Attachment B, Pond Sampler) consists of a scoop or container attached to the end of a telescoping or solid pole. The sampler will be of non-reactive material such as wood, plastic, or stainless steel. The sample will be collected in a jar or beaker made of stainless steel or Teflon7. Preferably, a disposable beaker that can be replaced prior to each sampling will be used at each station. Liquid wastes from water courses, ponds, pits, lagoons or open vessels will be ladled into the sample container.

Perform the following procedures when sampling with a pond sampler:

- Decontaminate the sampling equipment in accordance with SOP 2.01: *Cleaning & Decontaminating Sample Containers and Sampling Equipment*;
- Assemble pond sampler in accordance with manufacturer's instructions;
- Extend pole to length that will allow safe access to desired sample location;
- Submerge pond sampler to desired sample depth. Submerge the sampler very slowly to minimize surface disturbance;
- Allow the sampler to fill very slowly;
- Retrieve the sampling device with minimal surface water disturbance;

- Remove the cap from the sample bottle and slightly tilt the mouth of the bottle below the sampler edge;
- Empty the sampler slowly, allowing the sample stream to flow gently down the side of the bottle with minimal entry turbulence. Fill sample bottle to appropriate head space, if any;
- Identify or label samples carefully and clearly, addressing all the categories or parameters;
- After labeling of the sample bottles has been completed, place the filled sample containers on ice immediately;
- Decontaminate the sampling equipment in accordance with SOP 2.01: *Cleaning & Decontaminating Sample Containers and Sampling Equipment*.
- All field crew members handling the sampling equipment and/or sample bottles shall don new clean gloves prior to beginning sampling activities and between each successive sample point.
- Complete all chain-of-custody documents and record information in the field logbook (see the project specific QAPP for sample custody procedures).
- Mark sample location and approximate depth, if possible, and note on maps and in field log book.
- Collect additional grab samples to acquire field measurements such as temperature, pH, conductivity, turbidity, salinity (where applicable) and other significant characteristics.

5.6.5 Surface Water Manual Hand Pumps

Manual pumps are available in various sizes and configurations. Manual hand pumps are commonly operated by peristaltic, bellows or diaphragm, and siphon action. Manual hand pumps that operate by a bellows or diaphragm, and siphon action should not be used to collect samples that will be analyzed for volatile organics (Attachment C, Manual Hand Pump). These types of pumps should be constructed out of inert materials; i.e., Teflon7 or stainless steel.

Perform the following procedures when collecting surface water samples with a manual hand pump:

- Decontaminate the sampling equipment in accordance with SOP 2.01: *Cleaning & Decontaminating Sample Containers and Sampling Equipment*;
- Assemble and operate the pump in accordance with the manufacturer's instructions;
- The inlet hose and any surface of the pump used for sampling will be constructed of materials that are operable and non-reactive;
- To avoid agitation, insert the sampling tube into the liquid sample prior to pump activation;
- Insert a liquid trap (preferably the sample container) into the sample inlet hose to collect the sample and to prevent pump contamination;
- Identify or label samples carefully and clearly, addressing all the categories or parameters;

- After labeling of the sample bottles has been completed, place the filled sample containers on ice immediately;
- Decontaminate the sampling equipment in accordance with SOP 2.01: *Cleaning & Decontaminating Sample Containers and Sampling Equipment*.
- All field crew members handling the sampling equipment and/or sample bottles shall don new clean gloves prior to beginning sampling activities and between each successive sample point.
- Complete all chain-of-custody documents and record information in the field logbook (see the project specific QAPP for sample custody procedures).
- Mark sample location and approximate depth, if possible, and note on maps and in field log book. Record applicable data in the field log book (i.e. color, turbidity, pH, temperature, turbidity (where appropriate), degree of turbulence, and weather conditions).

5.6.6 Surface Water Peristaltic Pump

Gathering surface water samples with the assistance of a peristaltic pump is another commonly used sampling technique. In this method the sample is drawn through heavy-walled tubing and pumped directly into the sample container. This system allows the operator to extend into the liquid body to sample from depth, or sweep the width of narrow streams. Medical-grade silicon tubing is often used in the peristaltic pump and the system is suitable for sampling almost any parameter, including most organics (Attachment D, Peristaltic Pump).

Peristaltic pumps are available with a range of power sources. For field use the battery operated units have proven most convenient and very reliable.

Perform the following procedures when sampling with a peristaltic pump:

- Prepare the peristaltic pump in accordance with manufacturer's instructions. When using a battery-operated pump, be sure battery is fully charged prior to entering the field.
- In most situations, it is necessary to change the Teflon7 suction line and the silicon pump tubing between sample locations to avoid cross-contamination.
- Gently lower the pump intake tube to the desired sample depth. Avoid unnecessary agitation (aeration) of the liquid to be sampled and bottom sediments.
- Prior to activating the pump, note in which direction the pump will be rotating. (Most peristaltic pumps are capable of rotating in two directions.) Accidental reverse rotation of the pump will cause aeration of the liquid to be sampled.
- Run the pump until no air bubbles are noted in the discharge.
- Discharge water shall be released down stream from sampling area during sampling event.
- To prevent excess agitation and/or aeration of the sampler, fill the sample containers by tilting the container and flow the sample water down the side of sampling container.
- Identify or label samples carefully and clearly, addressing all the categories or parameters;

- After labeling of the sample bottles has been completed, place the filled sample containers on ice immediately;
- In most cases, no specific decontamination procedures are required due to the use of disposable tubing. However, site-specific sample procedures may require additional decontamination and will be specified in the project specific FSP.
- All field crew members handling the sampling equipment and/or sample bottles shall don new clean gloves prior to beginning sampling activities and between each successive sample point.
- Complete all chain-of-custody documents and record information in the field logbook (see the project specific QAPP for sample custody procedures).
- Mark sample location and approximate depth, if possible, and note on maps and in field log book. Record applicable data in the field log book (i.e. color, turbidity, pH, salinity (where applicable), degree of turbulence, and weather conditions).

When medical grade silicon tubing is not available for analytical requirements, the system can be altered as illustrated in Attachment E, Peristaltic Pump - Modified. In this configuration, the sample volume accumulates in the vacuum flask and does not enter the pump. This system will provide excellent sample integrity for most analyses; however, the potential for losing volatile fractions to the reduced pressure of the vacuum flask renders this method unacceptable for sampling of volatiles.

It may sometimes be necessary to sample large bodies of water where a near-surface sample will not sufficiently characterize the body as a whole. In this instance, the above-mentioned pump is appropriate. It is capable of lifting water from slightly deeper than six meters. It should be noted that this lift ability decreases somewhat with higher density fluids and with increased wear on the silicone pump tubing. Similarly, increases in altitude will decrease the pump's ability to lift from depth. When sampling a liquid stream that exhibits a considerable flow rate, it may be necessary to weight the bottom of the suction line.

5.6.7 Kemmerer Discrete Depth Sampler

A Kemmerer bottle (Exhibit 16-7) may be used in most situations where site access is from a boat or structure such as a bridge or pier, and where samples at depth are required. Sampling procedures are as follows:

1. Use a properly decontaminated Kemmerer bottle. Set the sampling device so that the sampling end pieces (upper and lower stoppers) are pulled away from the sampling tube (body), allowing the substance to be sampled to pass through this tube.

2. Lower the pre-set sampling device to the predetermined depth. Avoid bottom disturbance.

3. When the Kemmerer bottle is at the required depth, send down the messenger, closing the sampling device.

4. Retrieve the sampler and discharge from the bottom drain the first 10 - 20 mL to clear away any potential contamination of the valve.

5. Transfer the sample to the appropriate sample container.

5.6.8 Optional Surface Water Sampling Methods

The above-mentioned methods of surface water sampling will be used most often on HGL environmental projects; however, choice of sampling equipment depends on site specific conditions. Additional types of samplers available are:

- Wheaton sampler;
- Bacon Bomb sampler;
- D.O. Punker sampler; and
- Bailer.
- Stormwater samplers

Prior to any field work, the Project Manager or designee will review the available sampling equipment and choose the sampler that will best suit the project requirements. Samplers to be used will be specified in the project specific FSP.

5.6.9 Spring and Seep Sampling Methods

The method discussed is excerpted from the spring and seep SOP available on the California department of Toxic Substance Control (DTSC) web site for Santa Susana Field Laboratory (http://www.dtsc-ssfl.com/). A primary and alternate method is presented for sampling springs and seeps with pools and an additional method for sampling areas without pools. The primary syringe method should be used whenever practicable.

5.6.9.1 Primary Sampling Procedure for Locations with Pools

1. Put on a clean pair of unpowdered nitrile gloves;
2. Remove a clean syringe from its package;
3. Remove the caps from the sample containers;
4. Place the syringe tip at least one inch below the surface of the water at the designated
5. sampling location and fill it slowly by pulling back on the plunger. Avoid drawing sediment
6. or other foreign materials into the syringe;
7. Tilt the sample bottle at an angle and fill it slowly using the syringe until it is nearly full;
8. Turn the bottle upright and continue filling it until a convex meniscus forms above the mouth;
9. Replace the cap immediately;
10. If sampling for VOCs, check for air bubbles by inverting the vial and tapping sharply on it.

11. If bubbles are observed, discard the vial and collect a new sample.
12. Dry the sample bottle using a paper towel (this will help with labeling);
13. Label the sample container with the appropriate sample information using a fine-point
14. indelible marker;
15. Record the sample information on the chain-of-custody exactly as it appears on the sample
16. label;
17. Place the sample in a sealable plastic bag;
18. Place the sample into a cooler with ice or cool packs (blue ice).

5.6.9.2 Alternative Sampling Procedure for Locations with Pools or Non-Volatile Analytes

The alternative method should only be used when the primary method cannot be used (e.g. the sample volume required is too large). Care to ensure that foreign materials do not enter the collection vessel.

1. Put on a clean pair of unpowdered nitrile gloves;
2. Invert and submerge a clean, stainless steel pouring beaker at the desired sampling location;
3. Slowly rotate the beaker upright so that water flows in;
4. Lift the beaker out of the water and pour the sample into the appropriate container;
5. Repeat steps 3 and 4 until the required volume is obtained;
6. Replace the cap immediately;
7. The remaining steps are identical to steps 9 through 13 above.

5.6.9.3 Alternative Sampling Procedures for Seeps Without Pools

A seep may emerge from a fracture in a near-vertical rock face, a hillside, the side of a natural drainage or other such non-horizontal surface. Under these conditions, the water emerging from the seep may flow across the surface downward toward a pool that accumulates beneath the emergence point, or there may be no pool at all. In these circumstances it is preferable, especially if analyzing for VOCs, to collect the sample directly from the fracture or the surface flow as close to the emergence point as possible rather than sampling from the pool if one is present. This may be accomplished by collecting water directly from the fracture or surface with a syringe, by placing a sample bottle or collection vessel directly below the fracture or in the sheet flow, or by using a clean tool (hand trowel, stainless steel wire or rod, etc.) to direct water flow into a sample bottle or collection vessel. A seep may also present as an area of moist sediment without a pool of standing water. In these circumstances, it is permissible to us a clean hand trowel to dig out a depression in the sediment in which groundwater can accumulate and from which a sample can be collected. The sampler should make note of the size of the hole and the rate at which groundwater flows into it.

6.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Once samples have been collected, follow these procedures:

1. Transfer the sample(s) into suitable labeled sample containers.
2. Preserve the sample if appropriate, or use pre-preserved sample bottles.
3. Cap the container, put it in a Ziploc plastic bag and place it on ice in a cooler.
4. Record all pertinent data in the site logbook and on a field data sheet.
5. Complete the chain-of-custody form.
6. Attach custody seals to the cooler before shipment.
7. Decontaminate all sampling equipment before collection of additional samples.

7.0 CALCULATIONS

This section is not applicable to this SOP.

8.0 QUALITY ASSURANCE/QUALITY CONTROL

There are no specific quality assurance activities which apply to the implementation of these procedures. However, the following general QA/QC procedures apply:

- All data must be documented on field data sheets or within site logbooks.
- All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan.

Equipment checkout and calibration activities must occur prior to sampling/operation and they must be documented.

9.0 RECORDS

Documentation generated as a result of this procedure is collected and maintained in accordance with requirements specified in the project specific FSP.

- Document all daily field activities on a field activity report and in field log books in accordance with procedures listed in SOP 4.07: *Use and Maintenance of Field Log Books*.
- The Surface Water Sampling Data form contained in Attachment F must be filled out for each surface water sample collected; and

10.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA and specific health and safety procedures.

More specifically, when sampling lagoons or surface impoundments containing know or suspected hazardous substances, take adequate precautions. The sampling team member collecting the sample should not get too close to the edge of the impoundment, where bank failure may cause him or her to lose their balance. The person performing the sampling should be on a lifeline and be wearing adequate protective equipment. When conducting sampling from a boat in an impoundment or flowing waters, follow appropriate boating safety procedures.

11.0 REFERENCES

DTSC Web Site - http://www.dtsc-sfl.com/files/lib_rcra_groundwater/seeps_springs/samplingplan/3596_SOP%20-%20Seeps%20and%20Springs%20Sampling,%20Oct-2008.pdf.

U.S. Environmental Protection Agency, 1999. *Surface Water Sampling, Field Sampling Guidance Document #1225,* U.S.EPA Region 9 Laboratory, Richmond, California.

U.S. Army Corps of Engineers, 2001. *Requirements for the Preparation of Sampling and Analysis Plans* (EM200-1-3). Appendix C.3.

12.0 ATTACHMENTS

Attachment A	Weighted Bottle Sampler
Attachment B	Pond Sampler
Attachment C	Manual Hand Pump
Attachment D	Peristaltic Pump
Attachment E	Peristaltic Pump - Modified
Attachment F	Surface Water Sampling Data

EXHIBIT 16-1
Weighted Bottle Sampler

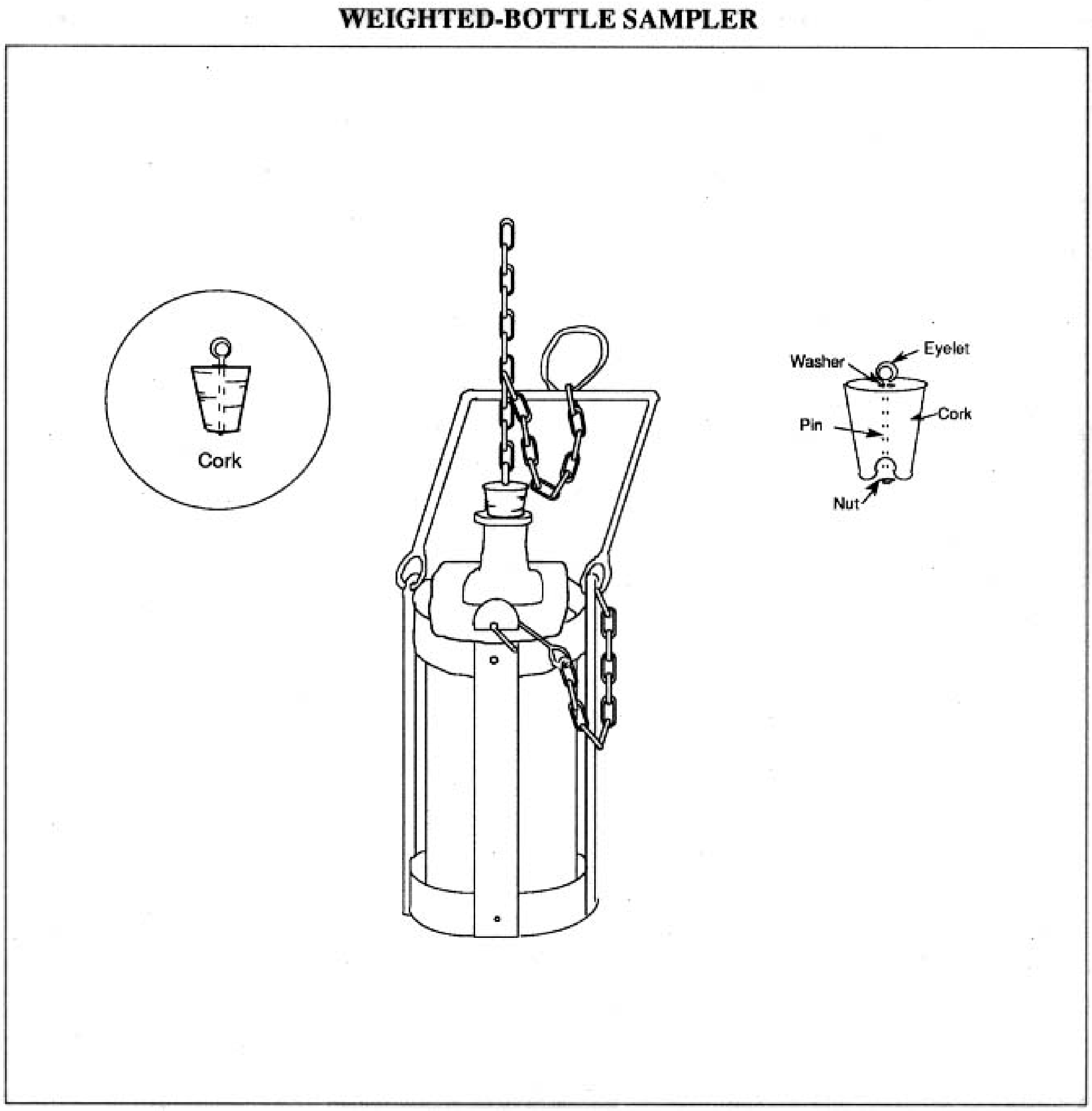


EXHIBIT 16-2
Pond Sampler

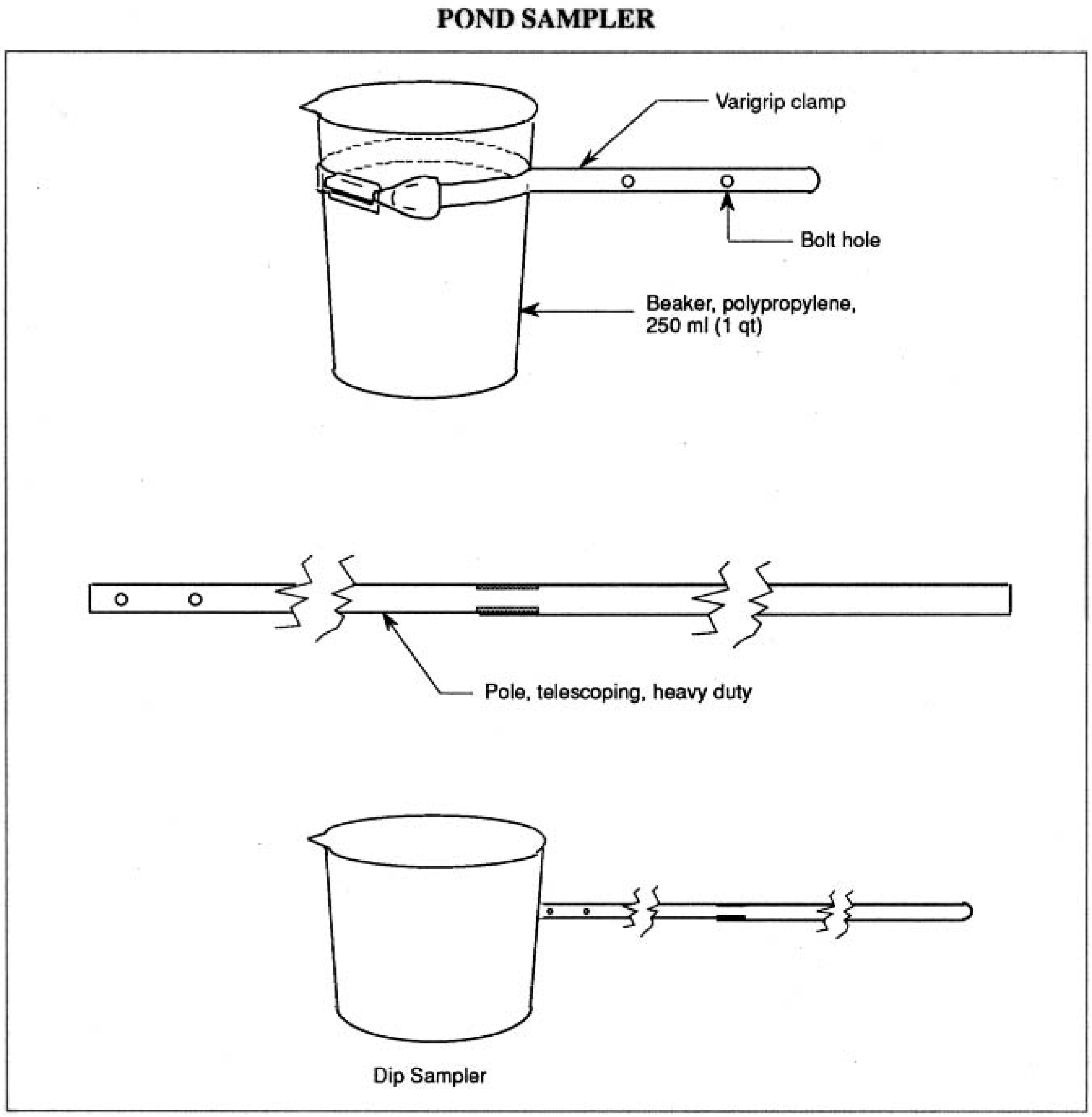


EXHIBIT 16-3
Manual Hand Pump

MANUAL HAND PUMP

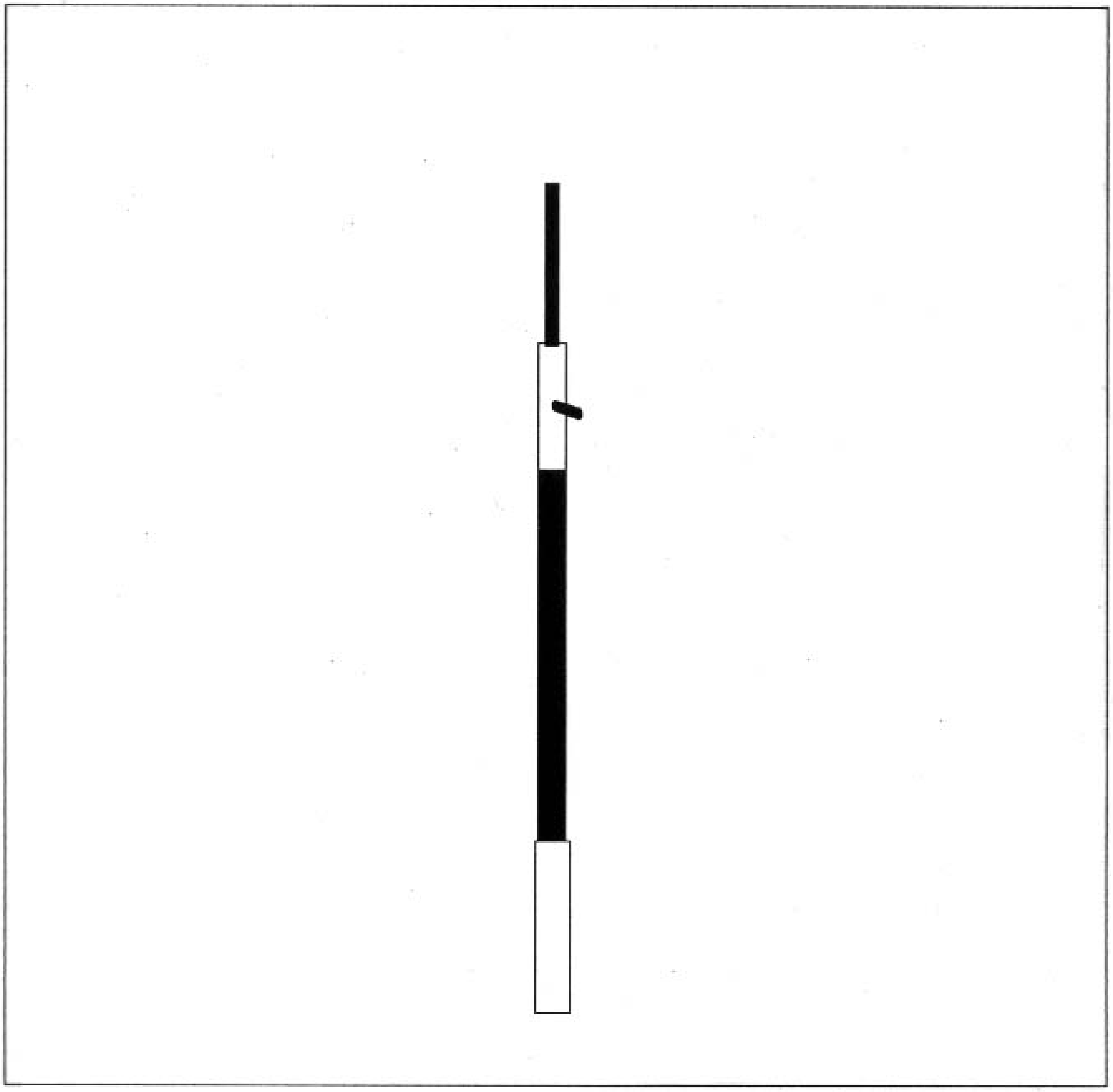


EXHIBIT 16-4
Peristaltic Pump

PERISTALTIC PUMP

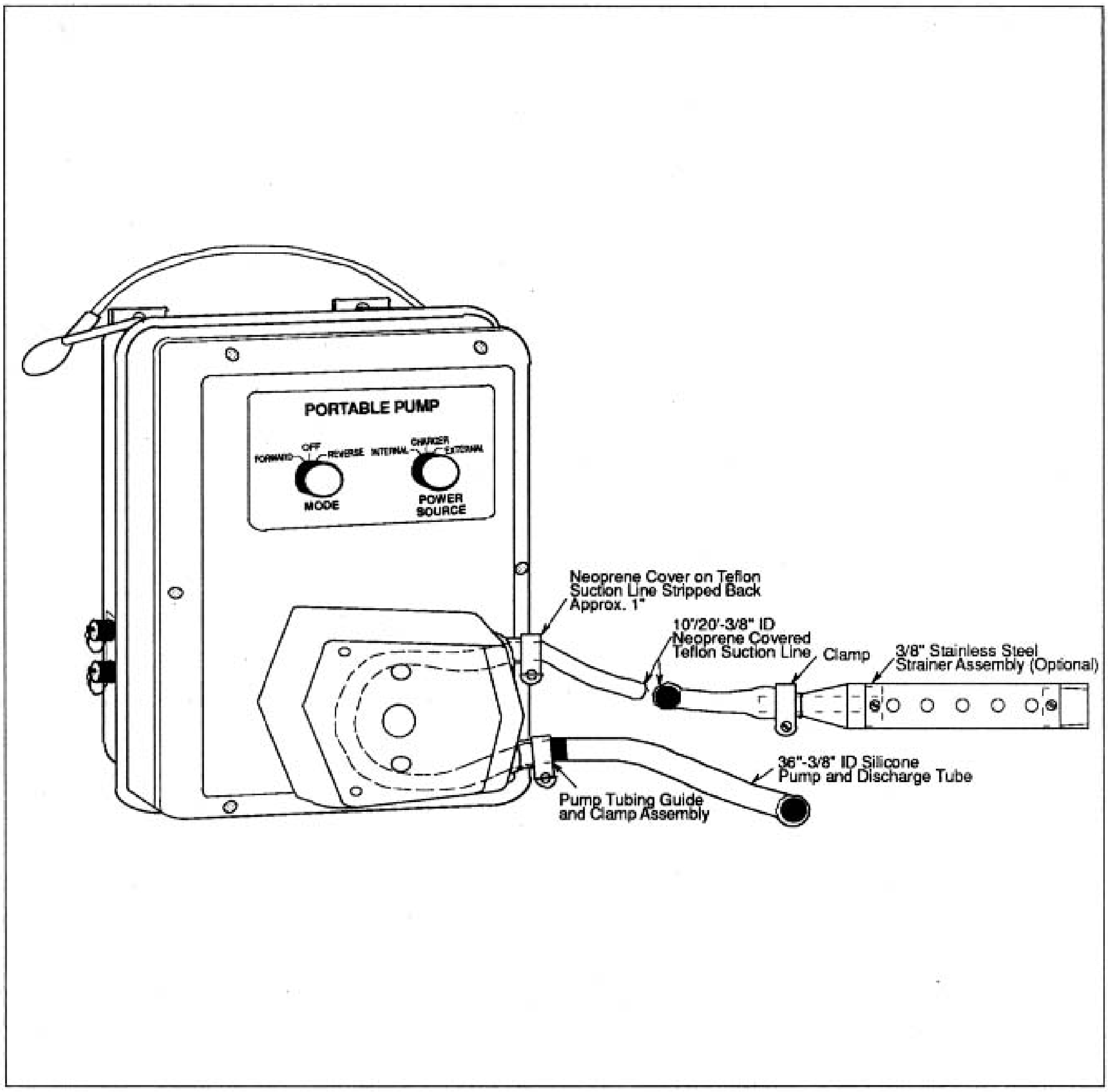


EXHIBIT 16-5
Peristaltic Pump - Modified

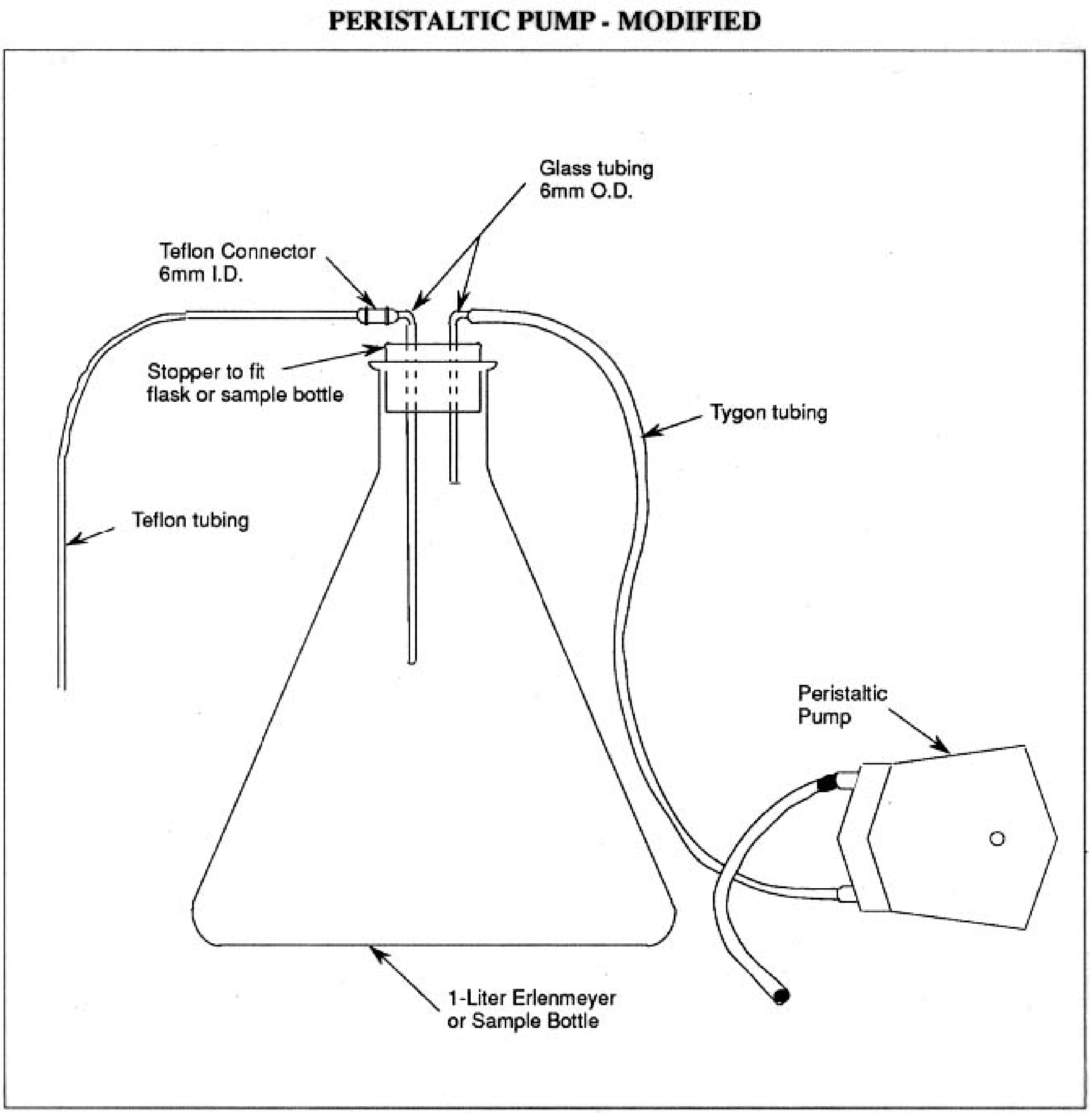


EXHIBIT 16-6
Surface Water Sampling Data

HGL HydroGeoLogic, Inc. Exceeding Expectations

Surface Water Sampling Data

Records Management Data

Project Number	Project Name	Page ____ of _____

Time/Date: ______________________ Elevation: ______________________

Sample No.: ______________________ Weather: ______________________

Location: ______________________ Amb. Temp (°F): ______________________

Sampling Method: ______________________

WATER SAMPLE DATA

Water Temp: ______________________ °C Method of Measurement: ______________________

Specific Conductance: ______________ micromhos Method of Measurement: ______________________

pH: ______________________ Method of Measurement: ______________________

Containers Used (VOA Vial, 1 liter jar, etc.): ______________________

Physical Appearance: ______________________

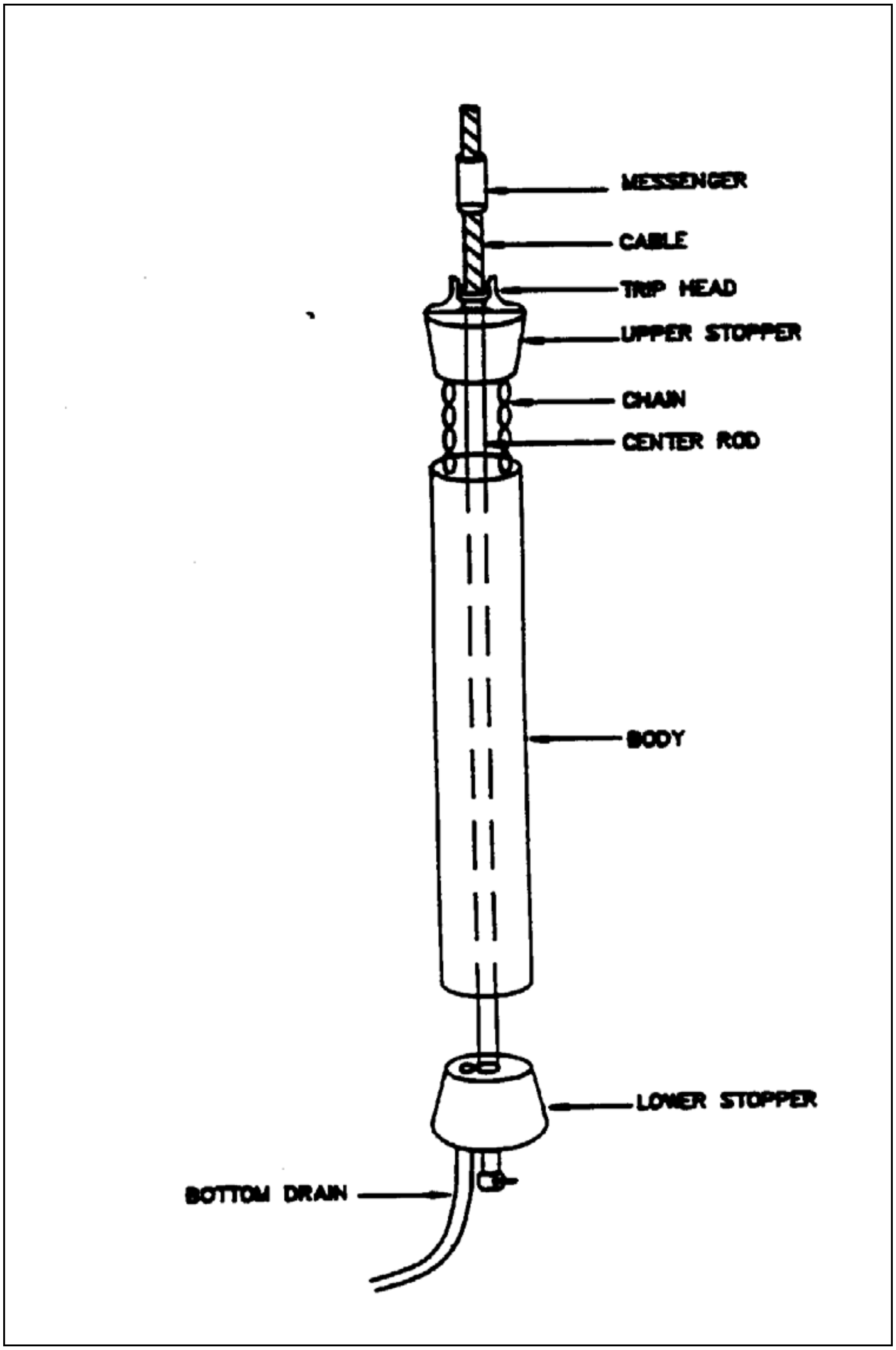
Contamination Observed: ______________________

Remarks: ______________________

Location Sketch

Recorded By:	Date	Checked By:	Date:

EXHIBIT 16-7
Kemmerer Sampler



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SOP 2.23
GROUNDWATER SAMPLING USING PROCEDURES OTHER THAN LOW FLOW
SANTA SUSANA FIELD LABORATORY
VENTURA COUNTY, CALIFORNIA

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to describe the equipment and operations for sampling groundwater monitoring wells. This SOP differs from the one specific to low-flow sampling described in HydoGeoLogic, Inc. (HGL) SOP 2.02: Low-Flow Groundwater Sampling. This SOP outlines methods for well purging, sample collection, and filtration when using bailers, submergible pumps, and bladder pumps.

