DRAFT STAGE 1 SOURCE CONTROL EVALUATION
WORK PLAN
RP - PORTLAND SITE

July 1, 2005

Submitted to:

Oregon Department of Environmental Quality
Northwest Region
2020 S.W. 4th Avenue
Portland, Oregon 97201

Submitted for:

SLLI
One Copely Parkway, Suite 309
Morrisville, North Carolina 27560

Submitted by:

AMEC Earth & Environmental, Inc.
7376 S.W. Durham Road
Portland, Oregon 97224

0-61M-107030/Phase 69

July 1, 2005

0-61M-107030/Phase 69

Mr. Tom Roick
Project Manager, Cleanup & Portland Harbor
Department of Environmental Quality
2020 S.W. 4th Avenue
Portland, Oregon 97201

Dear Mr. Roick:

Re: Draft Stage 1 Source Control Evaluation Work Plan
RP - Portland Site

On behalf of SLLI, AMEC Earth & Environmental, Inc. (AMEC) is submitting to the Oregon Department of Environmental Quality (DEQ) the enclosed Draft Stage 1 Source Control Evaluation (SCE) Work Plan (Stage 1 SCE WP). The investigative tasks described in the Stage 1 SCE WP support evaluation of groundwater adjacent to the Willamette River (River) near the Rhône-Poulenc (RP) Portland Site (Site), as agreed to in a June 1, 2005 meeting between SLLI and DEQ.

This Stage 1 SCE WP also includes the SCE Field Sampling Plan (Stage 1 SCE FSP) as Appendix A. The Stage 1 SCE FSP includes details on sample collection methodologies and planned analysis for the study area.

Following are responses to the DEQ letter dated June 9, 2005, providing comments on SLLI's Stage 1 Source Control Evaluation Scope of Work letter dated May 20, 2005. To facilitate your review, DEQ's comments are reproduced in their entirety, followed by SLLI's responses.

DEQ Comment No. 1:

Page 3, last paragraph. The proposal lists five objectives for this scope of work. As discussed in our meeting on June 1, 2005, DEQ views the primary goal of this source control evaluation as collection of the data necessary to evaluate the scope of source control actions needed to limit impacts from the RP Portland groundwater plume to the Willamette River. The results of the Stage 1 SCE field investigation should be a report that characterizes the nature and extent of upland RP-related groundwater contamination that is likely discharging to the Willamette River, as the basis for a subsequent scoping of source control actions.

SLLI Response:

SLLI agrees that the primary goal of this SCE is the collection of data necessary to evaluate the scope of source control actions needed to limit impacts from the RP Site groundwater plume to the River. A key component of this evaluation is to determine other sources of the same or similar constituents in order to allow DEQ to properly differentiate between RP sources and other sources. Future stages of the SCE will address any additional data gaps and evaluate source control actions related to RP-related groundwater discharge to the River, if warranted.

Since there is inadequate information to evaluate potential impacts from constituents related to other sources (e.g., Arkema) additional investigation is required to identify and account for any related discharge from this site in order to accurately evaluate the RP plume. Any conclusions that are not based on a full understanding of the potential multiple sources of chemical constituents that may possibly be entering the River will be highly uncertain, and may result in selection of an inadequate or inappropriate remedy, if a remedy is necessary at all.

DEQ Comment No. 2:

Page 1, last paragraph. DEQ will review SLLI submittals, prepared at your own discretion, to investigate the potential contribution from other possible sources of dioxin (or other contaminants of concern). On the basis of existing documented facility operational practices and site-specific data we consider SLLI to be a historic source and a likely current source of dioxin contamination to the Willamette River.

SLLI Response:

SLLI disagrees with the implications in DEQ's Comment No. 2 that evaluation of other sources of dioxin in the vicinity of the alleged RP plume is of no consequence to the characterization of this plume. SLLI will not be held responsible for dioxins related to historical or current operations at other facilities located in Portland Harbor, or anywhere else in the Willamette Basin. SLLI intends to vigorously defend itself against any assertion of responsibility for dioxins that did not originate from historical operations at the former RP facility.

DEQ Comment No. 3:

Page 5, Direct-Push Borings. The direct-push depth intervals for the Arkema upland and beach sampling appears similar. DEQ expects the sampling intervals to be offset due to the change in ground surface elevation between the upland and beach.

SLLI Response:

SLLI agrees that sampling depth intervals for Arkema Lots 1 and 2 and Beach Area should be offset due to the change in ground surface elevation. The scope of work provides for a 10-foot elevation difference in default sampling locations to account for this offset. Additional explanation regarding sampling intervals is provided in Section 2.1 of the Stage 1 SCE FSP (Appendix A).

DEQ Comment No. 4:

Page 5, Sonic Borings. AMEC should consider the potential for vertical mixing of groundwater during drilling with sonic drilling methods. DEQ has experienced this problem on other sites where the resulting groundwater sampling data was considered unreliable.

SLLI Response:

SLLI has reviewed an email provided by Mavis Kent of DEQ on June 6, 2005 relating directly to the failed sonic groundwater sampling event mentioned by DEQ. SLLI plans on employing multiple safeguards to help ensure collection of reliable data including the use of a submersible pump and inflatable packer assembly and purging of a sufficient amount of water prior to collection of targeted zone groundwater. Further description of the planned sampling procedures is provided in Section 2.1.2 and Standard Operating Procedure (SOP)-24 in Appendix A-1 of the Stage 1 SCE FSP.

DEQ Comment No. 5:

Page 5, Siltronic site work. Additional wells should be considered for the Siltronic Property (North of North Doane Lake) along the anticipated groundwater flow pathway from RP sources to the river in order to further evaluate the deep contamination detected on the Siltronic property.

SLLI Response:

SLLI will consider the addition of direct-push borings or monitoring wells downgradient between RP and the River on the Siltronic property following the evaluation of analytical data collected during this Stage 1 SCE. As discussed in SLLI's response to Comment No. 1, the scope of this Stage 1 SCE is to evaluate RP-related constituents directly adjacent to the River. Proposed additional investigation on the Siltronic property, if appropriate, will be provided by SLLI in the Stage 1 SCE Technical Memorandum (Section 7.0, Stage 1 SCE WP).

DEQ Comment No. 6:

On behalf of Siltronic Corporation, Maul Foster & Alongi provided comments on the SCE by letter to Matt McClincy, dated June 2, 2005 (copy to Roger Gresh at AMEC). DEQ concurs with their recommendations and requests that SLLI include applicable revisions to the work plan. Those recommendations are in brief:

- *Increased sampling frequency to better understand vertical distribution of contamination,*
- *Soil sampling to provide information for site-specific partitioning coefficients,*
- *Analysis for natural attenuation parameters related to trichloroethylene (TCE) degradation, and*
- *Siltronic wells with dedicated pumps (WS-11 and WS-12) may need to be sampled by alternative methods.*

SLLI Response:

In response to the bulleted items:

- SLLI agrees to collect an additional three groundwater samples per boring from 100 feet to refusal depth at boring locations located on the Siltronic property. These additional groundwater samples will be analyzed for volatile organic compounds (VOCs) by United States Environmental Protection Agency (EPA) Method 8260B. Section 3.3.1 of the Stage 1 SCE WP outlines the sampling depth intervals and rationale.
- SLLI plans to collect a limited number of soil samples, collocated with groundwater samples, for total organic carbon (TOC) as outlined in Table 2 of the Stage 1 SCE WP. The TOC results, along with constituent concentrations in collected groundwater, will allow calculation

of partitioning coefficients at each sampling location (based on the reasonable assumption that groundwater and soil beneath the Siltronic property are in equilibrium).

- EPA Method 8260B will provide degradation products of TCE such as 1,2-DCE and vinyl chloride. SLLI does not agree that collection of parameters such as ethane, ethene, and carbon dioxide will be of particular use in determining the source of TCE. If Siltronic would like to collect split samples for analysis of additional parameters, SLLI would certainly accommodate such a request.
- AMEC contacted Siltronic's consultant Maul Foster & Alongi on June 14, 2005 and obtained information regarding the dedicated bladder pumps installed in monitoring well clusters WS-11 and WS-12. These monitoring wells will be sampled using the same technique that will be used at monitoring well cluster RP-07.

DEQ Comment No. 7:

The Outfall 22B Storm Sewer is a preferential pathway for groundwater discharge to the river. DEQ acknowledges that SLLI has conducted sampling of the storm sewer as a separate phase of work, and we expect that SLLI will pursue additional work with respect to the storm sewer separately from this proposal. Nevertheless, the storm sewer should be identified in the SCE as a preferential pathway. SLLI should consider direct-push sampling or wells to evaluate groundwater concentrations and aquifer characteristics adjacent to the conveyance pipe, including where the pipe nears the river (supplemental to RP-01).

SLLI Response:

The Stage 1 SCE WP includes a mention of the Outfall 22B Storm Sewer as an apparent preferential pathway for groundwater, and that it has been evaluated in the Draft Outfall 22B Storm Sewer Sampling Report dated March 24, 2005. SLLI is currently developing a scope of work for an Interim Remedial Action Measure (IRAM) to mitigate infiltration of groundwater into this storm sewer that contains detections of RP-related constituents. Therefore, SLLI does not plan to conduct further investigations adjacent to the storm sewer.

DEQ Comment No. 8:

The proposed sampling locations should be placed based on the hydrogeologic conceptual site model. Additional information should be prepared and included in the work plan to identify groundwater plume data gaps and to develop the rationale for proposed boring/well locations, depths, and groundwater grab sample intervals. Specifically, the following tasks should be completed:

- *Prepare groundwater plume maps (for each impacted water-bearing zone) showing the estimated extent of groundwater contamination towards the river.*
- *Prepare geologic cross sections showing stratigraphy, the estimated horizontal and vertical extent of the groundwater plume(s); river bathymetry; and locations of proposed stratigraphy cores and discharge mapping points.*

- *Using the above information, identify data gaps in groundwater plume delineation to refine proposed boring/well locations.*

SLLI Response:

SLLI considered the current conceptual site model when developing and refining the scope of work for the Stage 1 SCE, and designed the Stage 1 SCE investigation to address identified data gaps. The Stage 1 SCE WP includes groundwater plume maps for each of the three water bearing zones for 1,2-dichlorobenzene, benzene, 2,4-dichlorophenol, 2,4-D, and 2,3,7,8-TCDD (Figures 7 through 9, Stage 1 SCE WP). Updated geologic cross sections based on the current hydrogeologic conceptual site model that show proposed Stage 1 SCE investigation locations and selected constituent concentrations are also included (Figures 4 through 6, Stage 1 SCE WP).

SLLI presumes that DEQ is referring to Lower Willamette Group (LWG) proposed locations of stratigraphy cores and discharge mapping points. Locations of proposed stratigraphy cores and discharge mapping points were not included in the Stage 1 SCE WP because the LWG *Portland Harbor RI/FS Round 2 Groundwater Pathway Assessment Work Plan* has not received agency approval. However, results of LWG in-water investigations will be considered in our overall evaluation, as available and appropriate.

DEQ Comment No. 9:

Page 6, last paragraph. DEQ expects SCE reports to include an updated, comprehensive hydrologic conceptual model; a description of the area of plume discharge (vertical and horizontal); identification of preferential flow pathways (e.g., zones of greater hydraulic conductivity); an estimate of plume discharge rate and contaminant loading to the river; a description of fate and transport and partitioning of contaminants between the dissolved phase and sediments.

SLLI Response:

SLLI reminds DEQ that this work plan is for Stage 1 of the SCE. As stated by DEQ during the June 1, 2005 meeting, the main objective of the SCE is to determine whether source control is necessary. Although some of DEQ's listed objectives will be met with Stage 1, such as development of an updated hydrologic conceptual site model, the Stage 1 SCE is not intended to obtain the information necessary to determine the area of RP-related constituent discharge to the River, nor to provide an estimate of plume discharge rate and contaminant loading to the River. SLLI is not currently proposing the in-river investigation that would be required to properly evaluate these topics. Some of the information required for such an evaluation may be provided by currently proposed LWG investigations, and if available and appropriate, LWG results may be considered in a future SCE report. It is SLLI's intention that the Stage 1 SCE results will be initially presented in a technical memorandum designed to transmit the results to DEQ and to propose any additional investigation and/or evaluation, if appropriate.

One clipped and three bound copies of this work plan are enclosed. If you have any questions, please call Roger Gresh at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

Roger T. Gresh, P.G.
Project Manager

Teresa A.R. Wilson
Task Manager

Encl: Draft Stage 1 Source Control Evaluation Work Plan

CLJ/lp

c: R. Ferguson, SLLI
S. Dearden, Sanofi-Aventis
J. Benedict, CHBH&L

Table of Contents

List of Tables

List of Figures

List of Appendices

1.0 INTRODUCTION

This Draft Stage 1 Source Control Evaluation (SCE) Work Plan (Stage 1 SCE WP) presents the data quality objectives (DQOs) and describes the scope of work for investigative activities to be conducted adjacent to the Willamette River (River) near the Rhône-Poulenc (RP) Portland Site (Site). The RP property is located at 6200 N.W. St. Helens Road in Portland, Oregon (Figure 1). The SCE investigation is being conducted in response to a letter from the Oregon Department of Environmental Quality (DEQ) dated February 22, 2005 requesting SLLI to conduct an "investigation between the existing downgradient groundwater monitoring wells and the river…to evaluate the extent and concentration of RP-related contaminant discharges to the Willamette River" (DEQ, 2005a). The scope of work for this Stage 1 SCE WP was presented to DEQ in a letter dated May 20, 2005 (AMEC, 2005a) and was discussed in a meeting between DEQ and SLLI on June 1, 2005. DEQ conditionally approved the scope as presented in the May 20, 2005 letter in DEQ's letter dated June 9, 2005 (DEQ, 2005b).