This SOP provides guidance for routine field operations on environmental projects. Site-specific deviations from the methods presented herein must be approved by the assigned HGL project manager and the HGL Quality Assurance/Quality Control Manager and discussed in the approved project plans.

2.0 DEFINITIONS AND ABBREVIATIONS

2.1 DEFINITIONS

Blank: An artificial sample designed to monitor the introduction of contaminants into a process. For aqueous samples, reagent-grade water is used as a blank matrix.

Field/Ambient Blanks: Blanks used to assess potential contamination resulting from exposure to ambient field conditions.

Rinsate/Equipment Blanks: Blanks prepared in the field from reagent-grade water that has been poured over or passed through the sample collection device after the device has been decontaminated, then collected in a sample container and returned to the laboratory for analysis. Rinsate blanks check the effectiveness of decontamination procedures. Rinsate blanks can also serve as field blanks if they are prepared at the site.

Specific Capacity: The discharge of a well expressed as a rate of yield per unit drawdown.

2.2 ABBREVIATIONS

DO	dissolved oxygen
FID	flame ionization detector
HGL	HydroGeoLogic, Inc.
ORP	oxidation reduction potential
PID	photoionization detector

SOP	standard operating procedure
μm	micrometer ($1x10^{-6}$ meters)

3.0 RESPONSIBILITIES

Sampling personnel are responsible for performing the applicable tasks and procedures outlined herein when conducting work related to environmental projects.

The project manager or an approved designee is responsible for ensuring that performance standards specified by this SOP are achieved. This will be accomplished by reviewing all documents, attachments, and field procedures.

4.0 EQUIPMENT AND PROCEDURES

4.1 GENERAL EQUIPMENT

Monitoring equipment and supplies used during sampling include the following:

- water level indicator
  - electric sounder
  - steel tape
  - transducer
  - reflection sounder
  - air line
- depth sounder
- appropriate keys for well cap locks
- steel brush
- photoionization detector (PID) or flame ionization detector (FID) (whichever is most appropriate)
- logbook
- calculator
- field data sheets
- chain-of-custody forms
- forms and seals
- sample containers
- engineer's rule
- sharp knife (locking blade)
- tool box (including screwdrivers, pliers, hacksaw, hammer, flashlight, adjustable wrench)
- leather work gloves
- appropriate health and safety gear
- 5-gallon pail
- plastic sheeting
- shipping containers

- packing materials
- bolt cutters
- zip-type plastic bags
- containers for evacuation of liquids
- decontamination solutions
- tap water
- non-phosphate soap
- several brushes
- pails or tubs
- aluminum foil
- garden sprayer
- preservatives
- distilled or deionized water
- watch
- multi-parameter probe such as a YSI 556

4.2 ELECTRICAL SUBMERSIBLE PUMP

- pump
- generator (110, 120, or 240 volt) or 12-volt battery if inaccessible to field vehicle
- 1-inch black PVC coil pipe (enough to dedicate to each well)
- hose clamps
- safety cable
- extension cords
- toolbox supplement
    - pipe wrenches
    - wire strippers
    - electrical tape
    - heat shrink wrap
    - hose connectors
    - Teflon tape
- winch or pulley
- gasoline and oil for generator
- flow meter with gate valve
- 1-inch nipples and various plumbing (e.g., pipe connectors)
- check valve mounted to pump

4.3 BLADDER PUMP

- non-gas contact bladder pump
- compressor or nitrogen gas tank
- batteries and charger
- Teflon tubing (enough to dedicate to each well)

- Swagelok fitting
- toolbox supplements (same as submersible pump)

4.4 PERISTALTIC PUMP

- Tubing (enough to dedicate to each well)
- toolbox
- plumbing fittings

4.5 BAILER

- clean decontaminated bailers of appropriate size (disposable single-use is preferred with bottom pour tube attachment.)
- nylon line (enough to dedicate to each well)
- sharp knife
- aluminum foil (to wrap clean bailers)
- 5-gallon bucket

4.6 PROCEDURES

- Read and follow the specific manufacturer's operating instructions before using any equipment.

- Prior to initiating sampling of a groundwater well, check that all equipment to be used is in good operating condition.

- If possible and where applicable, start at those wells that are the least contaminated and proceed to those wells that are the most contaminated.

- Clean all equipment entering the well by methods in accordance with SOP 2.01: Sampling Equipment Cleaning and Decontamination.

- Lay plastic sheeting around the well to prevent contamination of pumps, hoses, or lines with foreign material.

- Remove the casing cap from the well, noting in the logbook the following: personnel, well number, date, and time and weather conditions, as well as any evidence of damage or disturbance to the well. (This information will also be recorded on the groundwater sampling data form, Attachment 2.23-1, Monitoring Well Sampling Data).

- If required by site-specific conditions, monitor the headspace of the well with a PID, an FID, or other appropriate monitoring instrument and record the results in the logbook. (This information will also be recorded on the groundwater sampling data form, Attachment 2.23-1, Monitoring Well Sampling Data.)

- Check the water level as per the following: An interface probe shall be used if a nonconductive floating product layer is suspected in the well. The interface probe shall be used to determine the presence of floating product, if any, prior to measurement of the groundwater level. The groundwater level shall then be measured to the nearest 0.0l foot using an electric water level indicator. Water levels shall be measured from the notch located at the top of the well casing, or designated measuring point, and recorded. If well casings are not notched or no designated measuring point exists, measurements shall be taken from the north edge of the top of the well casing.

  The total depth of the well from the top of the casing shall be determined using an electric sounder and recorded. If the total depth of the well is known, avoid measuring the total depth until after sampling so as not to disturb the water column. . The saturated interval of the screen is the elevation of the bottom of the well screen to the elevation of the water within the screened interval. This is the saturated screened interval to be used in order to determine proper placement of the sampling pump. For wells in which the water column does not extend above the screen, the pump shall be placed in the center of the saturated portion of the screen in order to provide a representative groundwater sample.

  For wells in which the water level is above the screen, the pump shall be placed near the top of the water column and slowly lowered until the pump inlet reaches the elevation of the mid-point of the screen. All water level and total depth measuring devices shall be routinely checked with a tape measure to ensure that measurements are accurate.

- Purge the well as per Section 4.7, Well Purging.

- Sample the well as per Section 4.8, Sampling Procedures.

4.7 WELL PURGING

In order of preference the following equipment shall be used for well purging: peristaltic pumps, bladder pumps, electrical variable speed drive pumps, and bailers.

In order to obtain a representative sample of groundwater from a monitoring well, water that has stagnated and/or thermally stratified within the well casing and filter pack must be purged. This procedure allows representative formation water to enter the well. The preferred method of ensuring representative formation water is to monitor groundwater parameters during purging. A minimum of three well volumes should be removed from the well.

One well purge volume of static water, in gallons, can be calculated by using the following formula:

$$V = T \times F$$

Where: V = Static volume of well in gallons
T = Linear feet of static water in well
F = Factor for volume of a 1-foot section of well casing (gallons). The volume in gallons/feet for common size monitoring wells is as follows:

- 2-inch well = 0.1631
- 3-inch well = 0.3670
- 4-inch well = 0.6524
- 6-inch well = 1.4680

Measure pH, temperature, dissolved oxygen (DO), oxidation reduction potential (ORP), specific conductance, and turbidity at regular volumetric intervals (i.e., 0.5 casing volume or every 15 minutes) during well purging. When these parameters vary less than the following over three consecutive measurements and at least three well volumes have been removed, the well has been adequately purged (stabilized):

- Temperature: ± 0.5 degrees Celsius
- pH: ± 0.1 units
- Specific conductance: ± 3 percent
- DO: ± 10 percent
- ORP: ± 10 millivolts
- turbidity: <10 nephelometric turbidity units or ± 10 percent.

In wells with poor recovery, the well will be purged to near dryness and then allowed to recover prior to sampling. In wells with slow recharge rates, it may be necessary to wait several hours or until the next day to collect the sample. The sample should be collected when the well has recharged to 75 percent of its original volume or within 24 hours, whichever occurs first. In these cases, pH, specific conductance, dissolved oxygen, redox potential, temperature, and turbidity must be monitored during collection of the sample from the recovered volume.

When well water parameters do not stabilize within six purge volumes, then the well should be considered unstablized and can be sampled after six purge volumes have been removed. This phenomenon often occurs when the groundwater is highly contaminated.

Prior to initiating well sampling, record the following groundwater parameters on Attachment 2.23-1, Monitoring Well Sampling Data:

- static water level
- depth of well bottom
- height of water column
- volume of water in borehole
- time

- temperature
- conductivity
- pH
- DO
- ORP
- turbidity
- any other water quality parameters specified in the site plans
- approximate purge flow rate
- visual appearance
- odor

4.8 SAMPLING PROCEDURES

After purging the required volume of water from the well, sample within 2 hours. Do not exceed 2 hours between purging and sampling, except in cases when a slow recharge rate requires more time between well purging and sample collection. To ensure that the groundwater sample is representative of formation water, it is important to minimize the possibility of cross-contamination by performing the following steps:

- Use only Teflon®, stainless steel, or disposable sampling devices that have been decontaminated prior to use.

- Use dedicated sampling equipment. If dedicated sampling equipment is not available, thoroughly decontaminate the equipment prior to any sampling and between sampling events as per SOP 2.01: Sampling Equipment Cleaning and Decontamination. Collect rinsate blanks as outlined in the site plans.

Specify the order in which the samples are to be collected. Transfer the groundwater sample to a sample container in a manner that will minimize agitation and aeration. The sample containers to be used for specific analysis and sample preservation are outlined in the site plans. Samples should immediately be placed in a cool place out of direct sunlight, such as a cooler. The cooler should be kept at an appropriate temperature for preservation requirements for the applicable analyses. Immediately after the sample is collected, record applicable information in the field logbook.

4.9 SAMPLING METHODS

4.9.1 Bailer Method

Collect groundwater samples with a bailer by lowering the bailer into the well using a disposable nylon line. Avoid contacting the ground or any other surface with the decontaminated line and bailer. A plastic sheet can be used as an apron. Lower the bailer into the well in a slow manner to avoid agitation of the water surface, as the impact of the bailer may cause outgassing.

After the desired depth has been reached, raise the bailer to the surface and empty it through the bottom by a clamp valve or sampling tube. Empty the bailer at a slow, controlled rate to minimize sample aeration. After all sample containers have been filled, measure the pH, temperature, DO, ORP, conductivity, and turbidity of a fresh sample of water drawn from the well.. Record applicable information on Attachment 2.23-1, Monitoring Well Sampling Data.

The advantages of using bailers are that they are portable, easily cleaned or disposed of, and do not require an outside power source. The disadvantage to bailer sampling is that this method is slow when large volumes of water are required or when the well is deep.

4.9.2 Bailer Decontamination

Decontaminate bailers prior to use in each well as per SOP 2.01: Sampling Equipment Cleaning and Decontamination. In all cases, the bailer cord should be replaced prior to each sampling. Disposable bailers may be used in place of Teflon® or stainless steel bailers. Disposable bailers do not require decontamination after sampling but should be rinsed prior to use.

4.9.3 Bladder Pump Method

The bladder pump consists of a stainless steel housing that encloses a flexible membrane or bladder made of Teflon®. A screen is attached below the bladder to filter any material that may clog the bladder check valves. The pump may be operated by using an air compressor, compressed air, or compressed nitrogen.

The pump is lowered into the well to the desired depth. The air supply line is attached to the controller, and the discharge line is placed into a suitable receptacle. When collecting samples for analysis of volatile constituents, do not exceed a pumping rate of 100 milliliters/minute. Higher pumping rates may increase the loss of volatile constituents and may cause fluctuations in pH and pH-sensitive analytes. For non-sensitive analysis, higher pumping rates may be used. Do not allow the sampling flow rate to exceed the flow rate used while purging. Place the samples in sample containers as outlined in the site plans. Record applicable sampling information on Attachment 2.23-1, Monitoring Well Sampling Data.

The advantages to using bladder pumps include ease of operation, ability to pump larger volumes of water, and ability to lift the water higher. The disadvantages are that a power source is needed, some loss of volatile constituents is possible, and decontamination is difficult.

4.9.4 Bladder Pump Decontamination

Decontaminate the bladder pump prior to use in each well. Disassemble and inspect the pump prior to cleaning. Decontamination is completed by the methods outlined in the manufacturer's operating instructions for the specific type of bladder pump, and SOP 2.01: Sampling Equipment Cleaning and Decontamination.

4.9.5 Submerged Electrical Pump

An electrical pump should be constructed of stainless steel. Consult the specific manufacturer's operating instructions before operation. The pump is lowered into the well to the desired depth. The purge volume calculations should be determined prior to placing the pump in the well. Purge rates should not cause a drastic drawdown that results in water cascading into the well. When collecting samples for analysis of volatile constituents, do not exceed a pumping rate of 100 milliliters/minute. Higher pumping rates may increase the loss of volatile constituents and may cause fluctuations in pH and pH-sensitive analytes. For non-sensitive analyses, higher pumping rates may be used. Do not allow the sampling flow rate to exceed the flow rate used while purging. Place the samples in sample containers as outlined in the site plans. Record applicable sampling information on Attachment 2.23-1, Monitoring Well Sampling Data.

4.10 CHAIN-OF-CUSTODY

All samples shall be accompanied by an appropriate chain-of-custody form at the time of transfer. The chain-of-custody form should include the sample identification, matrix, date, sample time, and requested analysis. Complete all chain-of-custody documents and record information in the field logbook. (See the appropriate quality assurance project plan for sample custody procedures.)

4.11 SAMPLE LABELING

Fill the appropriate sample containers as specified in the site plans. Identify or label samples carefully and clearly, addressing all the categories or parameters.

4.12 POTABLE WATER SAMPLING

During certain phases of field investigations, it may be necessary to collect samples from existing domestic or municipal water supply systems. These systems shall be sampled in accordance with SOP 2.32: Domestic and Private Well Sampling.

5.0 RECORDS

Documentation generated as a result of this procedure is collected and maintained in accordance with requirements specified in the site plans.

- Document all daily field activities on a daily field activity report in accordance with procedures listed in SOP 4.01: Field Activity Documentation.
- Complete the field logbook in accordance with procedures listed in SOP 4.07: Field Logbook Use and Maintenance.

6.0 REFERENCES

U.S. Environmental Protection Agency, Region 9 Laboratory, 2004. Field Sampling Guidance Document #1220, Groundwater Well Sampling, Revision 1, September.

7.0 ATTACHMENTS

Attachment 2.23-1 Monitoring Well Sampling Data

Attachment 2.23-1
Monitoring Well Sampling Data

HGL HydroGeoLogic Inc. Exceeding Expectations	**Monitoring Well Sampling Data**	Records Management Data

Project Number	Project Name	Page ____ of _____
Well/Borehole Number	Well/Borehole Location	Static Water Level ft

Sample No.: ______________________ Elevation: ______________________
Sampling Method: ______________________ Weather: ______________________
Bar. Pres.: ______________________ Amb. Temp. (°F): ______________________

WATER ELEVATION DATA

1. Depth Water Surface: ______________________ Method of Measurement: ______________
(from casing top as marked)
2. Static Water Level Elevation: ______________ Product obs: ☐ Yes ☐ No
(casing top elevation minus 1)
3. Depth to Well Bottom: ______________________
(from casing top as marked)
4. Height of Water Column (h): ______________ Depth to Product: ______________
(3 minus 1) Method of Measurement: ______________

Volume of water in Well: (x) (h) = ______________ gals
(for 2" x = 0.163 gal/ft for 4" x=0.653 gal/ft)
Amount of Water Removed from Well: ______________
Method of Water Removal: ______________ Was Well Pumped Dry? ☐ Yes ☐ No

WELL PURGE DATA

Method: ____
Date: ______________________ Total Volume/Time: ______________________

Time	Temp °C	Conductivity	pH	Turbidity	Removed	Flow Rate	Observations

WATER SAMPLING DATA

Water Temp: ______________________ °C Method of Measurement:
Specific Conductance: ______________ micromhos Method of Measurement:
pH: ______________________
Containers Used (VOA Vial. 1 liter jar etc.): ______________________
Physical Appearance: ______________________
Remarks: ______________________

Recorded By:	Date	Checked By:	Date:

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SOP 2.33

DATA COLLECTION FOR POINT FEATURES
USING A TRIMBLE PRO XRS UNIT
SANTA SUSANA FIELD LABORATORY
VENTURA COUNTY, CALIFORNIA

1.0 PURPOSE

The purpose of this SOP is to describe the standard method and equipment used to perform data collection using a Trimble Pro XRS global positioning system. The general techniques described in this procedure are in general agreement with the procedures outlined in the 29 Palms Laboratory publication entitled "GPS Data Collection using Trimble for Point Features" (29 Palms Laboratory, 2002).

2.0 SCOPE AND APPLICATION

The following procedures describe the collection of Reference and Environmental longitudinal and latitudinal field data.

These procedures are not intended for tracking and marking a directional route.

2.1 DEFINITIONS

Trimble: A unit used to receive signals from satellites to pin point a location for use on a map.

Global Positioning System: A satellite system used to determine ground position

3.0 SUMMARY OF METHOD

- Complete field reconnaissance.
- Assemble and configure all equipment.
- Plan project.
- Collect data.
- Process data.
- Export data.

4.0 COMMENTS

Using this method, data accuracy is sub-meter and can be better than within 50 cm of actual location. This level of accuracy requires that the following settings be preserved:

- PDOP must be less than 6.
- Five or more satellites must be in view.
- SNR must be greater than 6.
- Elevation mask must be greater than or equal to 15 degrees.

In order to select the best time of day to collect measurements, it is recommended that the almanac be updated regularly (at least monthly). This is done by simply placing the assembled Trimble Receiver pack and logger outside for about ten minutes with the logger turned on. It will record a current almanac from the satellite provider. Refer to section 6.2.2.11 for transferring almanac data to Pathfinder office software during the planning phase.

5.0 APPARATUS

5.1 TRIMBLE PRO XRS DATA COLLECTOR

- GPS Receiver
- Antenna
- Data Logger
- Range poles
- Trimble rechargeable batteries
- Hip pack/ Backpack
- Antenna cable
- Dual battery cable
- TSC1 Power/Data cable
- Trimble Battery Charger
- Assembled GPS unit

5.2 GPS SOFTWARE

- Trimble Asset Surveyor v5.20
- Trimble GPS Pathfinder Office v2.80

5.3 INTERNET ACCESS FOR DIFFERENTIAL CORRECTION DATA

- National Geodetic Survey Cors, Pinon CA http://www.ngs.noaa.gov/cors/corsdata.html
- PKZip software for unzipping differential correction data that are downloaded from the Internet (Section 5.3.1).

5.4 SATELLITE SERVICE PROVIDER FOR REAL-TIME DATA COLLECTION

- Current Omnistar subscription expires on 8/01/03.

- To renew call ASC Scientific 2075 Corte del Nogal, Suite G Carlsbad, CA 92009 Telephone: 760-431-2655

5.5 DATABASE SOFTWARE

- Current software is Oracle 9i
- Interface with ArcSDE from ESRI

6.0 PROCEDURE

6.1 PERFORM FIELD RECONNAISSANCE

- Study site characteristics
  - Identify all features that can potentially be georeferenced using GPS.
  - Identify obstructions that may interfere with data collection.
  - Establish potential order of collecting GPS data from identified features.
- Communicate with all others who will be involved in data collection or processing.
  - Determine which features and attributes must be collected to achieve the desired end result of the project.
  - At least one feature must be collected per project, in addition to a fixed reference point.

6.2 CONFIGURE AND ASSEMBLE GPS EQUIPMENT

Charge Trimble batteries at least one day prior to the anticipated date of data collection.

- Plug the Trimble battery charger into the wall, using the power cord provided by Trimble.
- Insert the batteries into the Trimble battery charger. The batteries should be positioned so that the end with the metal tabs is down. When the batteries are inserted correctly, the small colored light below each battery will turn on.
- The batteries have finished charging when the small colored lights on the battery charger are green.
  - A solid orange light means the batteries are not charged.
  - A flashing orange light indicates a battery that is partially, but not fully, charged.
- Charge the Trimble data logger
  - Connect the data logger to the battery charger.
  - Use the TSC1 Power/Data cable to connect the data logger to the battery charger.
  - Do not unplug the battery charger from the wall outlet.
  - The data logger recharges fully in about three hours.
- Assemble GPS equipment.
  - Connect the range poles.

- Screw one end of the assembled range pole into the base of the Antenna.
- Screw the other end of the range pole to the top of the backpack.
- Secure the GPS Receiver into the backpack main compartment.
- Connect the Antenna Cable (Section 5.1.7) to the GPS Receiver.
- Route the free end of the Antenna Cable to outside the top of the backpack and connect it to the Antenna.
- Insert charged batteries into battery pockets located in the main backpack compartment on each side of the GPS Receiver.
- Connect the dual battery cable to port B of the GPS Receiver using the female pin connector.
- Connect the GPS Receiver to two batteries using battery clips on the dual battery cable.
- Connect the data/receiver connector of the dual battery cable to receiver connector of the TSC1 Power/Data cable.
- Connect the TSC1 Power cable to the Data Logger.
- Test assembled GPS connections
- Turn data logger on.
- After booting up, the data logger should show a message saying "Connecting to GPS."
- Within a minute or two, the number of satellites and PDOP should replace this message.
- During this time the satellites send information to the receiver and update the Almanac within 15 minutes.

• Check and/or adjust Asset Surveyor configuration.
    - Using the arrow keys on the data logger, select Configuration from the main menu.
    - Press the Enter key to scroll through each configuration option and ensure that each option conforms to the needs of the planned data collection.
    - Select GPS Rover option and press Enter.
    - Select Position Filters option and press Enter.
        ▪ Position Mode = Auto2D/3D
        ▪ Elevation Mask = 15°
        ▪ SNR Mask = 6
        ▪ PDOP Mask = 6
        ▪ PDOP Switch = 6
    - Press Esc to return to the GPS Rover menu.

- For real-time differential correction, move arrow down to select Real-time input and press Enter.
- Under Preferred Correction Source, move Up/Down Arrow to Choice 1.
- Press Left/Right Arrow to enter Choice 1 menu.
- Using the Up/Down Arrow, highlight the Integrated satellite option.
- Press Enter.
- Select Use uncorrected GPS option for Choice 2
- Under General real-time settings, set the Correction age limit to 50s.
- For uncorrected GPS measurements, select Use uncorrected GPS for Choice 1.
- Post processing of uncorrected GPA measurements is needed to obtain greater accuracy.
- Data are post-processed with base station files from the National Geodetic Survey website (Section 5.3.1) as described in section 8.
- Select Coordinate system option from Configuration menu and press Enter
  - System= Latitude/Longitude
  - Datum= WGS 1984(World Geodetic Survey of 1984)
  - Altitude units= Meters (m)
- Select Units and display option from and press Enter
  - Distance=Meters
  - Area= Square meters
  - Velocity= Meters/Second
  - Angles= Degrees
  - Angle format= DD°MM'SS.ss''
  - Order= North/East
  - North reference= True
  - Magnetic declination= Auto
  - Press Enter

6.3 PLAN PROJECT

6.3.1 Open GPS Pathfinder Office

Select an existing project or create a new project. When creating a new project folder, set the following parameters:

- Project Name

- The name should indicate title of project, followed by the next sequential project number.
- The next project number can be determined by looking in the GPS Logbook.
- An example of a project name is Irrigation Project.0001.

• Comments, Date and Time are not required since at the time of collection this information will be recorded as determined during the creation of the data dictionary.

• Project Folder
  - All Pathfinder project folders should created be in the directory C:\Pfdata.
  - The folder name is the project name
  - Example project folder: C:\Pfdata\IrrigationProject.0001

• Backup Folder
  - Use default
  - C:\Pfdata\ IrrigationProject.0001\backup

• Export Folder
  - Use default
  - C:\Pfdata\ Irrigation Project.0001\export

• Base File Folder
  - Use default
  - C:\Pfdata\ Irrigation Project.0001\base

6.3.2 Define Units and Coordinate System

In the main menu bar of Pathfinder Office, select the Options:

• Select Units from the drop-down menu

• Confirm appropriate Unit measurements from drop down menus.
  - Distance= meters
  - Area= Square meters
  - Velocity= meters per second
  - Offset= meters
  - Offset distance Format= Horizontal and Vertical Distance
  - Precisions= meters
  - Confidence= 99% Precisions
  - North Reference=True
  - Offset= meters

• 6.3.3.1.3 Left-click OK button to return to main menu window

- Select Coordinate System from Options drop-down menu
- For Select by, left-click next to coordinate system and zone and confirm the following:
  - System= Latitude/Longitude
  - Datum = WGS 1984(World Geodetic Survey of 1984)
  - Altitude units= Meters (m)
- Altitude measure from= Mean Sea Level
  - For the Geoid Model, select other and then choose DMA 10x10(Global) from drop-down menu.
- Left-click Ok button to return to main menu

6.3.3 Create Data Dictionary

In the main menu bar of Pathfinder Office, select the Utilities drop-down menu.

- Select Data Dictionary Editor.
- Create a name for the data dictionary.
  - Name the data dictionary by date of project collection. The name for the data dictionary should comply with the following format: YYYY-MM-DD
    - YYYY = year
    - MM = Month
    - DD = Day
  - Do not include spaces in the file name. The file extension assigned automatically to data dictionary files is .ddf. Example: 2002-18-08.ddf
- Add point features to the data dictionary (A point feature is defined as a physical object or location for which GPS information is to be collected.)
  - Left-click the New Feature button or press F3.
  - Under the Properties tab
  - Name the feature.
  - Define the feature as a point.
  - Left-click on the Default settings tab.
  - Adjust Logging Interval time to 1 second.
  - Adjust Minimum Positions setting to 10.
  - Left-click the OK button.
  - Repeat steps until all desired features have been entered.
- Assign attributes to each feature (An attribute is a piece of descriptive information about the chosen feature).

- Select a feature for which you want to define attributes by left-clicking on the feature name.
- Left-click on the New Attribute button and select one of the following attribute types at a time for each feature:
  - Menu
  - Numeric
  - Text
  - Date
  - Time
- Do not define an attribute as file name or separator.
- Left-click on the Add button.
- Set the following parameters in the New Attribute window for the selected attribute type:
  - Attribute name
  - Comments
  - Length
  - Default
  - Field Entry
  - On Creation
    - Normal
    - Required
    - Not Permitted
  - On Update
    - Normal
    - Required
    - Not Permitted
  - Auto Incrementing
    - No
    - Increment
  - Left-click the OK button
  - To assign additional attributes to the selected feature, repeat step

- To assign attributes to other features, repeat above steps
- From data dictionary main menu bar, left click on the File option and select the Save As option from the dropdown menu.
  - Create new subfolder in the current project folder with the date of data collection as the name of the folder using the following format: YYYY-MM-DD.
  - Press Save to save the data dictionary into the new subfolder.

Print the data dictionary to take out into the field to write notes on as needed and exit the Data Dictionary Editor.

6.4 TRANSFER DATA DICTIONARY TO THE GPS UNIT

6.4.1 Connect the Data Logger to the Computer

- Attach a 9-pin serial cable to the computer port on the battery charger.
- Connect the other end of the serial cable to COM2 serial port on the computer.
- Connect the data logger to the battery charger

6.4.2 Turn On the Data Logger

- After the data logger has finished booting up, press ESC to abort connection attempt to GPS satellites.
- Using the arrow keys on the data logger, select File Manager from the data logger main menu and press the Enter key on the data logger.
  - Select File Transfer and press Enter.
  - In GPS Pathfinder Office, select Utilities from the main menu bar.
    - Select Data Transfer option.
    - Wait for the computer to acknowledge the connection (indicated by a green check icon).
    - Select the Send tab.
    - Left-click the Add button.
    - Select Data Dictionary option from the drop down menu.
    - Browse to find the data dictionary or dictionaries to be transferred.
    - Select the data dictionary or dictionaries to be transferred, and left-click the Open button.
    - Left-click the Transfer All button.

6.5 TRANSFER THE ALMANAC FROM THE GPS TO THE PATHFINDER OFFICE

- Connect the data logger to the computer (Section 6.4.1).
- Turn on the data logger.
- After the data logger has finished booting up, press ESC to abort connection attempt to GPS satellites.
- Using the arrow keys on the data logger, select File Manager from the data logger main menu and press the Enter key on the data logger.
  - Select File Transfer and press Enter.

- In GPS Pathfinder Office, select Utilities from the main menu bar.
  - Select Data Transfer option.
  - Wait for the computer to acknowledge the connection (indicated by a green check icon).
  - Under the Receive tab, left-click the Add button.
  - Select Almanac from the drop-down menu.
  - Left-click the Transfer All button.
  - It will ask whether to replace an already existing almanac or not.
  - Selecting Yes will update the current almanac.

6.6 DETERMINE SATELLITE AVAILABILITY

In GPS Pathfinder Office, select Utilities from the main menu bar.

- From the Utilities drop-down menu, select Quick Plan option.
- Select the date that corresponds with the date of data collection.
- Left-click the OK button.
- Select the city that is closest to the planned site of data collection.
  - For projects that are located in the lower Coachella Valley, the nearest city listed would be Thermal.
  - For projects that are located in the upper Coachella Valley, the nearest city listed would be Palm Springs.
- Left-click the OK button, and a Plan Session window opens.
  - Select the Graphs option from the menu bar of the window.
  - From the Graphs drop-down menu, select Number SVs and PDOP option to reveal a graph of the number of available satellites andPDOP values, which are based on updated Almanac from section (6.3.5.)
    - Bars colored purple and dark blue indicate higher satellite availability.
    - Bars colored green and yellow indicate low satellite availability.
  - The optimal times for collecting data is when PDOP values are less than six (6) and the number of satellites available is equal to or greater than five (5).
  - Data should only be collected during optimal times of day.

6.7 COLLECT GPS DATA

Select a fixed reference point for quality assurance. Collect reference point data prior to going to the data collection sites.

- The selected reference point should have a clear view of the satellites.
- Turn data logger on.
- Wait for data logger to boot up and locate satellites.
- From the data logger main menu, select Data Collection using the Up/Down or Left/Right Arrow keys.
- Press the Enter key.
- From the Data Collection menu, select Create New File, and press Enter.
- From the Create New File menu, use the Up/Down Arrow to highlight the data dictionary option and press the Right Arrow.
- Select the data dictionary that was transferred in above section using the Up/Down Arrow and then press Enter.
- Record the default filename under the first reference point listed on the data dictionary printout.
- Press the Enter key to display the Start Feature menu.
- From the Start Feature menu, select the first reference feature.
- Press the Enter key only after placing the Trimble antenna directly adjacent to the point feature of interest.
- Remain stationary until the configured minimum positions of 10 seconds have been logged.
- Press Enter to save the reference one feature data.
- Press ESC and enter Yes to exit data collection.
- Press the Power button to turn off the data logger.

Travel to data collection sites listed in the data dictionary and collect feature point data at each site.

- At each site, the point feature should have a clear view of the satellites.
- Turn data logger on.
- Wait for data logger to boot up and locate satellites.
- From the data logger main menu, select Data Collection using the Up/Down or Left/Right Arrow keys.
- Press the Enter key.
- From the Data Collection menu, select Create New File, and press Enter.
- From the Create New File menu, use the Up/Down Arrow to highlight the data dictionary option and press the Right Arrow.

- Select the data dictionary that was transferred using the Up/Down Arrow and then press Enter.
  - Record the default filename under the point feature listed on the data dictionary printout.
  - Press the Enter key to display the Start Feature menu.
  - From the Start Feature menu, select the first reference feature.
  - Press the Enter key only after placing the Trimble antenna directly adjacent to the point feature of interest.
  - Remain stationary for at least 10 seconds.
  - Press Enter to save the point feature data.
  - Press ESC and enter Yes to exit data collection.
  - Press the Power button to turn off the data logger.
- Repeat for each feature listed in the data dictionary.
- After collecting data from the last point feature listed in the data dictionary, return to location of the reference point feature and collect new GPS data.

7.0 PROCESS DATA

7.1 TRANSFER DATAFILES FROM DATA LOGGER TO PC

- Connect the data logger to the computer.
- Open GPS Pathfinder Office on the computer.
- Select the same project that the data dictionary was created in.
- Turn on the data logger.
- Press ESC since the data logger is not connected to the receiver.
- On the data logger main menu, select File Manager and press Enter.
- From the File Manager menu, select File Transfer, and press Enter. NOTE: The message "connecting to PC" should be displayed.
- Left-click the Utilities option on the Pathfinder Office main menu bar.
- From the Utilities drop-down menu, select the Data Transfer option and wait for successful connection to the data logger.
- Select the Receive tab in the Data Transfer window.
- Left-click the Add button.
- Select Data File and highlight all data files that were recorded on the data dictionary printout while in the field.

- Left-click the Open button.
- Left-click the Transfer All button.
- Once the file transfer is complete, left-click the OK button to affirm transfer completion.
- Press the Close button to exit the Data Transfer window.

7.2 PERFORM DIFFERENTIAL DATA CORRECTION

- On the Pathfinder Office menu bar, select Utilities.
- Select the Differential Correction option. NOTE: Differential correction may also be run by left-clicking the target or bullseye-shaped symbol on the left hand margin of the Pathfinder window.
- Select the datafiles to be corrected.
- Choose the base files.
  - Choose the base station provider by left-clicking the Internet Search button.
  - Highlight the base station provider nearest to the data collection site. NOTE: Cors in Pinon, CA is the nearest base station provider for the Lower Coachella Valley.
  - If none of the listed base station providers are nearest to the data collection site, update the existing list by left-clicking the New button.
  - From the new provider window, select from current list option and press OK.
  - Highlight the base station that is closest to the data collection site and press OK to return to the new provider window.
  - Press OK to return to the Differential Correction window.
- Assign the Output Folder as the subfolder.
- Ensure that the Smart Code and Carrier Phase Processing button is selected.
- Left-click the OK button to open Confirm Internet Setup window.
- Left-click Yes button to copy files from the Internet.
- When file copy is complete, then the Confirm Selected Base File window is displayed.
- Press OK to return to the Differential Correction window.
- Press OK to differentially correct the datafiles.
- When differential correction is complete, press the more detail button to display the Differential Correction Log in Microsoft Windows Notepad.
  - The log is saved as a text file in the Output folder.
  - Ensure that the uncorrected datafiles with extension .ssf and corrected datafiles with extension .cor have been saved in the assigned Output folder

- Print the Differential Correction Log (See Appendix B for Sample of Differential Correction Log output).

- Choose an Export Setup
  - Select Sample ArcView Shapefile Setup from drop-down menu
  - Select files to export
  - Select Output Folder for where export data will be stored for retrieval.
  - Left-click the Browse button.
  - Navigate to C:GISserver/GISdata/GIS/WGS1984
  - Click ok to return to export window.
  - Left-click Properties button to set up Export parameters.
  - From the six tabs displayed, left-click Data tab.
  - Select Features- Position and Attributes from Type of data box.
  - Retain Export all features form drop-down menu.
  - Left-click Output tab.
  - For Output files, click mouse arrow to fill in circle next to Combine all input and output to project export files.
  - For System file format, select Windows files
  - Left-click Attributes tab
  - Fill in the circle next to Attribute Value from the ‘Export Menu Attributes as’ box to select it.
  - From the General Attributes box, Select each feature type by left-clicking each box next to each feature type.
  - Follow same procedure for Point Feature box
  - Left-click Units tab
  - Select Use Export Units.
    - o Distance=Meters
    - o Area= Square meters
    - o Velocity= Meters/Second
  - Select DD MM SS.sss for Latitude/Longitude Options.
  - Left-click Position filter tab.
  - Select Use Export Units
  - Left-click Coordinate System tab.
  - Select Use current display coordinate system.
  - Choose Export Coordinate as XYZ.

- Left-click OK to return to Export window.
- Left-click OK button to start export process
- Close Export Completed window when it appears.

- Open ArcCatalog and preview shapefile tables that were exported.
- Convert new shapefile to a Geodatabase following Geodatabase SOP

8.0 MAINTENANCE

Store inside Tribal EPA GIS Office when not in use.

- Keep logger and batteries charging while not in use
- Keep Clean
  - Use damp paper towel or cloth to clean logger of dust after each data collection session after logger is turned off and charging.

9.0 REFERENCES

Kennedy, M. and Kopp, S. Understanding Map Projections. Environmental Systems Research Institute, Inc. Redlands, CA. 1994-2000.

Palms Laboratory, 2002. GPS Data Collection using Trimble for Point Features, achells, CA.2

Trimble Mapping Systems: General Reference. Revision A, March 2001

Trimble Product Training: Land Survey/Mapping and GIS Systems, GPS Mapping for GIS with Asset Surveyor: Classroom Manual, Revision B, 1998.

Trimble Pro-XR/XRS Receiver Manual. Revision A, May 1998.

Trimble GPS Pathfinder Office: Getting Started Guide. Version 2.80, Revision A, March 2001.

TSC1 Asset Surveyor: software User Guide. Version 5.20, Revision A, March 2001.

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SOP 4.01

DOCUMENTATION – FIELD ACTIVITY REPORTS

1.0 PURPOSE

The purpose of this SOP is to provide guidance in the preparation of field activity reports. In providing this guidance it is expected that meaningful reports will be written and contribute to the overall effectiveness of our operation.

2.0 DISCUSSION

All HGL projects will require the generation of field activity reports on a daily basis by numerous personnel on site. It is the intent of this SOP to provide some basic items and topics of concern that should be addressed or included in each report.

3.0 PROCEDURES

The following procedure shall serve as a basic guideline in the preparation of a daily field activity report:

- The daily field activities should be recorded on a Daily Field Report form or in a field logbook, as determined by the Project Manager (PM).
- The field activity report for the day should be written no later than that day and, if possible, during several different episodes during the day so that information recorded is as accurately and detailed as possible.
- Typical daily field activities that should be noted include, but should not be limited to, pre-shift worksite inspection, safety meetings and inspections, crew lineout, various work activities being performed that day, any personnel issues or accidents, weather and ground conditions and any communications with the owner or outside inspectors. An end of shift estimation of production accomplished at the various work activities for the day should be recorded here as well.
- All supervisors, managers and professional personnel should submit a daily field report each day in the field.
- Copies of all daily field reports shall be kept on file by the HGL, Inc. (HGL) field activity supervisor.

4.0 ATTACHMENTS

Attachment 1 – Daily Field Report

ATTACHMENT 1
DAILY FIELD REPORT

Name/Initials:	Date:
Start Time:	Project Name:
Stop Time:	Project/Billing No.:
Work Performed (e.g. Wells Sampled):	
Deviations from Schedule:	
Deviations from Approved Plans/Procedures:	
Names of Field Crew (C) / Visitors (V):	
Problems Encountered:	
Comments / Miscellaneous:	

SOP 4.07

USE AND MAINTENANCE OF FIELD LOG BOOKS
SANTA SUSANA FIELD LABORATORY
VENTURA COUNTY, CALIFORNIA

1.0 PURPOSE

The purpose of this procedure is to describe the methods for use and maintenance of field log books. This procedure outlines methods, lists examples for proper data entry into a field log book, and provides the standardized HydroGeoLogic, Inc. (HGL) format.

This procedure provides guidance for routine field operations on environmental projects. Site-specific deviations from the methods presented herein must be approved by the HGL Project Manager and the HGL Quality Assurance Officer.

2.0 DEFINITIONS AND ABBREVIATIONS

2.1 2.1 DEFINITIONS

Not applicable.

2.2 ABBREVIATIONS

HGL	HydroGeoLogic, Inc.
IDW	investigation derived waste
SOP	Standard Operating Procedures

3.0 RESPONSIBILITIES

All field personnel who travel to a site to conduct work related to environmental projects are responsible for documenting field investigation activities in project field log books in a legible manner and maintaining field log books over the course of the project in accordance with this standard operating procedure (SOP). Daily logs will be kept during field activities by the HGL Field Team Leader, or approved designee, to provide daily records of significant events, observations, and measurements taken in the field.

The Project Manager or an approved designee is responsible for checking the field log books and verifying that the field log books have been completed in accordance with this SOP. This will be accomplished by reviewing all documents (Exhibits) and data produced during work performance.

4.0 4.0 PROCEDURE

4.1 INTRODUCTION

Field log books provide a means for recording observations and activities at a site. Field log books are intended to provide sufficient data and observation notes to enable participants to reconstruct events which occurred while performing field activities and to refresh the memory of field personnel while writing reports or giving testimony during legal proceedings. As such, all entries will be as factual, detailed and as descriptive as possible so that a particular situation can be reconstructed without reliance on the collector's memory. Field log books are not intended to be used as the sole source of project or sampling information. A sufficient number of log books will be assigned to a project to ensure that each field team has a log book at all times.

4.2 FIELD LOG BOOK IDENTIFICATION

Field log books shall be bound books with consecutively numbered pages. Log books will be permanently assigned to field personnel for the duration of a project, or sampling event. When not in use, the field log books are to be stored in site project files. If site activities stop for an extended period of time (i.e., two weeks or more), field log books will be stored in the project files in the appropriate HGL office.

The cover of each log book will contain the following information:

- Organization to whom the book is assigned (i.e., HydroGeoLogic, Inc.)
- Project number (if different than site number)
- Book number
- Site name

4.3 LOG BOOK ENTRY PROCEDURE

Every field team will have a log book and each field activity will be recorded in the log book by a designated field team member to provide daily records of significant events, observations, and measurements during field operations. Beginning on the first blank page and extending through as many pages as necessary, the following list provides examples of useful and pertinent information which may be recorded (optional).

- Serial numbers and model numbers for equipment which will be used for the project duration
- Formulas, constants, and example calculations
- Useful phone numbers
- County, state, and site address

Entries into the log book may contain a variety of information. At a minimum, log book entries must include the following information at the beginning of each day:

- Date
- Site name and location and project number
- Start time
- Weather
- All field personnel and subcontractors present and directly involved
- Level of personal protective equipment being used on the site
- Equipment used and calibration procedures followed
- Any field calculations

In addition, information recorded in the field log book during the day will include (but is not limited to) the following:

- Sample description including sample numbers, time, depth, volume, containers, preservative, and media sampled
- Information on field quality control samples (i.e., duplicates)
- Sample courier airbill numbers and associated chains-of-custody
- Observations about site and samples (odors, appearance, etc.)
- Information about any activities, extraneous to sampling activities, that may affect the integrity of the samples
- Any public involvement, visitors, or press interest, comments, or questions; as well as times present at site
- Equipment used on site including time and date of calibration along with calibration gas/fluid lot numbers and expiration dates
- Background levels of each instrument and possible background interferences
- Instrument readings for the borehole, cuttings, or samples in the breathing zone and from the specified depth of the borehole, etc.
- Field parameters (pH, specific conductivity, etc.)
- Unusual observances, irregularities or problems noted on site or with instrumentation used
- Maps or photographs acquired or taken at the sampling site, including photograph number and description
- A description of the investigation derived waste (IDW) generated, the quantity generated, and the manner of IDW storage employed
- Photo Log: subject and persons, distance to subject, person taking photo, distance, direction, time, photo number, noteworthy items
- Forms numbers and any information contained therein used during sampling should be referenced. Note: a form does not take the place of the field logbook

All log book entries will be made in indelible black or blue ink. No erasures are permitted. If an incorrect entry is made, the data will be crossed out with a single strike mark and initialed and dated by the originator. Entries will be organized into easily understandable tables if possible. A sample format is shown in Exhibit 6-2.

All log book pages will be initialed and dated at the top of the page. Times will be recorded next to each entry.

No pages or spaces will be left blank. If the last entry for a day is not at the end of the page, a diagonal line will be drawn through the remaining space and the line will be initialed and dated. Log books can become contaminated when used in the field. Every effort should be made by the field team to avoid contaminating the log book. Log books can be kept in seal top poly bags or temporary plastic covers may be used.

4.4 REVIEW

The Project Leader or an approved designee will check field log books, daily logs, and Exhibits for completeness and accuracy on an appropriate site specific schedule determined by the project leader. Any discrepancies in these documents will be noted and returned to the originator for correction. The reviewer will acknowledge that these review comments have been incorporated by signing and dating the applicable reviewed documents.

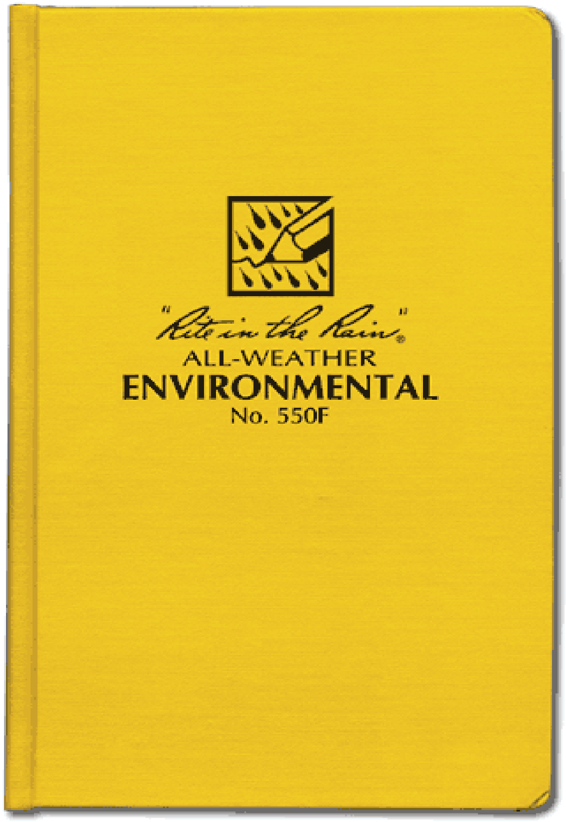
5.0 REFERENCES

Not applicable.

6.0 EXHIBITS

Exhibit 4.07-1 Example Field Log

EXHIBIT 4.07-1
EXAMPLE FIELD LOG BOOK



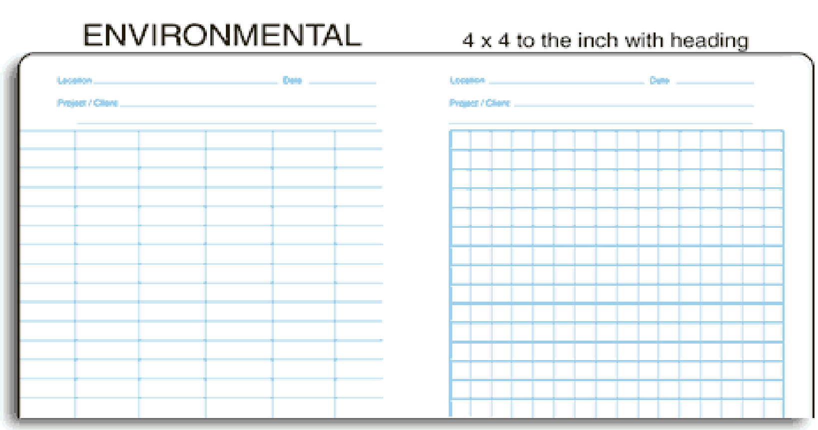
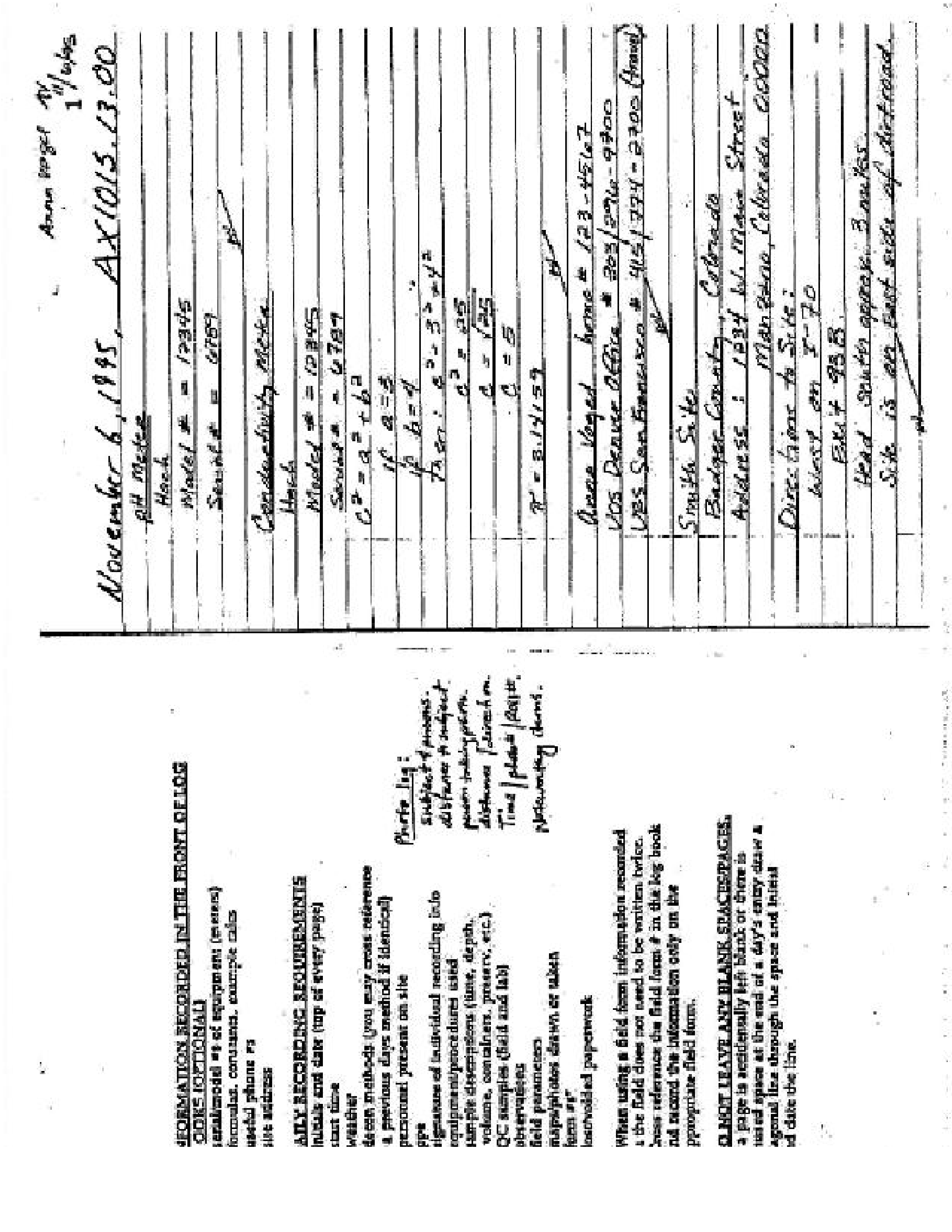


EXHIBIT 4.07-1 (Continued)
EXAMPLE FIELD LOG BOOK



NFORMATION RECORDED IN THE FRONT OF LOG OOKS (OPTIONAL)
serial/model #s of equipment (meters)
formulas, constants, example calcs
useful phone #s
site address

AILY RECORDING REQUIREMENTS
initials and date (top of every page)
start time
weather
decon methods (you may cross reference a previous days method if identical)
personnel present on site
ppe
signature of individual recording info
equipment/procedures used
sample descriptions (time, depth, volume, containers, preserv, etc.)
QC samples (field and lab)
observations
field parameters
maps/photos drawn or taken
form #s
lost/voided paperwork

When using a field form information recorded n the field does not need to be written twice. Cross reference the field form # in the log book nd record the information only on the ppropriate field form.

O NOT LEAVE ANY BLANK SPACES/PAGES. a page is accidentally left blank or there is unused space at the end of a day's entry draw a iagonal line through the space and initial nd date the line.

Photo log:
Subject of photo.
distance to subject
person taking photo.
distance / direction.
Time / photo # / Roll #.
Noteworthy items.

Anna Vogel AV 11/6/95
1

November 6, 1995, AX1015.13.00
pH Meter
Hach
Model # = 12345
Serial # = 6789

Conductivity Meter
Hach
Model # = 12345
Serial # = 6789
$c^2 = a^2 + b^2$
if $a = 3$
if $b = 4$
Then: $c^2 = 3^2 + 4^2$
$c^2 = 25$
$c = \sqrt{25}$
$c = 5$
$\pi = 3.14159$

Anne Vogel home # 123-4567
VOS Denver Office # 303/296-9700
VBS San Francisco # 415/774-2700 (travel)

Smith Site
Badger County, Colorado
Address: 1234 W. Main Street
Manzano, Colorado 00000
Directions to Site:
West on I-70
Exit 93B.
Head south approx. 3 miles.
Site is on East side of dirt road.

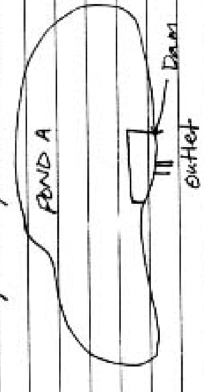
EXHIBIT 4.07-1 (Continued)
EXAMPLE FIELD LOG BOOK

AV 11/6/95
2

November 6, 1995 Site Visit
0700 Arrive on site
Weather: 80°, sunny, slight breeze (~5mph) from southwest.
UOS Field Team: EPA OSC:
M.R. Smith J.P. Scarton
K.W. Wagner
P.R. Lane
PRP representative, L.M. Stein, will be accompanying the UOS Field Team.
Personal Protective Equipment - LEVEL D will be used on-site (refer to site-specific health & safety plan).
All equipment will be deconed as follows:
- Brush equipment scrub-brush to remove gross particulates.
- Scrub thoroughly with Alconox/water solution.
- Rinse with reagent-grade distilled water.
- Rinse with reagent-grade Methanol.
- Rinse with reagent-grade distilled water.
Allow equipment to gravity drain
Wrap equipment in tinfoil if not immediately used.
Sample procedure:
All surface water samples will be taken using a clean decontaminated TEFLON scoop; stainless steel spoon and stainless steel bowl will be used for sediment samples.

AV 11/6/95
3

The samples will be taken from the ponds at the center of the dam opposite the outlets. (see below; refer to sample plan).
All total suspended solids (TSS) samples will be collected in a 500 ml polystyrene bottle - No preservative is necessary.
All VOA samples will be collected in two 40-ml amber glass vials and will be collected first. Preservation will be 4°C (ice).
→ Meters (pH) Decon = Rinse with reagent-grade distilled water.

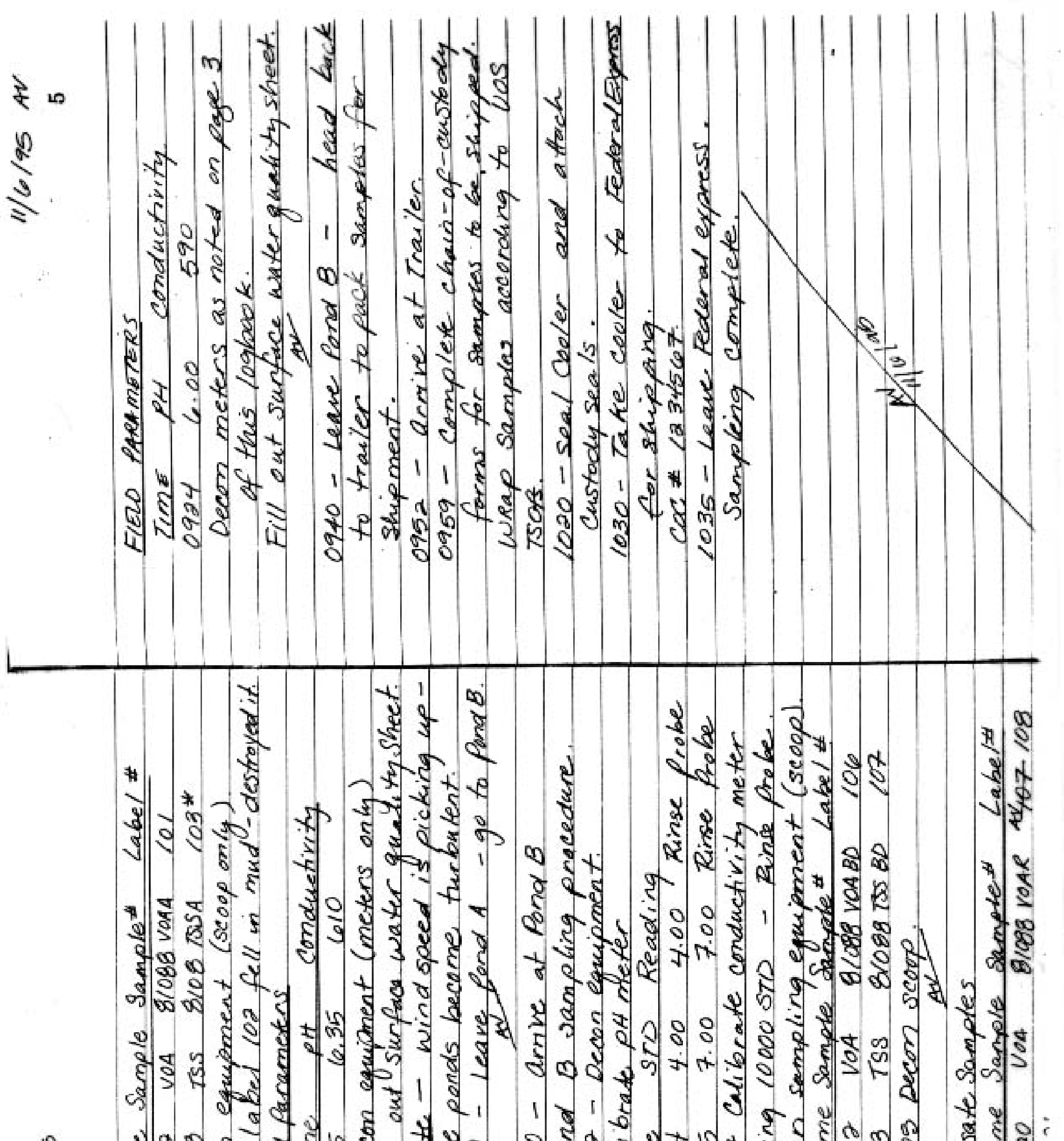


0730: leave trailer. Go to sample location SS-1 @ Pond A.
0745: Arrive @ POND A.
Decon. equipment as described on page 2 of this logbook.
Calibrate pH meter - Rinse probe

Time	STD	Reading	
0753	7.00	7.00	Rinse probe
0754	4.00	4.00	Rinse probe

0756 Calibrate Conductivity Meter using 10000 STD - Rinse probe

EXHIBIT 4.07-1 (Continued)
EXAMPLE FIELD LOG BOOK


AV 11/6/95
4

Time Sample Sample# Label #
0802 VOA 81088 VOAA 101
0803 TSS 8108 TSSA 103*
Decon equipment (scoop only).
*label 102 fell in mud - destroyed it.
Field Parameters
Time pH Conductivity
0815 6.35 610
Decon equipment (meters only)
Fill out surface water quality Sheet.
Note - wind speed is picking up -
The ponds become turbulent.
0829 - Leave Pond A - go to Pond B.
AV
0840 - Arrive at Pond B
Pond B sampling procedure.
0842 - Decon equipment.
Calibrate pH meter
Time STD Reading
0844 4.00 4.00 Rinse Probe
0845 7.00 7.00 Rinse Probe
0847 Calibrate conductivity meter
using 10000 STD - Rinse Probe.
Decon sampling equipment (scoop).
Time Sample Sample# Label #
0902 VOA 81088 VOA BD 106
0903 TSS 81088 TSS BD 107
0905 Decon scoop.
AV
Rinsate Samples
Time Sample Sample# Label#
0920 VOA 81088 VOAR AV 107 108

11/6/95 AV
5

FIELD PARAMETERS
TIME PH Conductivity
0924 6.00 590
Decon meters as noted on page 3
of this logbook.
Fill out surface water quality sheet.
AV
0940 - Leave Pond B - head back
to trailer to pack samples for
Shipment.
0952 - Arrive at Trailer.
0959 - Complete chain-of-custody
forms for samples to be shipped.
Wrap samples according to VOS
TSOP.
1020 - Seal Cooler and attach
Custody seals.
1030 - Take cooler to Federal Express
for shipping.
COC # 1234567.
1035 - Leave Federal express.
Sampling complete.
AV 11/6/95

APPENDIX B

FIELD FORMS

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AH&T INSURANCE
20 South King Street Leesburg, VA 20175 www.ahtins.com
Phone: 703.777.2341 Toll Free: 800.648.4807 Fax: 703.771.1852

AUTOMOBILE ACCIDENT REPORT FORM

- Date of accident: ______________________
- Location: ______________________
- Weather conditions: ______________________

INSURED (YOUR/COMPANY) VEHICLE

- Vehicle Year/Make/Model: ______________________
- Driver name/add/ph: ______________________
- Driver injuries: ______________________
- Passenger name/add/ph: ______________________

Passenger 2 ______________________

Passenger 3 ______________________

- Passenger injuries ______________________
- Witness name/add/ph: ______________________
- Vehicle damage: ______________________
- Vehicle location: ______________________
- Police department: ______________________
- Police Officer: ______________________ Phone ______________________

OTHER VEHICLE 1

- Vehicle Year/Make/Model: ______________________
- Registered owner name/add/ph: ______________________
- Driver name/add/ph: ______________________
- Driver injuries: ______________________
- Number of passengers: __________ Passenger injuries: ______________________
- Vehicle damage: ______________________
- Vehicle towed or driven from scene: ______________________

OTHER VEHICLE 2

- Vehicle Year/Make/Model: ______________________
- Registered owner name/add/ph: ______________________
- Driver name/add/ph: ______________________
- Driver injuries: ______________________
- Number of passengers: __________ Passenger injuries: ______________________
- Vehicle damage: ______________________
- Vehicle towed or driven from scene: ______________________

DESCRIPTION OF ACCIDENT

____

____

____

Revised 2/15/07

HGL
CHANGE REQUEST FORM

Contract/Project:____ Date:__________

Requested by:____

Description of requested change: ____

____

____

____

____

Reason for change: ____

____

____

____

____

Expected results or impact: ____

____

____

____

Submit this form to the project manager immediately.

Required before implementation of major changes:

Approved by:__________________________(Project Manager) Date:_______________

Approved by:__________________________(Title:___________) Date:_______________

____

cc: QA Staff Member

ATTACHMENT 1
DAILY FIELD REPORT

Name/Initials:	Date:
Start Time:	Project Name:
Stop Time:	Project/Billing No.:
Work Performed (e.g. Wells Sampled):	
Deviations from Schedule:	
Deviations from Approved Plans/Procedures:	
Names of Field Crew (C) / Visitors (V):	
Problems Encountered:	
Comments / Miscellaneous:	

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Supplemental Database Information Sheet - Chemical Samples (Fill in Perinent Data)

Field Name	Description	Data
Object_Type	Clasification Type of object sampled or installed (i.e., soil boring, monitoring well, tank, spring, etc.).	
Object_Name	Name of sampling location.	
Object_X	X Coordinate of the location.	
Object_Y	Y Coordinate of the location.	
Survey_X_Y_Units	Feet	
Survey_Datum	Project accepted projection and datum (e.g. California State Plane NAD 27, Zone 5, Feet). Please provide coordinates in the site-specified projection and datum.	
Sample_Name	Sample Name/ID	
Parent_Sample_Name	Required for duplicate and split samples. The primary sample that the split of duplicate is associated with.	
Sample_Name_Alias	Alternative sample name	
Collection_Date	Sample Collection date and time.	
Matrix_Type	Sample Matrix/Media	
Sample_Type	Indicates if the sample is a Primary Sample, Field Duplicate, Split Sample, etc	
Sample_Top_Depth	Indicates the top depth at which the sample was collected. Does not need to be populated for locations with fixed screens (e.g. monitoring wells).	
Sample_Bottom_Depth	Indicates the bottom depth at which the sample was collected. Does not need to be populated for locations with fixed screens (e.g. monitoring wells).	
Depth_Units	Must be completed if Depths information is filled in. Feet.	
Geological_Unit	Geological Unit in which the sample was collected.	

Supplemental Database Information Sheet - Water Levels (Fill in Perinent Data)

Field Name	Description	Data
Object_Name	Name of object location.	
Object_Type	Clasification Type of object sampled or installed (i.e., soil boring, monitoring well, tank, spring, etc.).	
Object_X	X Coordinate of the location.	
Object_Y	Y Coordinate of the location.	
Survey_X_Y_Units	Feet	
Survey_Datum	Project accepted projection and datum (e.g. California State Plane NAD 83, Zone 5, Feet). Please provide coordinates in the site-specified projection and datum.	
Top_Of_Casing_Z	The measuring point elevation, in feet msl, for the object.	
Monitoring_Date	Date of the measurement	
Monitoring_Event	Measurement event	
Depth_to_GW	Depth to groundwater from the Top of Casing Z	
Parameter_Units	Depth to GW unit	
Water_Level_Elevation	Water level elevation.	
WLE_Units	Water level elevation unit.	
Monitoring_Qualifier	Qualifier for measurement	
Remark	Comments pertaining to the measurement.	

CHAIN OF CUSTODY RECORD

HGL HydroGeoLogic, Inc
Northway 10 Executive Park
313 Ushers Road
Ballston Lake, NY 12019

Client: ______
Project Name/No.: ______
Project Manager: ______
Sampler: ______
Phone: (518) 877-0390 Fax: (518) 877-0414

APPLICABLE REGULATION
- ☐ RCRA
- ☐ ECRA
- ☐ CERCLA
- ☐ NPDES
- ☐ CWA
- ☐ SDWA
- ☐ OTHER

SAMPLE IDENTIFICATION	DATE COLL.	TIME COLL.	GRAB	COMPOSITE	MATRIX: SOIL	MATRIX: WATER	MATRIX: OTHER	TOTAL NO. OF CONTAINERS	ANALYSIS REQUIRED								REMARKS OR SAMPLE LOCATION

Special Instructions

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal
☐ Return to Client ☐ Disposal by Lab ☐ Archive for ______ Months

Turn Around Time Required ☐ Normal ☐ Rush

QC Level ☐ I. ☐ II. ☐ III.