This Stage 1 SCE WP will be implemented according to procedures outlined in the Stage 1 SCE Field Sampling Plan (FSP) (Appendix A), the site-specific Revised Quality Assurance Project Plan (QAPP) dated June 13, 2001 (AMEC, 2001), the site-specific Health and Safety Plan (HASP) dated June 24, 2005 (AMEC, 2005b), and any subsequent applicable updates to the QAPP and HASP.

1.1 Data Quality Objectives

The DQOs of the Stage 1 SCE are to evaluate:

1. Evaluate whether constituents are present in near-River groundwater at regulatory levels of concern;

2. Evaluate whether the constituents are from a RP source or other sources;

3. Evaluate the extent and the chemical makeup of the dioxin and chlorinated solvent plumes originating at the Arkema site flowing to the north/northwest and the potential for commingling with the RP plume.

4. Evaluate the connection, if any, between Siltronic's trichloroethylene (TCE) plume and deep TCE detected on their property; and

5. Evaluate regional (Arkema, RP, Siltronic) groundwater flow direction within the Alluvium and Basalt Zones near the River.

In addition, data from this Stage 1 SCE will be used to support the planned bioremediation pilot study and facilitated transport evaluation and to assist in planning for source control, if warranted.

1.2 Scope of Work

The scope of work to evaluate the above-listed DQOs has been divided into four tasks.

- **Task 1** - Drilling of reconnaissance borings near the River from the northwestern property boundary of Siltronic Corporation (Siltronic) to the southeastern boundary of Arkema, Inc (Arkema) along the riverbank of Lots 1 and 2, and at Arkema Lots 1 and 2 (Stage 1 SCE study area; Figure 2) by using both direct-push and sonic drilling technologies for lithologic logging and the collection of soil and groundwater analytical samples;
- **Task 2** - Installation of up to four monitoring well clusters adjacent to the River and three monitoring well clusters located on upland areas of Arkema Lots 1 and 2;
- **Task 3** - Groundwater sampling and water elevation monitoring of newly installed monitoring wells and selected existing monitoring wells; and
- **Task 4** - Transducer study to be conducted within selected newly installed monitoring wells and selected existing monitoring wells.

2.0 BACKGROUND INFORMATION

This section describes the RP facility location, its operational history, and the Stage 1 SCE study area geology and hydrogeology.

2.1 Site Description

The RP property is located in Section 30 of Range 1W, Township 1N and is presented on the RP Site vicinity map, Figure 1. The Site is located in a heavily industrialized area northwest of Portland, and southwest of the River. The RP property has been divided into three investigative areas for ease in reference. The three areas are the Herbicide Area (HA), Insecticide Area (IA), and Lake Area (LA). Surrounding and nearby property owners include the City of Portland, Siltronic, Schnitzer Investment Corporation, Arkema, ESCO Corporation (ESCO), Gould Electronics (Gould), Metro, and Burlington Northern Santa Fe Railroad (BNSF). The Gould and Schnitzer properties, along with the LA portion of the RP property, are part of the Gould Superfund Site. The study area for the Stage 1 SCE includes portions of the Arkema, BNSF, and Siltronic properties.

2.2 Site History

The former RP facility was used for the formulation and/or manufacture of insecticides and/or herbicides from 1943 to 1991. Early operations at the RP facility included the formulation of railroad right-of-way treatment liquids, fertilizer and insecticide mixtures, and sodium arsenite liquids. In the early 1950s the formulation of organic products, including phenoxy herbicides, DDT, endrin, aldrin, and heptachlor began. Operations were expanded in 1956 to include the manufacture and formulation of 2,4-D acid and esters. During the 1960s, manufacture and formulation of MCPA acid and esters, and 2,4-DB acid, occurred at the RP facility, and in 1971 the manufacture of bromoxynil products was added.

Prior to 1966, treated wastewater was discharged to West Doane Lake (WDL), and from 1966 to 1976 treated wastewater was discharged to the River. Beginning in 1977, treated wastewater was discharged to a City of Portland publicly owned treatment works (POTW). RP began operation of a shallow groundwater extraction and treatment system in 1984, which discharges to the River under a National Pollution Discharge Elimination System (NPDES) permit issued by DEQ.

2.3 Physical and Hydrogeological Setting

The geologic framework of the RP Site and surrounding properties was determined from geologic logs of borings completed in the area. Lithologic units at the RP Site and near the River are grouped into characterization zones including the Fill/Shallow Alluvium Zone, Alluvium Zone, and Basalt Zone. A cross section location map is given in Figure 3 that shows the location of two cross sections that extend from the RP property to the River (Figures 4 and 5). An additional cross section extends adjacent to the River from the northwestern property boundary of GASCO south to the southeastern property boundary of Arkema (Figure 6). Characterization zone designations were chosen from soil or rock type, the presence or absence of vertical gradients, and hydraulic properties (e.g., hydraulic conductivity, AMEC, 2003).

Fill/Shallow Alluvium Zone

The Fill/Shallow Alluvium Zone includes the fill lithologic unit and the upper 10 to 15 feet of the sandy silt lithologic unit as shown on the cross sections. The fill lithologic unit consists of variable amounts of sand, silt, clay, organic matter, occasional gravel, and miscellaneous debris that were used to infill Doane Lake. On the Siltronic property, the fill lithologic unit consists of variable amounts of quarry rock and River dredge spoils used to infill topographic depressions. Underlying the fill lithologic unit, the shallow alluvium consists of primarily native sandy silts with occasional discontinuous lenses of sand and clayey silt. The fill lithologic unit is unsaturated in the HA, IA, and northeast of NW Front Avenue, and is saturated in the LA and northwest of the BNSF railroad fill on the Siltronic property. Groundwater elevations at monitoring well clusters screened in the fill lithologic unit and the Alluvium Zone generally indicate a downward vertical gradient between the fill lithologic unit and the Alluvium Zone. The shallow alluvium has been observed to be saturated where it occurs throughout the RP Site.

Groundwater elevation measurements collected from monitoring wells completed in the Fill/Shallow Alluvium Zone indicate that groundwater in the Fill/Shallow Alluvium Zone is influenced by local surface water features, including WDL, North Doane Lake (NDL), and the Northwest Drainage Pond (NDP). Groundwater near the surface water features can discharge to the surface water feature or the surface water feature can recharge the groundwater system, depending on the water elevation in the surface water feature and seasonal changes in groundwater elevation.

Alluvium Zone

The Alluvium Zone includes the lower portion of the sandy silt lithologic unit, the clay lithologic unit, a shelf gravel lithologic unit, and a river gravel lithologic unit, as depicted in Figure 6.

- The lower portion of the sandy silt lithologic unit ranges in thickness from about 50 feet in the HA to 85 feet near monitoring well cluster W-09 (ESCO property) to 20 feet near monitoring well RP-02 cluster (Arkema property). The unit grades from silt at its top to a sand silt and is alluvial in origin;
- The clay lithologic unit is extensive, with an average thickness of about 20 feet. The clay lithologic unit is observed from the River south to the LA near monitoring well clusters W-09 and AL-06 and east underlying the Arkema facility. The unit consists of low permeability interbedded clayey silts and clays;
- The shelf gravel lithologic unit is weathered angular to subangular basalt gravel overlying competent basalt under the RP property, NDL, and the southwestern portion of the Siltronic property. The shelf gravel generally has a silt and clay matrix and is about 1 foot thick, but thickness extends to 10 feet near monitoring well cluster AL-05 in the LA;
- The river gravel lithologic unit is a high permeability rounded to subrounded gravel with cobble-sized clasts. The river gravel unit is thickest at monitoring well RP-07-119 (42.0 feet) and thinner toward the south, with gravel thickness of 16.5 feet at monitoring well W-19-D, 1.5 feet at monitoring well RP-06-87, and absent at monitoring wells MWA-14-I, W-11-B, RP-01-51, and RP-02-65; and

- The Alluvium Zone groundwater elevations indicate the regional groundwater flow direction is southwest to the northeast, from the Tualatin Mountains toward the River. Seasonally the general direction of groundwater flow and groundwater gradient does not change significantly.

Basalt Zone

The Basalt Zone consists of the basalt lithologic unit, which underlies the alluvial deposits, as depicted in the three cross sections (Figures 4 through 6). Basalt at the RP Site and surrounding properties is part of the Columbia River Basalt Group (CRBG). In the west Portland business district, the Columbia River Basalt is at least 700 feet thick and consists of a series of lava flows with discontinuous layers of interflow tuff (USGS 1963). At the RP Site, basalt is observed as highly fractured to massive and highly weathered to fresh. Groundwater elevations at monitoring well clusters screened in the Alluvium Zone and Basalt Zone generally indicate a downward vertical gradient between the Alluvium Zone and Basalt Zone. Groundwater elevations in the Basalt Zone generally flow from the southwest to the northeast, from the Tualatin Mountains towards the River.

2.4 Groundwater Constituent Distribution

SLLI has evaluated the distribution of constituents in groundwater and has presented results in the Groundwater Characterization Report (GCR; AMEC 2003). However, as part of the development of this Stage 1 SCE WP, groundwater constituent distribution maps based on screening level exceedances have been used to help identify data gaps near the River downgradient from the RP property. The Stage 1 SCE scope of work was developed to help evaluate the potential extent of constituents along the River, as well as to evaluate groundwater concentrations between the River and existing monitoring well locations.

Figures 7, 8, and 9 of this Stage 1 SCE WP provide outlines of groundwater concentrations for selected representative constituents based on criteria provided in Table 1. The criteria used for the constituent outlines were those submitted to the Lower Willamette Group (LWG) for the Draft Portland Harbor Remedial Investigation/Feasibility Study Conceptual Site Model Update (LWG, 2004). The criteria are not intended to represent appropriate regulatory levels for risk or cleanup, or to trigger any other action.

2.5 Data Gaps

Based on the conceptual hydrologic site model, including constituent distribution in groundwater (Figures 7, 8, and 9) and stratigraphic information as presented on the cross sections (Figures 4, 5, and 6), the following data gaps will be addressed by the SCE at the RP Site:

- Lack of a regional (Arkema, RP, and Siltronic) understanding of groundwater flow direction within the alluvium and basalt zones;
- The need for improved understanding of the basalt surface and gravel thicknesses, and their influence on regional flow directions;
- The need to further evaluate which RP-related constituents, if any, are detectable within the three lithologic units between existing monitoring wells near the riverbank and the River, in the area along the riverbank from the Arkema plant area to the northeastern Siltronic property boundary;
- The need to investigate potential other sources of detected constituents in groundwater near the River that do not appear to be RP-related (e.g., Arkema, Gasco, or Siltronic);
- The need to evaluate whether constituents at or above regulatory levels of concern are present in groundwater at the River, if any, as they relate to potential source control measures;
- The need to evaluate the source of detected constituents;
- The need to evaluate chemical differentiation and distribution of constituent sources; and
- The need to evaluate natural attenuation parameters in groundwater near the River between the Arkema plant area and the northwestern Siltronic property boundary.

It is anticipated that the scope of work for this Stage 1 SCE will at least partially address the above listed data gaps. SCE related to the preferential discharge of RP-related constituents to Outfall 22B Storm Sewer has been previously discussed in the Draft Outfall 22B Storm Sewer Sampling Report (AMEC, 2005c). A scope of work to mitigate infiltration of groundwater containing RP-related constituents into the storm sewer will be provided to DEQ under separate cover.

3.0 TASK 1 - RECONNAISSANCE ACTIVITIES

Task 1 consists of reconnaissance activities that include drilling of investigative borings within the Stage 1 SCE study area using both direct-push and sonic drilling technologies for lithologic logging and the collection of soil and groundwater analytical samples. Analytical results will be used to evaluate whether constituents at or above regulatory levels of concern are present near the River, and to help differentiate, using chemical forensic tools, between constituents derived from the former RP facility and constituents from other sources. The analytical and lithologic results will be used as factors in determining Task 2 monitoring well locations.

The Stage 1 SCE study area has been divided into three individual reconnaissance areas as shown on Figure 2 and includes:

- **Arkema Lots 1 and 2:** The upland area of Lots 1 and 2 within the Arkema site;
- **Beach Area:** The area directly adjacent to the River from just north of the BNSF railroad bridge to the southeastern boundary of Arkema Lot 2; and
- **Siltronic Riverbank:** The upland area directly adjacent to the River from near the BNSF railroad bridge to the northwestern property boundary of Siltronic.

The Task 1 field investigation approach for each of the above listed areas is described below. All drilling activities will be conducted by a driller licensed in the State of Oregon and will be monitored and recorded by an AMEC field representative working under the supervision of an AMEC State of Oregon Registered Geologist.

3.1 Arkema Lots 1 and 2

Investigative activities to be conducted in Arkema Lots 1 and 2 include advancement of direct-push borings for lithologic logging and soil and groundwater characterization. Boring locations are shown on Figure 2. Lithologic data collected from these boring locations will be used to refine the conceptual hydrogeologic site model. Groundwater analytical data from water-bearing zones of the three lithologic units will be used to evaluate both vertical and lateral distribution of RP-related constituents and to help differentiate those constituents from other sources (e.g., Arkema) within Arkema Lots 1 and 2. Groundwater analytical data will also allow an evaluation of natural attenuation processes for use in future remedy selection, if necessary. Specific sampling activities for Arkema Lots 1 and 2 are described below.

3.1.1 Direct-Push Borings

Direct-push borings within Arkema Lots 1 and 2 will be advanced to refusal depth, estimated at 60 feet below ground surface (ft bgs) based on previous site drilling. At each boring location soil will be sampled continuously for 1) lithologic logging, 2) field screening by a photoionization detector (PID) for the presence of volatile organic compounds (VOCs), and 3) visual inspection. Soil from the following four depths at a minimum will be retained for hydrogeologic parameter and/or chemical constituent analysis as summarized on Table 2 and as outlined in the FSP: 0 to 0.5 ft bgs, 5 to 5.5 ft bgs, directly above the water table within the capillary fringe, and at drill refusal depth. Ten soil samples from Arkema Lots 1 and 2 and the Beach Area will be analyzed for chemical constituents as summarized on Table 2. Additional soil samples will be submitted for chemical constituent analysis if visual and/or PID evidence during sample collection indicates potential soil impact. Soil samples will be collected in accordance with procedures outlined in the Stage 1 SCE FSP.