Project Specific (specify)

1. Relinquished by	Date	Time	1. Received by	Date	Time
2. Relinquished by	Date	Time	2. Received by	Date	Time
3. Relinquished by	Date	Time	3. Received by	Date	Time

Comments

HGL
HydroGeoLogic, Inc
Exceeding Expectations

SITE SAFETY BRIEFING FORM

Project ______________________ **Location** ______________________
Date ______________________ **Time** ______________________
Type of Work ______________________

SAFETY TOPICS PRESENTED

Protective Clothing/Equipment ______________________
____

Chemical Hazards ______________________
____

Physical Hazards ______________________
____

Biological Hazards ______________________
____

Emergency Procedures Refer to Site Safety and Health Plan ______________________

Hospital/Clinic ______________________ **Phone** ______________________
Hospital Address ______________________
Special Equipment ______________________
Other ______________________
____

ATTENDEES

Name (Printed)	**Signature**

Meeting Conducted by: ______________________

Site Safety Officer: ______________________

WASTE INVENTORY TRACKING FORM

LOCATION : ____

PROJECT NAME:____

ACTIVITIES: ____

Date Waste Generated	Activity Generating Waste (borehole # / well #)	Description of Waste	Field Evidence of Contamination	Estimated Volume	Type of Container (storage ID#)	Location of Container	Waste Characterization	Comments

Note: Describe whether soil or water samples have been collected for waste characterization, include date, if known.

Signature: ____

MONITOR WELL STATIC WATER LEVEL FORM

PROJECT NAME: ____________________________ DATE: __________________

WATER LEVEL INDICATOR ID # ____________ FIELD BOOK # ___________

LOCATION: ________________________________ PAGE # _________________

Monitor Well Number	Total Well Depth	Well Screen Length	Measuring Point Elev.	Time	Depth to Static Water Level	Sounding	Explosimeter Reading (above background)	PID Reading (above background)

Note: Total well depth to be measured at time of gauging.

Comments: ____

____

____

Sampler ______________________________ Observer ______________________________

ATTACHMENT 1

Page __ of __

GROUNDWATER FIELD SAMPLING DATA SHEET

Well No.:		Site:	
Sampler(s):		Project No.:	
Well Depth:		Date:	Time:
DTW (ft):	DTP (ft):	Courier: ___UPS ___Hand ___Other	
MP Ht. Above/Below Ground Surface:		Sampling Method (G=grab, B=bailer, SP=submersible pump	
Condition of Bottom of Well:		Type of Pump:	
Screen Interval (ft):		Weather (sun/clear, overcast/rain, wind direction, ambient temperature):	
Well Diameter (in):			
Placement of Pump (ft):			

TIME	DEPTH TO WATER (FT)	FLOW RATE (GPM)	TOTAL VOLUME (GAL)	PH	TEMP. (ºC)	COND. (UMHOS/ CM)	ORP	D.O. (MG/L)	TURB (N.T.U.)	COMMENTS

OBSERVATIONS

Color: Clear Other (describe):
Odor: None Low Medium High Very strong H2S Fuel-like
Notes:
PURGE VOLUME CALCULATIONS For: well casing volume = J $(Rc)^2$ (well depth - static H_2O depth) x (conversion 7.48 gal/ft3)
Signed/Sampler(s):

ATTACHMENT 2
CALIBRATION LOG

Page __ of ____

Project Name:______________________________

Project No.______________________________

Date/Time	Calibrated by	Instrument	Standard/ Manufacturer Lot #	Standard Concentration	Instrument Reading	Comments

HGL INCIDENT REPORT/ANALYSIS FORM

This report is for (check **ALL** that apply):
☐**close call** **OR**
☐employee injury/illness (reportable) **OR** ☐employee injury/illness (non-reportable) **OR** ☐damage to company equipment/ property/ vehicle
☐Third Party(private individual/contractor/client) injury/ illness **OR** **THEIR** ☐equipment/property/vehicle

If this incident involves off-site medical care or equipment damage >$1000, notify the Forensics Manager, Director of Engineering, or Director of Construction (whoever is responsible for the project/employee where the incident occurred) immediately.

SECTION 1. General Information (MUST be completed for EVERY incident – close calls and Third Party omit line 3)		
Date of Occurrence	**Time (am/pm)**	**Shift** ☐1st ☐2nd ☐3rd
Specific location of incident (e.g. bottom of excavation, office trailer, cab of haul truck, No. 203 monitoring well, etc.)		
HGL Employee Name: **HGL Job Title:** **HGL Employee Status** ☐ full time ☐ part time ☐ temporary ☐**Male** ☐**Female** **Time on Present Job:**		
Third Party -Company Name:		
Specific task or activity involved (e.g. opening wells, driving forklift, sampling soil, erecting scaffold, washing trucks, etc.)		
Was employee involved working extended hours? (In excess of 8 hrs/day or 40 hrs/week) ☐Yes ☐No **Has employee performed the task before?** ☐Yes ☐No		
Description of incident or close call: Describe incident/close call in DETAIL. Include who, what, when where, and how. If close call, specify injury/damage avoided. List type and manufacturer of PPE individual was wearing (e.g. hearing protection, goggles, fall protection, etc.). Include names of witnesses if any. Attach additional sheets if necessary.		

SECTION 2. Description of Injury or Illness (MUST be completed for EVERY injury or illness NOT close calls)	
Specific body parts affected: (e.g. right leg, left eye, back of the head, right index finger, etc.)	
Type of injury (List all that apply): ☐fatality ☐muscle strain ☐joint strain ☐bruise/contusion ☐fracture ☐laceration, puncture ☐concussion ☐dismemberment ☐unconsciousness ☐loss of senses ☐thermal burn ☐chemical burn ☐electrical burn ☐electrical shock ☐foreign object in eye ☐other (specify)	
Type of Illness: ☐skin ☐respiratory ☐eye ☐heat stress ☐hypothermia ☐CNS ☐cardiovascular ☐systemic (liver, kidney, etc,) ☐hearing loss ☐other (specify)	
What caused the injury or illness (check all that apply): ☐fall on same level ☐fall from higher elevation ☐struck by ☐struck against ☐caught in, under, between ☐slip, trip ☐abraded ☐over extension ☐contact with electrical current ☐contact with temperature extremes ☐contact with plant, animal, insect ☐contact with material ☐inhalation of material ☐other (specify):	
Method of Treatment: ☐none ☐on-site 1st aid ☐clinic/doctor 1st aid ☐doctor's care ☐hospitalization (Attach HGL *Medical Assessment/Work Capacity Report*)	
Is injury covered by Workers' Compensation? ☐Yes ☐No	**Is the injury OSHA recordable?** ☐Yes ☐No
Will injury result in restricted activity? ☐Yes ☐No	**Will injury result in a lost workday?** ☐Yes ☐No

SECTION 3. Description of Equipment/Property/Vehicle Damage (MUST be completed for ALL damage)			
Whose equipment/ property/ vehicle was damaged?	☐company	☐individual/contractor/client	
Extent of damage:	☐minor - usable as is	☐repairable	☐destroyed
Estimated cost of repair/ replacement:			

Describe the property damage:

☐heavy equipment ______________________________

☐process equipment ______________________________

☐tools ______________________________

☐vehicle ______________________________

☐building/structure ______________________________

☐utility ______________________________

☐other ______________________________

SECTION 4. Corrective Actions (MUST be completed for all injury, illness, equipment damage incidents)

How could this incident have been avoided: e.g. change in procedures, different equipment, and additional workers?

SECTION 5. Estimated Cost of Incident
(to be completed by Regional Manager for all injuries requiring medical care or equipment damage)

What is the TOTAL cost of this incident?

☐Medical (1st aid, emergency room, hospitalization, follow-up, rehab, etc.)	$
☐Equipment/Property/Vehicle (repair, replacement, rental)	$
☐Process (loss of product, down time, quality reduction, efficiency, etc.)	$
☐Personnel (coworkers, supervisor, replacement employee, manager, etc.)	$
☐Indirect (calculate increases in insurance, travel costs, regulatory fines, etc.)	$
☐Indirect (apply multiplier _____)	$
☐Other (specify)	$
TOTAL COST	**$**

SECTION 6. Corrective Actions Taken

SECTION 7. Signatures

Supervisor (print):	**Signature:**	**Date:**
Employee (print):	**Signature:**	**Date:**
Witness (print):	**Signature:**	**Date:**
Witness (print):	**Signature:**	**Date:**

EXHIBIT 16-6
Surface Water Sampling Data

HGL HydroGeoLogic, Inc. Exceeding Expectations

Surface Water Sampling Data

Records Management Data

Project Number	Project Name	Page
		____ of _____

Time/Date: ______________________ Elevation: ______________________

Sample No.: ______________________ Weather: ______________________

Location: ______________________ Amb. Temp (°F): ______________________

Sampling Method: ______________________

WATER SAMPLE DATA

Water Temp: ______________________ °C Method of Measurement: ______________________

Specific Conductance: ______________ micromhos Method of Measurement: ______________________

pH: ______________________ Method of Measurement: ______________________

Containers Used (VOA Vial, 1 liter jar, etc.): ______________________

Physical Appearance: ______________________

Contamination Observed: ______________________

Remarks: ______________________

Location Sketch

Recorded By:	Date	Checked By:	Date:

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APPENDIX C

RESPONSES TO COMMENTS RECEIVED ON DRAFT FINAL FIELD SAMPLING PLAN DATED APRIL 2010

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Responses to Draft Final Comments Groundwater, Surface Water, and Sediment FSP dated April 2010			
No.	**Reference or Page**	**Comment**	**Response**
1	General	Three key differences in the approach described in the Area IV FSP with regard to the sampling program described in the SSFL SW WQSAP were identified: 1. The purging and sampling equipment and methodologies described in the Area IV FSP are different than those proposed in the SSFL SW WQSAP, as discussed in prior meetings with EPA and DTSC. 2. The Area IV FSP indicates sampling in up to 70 wells in the vicinity of SSFL Area IV compared to approximately 30 in the SSFL SW WQSAP. 3. The filtering and analysis for radiochemical samples Area IV FSP is different than that indicated in the SSFL SW WQSAP. We recommend that these and other coordination issues be discussed in a meeting and clarified. Each issue is described in further detail below.	Comments acknowledged.
2	Coordination with Boeing	Any retrofit to wellhead or down-hole equipment (even temporarily) must be approved by Boeing and DTSC prior to any field sampling event.	Comments acknowledged.
3	General	The purging equipment and method at individual wells are not assigned in the Area IV FSP; therefore, they are not contrasted with those proposed in SSFL SW WQSAP on a well-by-well basis.	EPA will provide a table showing the locations in the sampling program to Boeing.

Responses to Draft Final Comments Groundwater, Surface Water, and Sediment FSP dated April 2010			
No.	**Reference or Page**	**Comment**	**Response**
4	SOP 2.02	The Area IV FSP indicates a minimum and maximum flow rate for low-flow purging of 200 milliliters per minute (ml/min) and 500, respectively. The SSFL SW WQSAP minimum flow rate for low-flow purging is that needed to "induce drawdown". Note that a minimum flow rate of 50 ml/min is required to conduct VOC sampling. The maximum flow rate is determined as less than the rate that would induce greater than 0.3 feet of drawdown in a well. It has been SSFL's experience that many shallow wells and piezometers at SSFL will not sustain a 200 ml/min flow rate.	The 200ml to 500ml flow rate in the FSP text is given as a general description. In the first paragraph of Section 4.6.2.2.1 there is a reference to SOP 2.02 which provides a detailed description of the Low-flow sampling procedures that will be used. In SOP 2.02, Section 4.2, the following is stated, "For wells known to have a less than a 0.2 lpm flow rate, a flow rate of 0.05 to 0.2 lpm should be attempted." It is understood that there are numerous shallow wells in Area IV that cannot be purged at >200 ml/min.
5	SOP 2.02	The Area IV FSP presents multiple alternative purging methodologies to account for exceptions to the general low-flow stabilization criteria when encountered. These exceptions differ somewhat in individual sections of the Area IV FSP and may benefit from standardization or clarification. For example, instructions are provided for when to sample a well if it has been purged dry using low-flow methods in SOP 2.02; on the following page it is indicated that wells shall under no circumstances be purged to dryness.	The text: "Under no circumstances should the well be pumped dry" has been deleted from SOP 2.02. The text on page 2.02-5 has been changed to read: "If under these minimal pumping conditions drawdown continues then the low-flow technique is assumed to be invalid and should be discontinued because groundwater flow to the pump is no longer considered to be laminar across the screen within the aquifer. The flow in the vicinity of the pump now contains a vertical component from the stagnant water column in the filter pack and screened casing. In these cases procedures for sampling will be changed to those described in SOP 2.23 (Groundwater Sampling using Procedures other than Low Flow). This information should be noted in the field notebook or ground-water sampling log."

Responses to Draft Final Comments Groundwater, Surface Water, and Sediment FSP dated April 2010			
No.	**Reference or Page**	**Comment**	**Response**
6	SOP 2.02	The Area IV FSP indicates temperature as a stabilization criterion for low-flow sampling. The SSFL SW WQSAP indicates temperature will be recorded, but not used for parameter stabilization determination. The SSFL SW WQSAP is consistent with EPA Low-Flow guidance (Low-Flow (Minimal Drawdown) Groundwater Sampling Procedures by Robert W. Puls and Michael J. Barcelona, 1996) which does not include temperature criteria for determining stabilization prior to sampling.	Temperature has been removed as a stabilization criteria in SOP 2.02
7	General	The Area IV FSP includes sampling of all available wells in Area IV and up to 20 wells off-site to the north and northwest, for a total of approximately 70 wells. The SSFL SW WQSAP includes sampling of approximately 30 wells in Area IV, and in the undeveloped land and off-site west and north of Area IV.	Discussions of off-site well sampling have been removed from this Phase I FSP. The Phase I FSP indicates that up to 70 on-site monitoring wells will be sampled.
8	V	Change The Boeing Corporation to The Boeing Company	The text has been changed as requested.

Responses to Draft Final Comments Groundwater, Surface Water, and Sediment FSP dated April 2010			
No.	**Reference or Page**	**Comment**	**Response**
9	1-2	Both the media and the lab analysis protocols are identical for sediment and soil. Why is sediment included in the water sampling program and not included in the soil sampling program. Will sufficient background sediment samples be split in the DTSC chemical background study to establish a statistically valid sediment background data-set and to enable meaningful comparisons to the on-site sediment samples. The distinction between Phase I and Phase II is not clear.	The objectives for the groundwater, surface water and sediment study are different from the soil study in that they are primarily to confirm (or not) prior data. If data is collected that indicates that that sediment is contaminated, we will need to determine how to allocate remaining samples (see below for discussion of phase II). In addition, at that point, soil results may be available as well so that we can better determine where to locate additional samples. EPA has said that it will consider collecting background sediment samples along-side DTSC when they conduct their field work for their chemical background study. Phase II sampling is intended to allow for additional data collection at deposition locations both up and down gradient of the Phase I sample locations. The Phase II FSP will be issued to address the Phase II activities which will be available for Stakeholder input prior to being finalized.
10	2-2	The SDF was not a "nuclear facility " A "nuclear facility" is a nuclear reactor, or non-reactor facility in which special nuclear (fissionable) material is used, processed or stored in such quantities as to require criticality controls. The presence of environmental radiological contamination (as in the case of the SDF) does not make it a "nuclear facility.	The text has been changed to read: "Other operations that handled radiological material within Area IV included the Radioactive Materials Disposal Facility and the Hot Laboratory, as well as the Sodium Disposal Facility, or Area IV burn pit."

Responses to Draft Final Comments Groundwater, Surface Water, and Sediment FSP dated April 2010			
No.	**Reference or Page**	**Comment**	**Response**
11	2-3	Gross alpha and beta analyses are done as screening analysis. Be more specific about what can be subtracted (e.g. uranium and radon from gross alpha and K-40 from gross beta).	The text has been changed as follows: "Gross alpha and gross beta analyses are used to measure alpha and beta emissions. These can be used to infer that radionuclides may be present in addition to those radionuclides measured using different analytical methods. As an example, many beta emitting radionuclides also emit gamma radiation, therefore those beta-emitting radionuclides measured via gamma spectrometry and specific methods (e.g. Sr-90, H-3, etc.) can be summed and compared to the gross beta result or a particular sample. If the gross beta result is significantly greater than the summed value, then it is possible that the sample contains beta activity from a radionuclide which had not been measured or detected. Gross alpha data can be similarly inspected. The gross results can be compared to the Federal maximum contaminant level (MCL) for gross alpha activity (15 pCi/L) or the California MCL of 50 pCi/L for gross beta activity. The Federal gross alpha MCL excludes uranium and radon so activities associated with these radionuclides should be used to calculate and adjusted gross alpha value for comparison to the MCL. Similarly, naturally occurring potassium-40 activity should be subtracted from gross beta activity to provide a value to compare to the MCL."

Responses to Draft Final Comments Groundwater, Surface Water, and Sediment FSP dated April 2010			
No.	**Reference or Page**	**Comment**	**Response**
12	3-2	The distinction between Phase I and Phase II is unclear.	The revised FSP now includes one round of groundwater sampling in July 2010 during the dry season. The Phase II FSP will describe the second event in the wet season. The need and frequency of subsequent sampling events will be based on evaluation of the analytical results from these two events. As determined the rationale for subsequent rounds of sampling will be incorporated by addendum.
13	Table 2-1	Why TBD?	Tritium will be analyzed as described in the text of the FSP. This error has been corrected.
14	Figure 2.2	Acrobat 9 Pro reported an error on this page.	Error will be corrected in the final document.
15	2.01-3	So what are the options? Is there one method for cesium-137 and one method for strontium-90?	There are no differences. The referenced text will be deleted.
16	2.01-7	So you have listed some potential issues. What are the solutions and controls?	Activity hazard analysis (AHA) forms that identify potential health and safety hazards associated with each major task associated with this project are provided in Appendix B of the Site Safety and Health Plan. No potential hazards like those identified in this section have been identified in the AHA for decontamination. A sentence will be added to the end of this section that indicates: "Workers shall read the activity hazard analyses provided in the Site Safety Plans prior to starting work. These analyses will identify hazards and protective measures for site personnel."
17	2.16-15	Does EPA plan to sample the groundwater in the 56 hole.	EPA will acquire one surface water and one sediment sample from the Building 4056 excavation pond. The FSP will be revised accordingly.

Responses to Draft Final Comments Groundwater, Surface Water, and Sediment FSP dated April 2010			
No.	**Reference or Page**	**Comment**	**Response**
18		The report also states that sediment samples will be used to further characterize the extent of radionuclides of concern but it does not provide any details about what such further characterization might entail.	The objectives for the groundwater, surface water and sediment study are different from the soil study in that they are primarily to confirm (or not) prior data. If data is collected that indicates that that sediment is contaminated, we will need to determine how to allocate remaining samples (see below for discussion of phase II). In addition, at that point, soil results may be available as well so that we can better determine where to locate additional samples. EPA has said that it will consider collecting background sediment samples along-side DTSC when they conduct their field work for their chemical background study. Phase II sampling is intended to allow for additional data collection at deposition locations both up and down gradient of the Phase I sample locations. An addendum to the FSP will be issued to address the Phase II activities which will be available for Stakeholder input prior to being finalized.
19	4.07-1	Repeated SOP.	Duplicate SOP was removed.
20	Page 1-2	One or two rounds of groundwater sampling appears inadequate to provide representative data. Although this relates in part to subsequent sampling, it impacts the initial round. We are troubled by the change in plans to merely take two rounds of on-site groundwater samples. We had understood that there would be quarterly EPA measurements from the 2nd quarter of 2010 (we had hoped for it to start earlier) through the end of the study. Given the potential for variability, quarterly sampling so that one would have at least 6 rounds of sampling seemed appropriate. Similarly, I am troubled by the single round of offsite samples. How likely is it for this	EPA has been working to find options to optimize the water sampling program within program limitations. EPA has elected to provide the best coverage over-time within these limitations. The Phase I FSP has been revised to include one round of groundwater sampling to evaluate the dry season. The Phase II FSP will detail wet season sampling for the second event. Each of the two rounds of sampling will include analysis of all available wells in Area IV and the NBZ for the highest priority analytes (H-3, Sr-90, U isotopes, gamma emitters, gross alpha and beta). Certain lower priority

Responses to Draft Final Comments Groundwater, Surface Water, and Sediment FSP dated April 2010			
No.	**Reference or Page**	**Comment**	**Response**
		to be representative? (I am not commenting here on the other offsite sampling issues, as we understand it is deferred to a later stage and we are to comment here on the initial round of 21 groundwater sampling.) We see substantial variations quarter to quarter in even the Boeing sampling.	radionuclides have been reported in the Study Area. During the first sampling event EPA will analyze water from locations where these analytes have been reported in the past. Because there are cost limitations, the locations where the highest concentrations of these lower priority analytes were reported may be sampled in preference to locations where lower concentrations may have been reported. The scope for the second round of sampling will include the highest priority analytes, as described above, and will also include additional analytes as determined by results of the first round of sampling, historical water data from each well, HSA information indicating the need to sample, Stakeholder input, and possibly the results of soil sampling and gamma scanning. The Phase II FSP will describe the additional analyses proposed for the second round and take into account changing budgets. Stakeholders will be given the opportunity to comment on the Phase II FSP. In addition, the need and frequency of subsequent sampling, beyond the two rounds described will be based on evaluation of the analytical results from these two events and budget. As determined the rationale for subsequent rounds of sampling will be incorporated to this by addendum.

Responses to Draft Final Comments Groundwater, Surface Water, and Sediment FSP dated April 2010			
No.	**Reference or Page**	**Comment**	**Response**
21	Table 2-1	Large number of important radionuclides left as "to be determined" as to whether they will be monitored for.The text at p. 2-2 indicates that the list of radionuclides to be analyzed for surface water and sediment is presented in Table 2-1, but is silent as to where to find the analytic radionuclide list for groundwater. Table 2-1 itself, however, has a column for surface water and groundwater. It is unclear which is operative, the description of the table at p. 2-2 (that it only applies to surface water) or the table itself (that it applies to groundwater as well).Table 2-1 lists a number of radionuclides as "To Be Determined" (TBD) for the water measurements. What has been determined as to whether to include those? Will we be in the loop on that determination? For example, Am-241 is TBD. It is an important radionuclide and shouldn't it be analyzed for? Similarly for the curiums, iron-55, and especially tritium. Given the tritium plume onsite, why in the world would one exclude it from sampling? (And if measured, would it only be looked for in the organic form, as opposed to HTO?) Similarly, nickel-59 and -63 are potentially important. Please explain why one would look for neptunium-236 and -239 but not -237. Isn't lead-210 important? And certainly one should look for promethium-147. Boeing and its predecessors had a state radioactive materials license for 150,000 curies of it in unsealed oxide form for manufacture of sources. Polonium-210 would seem important; used in neutron initiators, for example. And why would one possibly want to exclude the plutoniums? They had a plutonium fuel fabrication at the site, and Pu-238 was found at Brandeis during the McLaren-Hart study, suggesting in addition to the regular mix of Pu-239/240 etc. in Pu fuel, they may have been making Pu-238 radioisotope thermal generators (RTGs). Technetium-99 would seem important. Why exclude all the longer-lived thoriums, including only isotopes with a half-life of hours or days (which should have	Each of the two rounds of groundwater sampling will include analysis of all available wells in Area IV and the NBZ for the highest priority analytes (H-3, Sr-90, U isotopes, gamma emitters, gross alpha and beta). Certain lower priority radionuclides have been reported in the Study Area. During the first sampling event EPA will analyze water from locations where these analytes have been reported in the past. Because there are cost limitations, the locations where the highest concentrations of these lower priority analytes were reported may be sampled in preference to locations where lower concentrations may have been reported. The scope for the second round of sampling will include the highest priority analytes, as described above, and will also include additional analytes as determined by results of the first round of sampling, historical water data from each well, HSA information indicating the need to sample, Stakeholder input, and possibly the results of soil sampling and gamma scanning. A Phase II FSP will be issued that describes the additional analyses proposed for the second round that takes into account changing budgets. Stakeholders will be given the opportunity to comment on this addendum. In addition, the need and frequency of subsequent sampling, beyond the two rounds described will be based on evaluation of the analytical results from these two events and budget. As determined the rationale for subsequent rounds of sampling will be incorporated to by addendum.The word "surface water" has been changed to "groundwater" on page 2-2 to clarify that the discussion and Table 2.1 refer to the analytes for all groundwater samples only. In addition the column on Table 2.1 "Analyze in Sediment" has been changed to "Analyze in

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		decayed) but leaving out those with half-lives in years, that would be expected to still be around? The longer-lived thoriums should be monitored for, particularly since the facility did work with thorium-based fuels.Note that on p. 2-2 tritium is listed as a contaminant of particular concern for groundwater, detected onsite and requiring analysis in this sampling, yet it is listed as TBD in Table 2-1. On p. -3 tritium is listed as the highest priority for well analysis, yet listed as TBD in the table.If the "TBD" listing is because of cost concerns, we need to see what the costs are to make a sensible weighting decision. [If what drives it is an effort to detect concentrations at the PRG level instead of MCLs (taking into account the sum-of-the-fractions rule), talk to me.]And if the reason for TBD is due to the need to stay within a $100,000 budget for the lab if the sampling is done before November; and if one is racing to do the first round before November because Boeing is insisting on altering the wells thereafter in ways EPA finds objectionable (see below); then we need to resolve those issues, and fast. Rather than acquiescing to Boeing, Boeing should not interfere with EPA's sampling efforts.	Sediment and Surface Water."The specific requests for analyses presented in this comment will be discussed in a meeting with Stakeholders and changes may be made. Tritium will be analyzed for all samples. The "TBD" designation for tritium is in error on Table 2.1 and has been corrected.The budget is of particular concern for the first sampling event. The budget and timeframe for sampling will be discussed at an upcoming stakeholder meeting.

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22	General	Problematic that Boeing intends, over EPA objections, to change the pump locations (permanent replacement with low-flow pumps) in the wells after the first round of sampling, making data sets of reduced inter-comparability. EPA has expressed concerns about Boeing plans to change the pump locations in the wells. We already have significantly problems comparing groundwater data sets, since the years of groundwater monitoring by Boeing have been criticized by EPA—and long criticized by the community—for having filtered the samples before measurement (and throwing out the filters rather than measuring what was on them and adding it in). Now, we will get one single set of EPA measurements with the proper filtering technique, but then Boeing will modify the wells, making subsequent measurements not comparable to even the prior EPA first round measurements. Furthermore, EPA has questioned the rationale for the change, raising questions about the representativeness of samples after the change is made. None of this is disclosed in any detail in the Field Sampling Plan, nor is there any resolution of the problem. The Plan should be amended to fully disclose the problem and EPA's objections and reasons therefore; and the full group needs to discuss the matter and try to press that Boeing not alter the wells. There also needs to be direct communication between EPA and DTSC SSFL Project Manager Brausch, since DTSC must approve Boeing's proposed changes to the wells. This needs to occur quickly, since apparently Boeing is going ahead and modifying wells in other parts of the site. If EPA is right and this will produce even more unrepresentative sampling results, it needs to be stopped now.	EPA cannot confirm who originally proposed the switch to low-flow sampling. DTSC and Boeing should be consulted. These issues will be discussed at an upcoming Stakeholder meeting however, we reiterate that DTSC, as the lead regulatory agency, will determine where the pumps will be placed and when and if the change will occur. As a point of clarification, EPA does not take issue with the low-flow sampling methodologies. Our discussions have centered on acquisition of samples that are representative of formation water. Purging techniques and pump placement are important considerations when using low-flow. EPA has chosen to use low-flow techniques for wells with short screens (10 feet in length or less). Most of the wells with short screens in Area IV and the NBZ are screened within the unconsolidated overburden. Shallow overburden wells do not generally suffer from complications associated with flow through fractures in rock. However, these wells are generally more prone to development of artificial turbidity during the purging process. This artificial turbidity, if included in the samples, could introduce contaminants to the sample that are not representative of what is present in the groundwater The low-flow techniques, to be employed for wells with short screens, have been adopted to limit this artificial turbidity. As described in Section 4.1.4, the activity of radionuclides contained in the turbidity of all water samples will be measured to provide for a total activity when summed with the activity of the water itself.

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23	General	Significant concerns with plans to change the purging technique.In 1989, Boeing's predecessor, faced with measured radionuclide concentrations in groundwater an order of magnitude above MCLs, commenced with creative approaches to remove the radioactivity from the groundwater samples before measuring them. They first tried decanting, and then settled on filtering. The radioactivity filtered out of the water was discarded and not measured. This process resulted in a ten-fold reduction in measured values from the prior measurements. It was, and remains, a highly controversial practice.Gregg Dempsey has said it is improper. That if one must filter, one must measure what is on the filter and add it (converted into a volumetric concentration) to the value from the filtered water.Now it is proposed to use a new technique, described as low-flow purging. The description of the rationale for using this technique is that it reduces the concentration of colloids and the turbidity in the samples. We are concerned that this is just a new way of artificially lowering the radionuclide concentration in the sample before measuring—a new way of doing what the old filtering did.We would appreciate knowing who first proposed the switch to this technique. Was it Boeing?In any case, there needs to be substantial discussion of the proposed change.Remember, the groundwater measurements are designed in part to tell us whether radioactivity has migrated into the aquifer. Trying to keep the colloidal content and the suspended fraction low may be depriving us of data that are important.	EPA cannot confirm who originally proposed the switch to low-flow sampling. DTSC and Boeing should be consulted. These issues will be discussed at an upcoming Stakeholder meeting however, we reiterate that DTSC, as the lead regulatory agency, will determine where the pumps will be placed and when and if the change will occur.As a point of clarification, EPA does not take issue with the low-flow sampling methodologies. Our discussions have centered on acquisition of samples that are representative of formation water. Purging techniques and pump placement are important considerations when using low-flow. EPA has chosen to use low-flow techniques for wells with short screens (10 feet in length or less). Most of the wells with short screens in Area IV and the NBZ are screened within the unconsolidated overburden. Shallow overburden wells do not generally suffer from complications associated with flow through fractures in rock. However, these wells are generally more prone to development of artificial turbidity during the purging process. This artificial turbidity, if included in the samples, could introduce contaminants to the sample that are not representative of what is present in the groundwater The low-flow techniques, to be employed for wells with short screens, have been adopted to limit this artificial turbidity. As described in Section 4.1.4, the activity of radionuclides contained in the turbidity of all water samples will be measured to provide for a total activity when summed with the activity of the water itself.

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24	SOP 2.02 and 2.23	Strange sections of the SOP that appear to have been written by Boeing, rather than EPA, and for chemicals, not radioactivity. SOP 2.02 and 2.23 are filled with passages about measuring for VOCs and other chemicals, rather than radioactivity, and discussions of filtering that contradict statements earlier in the plan to the contrary. They sound almost as though these are Boeing's SOPs that were copied verbatim as though they were EPA's. This needs to be explained and remedied. It would also help regarding transparency if EPA could disclose whether there were meetings between EPA and Boeing and its contractors, outside of the working group, over the preparation of the Field Sampling Plan. There are little hints in the report that much of this was worked out in advance with the RP, and that the RP may have been pushing for certain outcomes. If EPA felt it was inappropriate for Boeing to change the pump locations and yet Boeing has refused to alter its plans, that should be made crystal clear in the FSP and tagged as a significant issue for discussion. If Boeing is proposing the low-flow purging technique, that should be made clear. EPA has made great progress towards increasing transparency, but it would be a step backwards if some of the key decisions were being made in private and in response to Boeing (or other RP) pressure or incalcitrance. It would be helpful to disclose if EPA and its contractors had had meetings with the RPs and their contractors on these subjects about which we were not informed and to which we were not invited. I recommend that, before these decisions are made final, we have a full discussion of the matters identified above. Attached please find also a copy of the Draft Final Field Sampling Plan, with additional comments attached throughout it.	The discussions concerning chemicals other than radionuclides have been removed from these SOPs. Please note that many chemical procedures are applicable and adaptable to radiological procedures; thus, SOPs can be modified accordingly. EPA has had no specific discussions with Boeing or DTSC in development of the scope or methods to be used in the FSP. Although several phone calls and one meeting were held between EPA, DTSC, and Boeing to discuss low-flow sampling, these SOPs were modified from existing EPA and/or HGL specific SOPs and no consultation with Boeing or DTSC occurred in their development. Note that no decisions have been made and we are consulting with Stakeholders now prior to collecting samples.

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25	Page 1-1 Text: "Confirm the results of data collected by others;"	This objective would be more fairly stated as "assessing the validity of data collected by others." It could be read as written as aiming to affirm prior measurements.	The text has been changed to read: "Provide high-quality data for comparison to data reported by others;"
26	Page 1-1 Text: "Provide data for areas that may require additional assessment."	One should also be providing data on radionuclides previously assessed. One is trying to get good data using methods acceptable to EPA, given past measurements by Boeing having been questioned by EPA and others due to questionable methodologies (e.g., filtering).	The text has been changed to read: "Provide high-quality data for comparison to data reported by others;"
27	Page 1-2 Text: "Collect one round of groundwater samples from approximately 20 off-site wells."	I am troubled by this. I thought EPA had previously said it would do quarterly measurements during the period of its study, beginning in the 2nd quarter of 2010. We need to discuss this.	The FSP will be amended to include only the initial round of sampling that will include all viable monitoring wells in Area IV. The frequency of sampling and analyte list for subsequent groundwater sampling events will be determined after evaluation of the initial round of analytical data, information provided by the HSA, and data from the gamma scanning. These subsequent rounds of sampling will be incorporated into the Phase II FSP as addendum.
28	Same as comment 8.	Again, does this make sense to restrict it to a single set of samples, given the potential for variability?	See response to comment 20.
29	Page 2-1 fourth paragraph.	Again, does this make sense to restrict it to a single set of samples, given the potential for variability?	See response to comment 20.