Three reconnaissance groundwater samples will be collected per boring for laboratory analysis as summarized on Table 2. Water samples will be collected from 1) the first water-bearing zone, 2) directly above the clay layer (estimated at 40 ft bgs), and 3) drill refusal depth. Groundwater samples will be collected in accordance with procedures outlined in the Stage 1 SCE FSP.

3.2 Beach Area Investigation

Investigative activities to be conducted in the Beach Area include advancement of direct-push and sonic borings for lithologic logging and soil and groundwater characterization. Boring locations are shown on Figure 2. Lithologic data collected from these boring locations will be used to refine the conceptual hydrogeologic site model. Groundwater analytical results from the Beach Area investigation will be used to evaluate whether constituents at or above regulatory levels of concern are present near the River at various elevations within water-bearing zones of the three lithologic units. Specific sampling activities for the Beach Area are described below.

3.2.1 Direct-Push Borings

Direct-push borings within the Beach Area will be advanced to refusal depth, estimated at 50 ft bgs. At each boring location soil will be sampled continuously for 1) lithologic logging, 2) field screening by PID, and 3) visual inspection. Soil from the following four depths at a minimum will be retained for hydrogeologic parameter and/or chemical constituent analysis as summarized on Table 2 and as outlined in the Stage 1 SCE FSP: 0 to 0.5 ft bgs, 5 to 5.5 ft bgs, directly above the water table within the capillary fringe, and at drill refusal depth. Because the water table is anticipated to be much shallower within the Beach Area, the 5 to 5.5 ft bgs sample may be analogous to the capillary fringe sample; therefore, only three depth intervals will likely be collected in this area. Ten soil samples from Arkema Lots 1 and 2 and the Beach Area will be analyzed for chemical constituents as summarized on Table 2. Additional soil samples will be submitted for chemical constituent analysis if visual and/or PID evidence during sample collection indicates potential soil impact. Soil samples will be collected in accordance with procedures outlined in the Stage 1 SCE FSP.

Three reconnaissance groundwater samples will be collected per boring for laboratory analysis as summarized on Table 2. Water samples will be collected from 1) the first water-bearing zone, 2) directly above the clay layer (estimated at 30 ft bgs), if present, and 3) drill refusal depth. Groundwater samples will be collected in accordance with procedures outlined in the Stage 1 SCE FSP.

3.2.2 Sonic Borings

Borings drilled using sonic technologies, as shown on Figure 2, will be advanced to confirm lithologic logging from the direct-push borings, to document the basalt surface elevation and surface condition (e.g., fracturing and weathering) and gravel thickness (if observed), and to evaluate groundwater quality in the basalt zone. Borings will be advanced approximately 10 ft into the weathered basalt. Soil sampling will be conducted continuously for lithologic logging and documentation of visually impacted soils. No soil samples for analytical analysis are planned from the Beach Area sonic borings. One reconnaissance groundwater sample will be collected from the basalt zone at these boring locations for laboratory analysis of chemical constituents as summarized in Table 1. An additional groundwater sample will be collected if the gravel unit is encountered during drilling and if a sample was not obtained from this zone from a nearby direct-push boring. Sample collection procedures will follow those as outlined in the Stage 1 SCE FSP.

3.3 Siltronic Riverbank Investigation

Investigative activities to be conducted on the Siltronic Riverbank include advancement of direct-push and sonic borings for lithologic logging and soil and groundwater characterization. Boring locations are shown on Figure 2. Lithologic data collected from these boring locations will be used to refine the conceptual hydrogeologic site model. Soil samples will be analyzed for selected parameters to help evaluate partitioning coefficients at the Siltronic Riverbank. Groundwater analytical results will be used to evaluate whether constituents at or above regulatory levels of concern are present near the River at various elevations within water-bearing zones of the three lithologic units. Specific sampling activities for the Siltronic Riverbank are described below.

3.3.1 Direct-Push Borings

Direct-push borings within the Siltronic Riverbank will be advanced to refusal depth, estimated at 100 ft bgs near the BNSF railroad bridge to 220 ft bgs near the Siltronic plant area. At each boring location soil will be sampled continuously for lithologic logging, field screening by PID and visual inspection. No soil samples for chemical analysis are planned from these boring locations. Soil samples for hydrogeologic parameters, including total organic carbon (TOC), will be collected and analyzed as outlined in the Stage 1 SCE FSP.

Up to six reconnaissance groundwater samples will be collected per boring for laboratory analysis as summarized on Table 2. Water samples will be collected from 1) the first water-bearing zone, 2) approximately 100 ft bgs, 3) every 30 ft thereafter until drill refusal, and 4) at drill refusal depth. Groundwater samples will be collected in accordance with procedures outlined in the Stage 1 SCE FSP.

3.3.2 Sonic Borings

Borings drilled using sonic technologies, as shown on Figure 2, will be advanced to confirm lithologic logging from the direct-push borings, to document the basalt surface elevation and surface condition (e.g., fracturing and weathering) and gravel thickness (if observed), and to evaluate groundwater quality in the basalt zone. Borings will be advanced approximately 10 ft into the weathered basalt. Soil sampling will be conducted continuously for lithologic logging and documentation of visually impacted soils. One reconnaissance groundwater sample will be collected from the basalt zone at these boring locations for laboratory analysis of chemical constituents as summarized in Table 2. An additional groundwater sample will be collected if the gravel zone is encountered during drilling and if a sample was not obtained from this zone from a nearby direct-push boring. Sample collection procedures will follow those as outlined in the Stage 1 SCE FSP.

4.0 TASK 2 - MONITORING WELL INSTALLATION

The number of monitoring wells to be installed during Task 2, the completion depth of each well, and well locations will be determined based on evaluation of the combined lithologic and analytical data obtained during the Task 1 reconnaissance field investigation activities. Currently, it is anticipated that three well clusters will be installed in the Beach Area and one cluster will be installed on the Siltronic Riverbank, as shown on Figure 2. In addition, up to three monitoring well clusters will be installed at Arkema Lots 1 and 2 (Figure 2). Monitoring well clusters will be screened within each lithologic unit (i.e., Fill/Shallow Zone, Alluvium Zone, and the Basalt Zone). If a gravel unit at the base of the Alluvium Zone is encountered, an additional monitoring well will be installed and completed within the gravel unit.

Boreholes for monitoring wells will be drilled using sonic drilling technologies by a well driller licensed in the State of Oregon. Monitoring wells will be constructed with schedule 40 PVC casing and screening as described in Section 2.2 of the Stage 1

SCE FSP (see Appendix A). Soil samples will be collected continuously for lithologic logging at each monitoring well location. The new monitoring wells will generally be constructed with above-ground protective casing (unless prohibited by site traffic) in accordance with Oregon Administrative Rule (OAR) 690-240-0110 and will be surveyed by a licensed surveyor following completion.

5.0 TASK 3 - GROUNDWATER MONITORING

Groundwater samples will be collected at each of the new monitoring well clusters installed during the Task 2 monitoring well installation activities in addition to selected existing wells. The groundwater monitoring has been divided into two separate events based on the overall project schedule discussed in further detail in Section 8.0. The first groundwater monitoring event will be conducted following the installation of the monitoring well clusters on Arkema Lots 1 and 2 and will include sampling of these wells in addition to RP monitoring well clusters RP-01, RP-02, W-19 and Arkema monitoring wells MWA-3, MWA-5, MWA-9i, MWA-13d, MWA-14i, MWA-17si, and MWA-21b. The second groundwater monitoring event will occur following the installation of monitoring wells at the Beach Area and Siltronic Riverbank. This event will include sampling of all newly installed monitoring wells, the wells sampled during the first event, RP monitoring well clusters MW-05 and RP-07, and Siltronic monitoring well pairs WS-11 and WS-12. Groundwater monitoring locations are shown on Figure 10. During the second groundwater monitoring event, a round of water levels will be collected from all RP Site wells.

Groundwater samples will be collected using the same techniques as those described in Section 2.3.2 of the Stage 1 SCE FSP. Groundwater samples will be analyzed for the same list of constituents used for the Task 1 reconnaissance investigation described above in addition to natural attenuation parameters. The frequency of additional sampling events at each monitoring well, if needed, will be determined by SLLI and described in the SCE technical memorandum (See Section 7.0).

6.0 TASK 4 - TRANSDUCER STUDY

Following the completion of the Task 3 groundwater monitoring events, a transducer study will be conducted within selected newly installed monitoring well clusters and selected existing monitoring well clusters to evaluate hydraulic gradients and tidal influence on the three lithologic units near the River. Planned pressure transducer installation locations include each monitoring well in well clusters W-19 and RP-02, and in each well of two of the newly installed Beach Area and/or Arkema Lots 1 and 2 monitoring well clusters. Final transducer study locations will be determined following the evaluation of hydrogeologic data collected during Tasks 1 through 3 of this Stage 1 SCE.

7.0 REPORTING

Following the completion of the Stage 1 SCE field activities, analytical results will be validated, evaluated, and submitted to DEQ in a technical memorandum. The Stage 1 SCE technical memorandum will include a description of field activities and observations, a summary of the analytical results, summary and conclusions of the observations and results of the Stage 1 SCE, revisions to the hydrogeologic conceptual site model, and any proposed future investigations. Following subsequent investigations, if needed, a SCE report will be submitted to DEQ that will include an evaluation of data from the Stage 1 SCE, the additional investigations, and LWG in-water investigation as appropriate.

8.0 SCHEDULE

The Stage 1 SCE field activities are anticipated to begin within two weeks following DEQ approval of this work plan. Based on discussions with DEQ during the June 1, 2005 meeting with SLLI, an expedited DEQ review process is anticipated. The proposed schedule, illustrated on Figure 11, includes mobilization and completion of field programs, laboratory analysis of samples, data validation, and evaluation and reporting of the data for the Stage 1 SCE.

Tasks 1 through 3 for Arkema Lots 1 and 2 have been expedited to allow documentation of changes in groundwater chemistry beneath Lots 1 and 2 in response to Interim Remedial Measures (IRM) scheduled to be conducted on Arkema Lots 3 and 4 during spring/summer 2005. Preliminary analysis of chemical distribution and hydrology throughout the area indicates that these IRMs could impact groundwater quality beneath Arkema Lots 1 and 2; therefore, these investigative activities are planned for July/August as indicated on Figure 11. The expedited Arkema Lots 1 and 2 schedule will be dependent upon obtaining property access in a timely manner.

The remaining investigative activities are anticipated to be conducted in late summer or early fall 2005, following approval of SLLI's joint removal/fill Army Corp of Engineers and Division of State Lands permit application. The remaining activities are also dependent upon obtaining property access prior to the scheduled field implementation.

The proposed schedule is based on assumptions consistent with current knowledge and experience, recent discussions with DEQ, and timing of site access and permitting. The schedule may change if actual site conditions or program implementation deviate from these assumptions.

REFERENCES

AMEC, 2001. *Revised Quality Assurance Project Plan, RPAC - Portland Site*, prepared for Aventis CropScience, prepared by AMEC Earth & Environmental, submitted to Oregon Department of Environmental Quality, June 13, 2001.

AMEC, 2002. *Draft Quality Assurance Project Plan Addendum No. 1, RPAC - Portland Site*, prepared for RPAC, prepared by AMEC Earth & Environmental, Inc. submitted to Oregon Department of Environmental Quality, August 1, 2002.

AMEC, 2003. *Final Groundwater Characterization Report, RPAC - Portland Site*, prepared by AMEC Earth & Environmental, Inc. submitted to Oregon Department of Environmental Quality, March 28, 2003.

AMEC 2005a. Stage 1 Source Control Evaluation, RP - Portland Site, prepared for SLLI, prepared by AMEC Earth & Environmental, Inc. submitted to Oregon Department of Environmental Quality, May 20, 2005.

AMEC, 2005b. *Site-Specific Health and Safety Plan*, prepared by AMEC Earth & Environmental, Inc., submitted to Oregon Department of Environmental Quality, June 24, 2005.

AMEC 2005c. Draft Outfall 22B Storm Sewer Sampling Report, RP - Portland Site, prepared for SLLI, prepared by AMEC Earth & Environmental, Inc. submitted to Oregon Department of Environmental Quality, March 24, 2005.

DEQ 2005a. Letter from Thomas E. Roick, *Source Control Evaluation, Rhone Poulenc Portland Site*. February 22, 2005.

DEQ 2005b. Letter from Thomas E. Roick, *Stage 1 Source Control Evaluation, Rhone Poulenc Portland Site*. June 9, 2005.

LWG 2004. Draft Portland Harbor Remedial Investigation/Feasibility Study Conceptual Site Model Update. September 17, 2004.

LIMITATIONS

This report was prepared exclusively for SLLI by AMEC Earth & Environmental, Inc. (AMEC). The quality of information, conclusions, and estimates contained herein is consistent with the level of effort involved in AMEC services and based on: i) information available at the time of preparation, ii) data supplied by outside sources, and iii) the assumptions, conditions, and qualifications set forth in this report. This Draft Stage 1 Source Control Evaluation Work Plan is intended to be used by SLLI for the RP - Portland Site, 6200 N.W. St. Helens Road, Portland, Oregon only, subject to the terms and conditions of its contract with AMEC. Any other use of, or reliance on, this report by any third party is at that party's sole risk.