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30	Page 2-1 fifth paragraph.	One shouldn't skew the history solely towards the civil side; a great deal of the work and associated contamination were the result of DOD work on missiles for the nuclear program (e.g., MX missile)	The following text has been added to the history: "While some portions of SSFL outside Area IV supported rocket engine static testing for development and improvement of military missiles, on-going historical research is incomplete concerning potential Department of Defense activities in Area IV."
31	Page 2-6 last paragraph.	I assume "feet" was inadvertently left out here.	Correction made in text.
32	Page 2-7 first paragraph.	I think EPA and its contractors should not be repeating in these first two sentences these claims made by Boeing, which are unproven, questioned by DTSC, and controversial. Boeing has been arguing that it need not clean up contamination because of allegedly barriers to migration. Wilshire (http://www.ssflpanel.org/files/Wilshire.pdf) disputes these claims.	The entire paragraph referenced has been removed.
33	Page 2-7 second paragraph.	I don't think EPA should be seen as endorsing the controversial Cherry et al. report or its conclusions. This is a document put forward by Boeing to try to walk away from cleaning up contamination.	All references to and information from Cherry et al. have been removed.
34	Page 3-4 second full paragraph.	Again, I don't think "confirm" is the appropriate term, as it implies a bias toward affirming Boeing's prior measurements, which EPA has criticized, rather than finding out whether they are accurate.	Text has been changed as in comment 26.

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35	Page 3-4 second full paragraph.	I am deeply troubled by this. EPA has criticized Boeing's plan to retrofit. It may make readings unrepresentative; and will further complicate comparing values. Boeing's earlier measurements were made with filtering; EPA's first round will be with current pump placement, but the second with a different pump placement. If EPA is concerned about this, as it has said it is, the retrofitting should not go forward, at least until EPA's survey work at the site ends.	See response to comment numbers 23 and 24. Stakeholders will be given the opportunity to comment at future meetings. Up to 30 wells may be sampled using the two different methodologies employed by Boeing and EPA.
36	Page 4-8, Section 4.6.2.2 first numbered item.	These techniques need to be explained and the rationale for them given; and a discussion that this represents a change from past techniques and will make comparison with past measurements even more difficult.	The following text has been added to Section 4.6.2.2 to describe the rationale for low-flow sampling in wells with short screens. "Multi-level and open-hole bedrock well purging procedures, as described below, are similar to procedures that have been employed during previously sampling by others at SSFL." See response to comment 24.
37	Page 4-8, Section 4.6.2.2 second numbered item.	The rationale for this approach needs to be provided, and a discussion of alternatives included and the reason why they were rejected.	The well-volume purging approach is the method used in the recent past by Boeing (as described above). This approach is being adopted for open bore wells and wells with long screens (which are the majority of wells) to be generally consistent with historical sampling practices.

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38	Page 4-8, Section 4.6.2.2 third numbered item.	This is troubling. What is the rationale for not having EPA control its sampling?	The multi-level FLUTe systems in Area IV are instrumented and expensive installations. These systems can be damaged by improper sampling techniques. Boeing prefers, and EPA concurs, that Boeing personnel (or contractors) continue to perform this sampling). The sample techniques are standardized by the manufacturer and modification of the manufactures technique is limited. EPA will monitor the procedure employed during sampling and will fill their own sample containers retaining Chain of Custody.
39	Page 4-9 first sentence.	What does this mean? Are you implying that Boeing has refused to permit EPA to sample these particular wells? What coordination is ongoing? Needs more transparency here.	This section has been removed since off-site well sampling is now deferred to the Phase II FSP.

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40	Section 4.6.2.2.1 first paragraph.	I am quite concerned about this and believe the full group needs to discuss it directly. Was the suggestion to use this new technique initiated by EPA, or does it come from Boeing and EPA has acquiesced in it? The rationale given--that it reduces the concentration of colloids in the sample and generally reduces turbidity--raises the question whether it is simply another way to keep radioactive material out of the sample so as to lower the measured value? In other words, after decades of filtering to artificially lower measured values, has Boeing now proposed a purging technique that would have the same effect? This is an important issue that the full group should discuss openly.	EPA has elected to use the low-flow technique for approximately 34 wells with short screens. Stakeholders will be provided the opportunity to comment at future meetings. Turbidity often found in groundwater samples collected from monitor wells is typically the result either poor well construction or sediment that has settled and accumulated in the bottom of the monitor well. Most aquifers tend to have relatively low turbidity due to natural filtration of the aquifer. Disturbance of the well filter pack or sediment in the bottom of the monitor well leads to a turbid sample that is not representative of natural aquifer conditions. The intent of low-flow sampling is to minimize disturbance of the well and aquifer; thus, creating minimal disruption of sediment providing a less turbid groundwater sample. It is important to note that turbid samples usually are not representative of natural aquifer conditions. The intent is not to collect the most turbid groundwater sample you can but to collect a truly representative formation groundwater sample. Note that EPA is proposing to collect water samples from wells that are known to go dry under any pumping conditions and not recover for extended periods of time (weeks to months). This technique includes acquisition of a grab water sample after agitation of the water column. The objective of this sampling is to acquire some data for further evaluation where none would have been otherwise collected.

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41	Page 4-9, second to last paragraph.	Again, since EPA will be filtering and measuring both the water that passes through the filter and the material collected on the filter, this shouldn't be an issue in the first place and efforts to artificially reduce the amount of radioactive material suspended in the sample is very troublesome. We need to discuss this.	See the responses to comments 23 and 40.
42	Page 4-10 "Low Flow Well Purging."	This needs to be discussed. Again, one needs to assure measures aren't being implemented to reduce the contaminant load in water before measuring.	See the responses to comments 23 and 40.
43	Page 4-12 Section 4.6.2.2.2.	Again, I would appreciate a full discussion with the group about whether this procedure produces an accurate representation. Remember, we are interested in what radioactive material may migrated into the aquifer.	See the responses to comments 23 and 40.
44	Page 4-13 Section 4.6.2.4.	How can this be? Boeing to control these sampling events AND procedures? We need to be told what is behind this and discuss fully.	See the response to comment number 38.
45	Page 4-13 Section 4.6.2.5 first paragraph.	I am troubled by this and believe we need to talk about it Also looks like you would be using different purging techniques, creating even more difficulty in intercomparability of measurements.	See the response to comment number 38. The purging techniques proposed by Boeing for the WQSAP are different. Comparisons of the data sets will require additional examination. These issues will be discussed at Stakeholder meetings.
46	Page 4-13 Section 4.6.2.5 second paragraph.	THEN THIS CHANGE SHOULDN'T HAPPEN! We need to discuss this, including with DTSC project director Brausch.	See response to comment 45.

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47	Page 2.02-5 Second full paragraph.	I think we need a comprehensive discussion with the group to convince us that this is not just a different way of trying to achieve what the controversial filtering did, keeping radioactivity out of the sample to be measured.	See response to comment 23. These issues will be discussed at Stakeholder meetings.
48	Page 2.02-5 last paragraph.	What does this mean? Why is it here? I thought there was to be no field filtering whatsoever. We need to discuss this.	The first sentence in the referenced paragraph is a relic of a generic SOP and has been deleted.
49	Page 2.02-5 last paragraph.	Where is this language coming from? Is it some boilerplate? Who is the client--Boeing? Is EPA contemplating ordering the abandonment of wells and replacement with new ones?	The text discussing the possibility of abandonment and replacement of a well has been deleted.
50	Page 2.02-6 Section 4.3 first paragraph.	Why are we even talking about VOCs? Did EPA just accept verbatim a SOP written by Boeing?	All language discussing chemicals other than radionuclides and metals (since most of the radionuclides of interest are metals) and filtering has been removed.
51	Page 2.02-6 last paragraph.	What the heck is going on here? This is an SOP for chemicals, not rad. Did you just plop into your report Boeing's procedures?	See response to comment 50.
52	Page 2.02-7 first full paragraph.	Again, this seems to have been written by Boeing, not EPA, and for chemicals, not rad. I thought there was to be no filtering. Something is amiss.	See response to comment 50.
53	Page 2.02-7 Section 6.0	This is nutty; why are we reading about VOCs?	See response to comment 50.
54	Page 2.23-5 last bullet on page.	What is going on here? There is supposed to be NO field sampling.	See response to comment 50.
55	Page 2.23-8 top of page sample collection order.	Again, what is going on here? This is a SOP for chemicals primarily, with rad as an after thought. Is there some plan to split these samples with DTSC for chems; or why all this discussion of chems?	See response to comment 50.

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56	Page 2.23-10 Sample Filtering.	This makes no sense. Elsewhere you have said there will be NO field filtering.	See response to comment 50.
57	General	We learned from CDM and SAIC at the Scoping meetings that AREA IV drains to Simi Valley and Bell Canyon. Therefore, I believe that your scope of work should contain groundwater, seeps and springs, and surface water in the Southern Buffer Zone.	The sampling program includes samples up to the southern border of Area IV. These areas may be considered in the Phase II FSP.
58	General	I believe that you should chase all drainages and sewers to ponds that are not in AREA IV. I think that you should investigate Outfalls 1 and 2 that lead to Bell Creek. I think that you should sample Bell Creek.	See response to comment 57.
59	General	I also have attached a letter regarding Dayton Canyon. It mentions radionuclides that were sampled for there in 2007. I think that when you have your Background numbers, you will be able to more adequately assess what are naturally occurring radionuclides. I would appreciate it if your consultant looks at this document, and determines whether there is reason to look at Dayton Canyon.	Historical data, including the 22 February 2007 letter from CDHS will be considered during development of additional phases of work.

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60	1.1 Project Objectives	In the introduction, it immediately narrows the objective to study of Area IV and the NBZ with no mention in that same introduction that most of the drainage from Area IV leads to the south, making the drainage to the SBZ [southern buffer zone] equally important if we are to seriously examine the purpose of the study, which is to determine the nature and extent of the radiological contamination of the Santa Susana Field Laboratory.I understand that the specific objectives as outlined in HR2764 refer to Area IV specifically and that the Northern Buffer Zone is included because it was purchased through acquisition of previously off-site land found to be contaminated and sold/transferred through litigation settlement. The same is true for the acquisition of the land to the south. It should be understood, especially with regard to water quality violations that continue to the south and north (recent $500k fine (Consent Judgment + $300k in remediation funding) demonstrates a chronic problem with contaminants leaving the site both the north and the south. My request here, is to acknowledge the drainage to the south in the introduction and the decision (to or not to) determine whether these contaminants might include radionuclides from Area IV (when following stormwater topography including concrete swales specifically constructed for the purpose of diverting water to the south from Area IV nuclear related buildings.	Work in areas outside of the study boundaries may be considered for subsequent phases of work (for example the sediment sampling Phase II). EPA will begin its work in the study boundary which includes Area IV and the NBZ. The following text has been added to the first paragraph of the introduction:"While the Study Area for this FSP is clearly defined, characterization of areas outside of the Study Area may be considered by EPA based upon initial results ."

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61	1.1 Project Objectives	I am deeply troubled by the statement that the data to be collected is not intended to be comprehensive when this is the only real investigation of its' kind that will occur at the site. The reason we are doing this is because it has not been adequately characterized for decades. In fact, the order by Judge Conti specifically requires DOE to complete an EIS which this part of the radiological study will be used, in order to finally determine what is needed for appropriate remedy of the site contamination. Further, the MARSSIM process being used is specifically being used in the investigative phase and NOT in the final status survey process as it is normally used. This is not clearly described here, nor are the differences in the use of this radiological investigative tool here, vs. how it is otherwise used, implemented, and interpreted.	The majority of the funding for this study is going toward soil samples. If after results become available, it appears more funds should be allocated to surface water and sediment, we will make that determination along with stakeholder input. It is not possible to determine the level of effort for additional work until the first phase of sampling, as described in the FSP, is completed. MARSSIM applies strictly to contaminated soil and buildings. The reference to MARSSIM final status surveys will be removed from this section.
62	1.2 Scope of Work	Sampling of major drainages should specifically include the drainages below the monitoring outfalls for the NPDES permit as many of these locations are inadequately placed.	Surface water and sediment samples have been placed downgradient of the active NPDES monitoring locations within the Area IV Study area, as depicted on Figures 3.1 and 3.2. NPDES monitoring locations have been added to these figures.
63	1.2 Scope of Work	Areas that manage/store/treat contaminated stormwater and groundwater should be treated as active areas, and they are not adequately identified in this plan Examples include the Area IV burn pit treatment area, as well as the building 9 parking lot area.	The active facilities are subject to investigation under the RCRA RFI investigations. Releases of chemicals at active facilities will not be investigated in this program.

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64	1.2 Scope of Work	Pond at SPTF is not adequately identified. This is an industrial wastewater pond specifically constructed to hold process water, yet the drainages and related swales are not adequately identified within this plan	Historical information is being gathered for this feature. EPA will consider sampling this area once the information is assessed.
65	1.2 Scope of Work	The scope of work should properly identify the purpose of determining the extent of radiological contamination in sediments, and propose in more detail, the intended phase II step-out and down-drainage follow up sampling that should occur in order to provide adequate data to make feasibility remedy decisions moving forward, which is the overall end-purpose of all of this work.	Phase II sampling is intended to allow for additional data collection at deposition locations both up and down gradient of the Phase I sample locations. A phase II FSP will be issued to address the Phase II activities which will be available for Stakeholder input prior to being finalized.
66	1.2 Scope of Work	Locations to be determined through field observations generally after significant rain events - this should have already happened as we have potentially already had our last rain event for the season.	EPA has personnel located at the site generally from 7:30 AM to 5:30 PM 5-days a week. There will be opportunity to properly identify sampling locations after rainfall events.
67	1.2 Scope of Work	Spring/seep samples from 10 locations is entirely inadequate when considering the number of seeps that exist, as well as the many drainages that lead specifically to a children's camp. Again, the point of this exercise is to protect the public which cannot occur if you don't even look down all the drainage areas properly.	The scope is currently limited to 10 locations. It is possible that as results become available additional areas will be tested as part of a Phase II. A discussion has been added to Section 1 that describes flexibility in the sampling approach as results become available.
68	1.2 Scope of Work	Please provide us with a list of the proposed off-site wells to be sampled (20).	The off-site wells have been moved to the Phase II FSP. The list of wells to be sampled will be presented in that document.

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69	2.2 Radionuclides of Interest	Higher consideration for any wells where prior hits of the particular radionuclide have occurred. Additionally, of the wells that are not used in this process that are located within the study area, please provide us a list of any radionuclides that have been found at any of the wells that are now deemed either dry or inoperable and provide alternative wells to be sampled to determine the current nature and extent of that radionuclide.	The analyte priority list for the first sampling event will be incorporated into this Phase I FSP. Analytical details for the second of two sampling event will be incorporated into the Phase II FSP after the first event. Please note that all viable monitoring wells in Area IV will be sampled during the first and second event that are planned for July, 2010 and winter 2011. A table showing the radionuclide data for the dry and abandoned locations is attached to this response to comments.

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70	Section 2.3	Topography and drainage section does not adequately describe the fact that most of the drainage leads to the south and outside of the defined study area and that those investigative limitations have been proposed despite the topographical facts. Further, it incorrectly states that there is no drainage to the east or west and does not adequately acknowledge the Burro Flats fault that may act as a conduit that carries contaminants from Area IV to the East to the San Fernando Valley as this fault continues down to the Chatsworth Reservoir below (which was used as a drinking water reservoir until the last sixties.	EPA acknowledges the facts that there is surface water flow to the west-northwest and south. Section 1.2 explicitly explains that the scope of work at this point only includes Area IV and the NBZ for surface water and sediment. The text has been modified to read as follows: "Surface water drainage in the northern portion of the Area IV Study Area flows north into Meier Canyon and west-northwest into Runkle Canyon, which are tributaries to the Arroyo Simi, flowing westward and terminating in the Pacific Ocean. Drainage of the majority of Area IV leads to the southeast into the Bell Creek drainage system as suggested by the location of the northeast-southwest trending drainage divide on Figure 2.1. Bell Creek is the headwater and tributary of the Los Angeles River which flows south and eastward terminating in the Pacific Ocean. Given the topographic divide and topographical rises to the east and west of Area IV, there is no drainage directly to the west or east from Area IV (USGS, 1952). The northern portion of Area IV drains generally to the north into the NBZ, which itself drains generally to the north." EPA appreciates the concern over flow along geologic structures to the east. Because there are still concerns over the hydrogeologic model for the site, discussion of flow along faults has not been added.

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71	Section 2.3.2	Hydrology does not adequately acknowledge the drainage that surpasses the processing pond and leads down toward Outfall 2 (which is also where they have a seep problem with high concentrations of VOCs). Many of these chronic problem areas carry waste constituents where chemicals are co-mingled with metals and radionuclides. This may not have been adequately investigated in the past, and since it is not acknowledged here, I believe it should be changed to ensure that this is considered.	In Section 2.3.2 it is stated that there is flow to the south. The investigation includes locations up to the southern boundary. While currently not in within EPA's scope, investigation of the surface water leaving Area IV to the south may be considered for the Phase II FSP.
72	Geology	Why is Thomas Diblee data being referenced when the formation determination process within this study determined that his maps were incorrect? If they are incorrect, why do they continue to be used as reference?	The reference to Diblee has been removed.
73	Section 2.3.4.5	Geologic Structures at the Santa Susana Field Laboratory The soil make-up (clay v sand) along the entire length of the Burro Flats fault as well as the smaller faults to the north, need to be considered here as this difference may be the difference between an obstacle to contamination leaving the site, and that of a conduit. Also, some of these MWH maps have removed the Delta Structure from being a fault even though these is no basis to make this conclusion. This is an example of a potential migration pathway being missed, or dismissed where it might be very important as a contributing factor to the surrounding contamination and that down-stream.	EPA appreciates the concerns over flow along the geologic structures at SSFL. Because a detailed conceptual model of the site has not been adopted by EPA, additional discussion of hypothesized flow along these structures has not been included in the FSP.

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74	Hydrogeolog y	Does not adequately acknowledge the fact that the groundwater flow is not really understood and is specifically under debate. This is important when using work from these other studies to formulate decisions, and basis for sampling targets.	The third paragraph of Section 2.4 was changed to read: “Groundwater flow at SSFL has been the subject of numerous studies by Boeing and the DOE. Montgomery Watson Harza (MWH, 2009a) discusses results of recent flow characterization efforts including horizontal and vertical flow. A groundwater divide occurs near the center of the Area IV Study Area (Figure 2.1). Downward and upward vertical gradients have been reported at SSFL. Groundwater flow through fractures in the hydrogeologic units at SSFL is also discussed in WMH 2009a. The hydrogeologic investigation and agreement concerning the conceptual model is on-going.”
75	3.1 Surface water and seep sampling	I request to be able to visit these field areas, as prior discussions with the "offsite sampling" DTSC staff, it was revealed that many of the identified seep locations are either incorrect, or "estimated" meaning they haven't been sampled due to accessibility. This makes the adequateness of this sampling effort in question if this offsite data is being used to make these field decisions. (ref. Abrams, Sheeks, Pappas conference call) where it was found that the diagram describing these locations was not accurate. I also ask that the samples that are filtered be specifically identified so that the sediment can also be analyzed for a cumulative total.	EPA will coordinate a site visit to look at potential locations in the future. Section 4.1.4 describes filtering of all water samples and analysis of the water and residue to derive a total activity result. All water samples will be subject to this procedure.
76	Section 3.2	I appreciate the opportunity to provide recommendations for spring seep sampling as part of the technical stakeholders committee and look forward to an opportunity to discuss this process in more detail.	None Required

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77	Section 3.4.1	Off-site well data that is referenced makes specific conclusive statements about faults precluding the movement of groundwater offsite. I ask that this data be used with the understanding and context that we believe that some of those conclusions are specifically driven by their placement or choice of wells to analyze.	Off-site well sampling has been moved to the Phase II FSP. This entire section has been removed.
78	Section 3.4.1	I am very troubled with the notion that of 127 wells, only 20 are active and ask how this presumption has been made?	Off-site well sampling has been moved to the Phase II FSP. This entire section has been removed.
79	Section 3.4.2 Onsite well monitoring	In recent discussions on a conference call with DTSC staff (Abrams, Sheeks, Seckington) it was determined that the groundwater plume map used does not accurately reflect the wells that are used to support this map. Further, many of the areas deemed either impacted or not impacted, are based on wells outside of that area, as was discovered during this conversation. I have asked for a new map, that accurately depicts the locations of the chemical contamination plumes as well as the tritium, and ask that this new map be used here.	We believe that this comment refers to the plume maps presented in Haley and Aldrich, 2009 Site-Wide Water Quality Sampling And Analysis Plan, Figure 3. EPA is reluctant to include the revised map (which we have not received) because it interprets old data and a tritium plume that will be more fully understood after the sampling presented in this FSP.
80	4.0 Field Activity Methods and Procedures	During this last year their sitewide "housekeeping program" has resulted in debris being moved to various staging and storage areas throughout the site. I ask that all of these areas be gamma scanned as these materials have been moved across operational lines in some cases.	100% of the accessible areas in Area IV and the NBZ will be scanned (excluding buildings). No work is planned outside these areas at this time; however, Stakeholders will have the opportunity to provide input prior to the Phase II FSP.

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81	Section 4.1	I appreciate the fact that this suggestion was taken seriously as I believe it will result in a safer and more efficient field process. Thank you for considering this area for your investigation and pushing forward with NASA and GSA to make it happen. I know it was not easy and those efforts to step up are truly appreciated, especially when it benefits all concerned and provides a more appropriate use of the property under the "declared excess" issue with NASA and GSA	None required
82	Section 4.1.4	Analysis of Total Activity and Activity of filtered water samples. Please confirm that no field filtering means that total activity will be measured since all sediment separation will occur in the lab and be measured. I just want to be sure I understand this clearly, so I can support this decision.	The total activity will be measured. This activity will be a sum of the activity of the liquid fraction and the solid residue separated from the water in the lab.
83	Section 4.2.1 Active off-site well evaluation	Please make this information widely available so that potential property owners with wells that have not been previously identified (due to ownership changes and property use changes) may have an opportunity to suggest and provide permission for their wells to be tested should they be found to be within an appropriate distance from the lab.	We will work with the stakeholders to achieve this goal.

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84	Section 4.2.2	Identification of potential onsite spring and seep locations including NBZ locations should include outfall 10 where plutonium was previously found as well as the recent cesium findings located near, and contributing to, outfall 9 below the ELV area where Building 204 and the EPA office is located. We have studied this area extensively both on-foot as well as through aerial photographs we have taken, and google-earth comparisons to the overlay of the radiological survey done in 1979 and wish to have an opportunity to provide this information to the decision makers of the sampling locations prior to field work starting.	EPA will commit to sampling at least one seep/spring in these areas if identified. EPA greatly appreciates the opportunity to exchange information for the surface water and seep sampling. A meeting will be scheduled in order to share information and look at locations on the site.
85	4.6.2.1 Wide Water level measurement Event	I appreciate that these water-level gauging events will be conducted and ask that this information be shared with the groundwater team at DTSC and that a more in-depth dialogue take place that includes us as stakeholders, the RPs as well as the DTSC and EPA teams to discuss what has been learned, what is agreed and what is not. It is otherwise very difficult for the community to be able to weigh-in effectively or substantively on this issue.	SSFL Technical Stakeholder meetings will be held to continue the transfer of information. Special meetings may be called to specifically address groundwater findings.
86	Section 4.6.2.2.1	The sampling that takes place after the low-flow purge changes have taken place need to be specifically identified for statistical work since these will not be of the "same population" as prior sampling work that might be included in the analysis. Please explain how this will be handled.	Because limited data will be collected using the well-volume approach from the approximately 30 wells that will be converted to low-flow wells, statistical comparison of the data set populations will not be possible at this time. However; once a sufficiently large data set of low-flow data is available the populations of new data may be compared to old data to assess whether the two populations are statistically distinguishable. If the populations are not distinguishable the data may be comparable.

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87	4.6.2.3 Artesian Wells included	Please be sure to include "bathtub well #1" on the Brandeis property for all radionuclides on the list of interest as this has been a well of interest due to prior contamination findings.	We believe this comment refers to well OS-9 or OS-9R. Both wells are in the sampling program as listed in Table 3.4. These off-site wells are to be removed from the Phase I FSP and will be included in the Phase II FSP.
88	Table 2.1 Proposed Radionuclides for Analysis	Please provide a list of the specific detection and analysis challenges to meeting the PRG levels for SB990 purposes and what levels are attainable so that this issue can be better understood within the context of the list of interest.	The analytes for the first groundwater sampling event will be incorporated into this FSP. A Phase II FSP will be issued to discuss the analytes selected for subsequent events. Detection limits will also be incorporated into the QAPP by addendum after award of the laboratory contract.
89	Table 3.1 Preliminary Surface Water Sampling Locations (Draft)	Please provide a column indicating which of these locations have been "groundtruth'd" and an opportunity at one of the upcoming meetings to discuss this in detail with maps in front of us. I also request that a follow-up field visit be provided so that location issues can be discussed and debated with the interested public.	Locations that were ground truthed have been added to the table. All locations will be verified during periods of precipitation. There will be a Stakeholder site visit to go over locations.
90	Table 3.3	(Same comment as for Table 3.1)	Locations that were ground truthed have been added to the table. All locations will be verified during periods of precipitation. There will be a Stakeholder site visit to go over locations.

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91	Table 3.4	(Same as above, and I also find this list to be inadequate as it does not include locations of known contamination found, as well as gaps in data that should be addressed here.	Note the off-site well sampling is being removed from the Phase I FSP and will be included in the Phase II FSP. None of the locations listed have been field checked; however, those locations that are routinely sampled by Boeing are expected to have no issues such as access or being dry. EPA will establish rights-of-entry for other locations before inspections of other locations. Data from all the off-site wells are not presented because the intent is to re-sample for at least the radionuclides listed on Table 2-1 and in the forthcoming Phase II FSP. This sampling will confirm (or not) data for those radionuclides previously reported.
92	Table 3.5	(Same as above)	All of the well locations that are not actively sampled, with the exception of FLUTe well locations, have been field checked. Because all available wells are to be sampled, the locations that were field checked are not included in the table.
93	Specific Sampling recommendat ions	From the Sampling Locations figure (3.1) indicates that the location where these drainages converge below EPASW21 and EPASW22 will not be sampled. Due to contributing factors from the Area IV burnpit, the known plume issue below, this is particularly important that migration pathways of this water be understood through appropriate downgradient sampling since it is possible that cracks and fractures might divert from the assumed directions based on visual topographical observations.	For the initial phase of sampling locations selected will be within Area IV and the NBZ. Some of these areas may be more appropriately sampled as part of the soil sampling program. EPA will provide Stakeholders the opportunity to comment on locations for the initial and subsequent phases of work.

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94	Specific Sampling recommendations	The drainage below the RMHF pictured above with property line overlay from GoogleEarth indicates steep drainage that is not adequately going to be sampled under the proposed plan. This lower area used to be an unlined pond (what is now a discharge tank) and therefore more sampling is needed.	Samples above and below Outfall 3 near the RMHF are planned. Only a limited number of surface water and sediment samples can be acquired. Because the work will be completed in phases, EPA may consider additional sampling based upon the results of initial sampling and project resources. Stakeholders will have the opportunity to comment on all phases of work before plans are finalized.
95	Specific Sampling recommendations	Location EPASW10 is near the plutonium finding, from the prior background study done by McLaren Hart. Please provide targeted sampling that focuses on the specific locations of those findings and add sampling down drainage to confirm. Also, please sample below EPASW10 below where the two drainages converge for proper understanding of those two contributing drainages. The road that leads to the area EPASW09 area was previously lined with waste drums and debris in historical photographs previously submitted by cleanuprocketdyne.org (me) which indicate that this area MUST have a much greater degree of sampling for all radionuclides of interest.	Currently there is a surface water/sediment sample (EPASW10 and EPASED31) location in the area where the plutonium was detected. If radionuclides are detected additional samples will be collected during Phase II. Stakeholders will be given the opportunity to provide specific sampling recommendations at upcoming meetings and for Phase II.
96	Specific Sampling recommendations	This view (above) shows the steep cliffs that are the NBZ and therefore the importance of looking below and where these seeps might surface and impact residents below.The seeps and springs located below (downgradient) from EPASW09 are inaccurately located and/or estimated due to limited access according to the offsite data provided by DTSC. It is therefore necessary here to sample below these stream/seep areas to ensure that impacts that might have occurred will be understood.	Additional sampling for subsequent phases of work may be considered. Stakeholders will be provided the opportunity to comment on additional work before the Phase II plans are finalized.

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97	Specific Sampling recommendations	RE: Pond area not previously identified (adjacent to ELV area, Area II) this is the pond area not previously identified which is where the cesium was recently found during the ISRA sampling at Area II. This was a known burn/runoff pond and a chronic problem area identified in the ISRA process and therefore must be included within this study (since it is known radiological contamination)	Additional sampling for subsequent phases of work may be considered. Stakeholders will be provided the opportunity to comment on additional work before the Phase II plans are finalized.
98	Specific Sampling recommendations	Overlay of aerial radiological survey indicates areas of the NBZ that require a much closer look than what is identified on the sampling map in this figure.	Additional sampling for subsequent phases of work may be considered. Stakeholders will be provided the opportunity to comment on additional work before the Phase II plans are finalized.
99	Specific Sampling recommendations	In looking at the maps defining the study area, it seems that known information provided during the John Pace visit is not adequately considered. I would ask that the drainage from the release pond, the "pile out back" area, as well as the hot storage on the hill above be more appropriately targeted so that these areas can be better understood. In fact, the "solid waste area of concern" green shading does not even include the area where temporary hot storage of radioactive waste was stored from the SRE which had many accidents and fires including the 1959 partial meltdown estimated by many experts to be the worst nuclear accident in U.S. History. How can the operational storage area of radioactive "hot waste" not be included? (please note the road leading to the hill above the SRE just above the nw corner of the shaded green area).	EPA is currently researching the information provided by the commenter (John Pace information). See response to comment 60. The shaded green area is from plans provided by others. These areas will be removed from Figures 3.1, 3.2, and 3.4. Gamma scanning is planned for the SRE area. Additional sampling for subsequent phases of work may be considered. Stakeholders will be provided the opportunity to comment on additional work before the Phase II plans are finalized.

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100	Specific Sampling recommendations	Please note the drainage leading out of Area IV just below EPASW24 where the Bell1.4 ditch is also identified. This drainage leads to outfall 2 and is completely missed by this study. As confirmed by Laura Rainey of DTSC who did the primary review work for Area IV, there is a drainage "sheet flow" as indicated by the steep "v" noted (above and right of "B353 leach field" label). She has also indicated in her notes and concerns that the metals seen in Area IV are seen here as well, giving further supportive data that sampling below this area is needed.	EPA will examine this area during periods of rainfall and determine potential appropriate sampling locations to be considered for subsequent work.
101	General	Given the many overlapping deadlines related to SSFL stormwater, rcra investigative work as well as this important work done by EPA, my comments are not complete based on my own research. I have thousands of photographs and maps directly related to these sampling proposed areas and hereby request an opportunity to discuss these and other concerns in further detail in person. I feel this information is directly relevant to the areas most in need of sampling, and want to make sure that opportunity is there, on a timely basis so that my information may be adequately absorbed and considered within the process.	Additional sampling for subsequent phases of work may be considered. Stakeholders will be provided the opportunity to comment on additional work before the Phase II plans are finalized.
102	General	On another topic, I was told that I would be sent a copy of the photographic work done to my new address, and have not received it as yet (Andrew Taylor).	EPA is coordinating supplying a copy.

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103	General Comments	1. As described more fully in EPA guidance, the Quality Assurance Project Plan (QAPP) provides the Data Quality Objectives (DQOs), quantification limits, and other critical information needed to understand the study and ensure that the study meets remedial investigation objectives. Separation of the QAPP from the field sampling plan (FSP) is therefore troubling. DOE suggests that at the June 2, 2010 technical workgroup meeting a discussion be held to develop and refine the DQOs and that the QAPP associated with this sampling effort be sent for review and comment prior to the June 2nd meeting. If, this is a problem due to scheduling the sampling, DOE would be happy to assist EPA to ensure that the proposed low-flow sampling pumps not be installed until EPA has completed their first round of water sampling.	The QAPP is under review by EPA's QA/QC office. The QAPP and Final FSP will be made available to Stakeholders soon.
104	General Comments	Throughout the FSP EPA makes statements that the study may be funding limited. EPA's overall objective of the radiological study of Area IV is to complete the characterization per CERCLA guidelines. If EPA believes that they require more than the $40 Million that they proposed, then EPA should suggest the amount that they believe they need to complete their work, rather than continue to note that the study is funding limited.	Many of the references to budget have been removed from the FSP. Text has been changed throughout the FSP to indicate "current project limitations…" EPA has retained the text in Section 4.2 that lists available budget as a project constraint.

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105	General Comments	Throughout the FSP EPA makes statements that the study may be funding limited. EPA's overall objective of the radiological study of Area IV is to complete the characterization per CERCLA guidelines. If EPA believes that they require more than the $40 Million that they proposed, then EPA should suggest the amount that they believe they need to complete their work, rather than continue to note that the study is funding limited. Under the Scope of Work, EPA states it intends to sample sediments to "determine the general extent of contamination in sediments." Many of the radionuclides found at SSFL either have a natural background or a global fallout origin. What is going to be EPA's method for determining what background when it does not have a background value for sediment? There are a number of papers in the literature that demonstrate how fluvial processes separate and concentrate sediment particles in drainages. This is an example of why separation of the QAPP and the DQOs results in a breakdown in objectives, data usage, and interpretation.	See response to comment 104. The QAPP is forthcoming. EPA understands that there are additional investigation requirements for a comprehensive study of sediment that are not included in the FSP. The work described in the FSP for sediment is considered to produce a general understanding of the nature and localized extent of radionuclide contamination in this media only. The objectives for the groundwater, surface water and sediment study are different from the soil study in that they are primarily to confirm or (not) prior data. If data is collected that indicates that that sediment is contaminated, we will need to determine how to allocate remaining samples. In addition, at that point, soil results may be available as well so that we can better determine where to locate additional samples. EPA has said that it will consider collecting background sediment samples along-side DTSC when they conduct their field work for their chemical background study.

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106	General Comments	Under the Scope of Work, EPA states that it intends to sample spring/seeps "generally after significant rain events." However EPA does not provide objectives for the sampling nor how it intends to interpret or use the results. If it is EPA's intent to sample emergent water at springs, sampling after significant rains would mostly likely only result in the sampling of recent surface water infiltration, and not true groundwater. If EPA's objectives were to sample true groundwater emerging at seeps, sampling would be performed after the surface infiltration effects were past. What does EPA intend to do to demonstrate that what is being sampled is groundwater and not recently infiltrated surface water? This is another example of not having the QAPP DQOs available thus making it difficult to understand EPA's objectives.	The area included in the study (Area IV and the NBZ) are normally dry. Flowing springs and seeps observed during dry periods will also be considered for sampling. The text will be changed to clarify. The objective is to report the levels of radionuclides in seeps in springs for further evaluation.
107	General Comments	The surface water and seep study as presented by EPA focuses on the Northern Undeveloped Land. However, one-third of Area IV drains to the north and two-thirds to the south. More importantly, 80 percent of the developed area of Area IV and most of ETEC drains to the south. How does EPA account for its sampling emphasis, given the general terrain and prior land uses of the study area?	EPA attempted to provide coverage of major drainages from area IV without bias. For the initial phase of sampling locations selected will be within Area IV and the NBZ. EPA will provide Stakeholders the opportunity to comment on locations for the initial and subsequent phases of work.

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108	Page 2-3	Second bullet, states that a "large suite of radionuclides" can be analyzed by gamma spectroscopy at "relatively low-cost." For the background soil investigation, this large suite of analytes became quite expensive. Is EPA only planning routine analyses for the groundwater samples?	A phased approach to groundwater sampling will be employed. EPA has selected a priority list of analytes for the first phase of sampling that will be incorporated into the FSP. The analyte suite for subsequent sampling rounds will be clarified in the Phase II FSP that will be subject to Stakeholder review. The selection criteria for the subsequent sampling will be based on the results of the first round of sampling, HSA information, Stakeholder input, and other data that may become available prior to the subsequent sampling events.
109	Pages 2-5 and 2-6, Subsections 2.3.4.3 and 2.3.4.4, respectively	The Las Virgenes Sandstone and the Simi Conglomerate are members of the Santa Susana Formation.	Clarification has been made in the text
110	Page 3-1	Fifth paragraph states: "The required sample volumes for water samples and containers will be clarified in an Addendum to this FSP." Like the QAPP, when will this addendum be available? Will it be subject to Stakeholder review?	This addendum will be part of the QAPP and will be transmitted after the analytical lab is selected. Clarification will be made in the Phase I FSP.
111	Page 3-2	Third paragraph: "Radionuclides from potential sources in Area IV could have been deposited in the sediments through airborne deposition, transported onto soil particles, or precipitated out of solution." The same processes that accumulate radionuclides of on-site origin, accumulate naturally occurring and global fallout radionuclides. How does EPA intend to differentiate the origin of radionuclides found in sediment?	EPA will use values from its radiological background study for initial comparisons.

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112	Page 3-2	Third paragraph: identification of the movement of contaminants in drainage sediments is critical site delineation DQO. Sampling of sediments cannot be budget limited.	The QAPP is forthcoming. EPA understands that there are additional investigation requirements for a comprehensive study of sediment that are not included in the FSP. The work described in the FSP for sediment is considered to produce a general understanding of the nature and localized extent of radionuclide contamination in this media only. The objectives for the groundwater, surface water and sediment study are different from the soil study in that they are primarily to confirm or (not) prior data. If data is collected that indicates that that sediment is contaminated, we will need to determine how to allocate remaining samples. In addition, at that point, soil results may be available as well so that we can better determine where to locate additional samples. EPA has said that it will consider collecting background sediment samples along-side DTSC when they conduct their field work for their chemical background study.
113	Page 3-2	Fourth paragraph; "Sediment sampling will target the portions of the drainage features where sediment is accumulating." This is biased sampling. What will be EPA's point of reference for comparison of data from accumulated sediment? See also Section 4.5.	See response to comments 111, 112.
114	Figure 3-2	Figure 3-2 shows that EPA plans to focus all but one of the sediment samples for the northern drainages. However, 80 percent of the developed portion of Area IV flows to the south. How does EPA account for this discrepancy?	EPA intends to augment the sampling depicted on Figure 3.2 with additional samples after the gamma scanning program and as part of the soil sampling program.

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115	Page 3-3	Page 3-3, third paragraph: "Chemical contamination of groundwater at SSFL has been shown to extend off site." DOE believes that this statement applies to the Area I TCE plume and not Area IV, the focus of EPA's study. DOE is not aware of chemical groundwater contamination that extends beyond Area IV or the Northern Undeveloped Land.	The referenced sentence has been removed.
116	Page 3-4	Page 3-4, second paragraph: "The groundwater sampling program is designed to confirm the current groundwater concentrations in the [on-site] Area IV Study Area and provide data for radionuclides not previously tested using the existing monitoring network." Although DOE agrees with the objectives of the sampling effort, DOE questions why it will take sampling of 70 wells to accomplish the objective, given EPA's belief it is funding limited. Typically in a groundwater sampling program there is an objective stated for the sampling of each well, which is not included in the FSP. If EPA were to develop a well-by-well sampling objective, it may determine that it is not needed to sample every well in the Study Area and use the funding for other critical efforts.	Initial review of the existing data shows that historical sampling of the all the existing wells in Area IV was sporadic. Additionally, the analyte selection was not consistent through individual events and over time. The planned initial sampling of all of the wells for priority ROI's will provide a standard base line from which to design subsequent sampling events.
117	Page 4-2	Page 4-2, last paragraph regarding analysis of filter residue in the lab. Has EPA determined the mass of sample to be collected on a filter necessary to determine activity? Will EPA be required to collect extra sample volume in order to collect the required solids mass?	No. The filter residue is a measure of the undissolved solids content of the water sample and the results are to be arithmetically recombined with the water results for a "total" analyte concentration in water, in units of pCi/L. Consequently, the solids obtained from a given volume of water are considered to be representative of that volume of water, regardless of the mass of residue obtained. Filtering one liter of water, for example, results in a mass of residue that may be variable (and possibly indeterminate) but is still representative of one liter of water. The controlling parameter is the volume of water sampled.

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118	Page 4-9	Page 4-9, fifth paragraph: "Turbidity readings below 50 NTUs are desired, especially when metal samples are to be collected." EPA is not collecting metals samples, it is collecting radionuclide samples. Does this criterion also apply to radionuclides?	Many of the radionuclides of interest are metals. The objective is to limit the amount of solid aquifer material that could contribute anomalous concentrations of contaminants not naturally available in the aquifer where turbidity would generally be low. Radionuclides could be associated with the natural aquifer solids either as part of the mineral matrix or sorbed to mineral surfaces or organic carbon in the matrix.
119	General	For a while now I have been asking for further off-site sampling in the West Hills Area. Several areas that I've wanted DTSC and the Boeing Co to look at coincide with locations selected for the EPA Water Sampling Plan. That is very heartening to see. I'd like to add to that list.	EPA will be removing off-site well sampling from the Phase I FSP. We will revisit Stakeholder requests for off-site well sampling and solicit input for the Phase II FSP.

Responses to Draft Final Comments Groundwater, Surface Water, and Sediment FSP dated April 2010			
No.	**Reference or Page**	**Comment**	**Response**
120	Off-Site Sampling	I've been working out of the Off-Site Data Evaluation Report (MWH, 2007). It seems to be the most complete compilation of surveys that I've managed to find and is of special interest to the West Hills Neighborhood Council, Environment Committee. There are several studies that have not been included in that report however. The one of most interest to us is the report prepared for the Hidden Lake Homeowners Association in 1990-92 by McLaren-Hart. They detected TCE in monitoring wells adjacent to the Hughes Missile Systems facility on the corner of Fallbrook and Roscoe aves. Some of these samples are almost twice the reporting limits. The last date I see on the 5 reports I have is June 15 1992. Another report I have from Groundwater Resources Consultants, Inc. dated January 29, 1992. It indicates the presence of radium-226/228, radon-222 and uranium-234/235/238, all of which are natural occurring, in these same monitoring wells. As near as I can tell they ONLY looked for naturally occurring radionuclide's. According to the reports, groundwater in this area is only 5 feet deep and is spread under several dozen homes in the Hidden lake Development. Naturally, some of the residents have concerns. These reports are very old and the trust in the analysis is very low based on the past situation with the community and the responsible parties. Now would be a good time to re-visit these wells and come up with data we can trust. Alec Uzemic and I may have the only copies of these reports extant. I can make them available to you as you need them.	The suggested sampling of the residential locations in the comment is currently beyond the scope of the investigation. Should project resources become available for additional work Stakeholder input will be used to consider the best use of those resources in the Phase II FSP.

Responses to Draft Final Comments Groundwater, Surface Water, and Sediment FSP dated April 2010			
No.	**Reference or Page**	**Comment**	**Response**
121	Off-Site Sampling	As I look at the Proposed Off-Site Well Sampling Locations, (Figure 3.3, Draft FSP, 4-16-10) I see included wells OS-19 and OS-20. In the Off-Site Data Evaluation Report there is also listed an additional 2 well, OS-18. I believe these were old domestic water supply wells for the ranch that used to be on this property. I have been trying to find the well heads to no avail. These are the locations I've asked the DTSC and Boeing to sample. Both Art Lenox and Tom Seckington have concurred that the wells would be a good place to look. I don't believe the wells exist anymore. They were destroyed when the housing development that currently sits on the property was built in the late 1980's. A local resident and member of the West Hills Neighborhood Council, Barry Seibert, has a shallow piezometer in his back yard that was installed several years ago when he had some construction done on his home. His house is either on the same block as well OS-19, possibly on property immediately adjacent to where OS-19 used to be. He and I have both asked DTSC to take samples from his back yard and Tom Seckington said there would be a benefit. Art Lenox did not think it would be appropriate. We would very much like to put his back yard on the list if you cannot find OS-19 or OS-20. If you like I'll take you around and show you these locations.	Sampling off-site wells has been removed from the Phase I sampling. Work in areas off-site will be considered for Phase II. EPA will begin its work in the study boundary which includes Area IV and the NBZ.

Responses to Draft Final Comments Groundwater, Surface Water, and Sediment FSP dated April 2010			
No.	**Reference or Page**	**Comment**	**Response**
122	Spring/Seep Sampling	I've been working off the map from the 2007 Off-Site Data Evaluation Report, Figure 2-1. On that map it lists many seeps and springs in the Woolsey Canyon/Dayton Canyon Drainage's. Of most interest to me are Spring FDP-729 and FDP-850. FDP-850 has been expanded into a well by the owner of the property to aid in his development of the lot. These springs are deep in a canyon immediately below a fault that extends from the top of Woolsey Canyon down towards the Chatsworth Nature Preserve and the Dayton Canyon Development. There is much controversy in the community surrounding these faults and for quite a while I have been looking for areas that could prove or disprove the theories of contaminant migration through them to the Chatsworth Nature Preserve. Under separate e-mail is my sampling request to Boeing and DTSC for reference, as well as Art Lenox' response (Included as Attachment 2 of these responses to comments). I would very much like to have these springs added to the list.	Sampling off-site wells has been removed from the Phase I sampling. Work in areas off-site will be considered for Phase II. EPA will begin its work in the study boundary which includes Area IV and the NBZ.
123	Offsite Sediment Sampling	In addition to the springs up stream in Woolsey/Dayton Canyon, there are areas of sediment accumulation in the drainage's of Woolsey and Box Canyon. These areas are immediately upstream to the Chatsworth Nature Preserve. I think they would be of interest for surface samples and once again, could serve to prove or disprove the theories of migration through the faults upstream in Woolsey and Box Canyon. Please see the attached Google Earth Projection in the supplemental e-mails (provided as Attachment 3).	Sampling off-site wells has been removed from the Phase I sampling. Work in areas off-site will be considered for Phase II. EPA will begin its work in the study boundary which includes Area IV and the NBZ.

Responses to Draft Final Comments Groundwater, Surface Water, and Sediment FSP dated April 2010			
No.	**Reference or Page**	**Comment**	**Response**
124	Storm Water	The only other area of interest to the WHNC is the ponds at the mouth of Bell Creek. There is a large pond immediately before the L.A. River becomes lined with concrete. Surface water runoff occurs there year round and would be of interest to us. Under separate e-mail I will include my request to Cassandra Owens of the Water Board for analysis of storm water at that location.	Sampling off-site wells has been removed from the Phase I sampling. Work in areas off-site will be considered for Phase II. EPA will begin its work in the study boundary which includes Area IV and the NBZ.
125	Surface Water Sampling	Christina Walsh brought up good points about surface sampling at STL-IV at the last Stakeholder meetings. I concur with her assessment of that area and since it drains into the Bell canyon area through Outfall 002, it becomes a matter of interest to our group.	EPA will examine this area during periods of rainfall and determine potential appropriate sampling locations to be considered for subsequent work.

RADIONUCLIDE DATA FOR DRY AND ABANDONED LOCATIONS									
Well	Chemical Name	Result Value	Unit	Analytical Method	Sample Date	Project Qualifier Code	MDA	Error Plus Minus	Error Type
PZ-107	Gross Alpha (filtered)	6.33	pCi/L	900.0	6/25/2005		3.37	4	Total Propagated Uncertainty or Error
	Gross Beta (filtered)	9.07	pCi/L	900.0	6/25/2005		8.82	6	Total Propagated Uncertainty or Error
	Cesium-134, Dissolved	1.64	pCi/L	901.1	6/25/2005	U	1.64		
	Cesium-137, Dissolved	1.54	pCi/L	901.1	6/25/2005	U	1.54		
	Cobalt -57, Dissolved	0.988	pCi/L	901.1	6/25/2005	U	0.988		
	Cobalt-60, Dissolved	1.64	pCi/L	901.1	6/25/2005	U	1.64		
	Europium-152, Dissolved	4.05	pCi/L	901.1	6/25/2005	U	4.05		
	Europium-154, Dissolved	4.81	pCi/L	901.1	6/25/2005	U	4.81		
	Manganese-54, Dissolved	1.48	pCi/L	901.1	6/25/2005	U	1.48		
	Potassium-40, Dissolved	35.1	pCi/L	901.1	6/25/2005	U	35.1		
	Sodium-22, Dissolved	1.64	pCi/L	901.1	6/25/2005	U	1.64		
RD-89	Tritium	95.9	pCi/L	906.0	5/24/2005	U	159	97	Total Propagated Uncertainty or Error
	Gross Alpha (filtered)	11.7	pCi/L	900.0	5/24/2005		4.75	56	Total Propagated Uncertainty or Error

RADIONUCLIDE DATA FOR DRY AND ABANDONED LOCATIONS									
Well	Chemical Name	Result Value	Unit	Analytical Method	Sample Date	Project Qualifier Code	MDA	Error Plus Minus	Error Type
RD-89 (Cont'd)	Gross Beta (filtered)	8.35	pCi/L	900.0	5/24/2005		6.94	4.8	Total Propagated Uncertainty or Error
	Cesium-134, Dissolved	2.31	pCi/L	901.1	5/24/2005	U	2.31		
	Cesium-137, Dissolved	1.85	pCi/L	901.1	5/24/2005	U	1.85		
	Cobalt -57, Dissolved	0.829	pCi/L	901.1	5/24/2005	U	0.829		
	Cobalt-60, Dissolved	2.2	pCi/L	901.1	5/24/2005	U	2.2		
	Europium-152, Dissolved	5.02	pCi/L	901.1	5/24/2005	U	5.02		
	Europium-154, Dissolved	6.09	pCi/L	901.1	5/24/2005	U	6.09		
	Manganese-54, Dissolved	1.97	pCi/L	901.1	5/24/2005	U	1.97		
	Potassium-40, Dissolved	21.3	pCi/L	901.1	5/24/2005	U	21.3		
	Sodium-22, Dissolved	2.07	pCi/L	901.1	5/24/2005	U	2.07		
	Tritium	75.8	pCi/L	906.0	5/24/2005	U	158	96	Total Propagated Uncertainty or Error
	Gross Alpha (filtered)	11.2	pCi/L	900.0	5/24/2005		5.08	5.6	Total Propagated Uncertainty or Error
	Gross Beta (filtered)	4.24	pCi/L	900.0	5/24/2005	U	6.92	4.3	Total Propagated Uncertainty or Error
	Cesium-134, Dissolved	2.12	pCi/L	901.1	5/24/2005	U	2.12		

RADIONUCLIDE DATA FOR DRY AND ABANDONED LOCATIONS									
Well	Chemical Name	Result Value	Unit	Analytical Method	Sample Date	Project Qualifier Code	MDA	Error Plus Minus	Error Type
RD-89 (Cont'd)	Cesium-137, Dissolved	1.99	pCi/L	901.1	5/24/2005	U	1.99		
	Cobalt -57, Dissolved	1.28	pCi/L	901.1	5/24/2005	U	1.28		
	Cobalt-60, Dissolved	2.02	pCi/L	901.1	5/24/2005	U	2.02		
	Europium-152, Dissolved	4.66	pCi/L	901.1	5/24/2005	U	4.66		
	Europium-154, Dissolved	6.05	pCi/L	901.1	5/24/2005	U	6.05		
	Manganese-54, Dissolved	1.86	pCi/L	901.1	5/24/2005	U	1.86		
	Potassium-40, Dissolved	37	pCi/L	901.1	5/24/2005	U	37		
	Sodium-22, Dissolved	2.06	pCi/L	901.1	5/24/2005	U	2.06		
	Tritium	55.2	pCi/L	906.0	6/1/2005	U	166	100	Total Propagated Uncertainty or Error
	Gross Alpha (filtered)	11.4	pCi/L	900.0	6/1/2005		5.32	5.4	Total Propagated Uncertainty or Error
	Gross Beta (filtered)	3.26	pCi/L	900.0	6/1/2005	U	7.35	4.4	Total Propagated Uncertainty or Error
	Cesium-134, Dissolved	1.74	pCi/L	901.1	6/1/2005	U	1.74		
	Cesium-137, Dissolved	1.47	pCi/L	901.1	6/1/2005	U	1.47		
	Cobalt -57, Dissolved	0.861	pCi/L	901.1	6/1/2005	U	0.861		

RADIONUCLIDE DATA FOR DRY AND ABANDONED LOCATIONS									
Well	Chemical Name	Result Value	Unit	Analytical Method	Sample Date	Project Qualifier Code	MDA	Error Plus Minus	Error Type
RD-89 (Cont'd)	Cobalt-60, Dissolved	1.62	pCi/L	901.1	6/1/2005	U	1.62		
	Europium-152, Dissolved	4.1	pCi/L	901.1	6/1/2005	U	4.1		
	Europium-154, Dissolved	4.32	pCi/L	901.1	6/1/2005	U	4.32		
	Manganese-54, Dissolved	1.5	pCi/L	901.1	6/1/2005	U	1.5		
	Potassium-40, Dissolved	25	pCi/L	901.1	6/1/2005	U	25		
	Sodium-22, Dissolved	1.46	pCi/L	901.1	6/1/2005	U	1.46		
RD-74	Tritium	30.2	pCi/L	906.0	5/13/1999	U	184	110	Counting Error +/-
	Gross Alpha (filtered)	8.82	pCi/L	900.0	5/13/1999		2.74	3.4	Counting Error +/-
	Gross Beta (filtered)	5.29	pCi/L	900.0	5/13/1999		2.72	1.9	Counting Error +/-
	Cesium-134, Dissolved	18.2	pCi/L	901.1	5/13/1999	U	18.2		
	Cesium-137, Dissolved	13	pCi/L	901.1	5/13/1999	U	13		
	Cobalt -57, Dissolved	5.96	pCi/L	901.1	5/13/1999	U	5.96		
	Cobalt-60, Dissolved	20.8	pCi/L	901.1	5/13/1999	U	20.8		
	Actinium-228, Dissolved	61.4	pCi/L	901.1	5/13/1999	U	61.4		
	Bismuth-212, Dissolved	100	pCi/L	901.1	5/13/1999	U	100		

RADIONUCLIDE DATA FOR DRY AND ABANDONED LOCATIONS									
Well	Chemical Name	Result Value	Unit	Analytical Method	Sample Date	Project Qualifier Code	MDA	Error Plus Minus	Error Type
RD-74 (Cont'd)	Bismuth-214, Dissolved	27.4	pCi/L	901.1	5/13/1999	U	27.4		
	Lead-210, Dissolved	111	pCi/L	901.1	5/13/1999	U	111		
	Lead-212, Dissolved	18.4	pCi/L	901.1	5/13/1999	U	18.4		
	Lead-214, Dissolved	26.3	pCi/L	901.1	5/13/1999	U	26.3		
	Potassium-40, Dissolved	179	pCi/L	901.1	5/13/1999	U	179		
	Radium-226, Dissolved	172	pCi/L	901.1	5/13/1999	U	172		
	Thallium-208, Dissolved	12.2	pCi/L	901.1	5/13/1999	U	12.2		
	Thorium-234, Dissolved	238	pCi/L	901.1	5/13/1999	U	238		
	Urainium-235, Dissolved	51.4	pCi/L	901.1	5/13/1999	U	51.4		
RS-27	Gross Alpha (filtered)	2	pCi/L	900.0	3/4/1992	U	2		
	Gross Beta (filtered)	4	pCi/L	900.0	3/4/1992		3	3	Counting Error +/-
	Gross Alpha (filtered)	-0.3	pCi/L	900.0	6/4/1992	U	2	1.5	Counting Error +/-
	Gross Beta (filtered)	2	pCi/L	900.0	6/4/1992	U	3	3	Counting Error +/-
	Gross Alpha (filtered)	1.1	pCi/L	900.0	5/17/1995	U	1.9	1.2	Counting Error +/-
	Gross Beta (filtered)	3.7	pCi/L	900.0	5/17/1995		2.1	1.4	Counting Error +/-

RADIONUCLIDE DATA FOR DRY AND ABANDONED LOCATIONS									
Well	Chemical Name	Result Value	Unit	Analytical Method	Sample Date	Project Qualifier Code	MDA	Error Plus Minus	Error Type
RS-27 (Cont'd)	Gross Alpha (filtered)	-0.216	pCi/L	900.0	5/7/1998	U	1.79	0.8	Counting Error +/-
	Gross Beta (filtered)	1.03	pCi/L	900.0	5/7/1998	U	2.01	1.2	Counting Error +/-
	Tritium	-472	pCi/L	906.0	3/4/1992	U	500	498	Counting Error +/-
	Tritium	60	pCi/L	906.0	5/17/1995	U	230	190	Counting Error +/-
	Tritium	-182	pCi/L	906.0	5/7/1998	U	220	120	Counting Error +/-
	Cesium-137, Dissolved	0.335	pCi/L	901.1	3/4/1991	U	10	5.16	Counting Error +/-

Notes: Radiological data was not located in the Boeing database for wells PZ-097, PZ-099, PZ-104, PZ-107, PZ-110, PZ-112, PZ-114, PZ-115, PZ-143, RD-74, RD-89, RS-24, RS-27
MDA – minimum detectable activity
pci/L – picocuries per liter
U – not reported above the MDA

APPENDIX C

RESPONSES TO COMMENTS RECEIVED ON DRAFT FINAL FIELD SAMPLING PLAN DATED APRIL 2010

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Responses to Draft Final Comments Groundwater, Surface Water, and Sediment FSP dated April 2010			
No.	**Reference or Page**	**Comment**	**Response**
1	General	Three key differences in the approach described in the Area IV FSP with regard to the sampling program described in the SSFL SW WQSAP were identified: 1. The purging and sampling equipment and methodologies described in the Area IV FSP are different than those proposed in the SSFL SW WQSAP, as discussed in prior meetings with EPA and DTSC. 2. The Area IV FSP indicates sampling in up to 70 wells in the vicinity of SSFL Area IV compared to approximately 30 in the SSFL SW WQSAP. 3. The filtering and analysis for radiochemical samples Area IV FSP is different than that indicated in the SSFL SW WQSAP. We recommend that these and other coordination issues be discussed in a meeting and clarified. Each issue is described in further detail below.	Comments acknowledged.
2	Coordination with Boeing	Any retrofit to wellhead or down-hole equipment (even temporarily) must be approved by Boeing and DTSC prior to any field sampling event.	Comments acknowledged.
3	General	The purging equipment and method at individual wells are not assigned in the Area IV FSP; therefore, they are not contrasted with those proposed in SSFL SW WQSAP on a well-by-well basis.	EPA will provide a table showing the locations in the sampling program to Boeing.

Responses to Draft Final Comments Groundwater, Surface Water, and Sediment FSP dated April 2010			
No.	**Reference or Page**	**Comment**	**Response**
4	SOP 2.02	The Area IV FSP indicates a minimum and maximum flow rate for low-flow purging of 200 milliliters per minute (ml/min) and 500, respectively. The SSFL SW WQSAP minimum flow rate for low-flow purging is that needed to "induce drawdown". Note that a minimum flow rate of 50 ml/min is required to conduct VOC sampling. The maximum flow rate is determined as less than the rate that would induce greater than 0.3 feet of drawdown in a well. It has been SSFL's experience that many shallow wells and piezometers at SSFL will not sustain a 200 ml/min flow rate.	The 200ml to 500ml flow rate in the FSP text is given as a general description. In the first paragraph of Section 4.6.2.2.1 there is a reference to SOP 2.02 which provides a detailed description of the Low-flow sampling procedures that will be used. In SOP 2.02, Section 4.2, the following is stated, "For wells known to have a less than a 0.2 lpm flow rate, a flow rate of 0.05 to 0.2 lpm should be attempted." It is understood that there are numerous shallow wells in Area IV that cannot be purged at >200 ml/min.
5	SOP 2.02	The Area IV FSP presents multiple alternative purging methodologies to account for exceptions to the general low-flow stabilization criteria when encountered. These exceptions differ somewhat in individual sections of the Area IV FSP and may benefit from standardization or clarification. For example, instructions are provided for when to sample a well if it has been purged dry using low-flow methods in SOP 2.02; on the following page it is indicated that wells shall under no circumstances be purged to dryness.	The text: "Under no circumstances should the well be pumped dry" has been deleted from SOP 2.02. The text on page 2.02-5 has been changed to read: "If under these minimal pumping conditions drawdown continues then the low-flow technique is assumed to be invalid and should be discontinued because groundwater flow to the pump is no longer considered to be laminar across the screen within the aquifer. The flow in the vicinity of the pump now contains a vertical component from the stagnant water column in the filter pack and screened casing. In these cases procedures for sampling will be changed to those described in SOP 2.23 (Groundwater Sampling using Procedures other than Low Flow). This information should be noted in the field notebook or ground-water sampling log."

Responses to Draft Final Comments Groundwater, Surface Water, and Sediment FSP dated April 2010			
No.	**Reference or Page**	**Comment**	**Response**
6	SOP 2.02	The Area IV FSP indicates temperature as a stabilization criterion for low-flow sampling. The SSFL SW WQSAP indicates temperature will be recorded, but not used for parameter stabilization determination. The SSFL SW WQSAP is consistent with EPA Low-Flow guidance (Low-Flow (Minimal Drawdown) Groundwater Sampling Procedures by Robert W. Puls and Michael J. Barcelona, 1996) which does not include temperature criteria for determining stabilization prior to sampling.	Temperature has been removed as a stabilization criteria in SOP 2.02
7	General	The Area IV FSP includes sampling of all available wells in Area IV and up to 20 wells off-site to the north and northwest, for a total of approximately 70 wells. The SSFL SW WQSAP includes sampling of approximately 30 wells in Area IV, and in the undeveloped land and off-site west and north of Area IV.	Discussions of off-site well sampling have been removed from this Phase I FSP. The Phase I FSP indicates that up to 70 on-site monitoring wells will be sampled.
8	V	Change The Boeing Corporation to The Boeing Company	The text has been changed as requested.

Responses to Draft Final Comments Groundwater, Surface Water, and Sediment FSP dated April 2010			
No.	**Reference or Page**	**Comment**	**Response**
9	1-2	Both the media and the lab analysis protocols are identical for sediment and soil. Why is sediment included in the water sampling program and not included in the soil sampling program. Will sufficient background sediment samples be split in the DTSC chemical background study to establish a statistically valid sediment background data-set and to enable meaningful comparisons to the on-site sediment samples. The distinction between Phase I and Phase II is not clear.	The objectives for the groundwater, surface water and sediment study are different from the soil study in that they are primarily to confirm (or not) prior data. If data is collected that indicates that that sediment is contaminated, we will need to determine how to allocate remaining samples (see below for discussion of phase II). In addition, at that point, soil results may be available as well so that we can better determine where to locate additional samples. EPA has said that it will consider collecting background sediment samples along-side DTSC when they conduct their field work for their chemical background study. Phase II sampling is intended to allow for additional data collection at deposition locations both up and down gradient of the Phase I sample locations. The Phase II FSP will be issued to address the Phase II activities which will be available for Stakeholder input prior to being finalized.
10	2-2	The SDF was not a "nuclear facility " A "nuclear facility" is a nuclear reactor, or non-reactor facility in which special nuclear (fissionable) material is used, processed or stored in such quantities as to require criticality controls. The presence of environmental radiological contamination (as in the case of the SDF) does not make it a "nuclear facility.	The text has been changed to read: "Other operations that handled radiological material within Area IV included the Radioactive Materials Disposal Facility and the Hot Laboratory, as well as the Sodium Disposal Facility, or Area IV burn pit."

Responses to Draft Final Comments Groundwater, Surface Water, and Sediment FSP dated April 2010			
No.	**Reference or Page**	**Comment**	**Response**
11	2-3	Gross alpha and beta analyses are done as screening analysis. Be more specific about what can be subtracted (e.g. uranium and radon from gross alpha and K-40 from gross beta).	The text has been changed as follows: "Gross alpha and gross beta analyses are used to measure alpha and beta emissions. These can be used to infer that radionuclides may be present in addition to those radionuclides measured using different analytical methods. As an example, many beta emitting radionuclides also emit gamma radiation, therefore those beta-emitting radionuclides measured via gamma spectrometry and specific methods (e.g. Sr-90, H-3, etc.) can be summed and compared to the gross beta result or a particular sample. If the gross beta result is significantly greater than the summed value, then it is possible that the sample contains beta activity from a radionuclide which had not been measured or detected. Gross alpha data can be similarly inspected. The gross results can be compared to the Federal maximum contaminant level (MCL) for gross alpha activity (15 pCi/L) or the California MCL of 50 pCi/L for gross beta activity. The Federal gross alpha MCL excludes uranium and radon so activities associated with these radionuclides should be used to calculate and adjusted gross alpha value for comparison to the MCL. Similarly, naturally occurring potassium-40 activity should be subtracted from gross beta activity to provide a value to compare to the MCL."

Responses to Draft Final Comments Groundwater, Surface Water, and Sediment FSP dated April 2010			
No.	**Reference or Page**	**Comment**	**Response**
12	3-2	The distinction between Phase I and Phase II is unclear.	The revised FSP now includes one round of groundwater sampling in July 2010 during the dry season. The Phase II FSP will describe the second event in the wet season. The need and frequency of subsequent sampling events will be based on evaluation of the analytical results from these two events. As determined the rationale for subsequent rounds of sampling will be incorporated by addendum.
13	Table 2-1	Why TBD?	Tritium will be analyzed as described in the text of the FSP. This error has been corrected.
14	Figure 2.2	Acrobat 9 Pro reported an error on this page.	Error will be corrected in the final document.
15	2.01-3	So what are the options? Is there one method for cesium-137 and one method for strontium-90?	There are no differences. The referenced text will be deleted.
16	2.01-7	So you have listed some potential issues. What are the solutions and controls?	Activity hazard analysis (AHA) forms that identify potential health and safety hazards associated with each major task associated with this project are provided in Appendix B of the Site Safety and Health Plan. No potential hazards like those identified in this section have been identified in the AHA for decontamination. A sentence will be added to the end of this section that indicates: "Workers shall read the activity hazard analyses provided in the Site Safety Plans prior to starting work. These analyses will identify hazards and protective measures for site personnel."
17	2.16-15	Does EPA plan to sample the groundwater in the 56 hole.	EPA will acquire one surface water and one sediment sample from the Building 4056 excavation pond. The FSP will be revised accordingly.

Responses to Draft Final Comments Groundwater, Surface Water, and Sediment FSP dated April 2010			
No.	**Reference or Page**	**Comment**	**Response**
18		The report also states that sediment samples will be used to further characterize the extent of radionuclides of concern but it does not provide any details about what such further characterization might entail.	The objectives for the groundwater, surface water and sediment study are different from the soil study in that they are primarily to confirm (or not) prior data. If data is collected that indicates that that sediment is contaminated, we will need to determine how to allocate remaining samples (see below for discussion of phase II). In addition, at that point, soil results may be available as well so that we can better determine where to locate additional samples. EPA has said that it will consider collecting background sediment samples along-side DTSC when they conduct their field work for their chemical background study. Phase II sampling is intended to allow for additional data collection at deposition locations both up and down gradient of the Phase I sample locations. An addendum to the FSP will be issued to address the Phase II activities which will be available for Stakeholder input prior to being finalized.
19	4.07-1	Repeated SOP.	Duplicate SOP was removed.
20	Page 1-2	One or two rounds of groundwater sampling appears inadequate to provide representative data. Although this relates in part to subsequent sampling, it impacts the initial round. We are troubled by the change in plans to merely take two rounds of on-site groundwater samples. We had understood that there would be quarterly EPA measurements from the 2nd quarter of 2010 (we had hoped for it to start earlier) through the end of the study. Given the potential for variability, quarterly sampling so that one would have at least 6 rounds of sampling seemed appropriate. Similarly, I am troubled by the single round of offsite samples. How likely is it for this	EPA has been working to find options to optimize the water sampling program within program limitations. EPA has elected to provide the best coverage over-time within these limitations. The Phase I FSP has been revised to include one round of groundwater sampling to evaluate the dry season. The Phase II FSP will detail wet season sampling for the second event. Each of the two rounds of sampling will include analysis of all available wells in Area IV and the NBZ for the highest priority analytes (H-3, Sr-90, U isotopes, gamma emitters, gross alpha and beta). Certain lower priority

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		to be representative? (I am not commenting here on the other offsite sampling issues, as we understand it is deferred to a later stage and we are to comment here on the initial round of 21 groundwater sampling.) We see substantial variations quarter to quarter in even the Boeing sampling.	radionuclides have been reported in the Study Area. During the first sampling event EPA will analyze water from locations where these analytes have been reported in the past. Because there are cost limitations, the locations where the highest concentrations of these lower priority analytes were reported may be sampled in preference to locations where lower concentrations may have been reported. The scope for the second round of sampling will include the highest priority analytes, as described above, and will also include additional analytes as determined by results of the first round of sampling, historical water data from each well, HSA information indicating the need to sample, Stakeholder input, and possibly the results of soil sampling and gamma scanning. The Phase II FSP will describe the additional analyses proposed for the second round and take into account changing budgets. Stakeholders will be given the opportunity to comment on the Phase II FSP. In addition, the need and frequency of subsequent sampling, beyond the two rounds described will be based on evaluation of the analytical results from these two events and budget. As determined the rationale for subsequent rounds of sampling will be incorporated to this by addendum.