TABLES

TABLE 1
Groundwater Screening Values
Draft Stage 1 Source Control Evaluation
RP - Portland Site

Chemical Class	Representative Constituent	Screening Value	Screening Value Basis and Comments
VOCs	Benzene	11 µg/L	5xAWQC used to contour; some outliers may have been eliminated from contour.
VOCs	1,2-Dichlorobenzene	2,100 µg/L	5xAWQC used to contour; some outliers may have been eliminated from contour.
Phenols	2,4-Dichlorophenol	385 µg/L	5xAWQC used to contour; some outliers may have been eliminated from contour.
Pesticides	Dieldrin	MDL	Screening levels are less than the analytical detection limit, so MDL was used to draw groundwater plume; some outliers may have been eliminated from contour.
Dioxins/Furans	2,3,7,8-TCDD	MDL	Screening levels are less than the analytical detection limit, so MDL was used to draw groundwater plume; some outliers may have been eliminated from contour.
Herbicides	2,4-D	1,825 µg/L	5xEPA Region IX tap water PRG used to contour; no AWQC available; some outliers may have been eliminated from contour.

Notes:

AWQC	Ambient Water Quality Criteria
EPA	United States Environmental Protection Agenecy
MDL	method detection limit
µg/L	micrograms per liter
PRG	Preliminary Remediation Goals
VOCs	volatile organic compounds

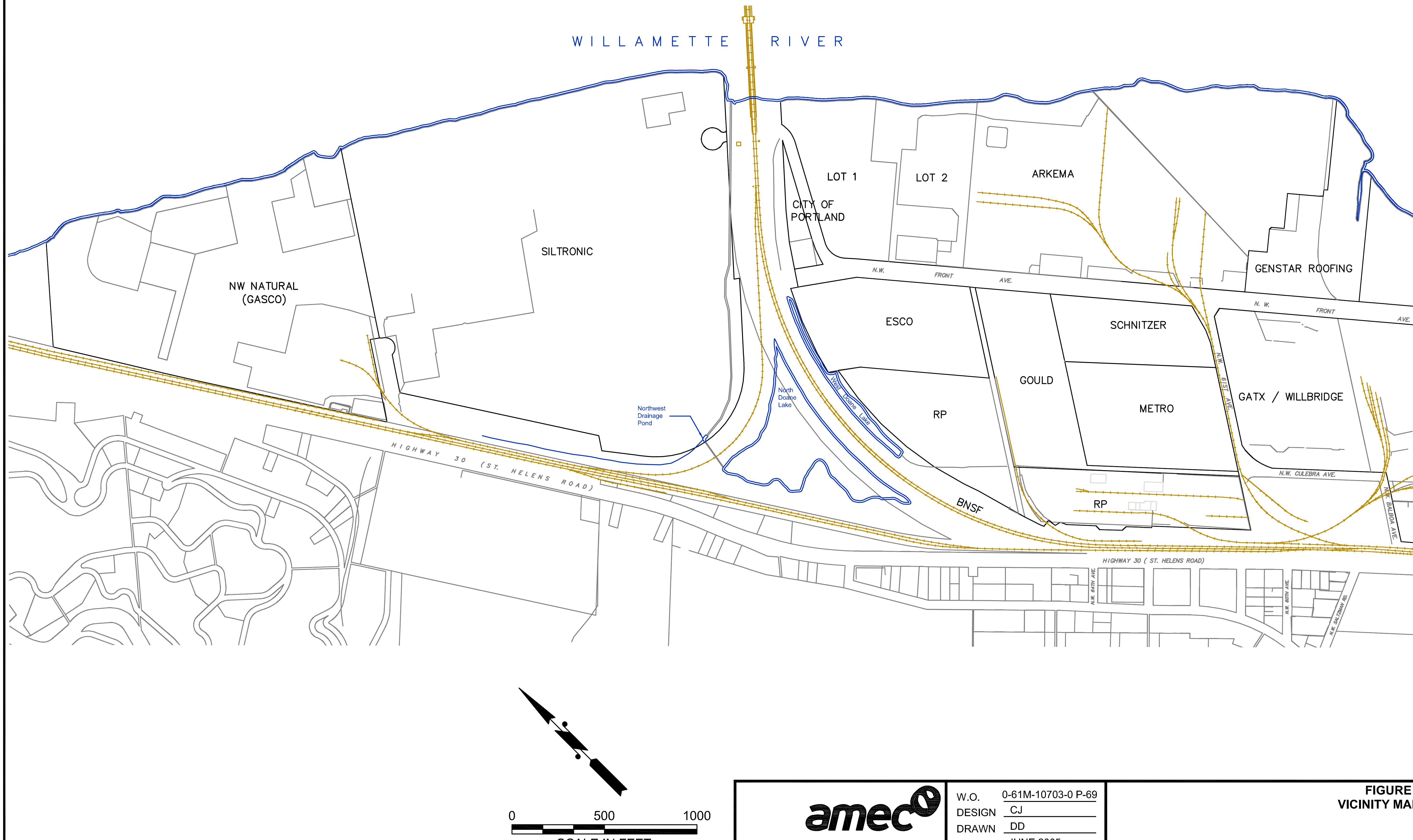
TABLE 2
Summary of Investigation Locations and Sampling Activities
Draft Stage 1 Source Control Evaluation
RP - Portland Site

Task	Study Area	Investigation Method	Sampling Media	Analytical Requirements: Proposed Analytical Sampling Depth (A)	VOCs by EPA Method 8260B	SVOCs by EPA Method 8270C	Herbicides by EPA Method 8151A	Pesticides by EPA Method 8081A	Dioxins/ Furans by EPA Method 8290	PCBs by EPA Method 8082A	TPH Diesel Range by NWTPH-Dx	Metals by EPA Methods 6010A/6020/7470A (B)	Compound Specific Isotope Analysis (GC/C/IRMS)	Chloride by EPA Method 300.0	Ammonia by EPA Method 350.3	Hydrogeologic Parameters (E)	Natural Attenuation Parameters (C)
Task 1 - Reconnaissance Activities	Arkema Lots 1 and 2	Direct-Push	Soil	0-0.5, 5-5.5, CF, 20-20.5 ft bgs, Refusal depth (D, F)	A	A	A	A	A	A	A	A	A			X	
			Groundwater	First WBZ, 40 ft bgs, Refusal depth	X	X	X	X	X		X	X	X	X	X		
		Sonic	Soil	No Samples Planned													
			Groundwater	Gravel WBZ, Basalt WBZ	X	X	X	X	X		X	X	X	X	X		
	Beach Area	Direct-Push	Soil	0-0.5, 5-5.5, CF, 30-30.5 ft bgs, Refusal depth (D, F)	A	A	A	A	A	A	A	A	A			X	
			Groundwater	First WBZ, 30 ft bgs, Refusal depth	X	X	X	X	X		X	X	X	X	X		
		Sonic	Soil	No Samples Planned													
			Groundwater	Gravel WBZ, Basalt WBZ	X	X	X	X	X		X	X	X	X	X		
	Siltronic Riverbank	Direct-Push	Soil	No Samples Planned (D)													
			Groundwater	First WBZ, 100 ft bgs, Refusal depth	X	X	X	X	X		X	X	X				
			Groundwater	130, 160, 190 ft bgs	X												
		Sonic	Soil	No Samples Planned													
			Groundwater	Gravel WBZ, Basalt WBZ	X	X	X	X	X		X	X	X				
Task 2 - Monitoring Well Installation	Various	Sonic	Soil	No Samples Planned													
			Groundwater	No Samples Planned													
Task 3 - Groundwater Monitoring	Various	NA	Groundwater	Various	X	X	X	X	X		X	X	X	X	X		X
Task 4 - Transducer Study	Various	NA	NA	NA													

Notes:
(A) Sampling depths may be adjusted based on field observations.
(B) Total and dissolved metals analysis for groundwater samples. Metals include: aluminum, calcium, iron, magnesium, potassium, sodium, arsenic, cadmium, chromium, copper, lead, manganese, nickel, vanadium, zinc, and mercury.
(C) Natural attenuation parameters include: ferrous iron, microbial enumerations, nutrients, total organic carbon, chemical oxygen demand, sulfate, sulfide, total alkalinity, major cations, and methane.
(D) Discrete soil samples will be analyzed for hydrogeologic parameters. Sampling depths will include planned groundwater sample intervals and depths based on field observations.
(E) Hydrogeologic parameters include: total organic carbon, mechanical sieve and 200 wash.
(F) Ten soil samples will be analyzed for VOCs, SVOCs, herbicides, pesticides, dioxins/furans, PCBs, TPH diesel range, metals and compound specific isotope analysis. Additional soil samples will be analyzed for chemical constituent analysis if visusal and/or photoionization detector evidence during sample collection indicates potential soil impact.

A	Archive, analyze only if evidence of contamination
bgs	below ground surface
CF	capillary fringe
EPA	Environmental Protection Agency
ft	feet
GC/C/IRMS	Gas Chromatography/Combustion Interface/Isotope Ratio Mass Spectrometer
NA	Not applicable
PCBs	Polychlorinated biphenyls
SVOCs	Semivolatile organic compounds
TPH	Total Petroleum Hydrocarbons
VOCs	Volatile organic compounds
WBZ	Water-bearing zone

FIGURES



amec

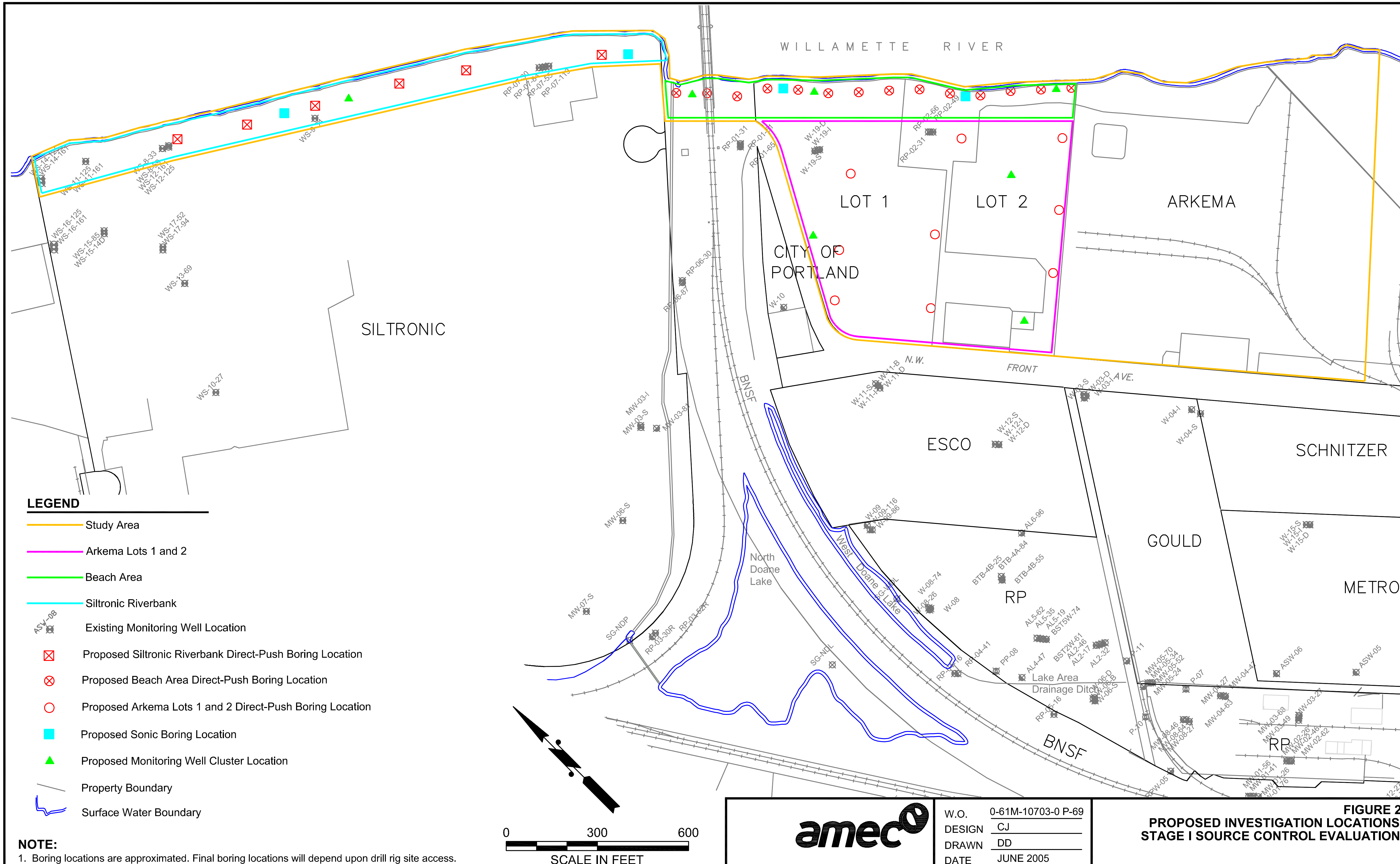
7376 SW Durham Road
Portland, OR, U.S.A. 97224-7307

W.O.	0-61M-10703-0 P-69
DESIGN	CJ
DRAWN	DD
DATE	JUNE 2005
SCALE	1"=500'

FIGURE 1
VICINITY MAP

RP-PORTLAND SITE

AMEC DRAWING NO. K: \ 10000 \ 10700 \ 10703 \ PHASE 69 Source Control Evaluation \ STAGE 1 SCE WP \ FIGURE 1.dwg



NOTE:

1. Boring locations are approximated. Final boring locations will depend upon drill rig site access.
2. Final monitoring well locations will be based on results from the reconnaissance borings.

amec

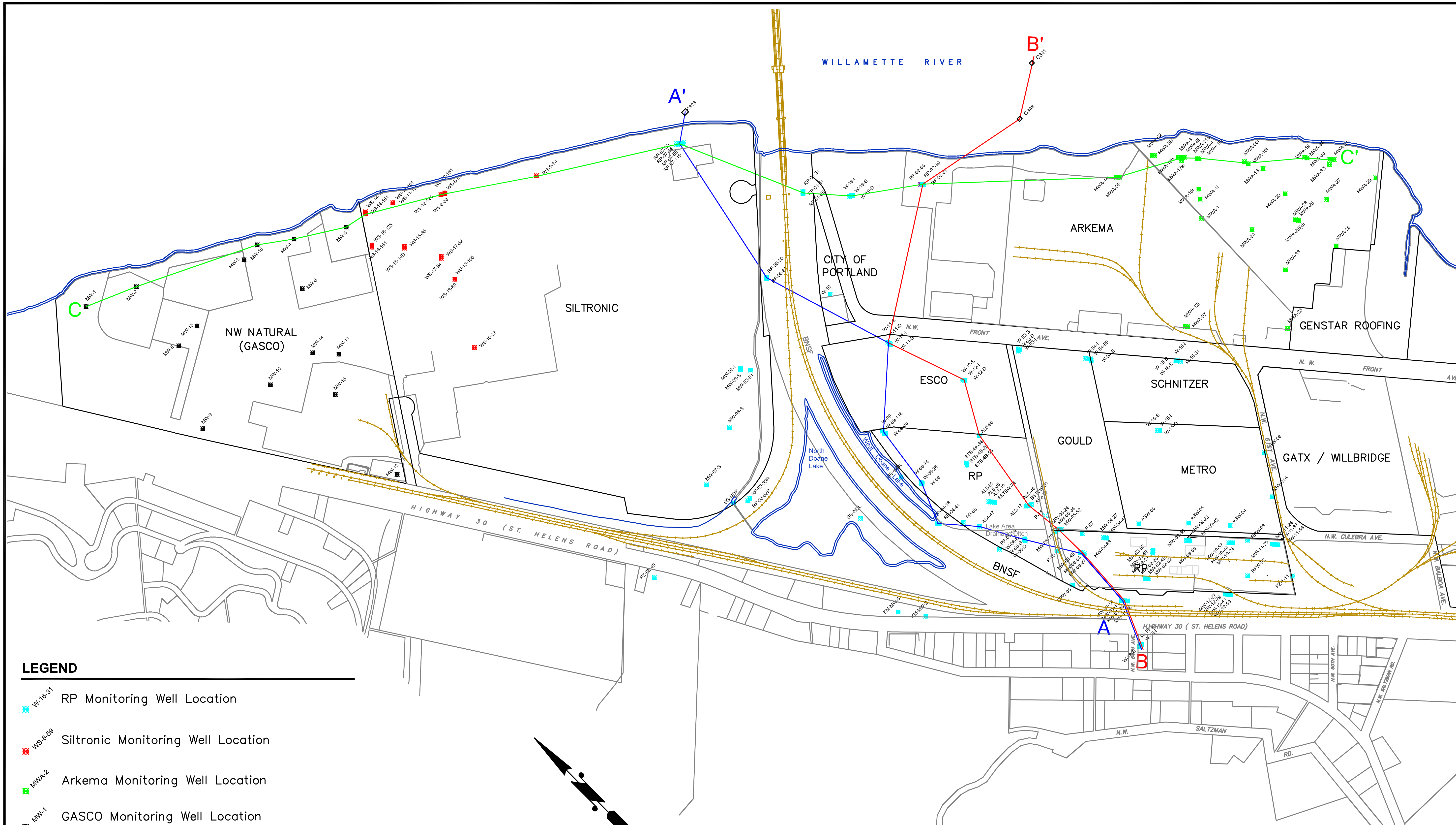
7376 SW Durham Road
Portland, OR, U.S.A. 97224-7307

W.O.	0-61M-10703-0 P-69
DESIGN	CJ
DRAWN	DD
DATE	JUNE 2005
SCALE	1"=300'

FIGURE 2
PROPOSED INVESTIGATION LOCATIONS
STAGE I SOURCE CONTROL EVALUATION

RP - PORTLAND SITE

AMEC DRAWING NO. K: \ 10000 \ 10700 \ 10703 \ PHASE 69 SOURCE CONTROL EVALUATION \ STAGE 1 SCE WP \ FIGURES \ FIGURE 2. dwg



amec

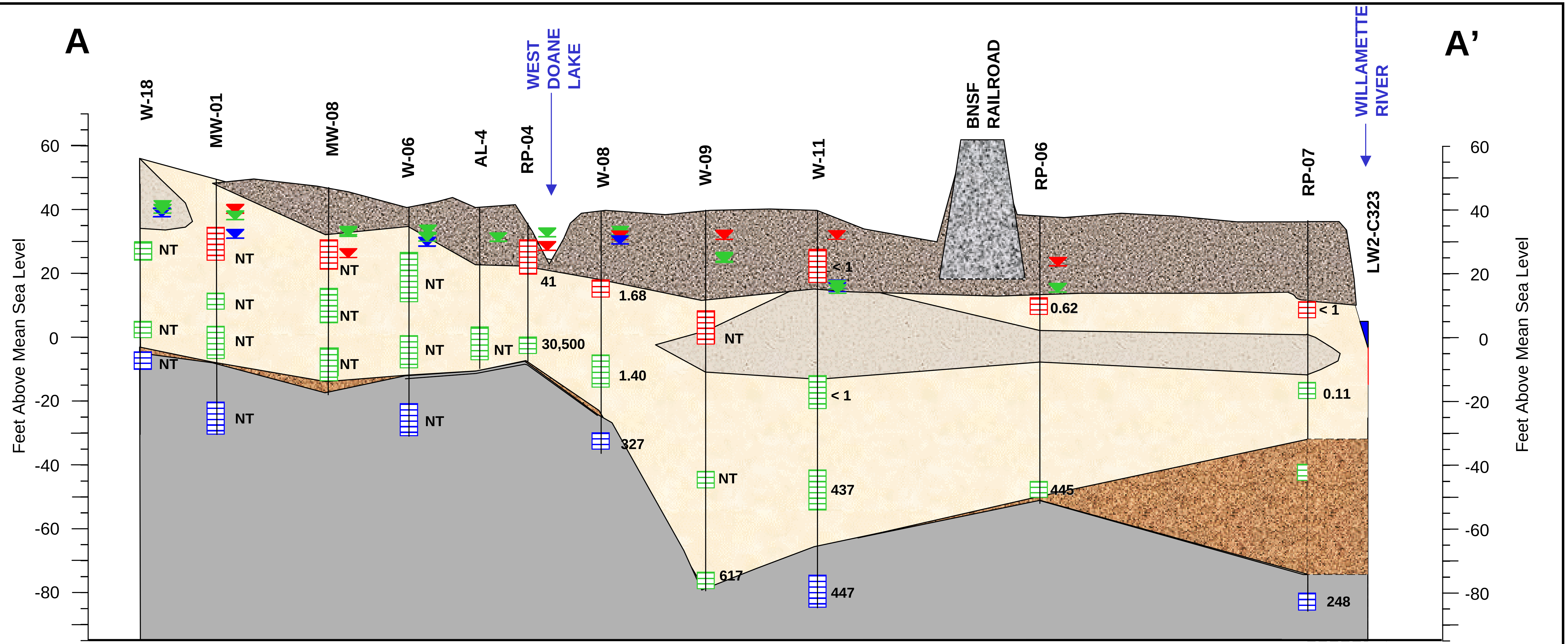
7376 SW Durham Road
Portland, OR, U.S.A. 97224-7307

W.O.	0-61M-10703-0 P-69
DESIGN	CJ
DRAWN	DD
DATE	JUNE 2005
SCALE	1"=500'

FIGURE 3
GEOLOGIC CROSS SECTION LOCATIONS

RP - PORTLAND SITE

AMEC DRAWING NO. K: \ 10000 \ 10700 \ 10703 \ Phase 69 SOURCE CONTROL EVALUATION \ STAGE 1 SCE WP \ FIGURE 3. DWG



VERTICAL EXAGGERATION IS 10x

LEGEND

W-18 Monitoring well cluster number and location

Screened interval from monitoring well located in the Fill/Shallow Alluvium Zone

Screened interval from monitoring well located in the Alluvium Zone

Screened interval from monitoring well located in the Basalt Zone

Groundwater elevation from Spring 2002 survey for monitoring well screened in the Fill/Shallow Alluvium Zone

Groundwater elevation from Spring 2002 survey for monitoring well screened in the Alluvium Zone

Groundwater elevation from Spring 2002 survey for monitoring well screened in the Basalt Zone

Approximate lithologic contact (dashed where inferred)

FILL OF THE FILL/SHALLOW ALLUVIUM ZONE

SANDY SILT OF THE ALLUVIUM ZONE

CLAYEY SILT OF THE ALLUVIUM ZONE

GRAVEL OF THE ALLUVIUM ZONE

BASALT ZONE

Sediment Core from 2004 LWG in-water investigation

RP Site Monitoring Well

447 1,2-Dichlorobenzene concentration in micrograms per liter from Spring 2002 ground water sampling.

NT Not tested

NOTES: Stratigraphy between depicted monitoring wells interpreted from additional wells not shown on this cross section.

Horizontal axis is not to scale.

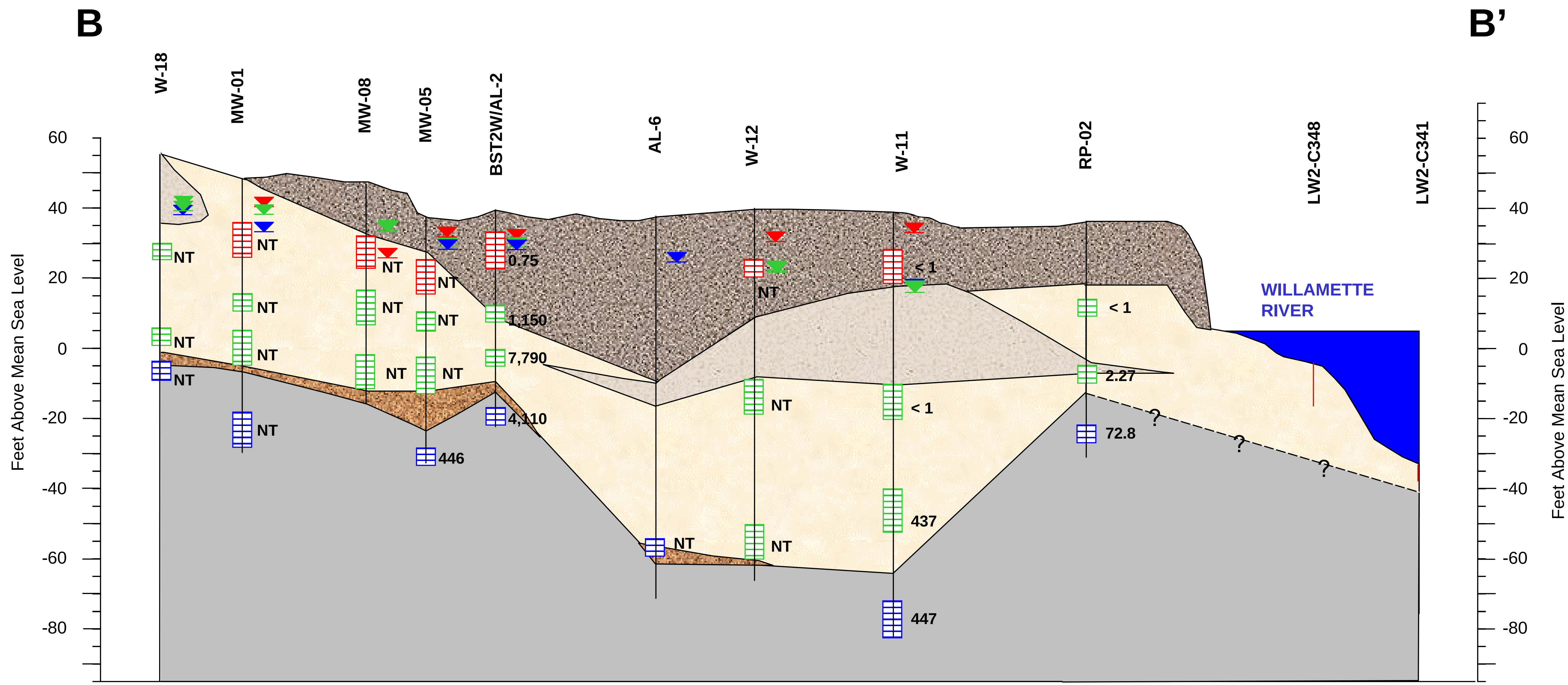
amec

7376 S.W. Durham Road
Portland, OR, U.S.A. 97224

W.O.	0-61M-10703-P69
DESIGN	VK AND CJ
DRAWN	MVK AND JE
DATE	JUNE 2005

FIGURE 4
GEOLOGIC CROSS SECTION W\ GROUNDWATER ELEVATIONS AND 1,2- DICHLOROBENZENE CONCENTRATIONS SECTION A - A’
RP - PORTLAND SITE

AMEC DRAWING NO. k:\10000\10700\10703\Phase 69 SCE\Stage 1SCE WP\Figure 4_cross section A to A'.ppt



VERTICAL EXAGGERATION IS 10x

LEGEND

W-18 Monitoring well cluster number and location

Screened interval from monitoring well located in the Fill/Shallow Alluvium Zone

Screened interval from monitoring well located in the Alluvium Zone

Screened interval from monitoring well located in the Basalt Zone

Groundwater elevation from Spring 2002 survey for monitoring well screened in the Fill/Shallow Alluvium Zone

Groundwater elevation from Spring 2002 survey for monitoring well screened in the Alluvium Zone

Groundwater elevation from Spring 2002 survey for monitoring well screened in the Basalt Zone

Approximate lithologic contact (dashed where inferred)

FILL OF THE FILL/SHALLOW ALLUVIUM ZONE

SANDY SILT OF THE ALLUVIUM ZONE

CLAYEY SILT OF THE ALLUVIUM ZONE

GRAVEL OF THE ALLUVIUM ZONE

BASALT ZONE

Sediment Core from 2004 LWG in-water investigation

RP Site Monitoring Well

447 1,2-Dichlorobenzene concentration in micrograms per liter from Spring 2002 ground water sampling.

NT Not tested

NOTES: Stratigraphy between depicted monitoring wells interpreted from additional wells not shown on this cross section.