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21	Table 2-1	Large number of important radionuclides left as "to be determined" as to whether they will be monitored for.The text at p. 2-2 indicates that the list of radionuclides to be analyzed for surface water and sediment is presented in Table 2-1, but is silent as to where to find the analytic radionuclide list for groundwater. Table 2-1 itself, however, has a column for surface water and groundwater. It is unclear which is operative, the description of the table at p. 2-2 (that it only applies to surface water) or the table itself (that it applies to groundwater as well).Table 2-1 lists a number of radionuclides as "To Be Determined" (TBD) for the water measurements. What has been determined as to whether to include those? Will we be in the loop on that determination? For example, Am-241 is TBD. It is an important radionuclide and shouldn't it be analyzed for? Similarly for the curiums, iron-55, and especially tritium. Given the tritium plume onsite, why in the world would one exclude it from sampling? (And if measured, would it only be looked for in the organic form, as opposed to HTO?) Similarly, nickel-59 and -63 are potentially important. Please explain why one would look for neptunium-236 and -239 but not -237. Isn't lead-210 important? And certainly one should look for promethium-147. Boeing and its predecessors had a state radioactive materials license for 150,000 curies of it in unsealed oxide form for manufacture of sources. Polonium-210 would seem important; used in neutron initiators, for example. And why would one possibly want to exclude the plutoniums? They had a plutonium fuel fabrication at the site, and Pu-238 was found at Brandeis during the McLaren-Hart study, suggesting in addition to the regular mix of Pu-239/240 etc. in Pu fuel, they may have been making Pu-238 radioisotope thermal generators (RTGs). Technetium-99 would seem important. Why exclude all the longer-lived thoriums, including only isotopes with a half-life of hours or days (which should have	Each of the two rounds of groundwater sampling will include analysis of all available wells in Area IV and the NBZ for the highest priority analytes (H-3, Sr-90, U isotopes, gamma emitters, gross alpha and beta). Certain lower priority radionuclides have been reported in the Study Area. During the first sampling event EPA will analyze water from locations where these analytes have been reported in the past. Because there are cost limitations, the locations where the highest concentrations of these lower priority analytes were reported may be sampled in preference to locations where lower concentrations may have been reported. The scope for the second round of sampling will include the highest priority analytes, as described above, and will also include additional analytes as determined by results of the first round of sampling, historical water data from each well, HSA information indicating the need to sample, Stakeholder input, and possibly the results of soil sampling and gamma scanning. A Phase II FSP will be issued that describes the additional analyses proposed for the second round that takes into account changing budgets. Stakeholders will be given the opportunity to comment on this addendum. In addition, the need and frequency of subsequent sampling, beyond the two rounds described will be based on evaluation of the analytical results from these two events and budget. As determined the rationale for subsequent rounds of sampling will be incorporated to by addendum.The word "surface water" has been changed to "groundwater" on page 2-2 to clarify that the discussion and Table 2.1 refer to the analytes for all groundwater samples only. In addition the column on Table 2.1 "Analyze in Sediment" has been changed to "Analyze in

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		decayed) but leaving out those with half-lives in years, that would be expected to still be around? The longer-lived thoriums should be monitored for, particularly since the facility did work with thorium-based fuels.Note that on p. 2-2 tritium is listed as a contaminant of particular concern for groundwater, detected onsite and requiring analysis in this sampling, yet it is listed as TBD in Table 2-1. On p. -3 tritium is listed as the highest priority for well analysis, yet listed as TBD in the table.If the "TBD" listing is because of cost concerns, we need to see what the costs are to make a sensible weighting decision. [If what drives it is an effort to detect concentrations at the PRG level instead of MCLs (taking into account the sum-of-the-fractions rule), talk to me.]And if the reason for TBD is due to the need to stay within a $100,000 budget for the lab if the sampling is done before November; and if one is racing to do the first round before November because Boeing is insisting on altering the wells thereafter in ways EPA finds objectionable (see below); then we need to resolve those issues, and fast. Rather than acquiescing to Boeing, Boeing should not interfere with EPA's sampling efforts.	Sediment and Surface Water."The specific requests for analyses presented in this comment will be discussed in a meeting with Stakeholders and changes may be made. Tritium will be analyzed for all samples. The "TBD" designation for tritium is in error on Table 2.1 and has been corrected.The budget is of particular concern for the first sampling event. The budget and timeframe for sampling will be discussed at an upcoming stakeholder meeting.

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22	General	Problematic that Boeing intends, over EPA objections, to change the pump locations (permanent replacement with low-flow pumps) in the wells after the first round of sampling, making data sets of reduced inter-comparability. EPA has expressed concerns about Boeing plans to change the pump locations in the wells. We already have significantly problems comparing groundwater data sets, since the years of groundwater monitoring by Boeing have been criticized by EPA—and long criticized by the community—for having filtered the samples before measurement (and throwing out the filters rather than measuring what was on them and adding it in). Now, we will get one single set of EPA measurements with the proper filtering technique, but then Boeing will modify the wells, making subsequent measurements not comparable to even the prior EPA first round measurements. Furthermore, EPA has questioned the rationale for the change, raising questions about the representativeness of samples after the change is made. None of this is disclosed in any detail in the Field Sampling Plan, nor is there any resolution of the problem. The Plan should be amended to fully disclose the problem and EPA's objections and reasons therefore; and the full group needs to discuss the matter and try to press that Boeing not alter the wells. There also needs to be direct communication between EPA and DTSC SSFL Project Manager Brausch, since DTSC must approve Boeing's proposed changes to the wells. This needs to occur quickly, since apparently Boeing is going ahead and modifying wells in other parts of the site. If EPA is right and this will produce even more unrepresentative sampling results, it needs to be stopped now.	EPA cannot confirm who originally proposed the switch to low-flow sampling. DTSC and Boeing should be consulted. These issues will be discussed at an upcoming Stakeholder meeting however, we reiterate that DTSC, as the lead regulatory agency, will determine where the pumps will be placed and when and if the change will occur. As a point of clarification, EPA does not take issue with the low-flow sampling methodologies. Our discussions have centered on acquisition of samples that are representative of formation water. Purging techniques and pump placement are important considerations when using low-flow. EPA has chosen to use low-flow techniques for wells with short screens (10 feet in length or less). Most of the wells with short screens in Area IV and the NBZ are screened within the unconsolidated overburden. Shallow overburden wells do not generally suffer from complications associated with flow through fractures in rock. However, these wells are generally more prone to development of artificial turbidity during the purging process. This artificial turbidity, if included in the samples, could introduce contaminants to the sample that are not representative of what is present in the groundwater The low-flow techniques, to be employed for wells with short screens, have been adopted to limit this artificial turbidity. As described in Section 4.1.4, the activity of radionuclides contained in the turbidity of all water samples will be measured to provide for a total activity when summed with the activity of the water itself.

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23	General	Significant concerns with plans to change the purging technique.In 1989, Boeing's predecessor, faced with measured radionuclide concentrations in groundwater an order of magnitude above MCLs, commenced with creative approaches to remove the radioactivity from the groundwater samples before measuring them. They first tried decanting, and then settled on filtering. The radioactivity filtered out of the water was discarded and not measured. This process resulted in a ten-fold reduction in measured values from the prior measurements. It was, and remains, a highly controversial practice.Gregg Dempsey has said it is improper. That if one must filter, one must measure what is on the filter and add it (converted into a volumetric concentration) to the value from the filtered water.Now it is proposed to use a new technique, described as low-flow purging. The description of the rationale for using this technique is that it reduces the concentration of colloids and the turbidity in the samples. We are concerned that this is just a new way of artificially lowering the radionuclide concentration in the sample before measuring—a new way of doing what the old filtering did.We would appreciate knowing who first proposed the switch to this technique. Was it Boeing?In any case, there needs to be substantial discussion of the proposed change.Remember, the groundwater measurements are designed in part to tell us whether radioactivity has migrated into the aquifer. Trying to keep the colloidal content and the suspended fraction low may be depriving us of data that are important.	EPA cannot confirm who originally proposed the switch to low-flow sampling. DTSC and Boeing should be consulted. These issues will be discussed at an upcoming Stakeholder meeting however, we reiterate that DTSC, as the lead regulatory agency, will determine where the pumps will be placed and when and if the change will occur.As a point of clarification, EPA does not take issue with the low-flow sampling methodologies. Our discussions have centered on acquisition of samples that are representative of formation water. Purging techniques and pump placement are important considerations when using low-flow. EPA has chosen to use low-flow techniques for wells with short screens (10 feet in length or less). Most of the wells with short screens in Area IV and the NBZ are screened within the unconsolidated overburden. Shallow overburden wells do not generally suffer from complications associated with flow through fractures in rock. However, these wells are generally more prone to development of artificial turbidity during the purging process. This artificial turbidity, if included in the samples, could introduce contaminants to the sample that are not representative of what is present in the groundwater The low-flow techniques, to be employed for wells with short screens, have been adopted to limit this artificial turbidity. As described in Section 4.1.4, the activity of radionuclides contained in the turbidity of all water samples will be measured to provide for a total activity when summed with the activity of the water itself.

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24	SOP 2.02 and 2.23	Strange sections of the SOP that appear to have been written by Boeing, rather than EPA, and for chemicals, not radioactivity. SOP 2.02 and 2.23 are filled with passages about measuring for VOCs and other chemicals, rather than radioactivity, and discussions of filtering that contradict statements earlier in the plan to the contrary. They sound almost as though these are Boeing's SOPs that were copied verbatim as though they were EPA's. This needs to be explained and remedied. It would also help regarding transparency if EPA could disclose whether there were meetings between EPA and Boeing and its contractors, outside of the working group, over the preparation of the Field Sampling Plan. There are little hints in the report that much of this was worked out in advance with the RP, and that the RP may have been pushing for certain outcomes. If EPA felt it was inappropriate for Boeing to change the pump locations and yet Boeing has refused to alter its plans, that should be made crystal clear in the FSP and tagged as a significant issue for discussion. If Boeing is proposing the low-flow purging technique, that should be made clear. EPA has made great progress towards increasing transparency, but it would be a step backwards if some of the key decisions were being made in private and in response to Boeing (or other RP) pressure or incalcitrance. It would be helpful to disclose if EPA and its contractors had had meetings with the RPs and their contractors on these subjects about which we were not informed and to which we were not invited. I recommend that, before these decisions are made final, we have a full discussion of the matters identified above. Attached please find also a copy of the Draft Final Field Sampling Plan, with additional comments attached throughout it.	The discussions concerning chemicals other than radionuclides have been removed from these SOPs. Please note that many chemical procedures are applicable and adaptable to radiological procedures; thus, SOPs can be modified accordingly. EPA has had no specific discussions with Boeing or DTSC in development of the scope or methods to be used in the FSP. Although several phone calls and one meeting were held between EPA, DTSC, and Boeing to discuss low-flow sampling, these SOPs were modified from existing EPA and/or HGL specific SOPs and no consultation with Boeing or DTSC occurred in their development. Note that no decisions have been made and we are consulting with Stakeholders now prior to collecting samples.

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25	Page 1-1 Text: "Confirm the results of data collected by others;"	This objective would be more fairly stated as "assessing the validity of data collected by others." It could be read as written as aiming to affirm prior measurements.	The text has been changed to read: "Provide high-quality data for comparison to data reported by others;"
26	Page 1-1 Text: "Provide data for areas that may require additional assessment."	One should also be providing data on radionuclides previously assessed. One is trying to get good data using methods acceptable to EPA, given past measurements by Boeing having been questioned by EPA and others due to questionable methodologies (e.g., filtering).	The text has been changed to read: "Provide high-quality data for comparison to data reported by others;"
27	Page 1-2 Text: "Collect one round of groundwater samples from approximatel y 20 off-site wells."	I am troubled by this. I thought EPA had previously said it would do quarterly measurements during the period of its study, beginning in the 2nd quarter of 2010. We need to discuss this.	The FSP will be amended to include only the initial round of sampling that will include all viable monitoring wells in Area IV. The frequency of sampling and analyte list for subsequent groundwater sampling events will be determined after evaluation of the initial round of analytical data, information provided by the HSA, and data from the gamma scanning. These subsequent rounds of sampling will be incorporated into the Phase II FSP as addendum.
28	Same as comment 8.	Again, does this make sense to restrict it to a single set of samples, given the potential for variability?	See response to comment 20.
29	Page 2-1 fourth paragraph.	Again, does this make sense to restrict it to a single set of samples, given the potential for variability?	See response to comment 20.

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30	Page 2-1 fifth paragraph.	One shouldn't skew the history solely towards the civil side; a great deal of the work and associated contamination were the result of DOD work on missiles for the nuclear program (e.g., MX missile)	The following text has been added to the history: "While some portions of SSFL outside Area IV supported rocket engine static testing for development and improvement of military missiles, on-going historical research is incomplete concerning potential Department of Defense activities in Area IV."
31	Page 2-6 last paragraph.	I assume "feet" was inadvertently left out here.	Correction made in text.
32	Page 2-7 first paragraph.	I think EPA and its contractors should not be repeating in these first two sentences these claims made by Boeing, which are unproven, questioned by DTSC, and controversial. Boeing has been arguing that it need not clean up contamination because of allegedly barriers to migration. Wilshire (http://www.ssflpanel.org/files/Wilshire.pdf) disputes these claims.	The entire paragraph referenced has been removed.
33	Page 2-7 second paragraph.	I don't think EPA should be seen as endorsing the controversial Cherry et al. report or its conclusions. This is a document put forward by Boeing to try to walk away from cleaning up contamination.	All references to and information from Cherry et al. have been removed.
34	Page 3-4 second full paragraph.	Again, I don't think "confirm" is the appropriate term, as it implies a bias toward affirming Boeing's prior measurements, which EPA has criticized, rather than finding out whether they are accurate.	Text has been changed as in comment 26.

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35	Page 3-4 second full paragraph.	I am deeply troubled by this. EPA has criticized Boeing's plan to retrofit. It may make readings unrepresentative; and will further complicate comparing values. Boeing's earlier measurements were made with filtering; EPA's first round will be with current pump placement, but the second with a different pump placement. If EPA is concerned about this, as it has said it is, the retrofitting should not go forward, at least until EPA's survey work at the site ends.	See response to comment numbers 23 and 24. Stakeholders will be given the opportunity to comment at future meetings. Up to 30 wells may be sampled using the two different methodologies employed by Boeing and EPA.
36	Page 4-8, Section 4.6.2.2 first numbered item.	These techniques need to be explained and the rationale for them given; and a discussion that this represents a change from past techniques and will make comparison with past measurements even more difficult.	The following text has been added to Section 4.6.2.2 to describe the rationale for low-flow sampling in wells with short screens. “Multi-level and open-hole bedrock well purging procedures, as described below, are similar to procedures that have been employed during previously sampling by others at SSFL." See response to comment 24.
37	Page 4-8, Section 4.6.2.2 second numbered item.	The rationale for this approach needs to be provided, and a discussion of alternatives included and the reason why they were rejected.	The well-volume purging approach is the method used in the recent past by Boeing (as described above). This approach is being adopted for open bore wells and wells with long screens (which are the majority of wells) to be generally consistent with historical sampling practices.

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38	Page 4-8, Section 4.6.2.2 third numbered item.	This is troubling. What is the rationale for not having EPA control its sampling?	The multi-level FLUTe systems in Area IV are instrumented and expensive installations. These systems can be damaged by improper sampling techniques. Boeing prefers, and EPA concurs, that Boeing personnel (or contractors) continue to perform this sampling). The sample techniques are standardized by the manufacturer and modification of the manufactures technique is limited. EPA will monitor the procedure employed during sampling and will fill their own sample containers retaining Chain of Custody.
39	Page 4-9 first sentence.	What does this mean? Are you implying that Boeing has refused to permit EPA to sample these particular wells? What coordination is ongoing? Needs more transparency here.	This section has been removed since off-site well sampling is now deferred to the Phase II FSP.

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40	Section 4.6.2.2.1 first paragraph.	I am quite concerned about this and believe the full group needs to discuss it directly. Was the suggestion to use this new technique initiated by EPA, or does it come from Boeing and EPA has acquiesced in it? The rationale given--that it reduces the concentration of colloids in the sample and generally reduces turbidity--raises the question whether it is simply another way to keep radioactive material out of the sample so as to lower the measured value? In other words, after decades of filtering to artificially lower measured values, has Boeing now proposed a purging technique that would have the same effect? This is an important issue that the full group should discuss openly.	EPA has elected to use the low-flow technique for approximately 34 wells with short screens. Stakeholders will be provided the opportunity to comment at future meetings. Turbidity often found in groundwater samples collected from monitor wells is typically the result either poor well construction or sediment that has settled and accumulated in the bottom of the monitor well. Most aquifers tend to have relatively low turbidity due to natural filtration of the aquifer. Disturbance of the well filter pack or sediment in the bottom of the monitor well leads to a turbid sample that is not representative of natural aquifer conditions. The intent of low-flow sampling is to minimize disturbance of the well and aquifer; thus, creating minimal disruption of sediment providing a less turbid groundwater sample. It is important to note that turbid samples usually are not representative of natural aquifer conditions. The intent is not to collect the most turbid groundwater sample you can but to collect a truly representative formation groundwater sample. Note that EPA is proposing to collect water samples from wells that are known to go dry under any pumping conditions and not recover for extended periods of time (weeks to months). This technique includes acquisition of a grab water sample after agitation of the water column. The objective of this sampling is to acquire some data for further evaluation where none would have been otherwise collected.

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41	Page 4-9, second to last paragraph.	Again, since EPA will be filtering and measuring both the water that passes through the filter and the material collected on the filter, this shouldn't be an issue in the first place and efforts to artificially reduce the amount of radioactive material suspended in the sample is very troublesome. We need to discuss this.	See the responses to comments 23 and 40.
42	Page 4-10 "Low Flow Well Purging."	This needs to be discussed. Again, one needs to assure measures aren't being implemented to reduce the contaminant load in water before measuring.	See the responses to comments 23 and 40.
43	Page 4-12 Section 4.6.2.2.2.	Again, I would appreciate a full discussion with the group about whether this procedure produces an accurate representation. Remember, we are interested in what radioactive material may migrated into the aquifer.	See the responses to comments 23 and 40.
44	Page 4-13 Section 4.6.2.4.	How can this be? Boeing to control these sampling events AND procedures? We need to be told what is behind this and discuss fully.	See the response to comment number 38.
45	Page 4-13 Section 4.6.2.5 first paragraph.	I am troubled by this and believe we need to talk about it Also looks like you would be using different purging techniques, creating even more difficulty in intercomparability of measurements.	See the response to comment number 38. The purging techniques proposed by Boeing for the WQSAP are different. Comparisons of the data sets will require additional examination. These issues will be discussed at Stakeholder meetings.
46	Page 4-13 Section 4.6.2.5 second paragraph.	THEN THIS CHANGE SHOULDN'T HAPPEN! We need to discuss this, including with DTSC project director Brausch.	See response to comment 45.

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47	Page 2.02-5 Second full paragraph.	I think we need a comprehensive discussion with the group to convince us that this is not just a different way of trying to achieve what the controversial filtering did, keeping radioactivity out of the sample to be measured.	See response to comment 23. These issues will be discussed at Stakeholder meetings.
48	Page 2.02-5 last paragraph.	What does this mean? Why is it here? I thought there was to be no field filtering whatsoever. We need to discuss this.	The first sentence in the referenced paragraph is a relic of a generic SOP and has been deleted.
49	Page 2.02-5 last paragraph.	Where is this language coming from? Is it some boilerplate? Who is the client--Boeing? Is EPA contemplating ordering the abandonment of wells and replacement with new ones?	The text discussing the possibility of abandonment and replacement of a well has been deleted.
50	Page 2.02-6 Section 4.3 first paragraph.	Why are we even talking about VOCs? Did EPA just accept verbatim a SOP written by Boeing?	All language discussing chemicals other than radionuclides and metals (since most of the radionuclides of interest are metals) and filtering has been removed.
51	Page 2.02-6 last paragraph.	What the heck is going on here? This is an SOP for chemicals, not rad. Did you just plop into your report Boeing's procedures?	See response to comment 50.
52	Page 2.02-7 first full paragraph.	Again, this seems to have been written by Boeing, not EPA, and for chemicals, not rad. I thought there was to be no filtering. Something is amiss.	See response to comment 50.
53	Page 2.02-7 Section 6.0	This is nutty; why are we reading about VOCs?	See response to comment 50.
54	Page 2.23-5 last bullet on page.	What is going on here? There is supposed to be NO field sampling.	See response to comment 50.
55	Page 2.23-8 top of page sample collection order.	Again, what is going on here? This is a SOP for chemicals primarily, with rad as an after thought. Is there some plan to split these samples with DTSC for chems; or why all this discussion of chems?	See response to comment 50.

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56	Page 2.23-10 Sample Filtering.	This makes no sense. Elsewhere you have said there will be NO field filtering.	See response to comment 50.
57	General	We learned from CDM and SAIC at the Scoping meetings that AREA IV drains to Simi Valley and Bell Canyon. Therefore, I believe that your scope of work should contain groundwater, seeps and springs, and surface water in the Southern Buffer Zone.	The sampling program includes samples up to the southern border of Area IV. These areas may be considered in the Phase II FSP.
58	General	I believe that you should chase all drainages and sewers to ponds that are not in AREA IV. I think that you should investigate Outfalls 1 and 2 that lead to Bell Creek. I think that you should sample Bell Creek.	See response to comment 57.
59	General	I also have attached a letter regarding Dayton Canyon. It mentions radionuclides that were sampled for there in 2007. I think that when you have your Background numbers, you will be able to more adequately assess what are naturally occurring radionuclides. I would appreciate it if your consultant looks at this document, and determines whether there is reason to look at Dayton Canyon.	Historical data, including the 22 February 2007 letter from CDHS will be considered during development of additional phases of work.

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60	1.1 Project Objectives	In the introduction, it immediately narrows the objective to study of Area IV and the NBZ with no mention in that same introduction that most of the drainage from Area IV leads to the south, making the drainage to the SBZ [southern buffer zone] equally important if we are to seriously examine the purpose of the study, which is to determine the nature and extent of the radiological contamination of the Santa Susana Field Laboratory.I understand that the specific objectives as outlined in HR2764 refer to Area IV specifically and that the Northern Buffer Zone is included because it was purchased through acquisition of previously off-site land found to be contaminated and sold/transferred through litigation settlement. The same is true for the acquisition of the land to the south. It should be understood, especially with regard to water quality violations that continue to the south and north (recent $500k fine (Consent Judgment + $300k in remediation funding) demonstrates a chronic problem with contaminants leaving the site both the north and the south. My request here, is to acknowledge the drainage to the south in the introduction and the decision (to or not to) determine whether these contaminants might include radionuclides from Area IV (when following stormwater topography including concrete swales specifically constructed for the purpose of diverting water to the south from Area IV nuclear related buildings.	Work in areas outside of the study boundaries may be considered for subsequent phases of work (for example the sediment sampling Phase II). EPA will begin its work in the study boundary which includes Area IV and the NBZ. The following text has been added to the first paragraph of the introduction:"While the Study Area for this FSP is clearly defined, characterization of areas outside of the Study Area may be considered by EPA based upon initial results ."

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61	1.1 Project Objectives	I am deeply troubled by the statement that the data to be collected is not intended to be comprehensive when this is the only real investigation of its' kind that will occur at the site. The reason we are doing this is because it has not been adequately characterized for decades. In fact, the order by Judge Conti specifically requires DOE to complete an EIS which this part of the radiological study will be used, in order to finally determine what is needed for appropriate remedy of the site contamination. Further, the MARSSIM process being used is specifically being used in the investigative phase and NOT in the final status survey process as it is normally used. This is not clearly described here, nor are the differences in the use of this radiological investigative tool here, vs. how it is otherwise used, implemented, and interpreted.	The majority of the funding for this study is going toward soil samples. If after results become available, it appears more funds should be allocated to surface water and sediment, we will make that determination along with stakeholder input. It is not possible to determine the level of effort for additional work until the first phase of sampling, as described in the FSP, is completed. MARSSIM applies strictly to contaminated soil and buildings. The reference to MARSSIM final status surveys will be removed from this section.
62	1.2 Scope of Work	Sampling of major drainages should specifically include the drainages below the monitoring outfalls for the NPDES permit as many of these locations are inadequately placed.	Surface water and sediment samples have been placed downgradient of the active NPDES monitoring locations within the Area IV Study area, as depicted on Figures 3.1 and 3.2. NPDES monitoring locations have been added to these figures.
63	1.2 Scope of Work	Areas that manage/store/treat contaminated stormwater and groundwater should be treated as active areas, and they are not adequately identified in this plan Examples include the Area IV burn pit treatment area, as well as the building 9 parking lot area.	The active facilities are subject to investigation under the RCRA RFI investigations. Releases of chemicals at active facilities will not be investigated in this program.

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64	1.2 Scope of Work	Pond at SPTF is not adequately identified. This is an industrial wastewater pond specifically constructed to hold process water, yet the drainages and related swales are not adequately identified within this plan	Historical information is being gathered for this feature. EPA will consider sampling this area once the information is assessed.
65	1.2 Scope of Work	The scope of work should properly identify the purpose of determining the extent of radiological contamination in sediments, and propose in more detail, the intended phase II step-out and down-drainage follow up sampling that should occur in order to provide adequate data to make feasibility remedy decisions moving forward, which is the overall end-purpose of all of this work.	Phase II sampling is intended to allow for additional data collection at deposition locations both up and down gradient of the Phase I sample locations. A phase II FSP will be issued to address the Phase II activities which will be available for Stakeholder input prior to being finalized.
66	1.2 Scope of Work	Locations to be determined through field observations generally after significant rain events - this should have already happened as we have potentially already had our last rain event for the season.	EPA has personnel located at the site generally from 7:30 AM to 5:30 PM 5-days a week. There will be opportunity to properly identify sampling locations after rainfall events.
67	1.2 Scope of Work	Spring/seep samples from 10 locations is entirely inadequate when considering the number of seeps that exist, as well as the many drainages that lead specifically to a children's camp. Again, the point of this exercise is to protect the public which cannot occur if you don't even look down all the drainage areas properly.	The scope is currently limited to 10 locations. It is possible that as results become available additional areas will be tested as part of a Phase II. A discussion has been added to Section 1 that describes flexibility in the sampling approach as results become available.
68	1.2 Scope of Work	Please provide us with a list of the proposed off-site wells to be sampled (20).	The off-site wells have been moved to the Phase II FSP. The list of wells to be sampled will be presented in that document.

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69	2.2 Radionuclides of Interest	Higher consideration for any wells where prior hits of the particular radionuclide have occurred. Additionally, of the wells that are not used in this process that are located within the study area, please provide us a list of any radionuclides that have been found at any of the wells that are now deemed either dry or inoperable and provide alternative wells to be sampled to determine the current nature and extent of that radionuclide.	The analyte priority list for the first sampling event will be incorporated into this Phase I FSP. Analytical details for the second of two sampling event will be incorporated into the Phase II FSP after the first event. Please note that all viable monitoring wells in Area IV will be sampled during the first and second event that are planned for July, 2010 and winter 2011. A table showing the radionuclide data for the dry and abandoned locations is attached to this response to comments.

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70	Section 2.3	Topography and drainage section does not adequately describe the fact that most of the drainage leads to the south and outside of the defined study area and that those investigative limitations have been proposed despite the topographical facts. Further, it incorrectly states that there is no drainage to the east or west and does not adequately acknowledge the Burro Flats fault that may act as a conduit that carries contaminants from Area IV to the East to the San Fernando Valley as this fault continues down to the Chatsworth Reservoir below (which was used as a drinking water reservoir until the last sixties.	EPA acknowledges the facts that there is surface water flow to the west-northwest and south. Section 1.2 explicitly explains that the scope of work at this point only includes Area IV and the NBZ for surface water and sediment. The text has been modified to read as follows: "Surface water drainage in the northern portion of the Area IV Study Area flows north into Meier Canyon and west-northwest into Runkle Canyon, which are tributaries to the Arroyo Simi, flowing westward and terminating in the Pacific Ocean. Drainage of the majority of Area IV leads to the southeast into the Bell Creek drainage system as suggested by the location of the northeast-southwest trending drainage divide on Figure 2.1. Bell Creek is the headwater and tributary of the Los Angeles River which flows south and eastward terminating in the Pacific Ocean. Given the topographic divide and topographical rises to the east and west of Area IV, there is no drainage directly to the west or east from Area IV (USGS, 1952). The northern portion of Area IV drains generally to the north into the NBZ, which itself drains generally to the north." EPA appreciates the concern over flow along geologic structures to the east. Because there are still concerns over the hydrogeologic model for the site, discussion of flow along faults has not been added.

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71	Section 2.3.2	Hydrology does not adequately acknowledge the drainage that surpasses the processing pond and leads down toward Outfall 2 (which is also where they have a seep problem with high concentrations of VOCs). Many of these chronic problem areas carry waste constituents where chemicals are co-mingled with metals and radionuclides. This may not have been adequately investigated in the past, and since it is not acknowledged here, I believe it should be changed to ensure that this is considered.	In Section 2.3.2 it is stated that there is flow to the south. The investigation includes locations up to the southern boundary. While currently not in within EPA's scope, investigation of the surface water leaving Area IV to the south may be considered for the Phase II FSP.
72	Geology	Why is Thomas Diblee data being referenced when the formation determination process within this study determined that his maps were incorrect? If they are incorrect, why do they continue to be used as reference?	The reference to Diblee has been removed.
73	Section 2.3.4.5	Geologic Structures at the Santa Susana Field Laboratory The soil make-up (clay v sand) along the entire length of the Burro Flats fault as well as the smaller faults to the north, need to be considered here as this difference may be the difference between an obstacle to contamination leaving the site, and that of a conduit. Also, some of these MWH maps have removed the Delta Structure from being a fault even though these is no basis to make this conclusion. This is an example of a potential migration pathway being missed, or dismissed where it might be very important as a contributing factor to the surrounding contamination and that down-stream.	EPA appreciates the concerns over flow along the geologic structures at SSFL. Because a detailed conceptual model of the site has not been adopted by EPA, additional discussion of hypothesized flow along these structures has not been included in the FSP.

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74	Hydrogeolog y	Does not adequately acknowledge the fact that the groundwater flow is not really understood and is specifically under debate. This is important when using work from these other studies to formulate decisions, and basis for sampling targets.	The third paragraph of Section 2.4 was changed to read: "Groundwater flow at SSFL has been the subject of numerous studies by Boeing and the DOE. Montgomery Watson Harza (MWH, 2009a) discusses results of recent flow characterization efforts including horizontal and vertical flow. A groundwater divide occurs near the center of the Area IV Study Area (Figure 2.1). Downward and upward vertical gradients have been reported at SSFL. Groundwater flow through fractures in the hydrogeologic units at SSFL is also discussed in WMH 2009a. The hydrogeologic investigation and agreement concerning the conceptual model is on-going."
75	3.1 Surface water and seep sampling	I request to be able to visit these field areas, as prior discussions with the "offsite sampling" DTSC staff, it was revealed that many of the identified seep locations are either incorrect, or "estimated" meaning they haven't been sampled due to accessibility. This makes the adequateness of this sampling effort in question if this offsite data is being used to make these field decisions. (ref. Abrams, Sheeks, Pappas conference call) where it was found that the diagram describing these locations was not accurate. I also ask that the samples that are filtered be specifically identified so that the sediment can also be analyzed for a cumulative total.	EPA will coordinate a site visit to look at potential locations in the future. Section 4.1.4 describes filtering of all water samples and analysis of the water and residue to derive a total activity result. All water samples will be subject to this procedure.
76	Section 3.2	I appreciate the opportunity to provide recommendations for spring seep sampling as part of the technical stakeholders committee and look forward to an opportunity to discuss this process in more detail.	None Required

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77	Section 3.4.1	Off-site well data that is referenced makes specific conclusive statements about faults precluding the movement of groundwater offsite. I ask that this data be used with the understanding and context that we believe that some of those conclusions are specifically driven by their placement or choice of wells to analyze.	Off-site well sampling has been moved to the Phase II FSP. This entire section has been removed.
78	Section 3.4.1	I am very troubled with the notion that of 127 wells, only 20 are active and ask how this presumption has been made?	Off-site well sampling has been moved to the Phase II FSP. This entire section has been removed.
79	Section 3.4.2 Onsite well monitoring	In recent discussions on a conference call with DTSC staff (Abrams, Sheeks, Seckington) it was determined that the groundwater plume map used does not accurately reflect the wells that are used to support this map. Further, many of the areas deemed either impacted or not impacted, are based on wells outside of that area, as was discovered during this conversation. I have asked for a new map, that accurately depicts the locations of the chemical contamination plumes as well as the tritium, and ask that this new map be used here.	We believe that this comment refers to the plume maps presented in Haley and Aldrich, 2009 Site-Wide Water Quality Sampling And Analysis Plan, Figure 3. EPA is reluctant to include the revised map (which we have not received) because it interprets old data and a tritium plume that will be more fully understood after the sampling presented in this FSP.
80	4.0 Field Activity Methods and Procedures	During this last year their sitewide "housekeeping program" has resulted in debris being moved to various staging and storage areas throughout the site. I ask that all of these areas be gamma scanned as these materials have been moved across operational lines in some cases.	100% of the accessible areas in Area IV and the NBZ will be scanned (excluding buildings). No work is planned outside these areas at this time; however, Stakeholders will have the opportunity to provide input prior to the Phase II FSP.

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81	Section 4.1	I appreciate the fact that this suggestion was taken seriously as I believe it will result in a safer and more efficient field process. Thank you for considering this area for your investigation and pushing forward with NASA and GSA to make it happen. I know it was not easy and those efforts to step up are truly appreciated, especially when it benefits all concerned and provides a more appropriate use of the property under the "declared excess" issue with NASA and GSA	None required
82	Section 4.1.4	Analysis of Total Activity and Activity of filtered water samples. Please confirm that no field filtering means that total activity will be measured since all sediment separation will occur in the lab and be measured. I just want to be sure I understand this clearly, so I can support this decision.	The total activity will be measured. This activity will be a sum of the activity of the liquid fraction and the solid residue separated from the water in the lab.
83	Section 4.2.1 Active off-site well evaluation	Please make this information widely available so that potential property owners with wells that have not been previously identified (due to ownership changes and property use changes) may have an opportunity to suggest and provide permission for their wells to be tested should they be found to be within an appropriate distance from the lab.	We will work with the stakeholders to achieve this goal.