Horizontal axis is not to scale.

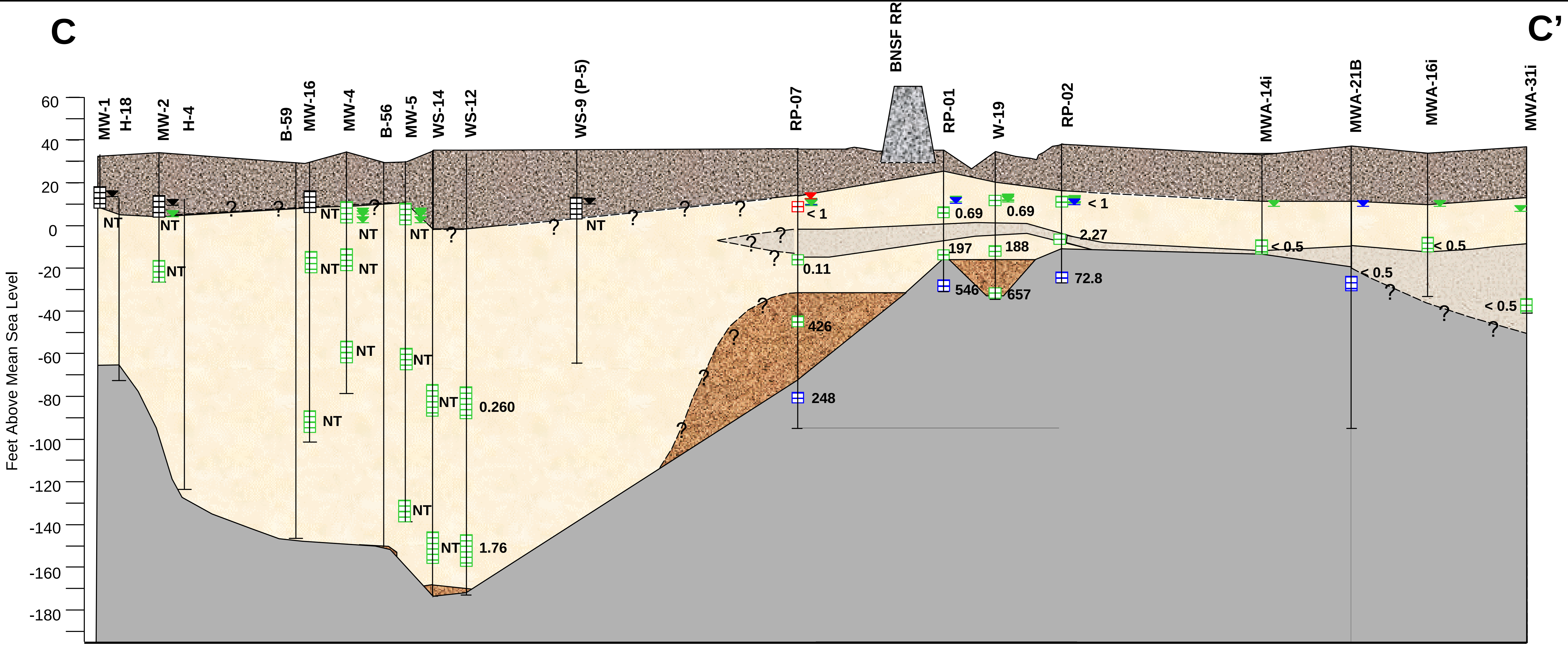
amec

7376 S.W. Durham Road
Portland, OR, U.S.A. 97224

W.O.	0-61M-10703-P69
DESIGN	MVK AND CJ
DRAWN	MVK AND JE
DATE	JUNE 2005

FIGURE 5
GEOLOGIC CROSS SECTION W
GROUNDWATER ELEVATIONS AND
1,2- DICHLOROBENZENE CONCENTRATIONS
SECTION B - B'

AMEC DRAWING NO. k:\10000\10700\10703\Phase 69 SCE\Stage 1 SCE WP\Figure 5_cross section B to B'.ppt



LEGEND

Screened interval from monitoring well located in the Fill/Shallow Alluvium Zone

Screened interval from monitoring well located in the Alluvium Zone

Screened interval from monitoring well located in the Basalt Zone

Groundwater elevation from Spring 2002 survey for monitoring well screened in the Fill/Shallow Alluvium Zone

Groundwater elevation from Spring 2002 survey for monitoring well screened in the Alluvium Zone

Groundwater elevation from Spring 2002 survey for monitoring well screened in the Basalt Zone

FILL OF THE FILL/SHALLOW ALLUVIUM ZONE

SANDY SILT OF THE ALLUVIUM ZONE

CLAYEY SILT OF THE ALLUVIUM ZONE

GRAVEL OF THE ALLUVIUM ZONE

BASALT ZONE

W-19 Monitoring well cluster number and location

Approximate lithologic contact (dashed where inferred)

447 1,2-Dichlorobenzene concentration in micrograms per liter from Spring 2002 ground water sampling.

NT Not tested

NOTES:

Stratigraphy between depicted monitoring wells interpreted from additional wells not shown on this cross section.

Elevations of WS-14 and P-5 assumed to be 35.0 feet above mean sea level.

Groundwater data for MWA-14i, -21B, -16i, and -31i were taken from Table 4-26 in ATOFINA Upland Remedial Investigation Report, ERM (2004).

Monitoring wells WELLS WS-12, WS-14, and MW-16 installed after Spring 2002 groundwater elevation survey.

Groundwater data for well WS-12 from October 2003 were taken from Table 3-7 in Siltronic Corp. Remedial Investigation Proposal, Maul Foster Alongi (2004).

Horizontal axis not to scale.

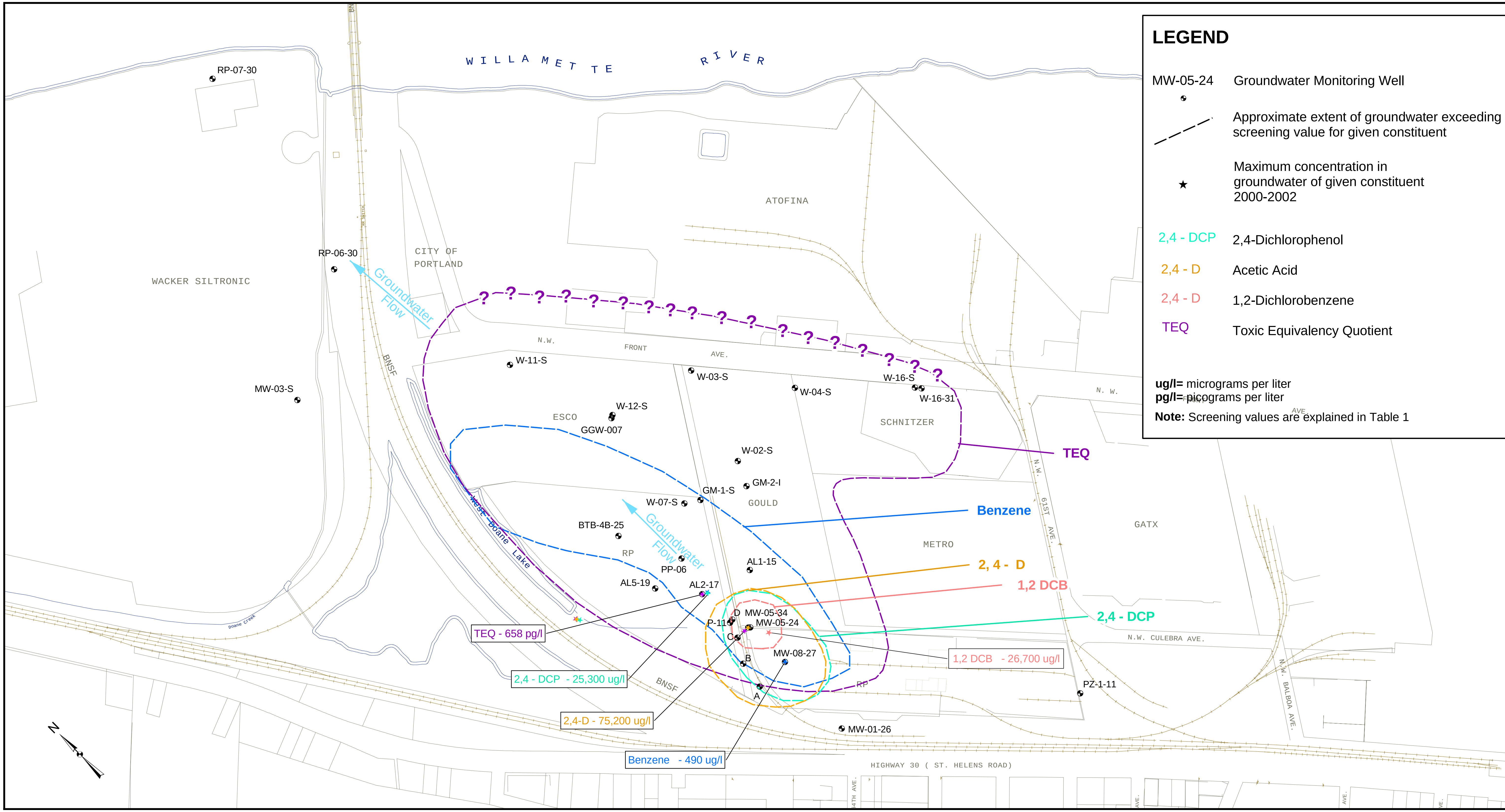
amec

7376 S.W. Durham Road
Portland, OR, U.S.A. 97224

W.O.	0-61M-10703-P69
DESIGN	MVK AND CJ
DRAWN	MVK AND JE
DATE	JUNE 2005

FIGURE 6
GEOLOGIC CROSS SECTION W\ GROUNDWATER ELEVATIONS AND 1,2- DICHLOROBENZENE CONCENTRATIONS SECTION C-C'
RP - PORTLAND SITE

AMEC DRAWING NO. k:\10000\10700\10703\Phase 69 SCE\Stage 1 SCE WP\Figure 6_cross section C to C'.ppt



Note: Groundwater concentrations from 2000-2002 as presented in the
FINAL GROUNDWATER CHARACTERIZATION REPORT
RP - PORTLAND SITE, prepared by AMEC, dated March 28, 2003

0 175 350 700 Feet

1 inch equals 350 feet

Basemap: AMEC X-MAINBASE.dwg

amec

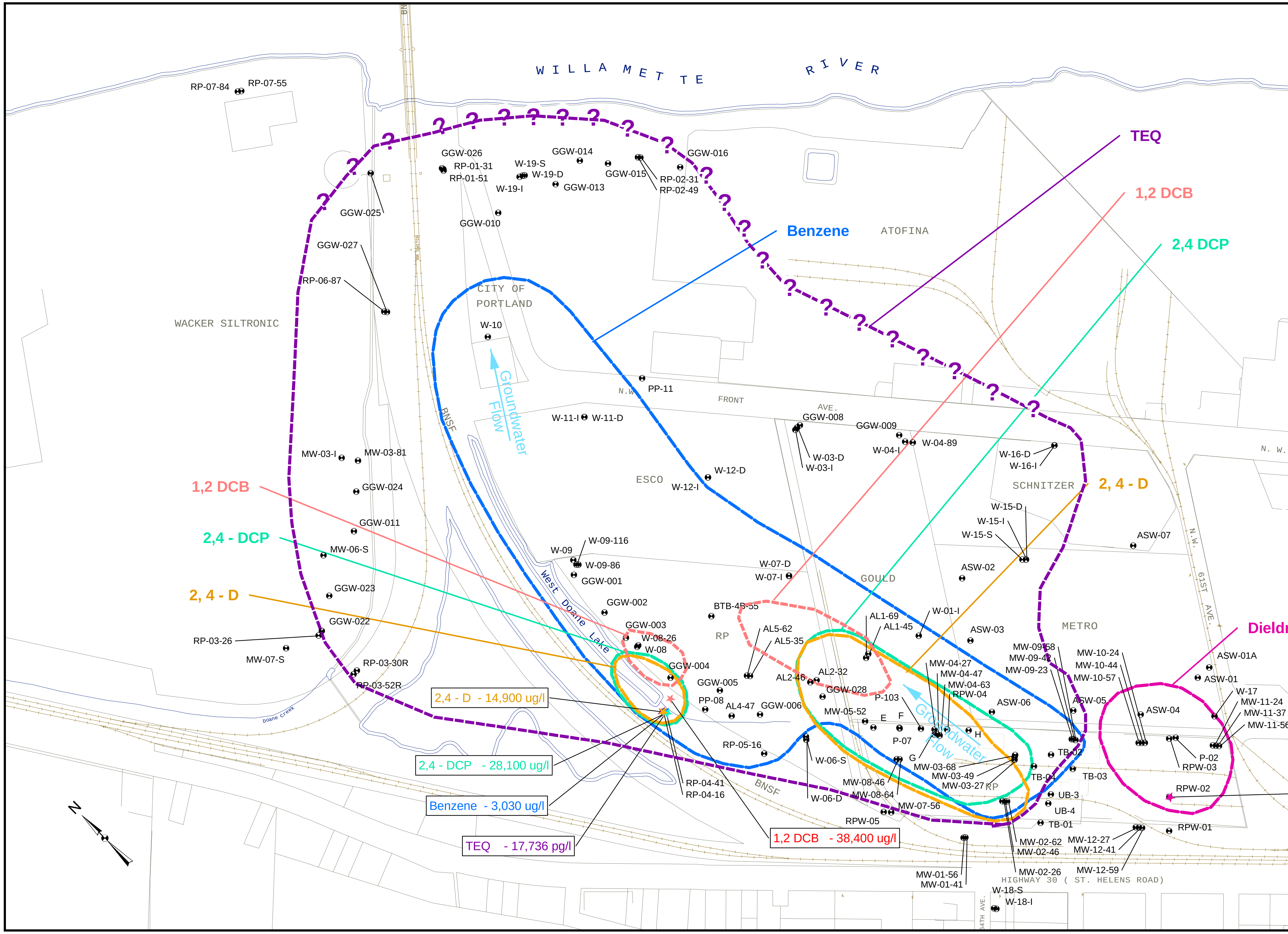
7376 SW Durham Road
Portland, OR, U.S.A. 97224

W.O.	0-61M-10703-0 T69
DESIGN	TARW / CLJ
DRAWN	BRJ / LM/ GSE
DATE	JUNE 2005

FIGURE 7
GROUNDWATER EXCEEDING SCREENING VALUES
SELECTED CONSTITUENTS
FILL / SHALLOW ALLUVIUM ZONE

RP - PORTLAND SITE

K:\10000\10700\10703\Phase 69 SCE\Stage 1 SCE WP\figures\Figure 7 Fill-Shallow Alluvium Zone --rev june 20051.mxd



LEGEND

MW-05-52	Groundwater Monitoring Well
	Approximate extent of groundwater exceeding screening value for given constituent
★	Maximum concentration in groundwater of given constituent 2000-2002
Dieldrin	Dieldrin
Benzene	Benzene
2, 4 - DCP	2,4-Dichlorophenol
2, 4 - D	Acetic Acid
1,2 - DCB	1,2-Dichlorobenzene
TEQ	Toxic Equivalency Quotient

ug/l= micrograms per liter
pg/l= picograms per liter
Note: Screening values are explained in Table 1

Note: Groundwater concentrations from 2000-2002 as presented in the
FINAL GROUNDWATER CHARACTERIZATION REPORT
RP - PORTLAND SITE, prepared by AMEC, dated March 28, 2003

0 175 350 700 Feet

1 inch equals 350 feet

Basemap: AMEC X-MAINBASE.dwg

amec

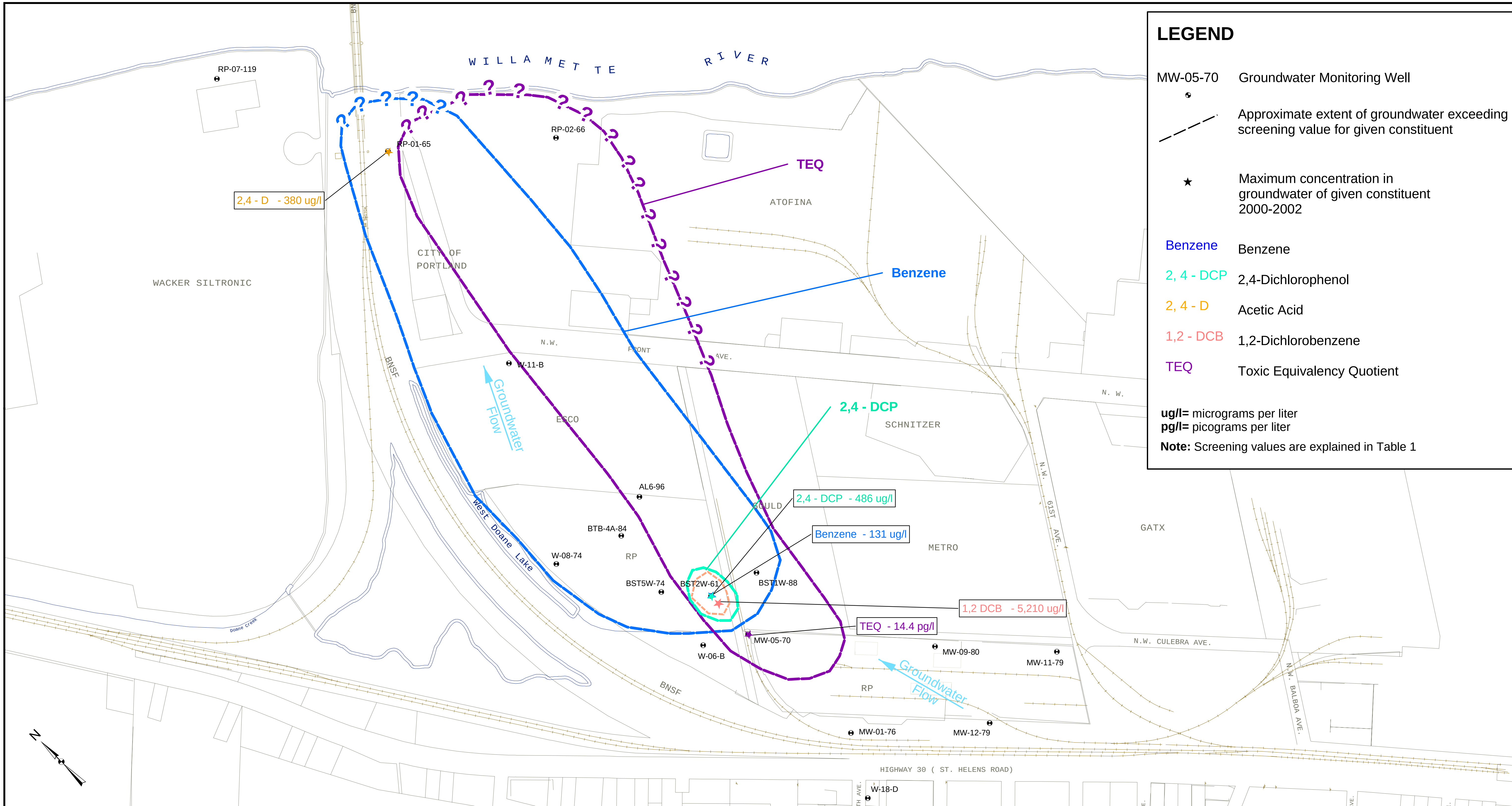
7376 SW Durham Road
Portland, OR, U.S.A. 97224

W.O.	0-61M-10703-0 P69
DESIGN	TARW / CLJ
DRAWN	BRJ /LM/ GSE
DATE	JUNE 2005

FIGURE 8
GROUNDWATER EXCEEDING SCREENING VALUES
SELECTED CONSTITUENTS
ALLUVIUM ZONE

RP - PORTLAND SITE

K:\10000\10700\10703\Phase 69 SCE\Stage 1 SCE WP\Figures\Figure 8 Alluvium Zone --rev june 20051.mxd



Note: Groundwater concentrations from 2000-2002 as presented in the
FINAL GROUNDWATER CHARACTERIZATION REPORT
RP - PORTLAND SITE, prepared by AMEC, dated March 28, 2003

0 175 350 700 Feet

1 inch equals 350 feet

Basemap: AMEC X-MAINBASE.dwg

amec

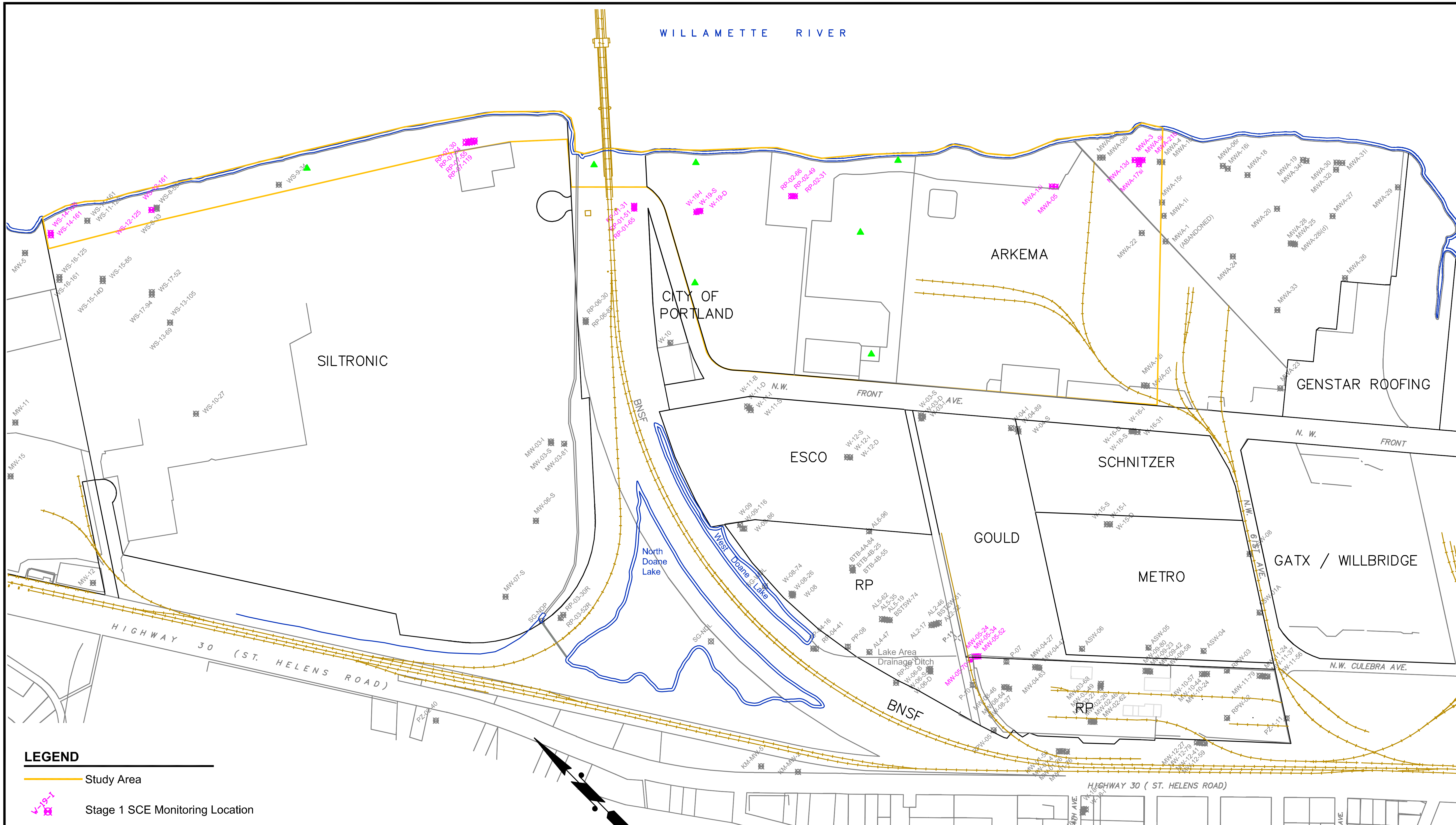
7376 SW Durham Road
Portland, OR, U.S.A. 97224

W.O.	0-61M-10703-0 P69
DESIGN	TARW / CLJ
DRAWN	BRJ / LM / GSE
DATE	JUNE 2005

FIGURE 9
GROUNDWATER EXCEEDING SCREENING VALUES
SELECTED CONSTITUENTS
BASALT ZONE

RP - PORTLAND SITE

K:\10000\10700\10703\Phase 69 SCE\Stage 1 SCE WP\figures\Figure 9 Basalt Zone -rev June 20051.mxd



amec

7376 SW Durham Road
Portland, OR, U.S.A. 97224-7307

W.O.	0-61M-10703-0 P-69
DESIGN	CJ
DRAWN	DD
DATE	JUNE 2005
SCALE	1"=375'

FIGURE 10
PROPOSED GROUNDWATER MONITORING LOCATIONS
STAGE 1 SOURCE CONTROL EVALUATION

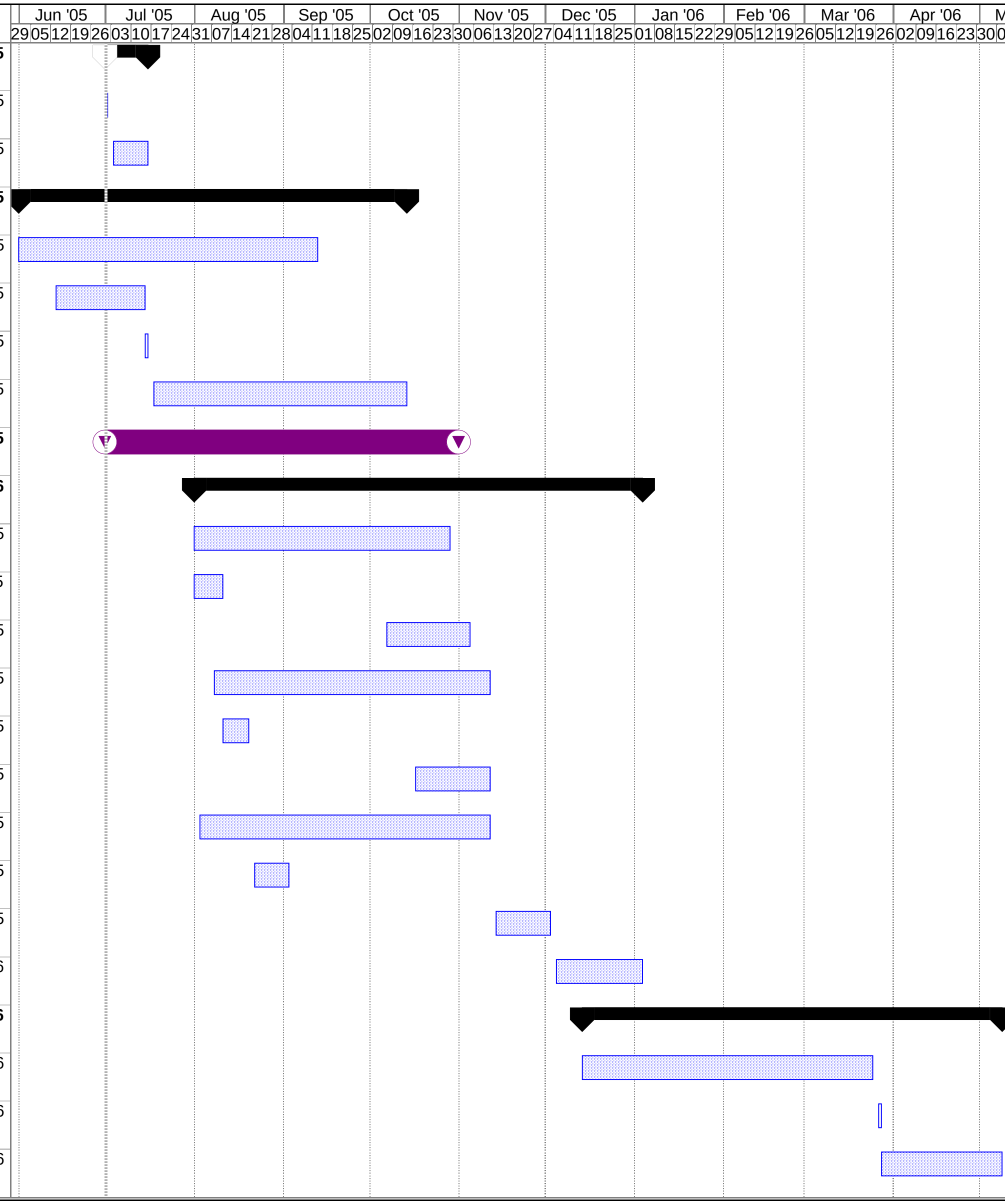
RP - PORTLAND SITE

AMEC DRAWING NO. K: \ 10000 \ 10700 \ 10703 \ Phase 69 SOURCE CONTROL EVALUATION \ STAGE 1 SCE WP \ FIGURES \ FIGURE 10. DWG