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84	Section 4.2.2	Identification of potential onsite spring and seep locations including NBZ locations should include outfall 10 where plutonium was previously found as well as the recent cesium findings located near, and contributing to, outfall 9 below the ELV area where Building 204 and the EPA office is located. We have studied this area extensively both on-foot as well as through aerial photographs we have taken, and google-earth comparisons to the overlay of the radiological survey done in 1979 and wish to have an opportunity to provide this information to the decision makers of the sampling locations prior to field work starting.	EPA will commit to sampling at least one seep/spring in these areas if identified. EPA greatly appreciates the opportunity to exchange information for the surface water and seep sampling. A meeting will be scheduled in order to share information and look at locations on the site.
85	4.6.2.1 Wide Water level measurement Event	I appreciate that these water-level gauging events will be conducted and ask that this information be shared with the groundwater team at DTSC and that a more in-depth dialogue take place that includes us as stakeholders, the RPs as well as the DTSC and EPA teams to discuss what has been learned, what is agreed and what is not. It is otherwise very difficult for the community to be able to weigh-in effectively or substantively on this issue.	SSFL Technical Stakeholder meetings will be held to continue the transfer of information. Special meetings may be called to specifically address groundwater findings.
86	Section 4.6.2.2.1	The sampling that takes place after the low-flow purge changes have taken place need to be specifically identified for statistical work since these will not be of the "same population" as prior sampling work that might be included in the analysis. Please explain how this will be handled.	Because limited data will be collected using the well-volume approach from the approximately 30 wells that will be converted to low-flow wells, statistical comparison of the data set populations will not be possible at this time. However; once a sufficiently large data set of low-flow data is available the populations of new data may be compared to old data to assess whether the two populations are statistically distinguishable. If the populations are not distinguishable the data may be comparable.

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87	4.6.2.3 Artesian Wells included	Please be sure to include "bathtub well #1" on the Brandeis property for all radionuclides on the list of interest as this has been a well of interest due to prior contamination findings.	We believe this comment refers to well OS-9 or OS-9R. Both wells are in the sampling program as listed in Table 3.4. These off-site wells are to be removed from the Phase I FSP and will be included in the Phase II FSP.
88	Table 2.1 Proposed Radionuclides for Analysis	Please provide a list of the specific detection and analysis challenges to meeting the PRG levels for SB990 purposes and what levels are attainable so that this issue can be better understood within the context of the list of interest.	The analytes for the first groundwater sampling event will be incorporated into this FSP. A Phase II FSP will be issued to discuss the analytes selected for subsequent events. Detection limits will also be incorporated into the QAPP by addendum after award of the laboratory contract.
89	Table 3.1 Preliminary Surface Water Sampling Locations (Draft)	Please provide a column indicating which of these locations have been "groundtruth'd" and an opportunity at one of the upcoming meetings to discuss this in detail with maps in front of us. I also request that a follow-up field visit be provided so that location issues can be discussed and debated with the interested public.	Locations that were ground truthed have been added to the table. All locations will be verified during periods of precipitation. There will be a Stakeholder site visit to go over locations.
90	Table 3.3	(Same comment as for Table 3.1)	Locations that were ground truthed have been added to the table. All locations will be verified during periods of precipitation. There will be a Stakeholder site visit to go over locations.

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91	Table 3.4	(Same as above, and I also find this list to be inadequate as it does not include locations of known contamination found, as well as gaps in data that should be addressed here.	Note the off-site well sampling is being removed from the Phase I FSP and will be included in the Phase II FSP. None of the locations listed have been field checked; however, those locations that are routinely sampled by Boeing are expected to have no issues such as access or being dry. EPA will establish rights-of-entry for other locations before inspections of other locations. Data from all the off-site wells are not presented because the intent is to re-sample for at least the radionuclides listed on Table 2-1 and in the forthcoming Phase II FSP. This sampling will confirm (or not) data for those radionuclides previously reported.
92	Table 3.5	(Same as above)	All of the well locations that are not actively sampled, with the exception of FLUTe well locations, have been field checked. Because all available wells are to be sampled, the locations that were field checked are not included in the table.
93	Specific Sampling recommendations	From the Sampling Locations figure (3.1) indicates that the location where these drainages converge below EPASW21 and EPASW22 will not be sampled. Due to contributing factors from the Area IV burnpit, the known plume issue below, this is particularly important that migration pathways of this water be understood through appropriate downgradient sampling since it is possible that cracks and fractures might divert from the assumed directions based on visual topographical observations.	For the initial phase of sampling locations selected will be within Area IV and the NBZ. Some of these areas may be more appropriately sampled as part of the soil sampling program. EPA will provide Stakeholders the opportunity to comment on locations for the initial and subsequent phases of work.

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94	Specific Sampling recommendations	The drainage below the RMHF pictured above with property line overlay from GoogleEarth indicates steep drainage that is not adequately going to be sampled under the proposed plan. This lower area used to be an unlined pond (what is now a discharge tank) and therefore more sampling is needed.	Samples above and below Outfall 3 near the RMHF are planned. Only a limited number of surface water and sediment samples can be acquired. Because the work will be completed in phases, EPA may consider additional sampling based upon the results of initial sampling and project resources. Stakeholders will have the opportunity to comment on all phases of work before plans are finalized.
95	Specific Sampling recommendations	Location EPASW10 is near the plutonium finding, from the prior background study done by McLaren Hart. Please provide targeted sampling that focuses on the specific locations of those findings and add sampling down drainage to confirm. Also, please sample below EPASW10 below where the two drainages converge for proper understanding of those two contributing drainages. The road that leads to the area EPASW09 area was previously lined with waste drums and debris in historical photographs previously submitted by cleanuprocketdyne.org (me) which indicate that this area MUST have a much greater degree of sampling for all radionuclides of interest.	Currently there is a surface water/sediment sample (EPASW10 and EPASED31) location in the area where the plutonium was detected. If radionuclides are detected additional samples will be collected during Phase II. Stakeholders will be given the opportunity to provide specific sampling recommendations at upcoming meetings and for Phase II.
96	Specific Sampling recommendations	This view (above) shows the steep cliffs that are the NBZ and therefore the importance of looking below and where these seeps might surface and impact residents below.The seeps and springs located below (downgradient) from EPASW09 are inaccurately located and/or estimated due to limited access according to the offsite data provided by DTSC. It is therefore necessary here to sample below these stream/seep areas to ensure that impacts that might have occurred will be understood.	Additional sampling for subsequent phases of work may be considered. Stakeholders will be provided the opportunity to comment on additional work before the Phase II plans are finalized.

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97	Specific Sampling recommendations	RE: Pond area not previously identified (adjacent to ELV area, Area II) this is the pond area not previously identified which is where the cesium was recently found during the ISRA sampling at Area II. This was a known burn/runoff pond and a chronic problem area identified in the ISRA process and therefore must be included within this study (since it is known radiological contamination)	Additional sampling for subsequent phases of work may be considered. Stakeholders will be provided the opportunity to comment on additional work before the Phase II plans are finalized.
98	Specific Sampling recommendations	Overlay of aerial radiological survey indicates areas of the NBZ that require a much closer look than what is identified on the sampling map in this figure.	Additional sampling for subsequent phases of work may be considered. Stakeholders will be provided the opportunity to comment on additional work before the Phase II plans are finalized.
99	Specific Sampling recommendations	In looking at the maps defining the study area, it seems that known information provided during the John Pace visit is not adequately considered. I would ask that the drainage from the release pond, the "pile out back" area, as well as the hot storage on the hill above be more appropriately targeted so that these areas can be better understood. In fact, the "solid waste area of concern" green shading does not even include the area where temporary hot storage of radioactive waste was stored from the SRE which had many accidents and fires including the 1959 partial meltdown estimated by many experts to be the worst nuclear accident in U.S. History. How can the operational storage area of radioactive "hot waste" not be included? (please note the road leading to the hill above the SRE just above the nw corner of the shaded green area).	EPA is currently researching the information provided by the commenter (John Pace information). See response to comment 60. The shaded green area is from plans provided by others. These areas will be removed from Figures 3.1, 3.2, and 3.4. Gamma scanning is planned for the SRE area. Additional sampling for subsequent phases of work may be considered. Stakeholders will be provided the opportunity to comment on additional work before the Phase II plans are finalized.

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100	Specific Sampling recommendations	Please note the drainage leading out of Area IV just below EPASW24 where the Bell1.4 ditch is also identified. This drainage leads to outfall 2 and is completely missed by this study. As confirmed by Laura Rainey of DTSC who did the primary review work for Area IV, there is a drainage "sheet flow" as indicated by the steep "v" noted (above and right of "B353 leach field" label). She has also indicated in her notes and concerns that the metals seen in Area IV are seen here as well, giving further supportive data that sampling below this area is needed.	EPA will examine this area during periods of rainfall and determine potential appropriate sampling locations to be considered for subsequent work.
101	General	Given the many overlapping deadlines related to SSFL stormwater, rcra investigative work as well as this important work done by EPA, my comments are not complete based on my own research. I have thousands of photographs and maps directly related to these sampling proposed areas and hereby request an opportunity to discuss these and other concerns in further detail in person. I feel this information is directly relevant to the areas most in need of sampling, and want to make sure that opportunity is there, on a timely basis so that my information may be adequately absorbed and considered within the process.	Additional sampling for subsequent phases of work may be considered. Stakeholders will be provided the opportunity to comment on additional work before the Phase II plans are finalized.
102	General	On another topic, I was told that I would be sent a copy of the photographic work done to my new address, and have not received it as yet (Andrew Taylor).	EPA is coordinating supplying a copy.

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103	General Comments	1. As described more fully in EPA guidance, the Quality Assurance Project Plan (QAPP) provides the Data Quality Objectives (DQOs), quantification limits, and other critical information needed to understand the study and ensure that the study meets remedial investigation objectives. Separation of the QAPP from the field sampling plan (FSP) is therefore troubling. DOE suggests that at the June 2, 2010 technical workgroup meeting a discussion be held to develop and refine the DQOs and that the QAPP associated with this sampling effort be sent for review and comment prior to the June 2nd meeting. If, this is a problem due to scheduling the sampling, DOE would be happy to assist EPA to ensure that the proposed low-flow sampling pumps not be installed until EPA has completed their first round of water sampling.	The QAPP is under review by EPA's QA/QC office. The QAPP and Final FSP will be made available to Stakeholders soon.
104	General Comments	Throughout the FSP EPA makes statements that the study may be funding limited. EPA's overall objective of the radiological study of Area IV is to complete the characterization per CERCLA guidelines. If EPA believes that they require more than the $40 Million that they proposed, then EPA should suggest the amount that they believe they need to complete their work, rather than continue to note that the study is funding limited.	Many of the references to budget have been removed from the FSP. Text has been changed throughout the FSP to indicate "current project limitations…" EPA has retained the text in Section 4.2 that lists available budget as a project constraint.

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105	General Comments	Throughout the FSP EPA makes statements that the study may be funding limited. EPA's overall objective of the radiological study of Area IV is to complete the characterization per CERCLA guidelines. If EPA believes that they require more than the $40 Million that they proposed, then EPA should suggest the amount that they believe they need to complete their work, rather than continue to note that the study is funding limited. Under the Scope of Work, EPA states it intends to sample sediments to "determine the general extent of contamination in sediments." Many of the radionuclides found at SSFL either have a natural background or a global fallout origin. What is going to be EPA's method for determining what background when it does not have a background value for sediment? There are a number of papers in the literature that demonstrate how fluvial processes separate and concentrate sediment particles in drainages. This is an example of why separation of the QAPP and the DQOs results in a breakdown in objectives, data usage, and interpretation.	See response to comment 104. The QAPP is forthcoming. EPA understands that there are additional investigation requirements for a comprehensive study of sediment that are not included in the FSP. The work described in the FSP for sediment is considered to produce a general understanding of the nature and localized extent of radionuclide contamination in this media only. The objectives for the groundwater, surface water and sediment study are different from the soil study in that they are primarily to confirm or (not) prior data. If data is collected that indicates that that sediment is contaminated, we will need to determine how to allocate remaining samples. In addition, at that point, soil results may be available as well so that we can better determine where to locate additional samples. EPA has said that it will consider collecting background sediment samples along-side DTSC when they conduct their field work for their chemical background study.

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106	General Comments	Under the Scope of Work, EPA states that it intends to sample spring/seeps "generally after significant rain events." However EPA does not provide objectives for the sampling nor how it intends to interpret or use the results. If it is EPA's intent to sample emergent water at springs, sampling after significant rains would mostly likely only result in the sampling of recent surface water infiltration, and not true groundwater. If EPA's objectives were to sample true groundwater emerging at seeps, sampling would be performed after the surface infiltration effects were past. What does EPA intend to do to demonstrate that what is being sampled is groundwater and not recently infiltrated surface water? This is another example of not having the QAPP DQOs available thus making it difficult to understand EPA's objectives.	The area included in the study (Area IV and the NBZ) are normally dry. Flowing springs and seeps observed during dry periods will also be considered for sampling. The text will be changed to clarify. The objective is to report the levels of radionuclides in seeps in springs for further evaluation.
107	General Comments	The surface water and seep study as presented by EPA focuses on the Northern Undeveloped Land. However, one-third of Area IV drains to the north and two-thirds to the south. More importantly, 80 percent of the developed area of Area IV and most of ETEC drains to the south. How does EPA account for its sampling emphasis, given the general terrain and prior land uses of the study area?	EPA attempted to provide coverage of major drainages from area IV without bias. For the initial phase of sampling locations selected will be within Area IV and the NBZ. EPA will provide Stakeholders the opportunity to comment on locations for the initial and subsequent phases of work.

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108	Page 2-3	Second bullet, states that a "large suite of radionuclides" can be analyzed by gamma spectroscopy at "relatively low-cost." For the background soil investigation, this large suite of analytes became quite expensive. Is EPA only planning routine analyses for the groundwater samples?	A phased approach to groundwater sampling will be employed. EPA has selected a priority list of analytes for the first phase of sampling that will be incorporated into the FSP. The analyte suite for subsequent sampling rounds will be clarified in the Phase II FSP that will be subject to Stakeholder review. The selection criteria for the subsequent sampling will be based on the results of the first round of sampling, HSA information, Stakeholder input, and other data that may become available prior to the subsequent sampling events.
109	Pages 2-5 and 2-6, Subsections 2.3.4.3 and 2.3.4.4, respectively	The Las Virgenes Sandstone and the Simi Conglomerate are members of the Santa Susana Formation.	Clarification has been made in the text
110	Page 3-1	Fifth paragraph states: "The required sample volumes for water samples and containers will be clarified in an Addendum to this FSP." Like the QAPP, when will this addendum be available? Will it be subject to Stakeholder review?	This addendum will be part of the QAPP and will be transmitted after the analytical lab is selected. Clarification will be made in the Phase I FSP.
111	Page 3-2	Third paragraph: "Radionuclides from potential sources in Area IV could have been deposited in the sediments through airborne deposition, transported onto soil particles, or precipitated out of solution." The same processes that accumulate radionuclides of on-site origin, accumulate naturally occurring and global fallout radionuclides. How does EPA intend to differentiate the origin of radionuclides found in sediment?	EPA will use values from its radiological background study for initial comparisons.

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112	Page 3-2	Third paragraph: identification of the movement of contaminants in drainage sediments is critical site delineation DQO. Sampling of sediments cannot be budget limited.	The QAPP is forthcoming. EPA understands that there are additional investigation requirements for a comprehensive study of sediment that are not included in the FSP. The work described in the FSP for sediment is considered to produce a general understanding of the nature and localized extent of radionuclide contamination in this media only. The objectives for the groundwater, surface water and sediment study are different from the soil study in that they are primarily to confirm or (not) prior data. If data is collected that indicates that that sediment is contaminated, we will need to determine how to allocate remaining samples. In addition, at that point, soil results may be available as well so that we can better determine where to locate additional samples. EPA has said that it will consider collecting background sediment samples along-side DTSC when they conduct their field work for their chemical background study.
113	Page 3-2	Fourth paragraph; "Sediment sampling will target the portions of the drainage features where sediment is accumulating." This is biased sampling. What will be EPA's point of reference for comparison of data from accumulated sediment? See also Section 4.5.	See response to comments 111, 112.
114	Figure 3-2	Figure 3-2 shows that EPA plans to focus all but one of the sediment samples for the northern drainages. However, 80 percent of the developed portion of Area IV flows to the south. How does EPA account for this discrepancy?	EPA intends to augment the sampling depicted on Figure 3.2 with additional samples after the gamma scanning program and as part of the soil sampling program.

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115	Page 3-3	Page 3-3, third paragraph: "Chemical contamination of groundwater at SSFL has been shown to extend off site." DOE believes that this statement applies to the Area I TCE plume and not Area IV, the focus of EPA's study. DOE is not aware of chemical groundwater contamination that extends beyond Area IV or the Northern Undeveloped Land.	The referenced sentence has been removed.
116	Page 3-4	Page 3-4, second paragraph: "The groundwater sampling program is designed to confirm the current groundwater concentrations in the [on-site] Area IV Study Area and provide data for radionuclides not previously tested using the existing monitoring network." Although DOE agrees with the objectives of the sampling effort, DOE questions why it will take sampling of 70 wells to accomplish the objective, given EPA's belief it is funding limited. Typically in a groundwater sampling program there is an objective stated for the sampling of each well, which is not included in the FSP. If EPA were to develop a well-by-well sampling objective, it may determine that it is not needed to sample every well in the Study Area and use the funding for other critical efforts.	Initial review of the existing data shows that historical sampling of the all the existing wells in Area IV was sporadic. Additionally, the analyte selection was not consistent through individual events and over time. The planned initial sampling of all of the wells for priority ROI's will provide a standard base line from which to design subsequent sampling events.
117	Page 4-2	Page 4-2, last paragraph regarding analysis of filter residue in the lab. Has EPA determined the mass of sample to be collected on a filter necessary to determine activity? Will EPA be required to collect extra sample volume in order to collect the required solids mass?	No. The filter residue is a measure of the undissolved solids content of the water sample and the results are to be arithmetically recombined with the water results for a "total" analyte concentration in water, in units of pCi/L. Consequently, the solids obtained from a given volume of water are considered to be representative of that volume of water, regardless of the mass of residue obtained. Filtering one liter of water, for example, results in a mass of residue that may be variable (and possibly indeterminate) but is still representative of one liter of water. The controlling parameter is the volume of water sampled.

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118	Page 4-9	Page 4-9, fifth paragraph: "Turbidity readings below 50 NTUs are desired, especially when metal samples are to be collected." EPA is not collecting metals samples, it is collecting radionuclide samples. Does this criterion also apply to radionuclides?	Many of the radionuclides of interest are metals. The objective is to limit the amount of solid aquifer material that could contribute anomalous concentrations of contaminants not naturally available in the aquifer where turbidity would generally be low. Radionuclides could be associated with the natural aquifer solids either as part of the mineral matrix or sorbed to mineral surfaces or organic carbon in the matrix.
119	General	For a while now I have been asking for further off-site sampling in the West Hills Area. Several areas that I've wanted DTSC and the Boeing Co to look at coincide with locations selected for the EPA Water Sampling Plan. That is very heartening to see. I'd like to add to that list.	EPA will be removing off-site well sampling from the Phase I FSP. We will revisit Stakeholder requests for off-site well sampling and solicit input for the Phase II FSP.

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No.	**Reference or Page**	**Comment**	**Response**
120	Off-Site Sampling	I've been working out of the Off-Site Data Evaluation Report (MWH, 2007). It seems to be the most complete compilation of surveys that I've managed to find and is of special interest to the West Hills Neighborhood Council, Environment Committee. There are several studies that have not been included in that report however. The one of most interest to us is the report prepared for the Hidden Lake Homeowners Association in 1990-92 by McLaren-Hart. They detected TCE in monitoring wells adjacent to the Hughes Missile Systems facility on the corner of Fallbrook and Roscoe aves. Some of these samples are almost twice the reporting limits. The last date I see on the 5 reports I have is June 15 1992. Another report I have from Groundwater Resources Consultants, Inc. dated January 29, 1992. It indicates the presence of radium-226/228, radon-222 and uranium-234/235/238, all of which are natural occurring, in these same monitoring wells. As near as I can tell they ONLY looked for naturally occurring radionuclide's. According to the reports, groundwater in this area is only 5 feet deep and is spread under several dozen homes in the Hidden lake Development. Naturally, some of the residents have concerns. These reports are very old and the trust in the analysis is very low based on the past situation with the community and the responsible parties. Now would be a good time to re-visit these wells and come up with data we can trust. Alec Uzemic and I may have the only copies of these reports extant. I can make them available to you as you need them.	The suggested sampling of the residential locations in the comment is currently beyond the scope of the investigation. Should project resources become available for additional work Stakeholder input will be used to consider the best use of those resources in the Phase II FSP.

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No.	**Reference or Page**	**Comment**	**Response**
121	Off-Site Sampling	As I look at the Proposed Off-Site Well Sampling Locations, (Figure 3.3, Draft FSP, 4-16-10) I see included wells OS-19 and OS-20. In the Off-Site Data Evaluation Report there is also listed an additional 2 well, OS-18. I believe these were old domestic water supply wells for the ranch that used to be on this property. I have been trying to find the well heads to no avail. These are the locations I've asked the DTSC and Boeing to sample. Both Art Lenox and Tom Seckington have concurred that the wells would be a good place to look. I don't believe the wells exist anymore. They were destroyed when the housing development that currently sits on the property was built in the late 1980's. A local resident and member of the West Hills Neighborhood Council, Barry Seibert, has a shallow piezometer in his back yard that was installed several years ago when he had some construction done on his home. His house is either on the same block as well OS-19, possibly on property immediately adjacent to where OS-19 used to be. He and I have both asked DTSC to take samples from his back yard and Tom Seckington said there would be a benefit. Art Lenox did not think it would be appropriate. We would very much like to put his back yard on the list if you cannot find OS-19 or OS-20. If you like I'll take you around and show you these locations.	Sampling off-site wells has been removed from the Phase I sampling. Work in areas off-site will be considered for Phase II. EPA will begin its work in the study boundary which includes Area IV and the NBZ.

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122	Spring/Seep Sampling	I've been working off the map from the 2007 Off-Site Data Evaluation Report, Figure 2-1. On that map it lists many seeps and springs in the Woolsey Canyon/Dayton Canyon Drainage's. Of most interest to me are Spring FDP-729 and FDP-850. FDP-850 has been expanded into a well by the owner of the property to aid in his development of the lot. These springs are deep in a canyon immediately below a fault that extends from the top of Woolsey Canyon down towards the Chatsworth Nature Preserve and the Dayton Canyon Development. There is much controversy in the community surrounding these faults and for quite a while I have been looking for areas that could prove or disprove the theories of contaminant migration through them to the Chatsworth Nature Preserve. Under separate e-mail is my sampling request to Boeing and DTSC for reference, as well as Art Lenox' response (Included as Attachment 2 of these responses to comments). I would very much like to have these springs added to the list.	Sampling off-site wells has been removed from the Phase I sampling. Work in areas off-site will be considered for Phase II. EPA will begin its work in the study boundary which includes Area IV and the NBZ.
123	Offsite Sediment Sampling	In addition to the springs up stream in Woolsey/Dayton Canyon, there are areas of sediment accumulation in the drainage's of Woolsey and Box Canyon. These areas are immediately upstream to the Chatsworth Nature Preserve. I think they would be of interest for surface samples and once again, could serve to prove or disprove the theories of migration through the faults upstream in Woolsey and Box Canyon. Please see the attached Google Earth Projection in the supplemental e-mails (provided as Attachment 3).	Sampling off-site wells has been removed from the Phase I sampling. Work in areas off-site will be considered for Phase II. EPA will begin its work in the study boundary which includes Area IV and the NBZ.

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124	Storm Water	The only other area of interest to the WHNC is the ponds at the mouth of Bell Creek. There is a large pond immediately before the L.A. River becomes lined with concrete. Surface water runoff occurs there year round and would be of interest to us. Under separate e-mail I will include my request to Cassandra Owens of the Water Board for analysis of storm water at that location.	Sampling off-site wells has been removed from the Phase I sampling. Work in areas off-site will be considered for Phase II. EPA will begin its work in the study boundary which includes Area IV and the NBZ.
125	Surface Water Sampling	Christina Walsh brought up good points about surface sampling at STL-IV at the last Stakeholder meetings. I concur with her assessment of that area and since it drains into the Bell canyon area through Outfall 002, it becomes a matter of interest to our group.	EPA will examine this area during periods of rainfall and determine potential appropriate sampling locations to be considered for subsequent work.

RADIONUCLIDE DATA FOR DRY AND ABANDONED LOCATIONS									
Well	Chemical Name	Result Value	Unit	Analytical Method	Sample Date	Project Qualifier Code	MDA	Error Plus Minus	Error Type
PZ-107	Gross Alpha (filtered)	6.33	pCi/L	900.0	6/25/2005		3.37	4	Total Propagated Uncertainty or Error
	Gross Beta (filtered)	9.07	pCi/L	900.0	6/25/2005		8.82	6	Total Propagated Uncertainty or Error
	Cesium-134, Dissolved	1.64	pCi/L	901.1	6/25/2005	U	1.64		
	Cesium-137, Dissolved	1.54	pCi/L	901.1	6/25/2005	U	1.54		
	Cobalt -57, Dissolved	0.988	pCi/L	901.1	6/25/2005	U	0.988		
	Cobalt-60, Dissolved	1.64	pCi/L	901.1	6/25/2005	U	1.64		
	Europium-152, Dissolved	4.05	pCi/L	901.1	6/25/2005	U	4.05		
	Europium-154, Dissolved	4.81	pCi/L	901.1	6/25/2005	U	4.81		
	Manganese-54, Dissolved	1.48	pCi/L	901.1	6/25/2005	U	1.48		
	Potassium-40, Dissolved	35.1	pCi/L	901.1	6/25/2005	U	35.1		
	Sodium-22, Dissolved	1.64	pCi/L	901.1	6/25/2005	U	1.64		
RD-89	Tritium	95.9	pCi/L	906.0	5/24/2005	U	159	97	Total Propagated Uncertainty or Error
	Gross Alpha (filtered)	11.7	pCi/L	900.0	5/24/2005		4.75	56	Total Propagated Uncertainty or Error

RADIONUCLIDE DATA FOR DRY AND ABANDONED LOCATIONS									
Well	Chemical Name	Result Value	Unit	Analytical Method	Sample Date	Project Qualifier Code	MDA	Error Plus Minus	Error Type
RD-89 (Cont'd)	Gross Beta (filtered)	8.35	pCi/L	900.0	5/24/2005		6.94	4.8	Total Propagated Uncertainty or Error
	Cesium-134, Dissolved	2.31	pCi/L	901.1	5/24/2005	U	2.31		
	Cesium-137, Dissolved	1.85	pCi/L	901.1	5/24/2005	U	1.85		
	Cobalt -57, Dissolved	0.829	pCi/L	901.1	5/24/2005	U	0.829		
	Cobalt-60, Dissolved	2.2	pCi/L	901.1	5/24/2005	U	2.2		
	Europium-152, Dissolved	5.02	pCi/L	901.1	5/24/2005	U	5.02		
	Europium-154, Dissolved	6.09	pCi/L	901.1	5/24/2005	U	6.09		
	Manganese-54, Dissolved	1.97	pCi/L	901.1	5/24/2005	U	1.97		
	Potassium-40, Dissolved	21.3	pCi/L	901.1	5/24/2005	U	21.3		
	Sodium-22, Dissolved	2.07	pCi/L	901.1	5/24/2005	U	2.07		
	Tritium	75.8	pCi/L	906.0	5/24/2005	U	158	96	Total Propagated Uncertainty or Error
	Gross Alpha (filtered)	11.2	pCi/L	900.0	5/24/2005		5.08	5.6	Total Propagated Uncertainty or Error
	Gross Beta (filtered)	4.24	pCi/L	900.0	5/24/2005	U	6.92	4.3	Total Propagated Uncertainty or Error
	Cesium-134, Dissolved	2.12	pCi/L	901.1	5/24/2005	U	2.12		

RADIONUCLIDE DATA FOR DRY AND ABANDONED LOCATIONS									
Well	Chemical Name	Result Value	Unit	Analytical Method	Sample Date	Project Qualifier Code	MDA	Error Plus Minus	Error Type
RD-89 (Cont'd)	Cesium-137, Dissolved	1.99	pCi/L	901.1	5/24/2005	U	1.99		
	Cobalt -57, Dissolved	1.28	pCi/L	901.1	5/24/2005	U	1.28		
	Cobalt-60, Dissolved	2.02	pCi/L	901.1	5/24/2005	U	2.02		
	Europium-152, Dissolved	4.66	pCi/L	901.1	5/24/2005	U	4.66		
	Europium-154, Dissolved	6.05	pCi/L	901.1	5/24/2005	U	6.05		
	Manganese-54, Dissolved	1.86	pCi/L	901.1	5/24/2005	U	1.86		
	Potassium-40, Dissolved	37	pCi/L	901.1	5/24/2005	U	37		
	Sodium-22, Dissolved	2.06	pCi/L	901.1	5/24/2005	U	2.06		
	Tritium	55.2	pCi/L	906.0	6/1/2005	U	166	100	Total Propagated Uncertainty or Error
	Gross Alpha (filtered)	11.4	pCi/L	900.0	6/1/2005		5.32	5.4	Total Propagated Uncertainty or Error
	Gross Beta (filtered)	3.26	pCi/L	900.0	6/1/2005	U	7.35	4.4	Total Propagated Uncertainty or Error
	Cesium-134, Dissolved	1.74	pCi/L	901.1	6/1/2005	U	1.74		
	Cesium-137, Dissolved	1.47	pCi/L	901.1	6/1/2005	U	1.47		
	Cobalt -57, Dissolved	0.861	pCi/L	901.1	6/1/2005	U	0.861		

RADIONUCLIDE DATA FOR DRY AND ABANDONED LOCATIONS									
Well	Chemical Name	Result Value	Unit	Analytical Method	Sample Date	Project Qualifier Code	MDA	Error Plus Minus	Error Type
RD-89 (Cont'd)	Cobalt-60, Dissolved	1.62	pCi/L	901.1	6/1/2005	U	1.62		
	Europium-152, Dissolved	4.1	pCi/L	901.1	6/1/2005	U	4.1		
	Europium-154, Dissolved	4.32	pCi/L	901.1	6/1/2005	U	4.32		
	Manganese-54, Dissolved	1.5	pCi/L	901.1	6/1/2005	U	1.5		
	Potassium-40, Dissolved	25	pCi/L	901.1	6/1/2005	U	25		
	Sodium-22, Dissolved	1.46	pCi/L	901.1	6/1/2005	U	1.46		
RD-74	Tritium	30.2	pCi/L	906.0	5/13/1999	U	184	110	Counting Error +/-
	Gross Alpha (filtered)	8.82	pCi/L	900.0	5/13/1999		2.74	3.4	Counting Error +/-
	Gross Beta (filtered)	5.29	pCi/L	900.0	5/13/1999		2.72	1.9	Counting Error +/-
	Cesium-134, Dissolved	18.2	pCi/L	901.1	5/13/1999	U	18.2		
	Cesium-137, Dissolved	13	pCi/L	901.1	5/13/1999	U	13		
	Cobalt -57, Dissolved	5.96	pCi/L	901.1	5/13/1999	U	5.96		
	Cobalt-60, Dissolved	20.8	pCi/L	901.1	5/13/1999	U	20.8		
	Actinium-228, Dissolved	61.4	pCi/L	901.1	5/13/1999	U	61.4		
	Bismuth-212, Dissolved	100	pCi/L	901.1	5/13/1999	U	100		

RADIONUCLIDE DATA FOR DRY AND ABANDONED LOCATIONS									
Well	Chemical Name	Result Value	Unit	Analytical Method	Sample Date	Project Qualifier Code	MDA	Error Plus Minus	Error Type
RD-74 (Cont'd)	Bismuth-214, Dissolved	27.4	pCi/L	901.1	5/13/1999	U	27.4		
	Lead-210, Dissolved	111	pCi/L	901.1	5/13/1999	U	111		
	Lead-212, Dissolved	18.4	pCi/L	901.1	5/13/1999	U	18.4		
	Lead-214, Dissolved	26.3	pCi/L	901.1	5/13/1999	U	26.3		
	Potassium-40, Dissolved	179	pCi/L	901.1	5/13/1999	U	179		
	Radium-226, Dissolved	172	pCi/L	901.1	5/13/1999	U	172		
	Thallium-208, Dissolved	12.2	pCi/L	901.1	5/13/1999	U	12.2		
	Thorium-234, Dissolved	238	pCi/L	901.1	5/13/1999	U	238		
	Urainium-235, Dissolved	51.4	pCi/L	901.1	5/13/1999	U	51.4		
RS-27	Gross Alpha (filtered)	2	pCi/L	900.0	3/4/1992	U	2		
	Gross Beta (filtered)	4	pCi/L	900.0	3/4/1992		3	3	Counting Error +/-
	Gross Alpha (filtered)	-0.3	pCi/L	900.0	6/4/1992	U	2	1.5	Counting Error +/-
	Gross Beta (filtered)	2	pCi/L	900.0	6/4/1992	U	3	3	Counting Error +/-
	Gross Alpha (filtered)	1.1	pCi/L	900.0	5/17/1995	U	1.9	1.2	Counting Error +/-
	Gross Beta (filtered)	3.7	pCi/L	900.0	5/17/1995		2.1	1.4	Counting Error +/-

RADIONUCLIDE DATA FOR DRY AND ABANDONED LOCATIONS									
Well	Chemical Name	Result Value	Unit	Analytical Method	Sample Date	Project Qualifier Code	MDA	Error Plus Minus	Error Type
RS-27 (Cont'd)	Gross Alpha (filtered)	-0.216	pCi/L	900.0	5/7/1998	U	1.79	0.8	Counting Error +/-
	Gross Beta (filtered)	1.03	pCi/L	900.0	5/7/1998	U	2.01	1.2	Counting Error +/-
	Tritium	-472	pCi/L	906.0	3/4/1992	U	500	498	Counting Error +/-
	Tritium	60	pCi/L	906.0	5/17/1995	U	230	190	Counting Error +/-
	Tritium	-182	pCi/L	906.0	5/7/1998	U	220	120	Counting Error +/-
	Cesium-137, Dissolved	0.335	pCi/L	901.1	3/4/1991	U	10	5.16	Counting Error +/-

Notes: Radiological data was not located in the Boeing database for wells PZ-097, PZ-099, PZ-104, PZ-107, PZ-110, PZ-112, PZ-114, PZ-115, PZ-143, RD-74, RD-89, RS-24, RS-27
MDA – minimum detectable activity
pci/L – picocuries per liter
U – not reported above the MDA