FIGURE 11
Project Schedule
Stage 1 Source Control Evaluation
RP - Portland Site

amec

ID	Task Name	Duration (business days)	Start	Finish
1	**Work Plan**	**11 days**	**Fri 07/01/05**	**Fri 07/15/05**
2	Work Plan - Submit to DEQ	1 day	Fri 07/01/05	Fri 07/01/05
3	Work Plan - DEQ Review Period	10 days	Mon 07/04/05	Fri 07/15/05
4	**Site Access/Permit Processing**	**97 days**	**Wed 06/01/05**	**Thu 10/13/05**
5	Site Access Negotiations	74 days	Wed 06/01/05	Mon 09/12/05
6	DSL-USACE Permit Application	23 days	Tue 06/14/05	Thu 07/14/05
7	Submit DSL-USACE Permit	1 day	Fri 07/15/05	Fri 07/15/05
8	DSL-USACE Review Period (90 calendar days)	64 days	Mon 07/18/05	Thu 10/13/05
9	**DSL-USACE Work Window Fall 2005**	**87 days**	**Fri 07/01/05**	**Mon 10/31/05**
10	**Field Activities**	**112 days**	**Mon 08/01/05**	**Tue 01/03/06**
11	***Task 1-Reconnassaince Activities***	65 days	Mon 08/01/05	Fri 10/28/05
12	Arkema Lots 1 and 2	8 days	Mon 08/01/05	Wed 08/10/05
13	Beach Area/Siltronic Riverbank	21 days	Fri 10/07/05	Fri 11/04/05
14	***Task 2-Monitoring Well Installation***	70 days	Mon 08/08/05	Fri 11/11/05
15	Arkema Lots 1 and 2	7 days	Thu 08/11/05	Fri 08/19/05
16	Beach Area/Siltronic Riverbank	20 days	Mon 10/17/05	Fri 11/11/05
17	***Task 3-Groundwater Monitoring***	73 days	Wed 08/03/05	Fri 11/11/05
18	Groundwater Monitoring Event #1	10 days	Mon 08/22/05	Fri 09/02/05
19	Groundwater Monitoring Event #2	15 days	Mon 11/14/05	Fri 12/02/05
20	***Task 4-Transducer Study***	22 days	Mon 12/05/05	Tue 01/03/06
21	**Stage 1 SCE Technical Memorandum**	**104 days**	**Wed 12/14/05**	**Mon 05/08/06**
22	Preparation of Technical Memorandum	73 days	Wed 12/14/05	Fri 03/24/06
23	Submit Technical Memorandum to DEQ	1 day	Mon 03/27/06	Mon 03/27/06
24	Technical Memorandum - DEQ Review Period	30 days	Tue 03/28/06	Mon 05/08/06



Project: Figure 8_ Stage 1 SCE Schedule
Date: Thu 06/30/05

Task	Progress	Summary	
Split	Milestone	Time Constraints for Field Activities	

APPENDIX A

Stage 1 Source Control Evaluation Field Sampling Plan

STAGE 1 SOURCE CONTROL EVALUATION
FIELD SAMPLING PLAN
RP - PORTLAND SITE

July 1, 2005

Submitted to:

Oregon Department of Environmental Quality
2020 S.W. 4TH Avenue
Portland, Oregon 97201

Submitted for:

SLLI
One Copely Parkway, Suite 309
Morrisville, North Carolina 27560

Submitted by:

AMEC Earth & Environmental, Inc.
7376 S.W. Durham Road
Portland, Oregon 97224

0-61M-107030/Phase 69

Table of Contents

Page

List of Tables

List of Figures

List of Appendices

1.0 INTRODUCTION

This Stage 1 Source Control Evaluation (SCE) Field Sampling Plan (FSP) describes the procedures for conducting field investigation activities adjacent to the Willamette River (River) near the Rhône-Poulenc (RP) Portland Site (Site). The RP property is located at 6200 N.W. St. Helens Road in Portland, Oregon (Figure 1). The SCE investigation is being conducted in response to a letter from the Oregon Department of Environmental Quality (DEQ) dated February 22, 2005 requesting SLLI to conduct an "investigation between the existing downgradient groundwater monitoring wells and the River…to evaluate the extent and concentration of RP-related contaminant discharges to the River."

The Stage 1 SCE FSP outlines the procedures for sampling of soil and groundwater, sample handling, field measurements, analytical methods, monitoring well installation and development, documentation, decontamination procedures, investigation derived waste (IDW) handling practices, and transducer study methodologies.

This work will be conducted according to procedures outlined in the site-specific Revised Quality Assurance Project Plan (QAPP) dated June 13, 2001 (AMEC, 2001), the Draft QAPP Addendum No. 1 (AMEC, 2002), the Site-Specific Health and Safety Plan (HASP) dated June 24, 2005 (AMEC, 2005), and subsequent addenda and updates, as appropriate.

1.1 Scope and Data Quality Objectives

The scope of work proposed along the River consists of collecting soil and groundwater samples for laboratory analysis, monitoring well installation and development, and a transducer study. The data quality objectives (DQOs) for the Stage 1 SCE are to:

1. Evaluate whether constituents are present in near-River groundwater at regulatory levels of concern;

2. Evaluate whether the constituents are from a RP source or other sources;

3. Evaluate the extent and the chemical makeup of the dioxin and chlorinated solvent plumes originating at the Arkema site flowing to the north/northwest and the potential for commingling with the RP plume.

4. Evaluate the connection, if any, between Siltronic's trichloroethylene (TCE) plume and deep TCE detected on their property; and

5. Evaluate regional (Arkema, RP, Siltronic) groundwater flow direction within the Alluvium and Basalt Zones near the River.

In addition, data from this Stage 1 SCE will be used to support the planned bioremediation pilot study and facilitated transport evaluation and assist in planning for source control if warranted.

1.2 Project Organization and Responsibilities

The field team will consist of a Field Manager and necessary field personnel to implement this field sampling program. The Field Manager will maintain or delegate responsibility for the logistical requirements of the sampling effort, including but not limited to:

- Event scheduling, coordination between AMEC staff, AMEC subcontractors, and representatives of off-site property owners;
- Delivery and shipping of sample containers and coolers;
- Quality assurance checking of sampling technique, documentation, and other paperwork completed by sampling crews;
- Distribution and proper use of personal protective equipment (PPE) as required by the HASP;
- Ensuring that daily health and safety meetings for field staff take place;
- Sample management and handling activities occurring at the Site; and
- Handling investigation-derived waste (IDW).

The Assistant Project Manager will be responsible for implementation of internal quality assurance (QA) checks on field procedures. The QA checks will include field procedures and health and safety reviews, to be performed by appropriate and qualified AMEC personnel not directly involved in field activities. The QA checks will include an unscheduled field visit and observation of procedures during some field events.

The current key AMEC personnel are:

Project Manager:	Roger Gresh
Assistant Project Manager:	Teresa Wilson
Field Manager:	Joe Fassio

2.0 FIELD INVESTIGATION PROCEDURES

The field investigation to evaluate the above-listed DQOs (Section 1.1) has been divided into four tasks:

- **Task 1 Reconnaissance Activities** - Drilling of reconnaissance borings within the Stage 1 SCE study area by using both direct-push and sonic drilling technologies for lithologic logging and the collection of soil and groundwater analytical samples.
- **Task 2 Monitoring Well Installation** - Installation of up to four monitoring well clusters adjacent to the River and three monitoring well clusters located on upland areas of Arkema Lots 1 and 2;
- **Task 3 Groundwater Monitoring** - Groundwater sampling and water elevation monitoring of newly installed monitoring wells and selected existing monitoring wells; and
- **Task 4 Transducer Study** - Transducer study to be conducted within selected newly installed monitoring wells and selected existing monitoring wells.

This section describes the general approach to be employed during the Stage 1 SCE.

Drilling of the soil borings and monitoring well installation described herein will be conducted in accordance with applicable Oregon Water Resource Department (OWRD) regulations as outlined in Oregon Administrative Rule (OAR) 690-240. Borings and monitoring well installations will be accomplished by a driller licensed in the State of Oregon and will be monitored and recorded by an AMEC field representative working under the supervision of a State of Oregon registered geologist. Soil will be described in accordance with the Unified Soil Classification System. Prior to initiation of drilling or any other invasive subsurface activity, the locations of each borehole will be checked in the field to locate all underground and aboveground utilities or other physical conditions that would prevent drilling at the proposed location; the final location for each borehole will be based on the findings of the field check.

2.1 Task 1 - Reconnaissance Activities

Task 1 consists of reconnaissance activities that include drilling of reconnaissance borings directly adjacent to the River from the Burlington Northern Santa Fe (BNSF) railroad bridge to the southeastern boundary of Arkema Lot 2 (Beach Area), upland area of Lots 1 and 2 within the Arkema site (Arkema Lots 1 and 2), and the upland area directly adjacent to the River from the BNSF railroad bridge to the northwestern property boundary of Siltronic (Siltronic Riverbank) by using both direct-push and sonic drilling technologies for lithologic logging and the collection of soil and groundwater analytical samples. Analytical results will be used to evaluate whether constituents at or above regulatory levels of concern are present near the River, and to help differentiate, using chemical forensic tools, between constituents derived from the former RP facility and potential constituents from other sources.

2.1.1 Direct-Push Drilling

Proposed locations for the direct-push borings, as shown on Figure 1, will be advanced for lithologic logging and soil and groundwater characterization. Borings will be advanced to refusal depth, estimated at 50 feet (ft) below ground surface (bgs) at the Beach Area, 60 ft bgs for Arkema Lots 1 and 2, and 100 ft bgs near the BNSF railroad bridge to 200 ft bgs near Siltronic's plant area for the Siltronic Riverbank borings. Soil sampling will be conducted continuously for lithologic logging, documentation of visually impacted soils, and selection for potential laboratory analysis. Soil samples will be archived for potential future chemical analysis from the Beach Area and Arkema Lots 1 and 2 as outlined on Table 1. Targeted zones include but are not limited to: 0 to 0.5 ft bgs, 5 to 5.5 bgs, capillary fringe, 20 to 20.5 ft bgs (Beach Area) and 30 to 30.5 ft bgs (Arkema Lots 1 and 2), and drill refusal depth. Because the water table is much shallower at the Beach Area, the 5 to 5.5 ft bgs sample may be analogous to the respective capillary fringe sample; therefore, only three depth intervals may be collected in this area. Ten soil samples from Arkema Lots 1 and 2 and the Beach Area will be analyzed for chemical constituents as summarized on Table 1. Additional soil samples will be submitted for chemical constituent analysis if visual and/or photoionization detector (PID) evidence during sample collection indicates potential soil impact. Soil samples for laboratory of chemical constituents will not be collected from the Siltronic Riverbank borings because historical RP activities have not been documented in these areas, and Gasco-related soil impact at the Siltronic property has been fairly well documented by Northwest Natural and Siltronic. Soil samples will be collected and analyzed for hydrogeologic parameters as outlined in Table 1. Soil samples which are submitted to the laboratory for chemical analysis as summarized in Table 1 will be analyzed for the following:

- Volatile organic compounds (VOCs) by United States Environmental Protection Agency (EPA) Method 8260B;
- Semi-volatile organic compounds (SVOCs) by EPA Method 8270C;
- Chlorinated herbicides by EPA Method 8151A;
- Organochlorine pesticides by EPA Method 8081A;
- Dioxins/furans by EPA Method 8290;
- Total petroleum hydrocarbons (TPH) diesel range by NWTPH-Dx;
- Polychlorinated biphenyls (PCBs) by EPA Method 8082A
- Metals by EPA Methods 6010A/6020/7470A; and
- Compound specific stable isotope analysis.

A field boring log (Appendix A-2) will be completed for each boring location and a soil sample collection form (Appendix A-2) will be completed for each soil sample collected and will be used to document sampling depths, sampling methods, sample recoveries, soil types, and stratifications, any evidence of contamination as indicated through visual observation and the use of PID, and other pertinent information.

Three reconnaissance groundwater samples will be collected per boring for the Beach Area and Arkema Lots 1 and 2. Water samples will be collected from the first water-bearing zone, directly above the clay layer, estimated at 30 ft bgs for the Beach Area and 40 ft bgs for Arkema Lots 1 and 2. Six reconnaissance groundwater samples will be collected from the Siltronic Riverbank for laboratory analysis. Samples will be collected from the first water-bearing zone, 100 ft bgs, 130 ft bgs, 160 ft bgs, 190 ft bgs and drill refusal depth. Groundwater samples will be analyzed, as summarized in Table 1, for the above mentioned soil sample analytical methods, with the exception of PCBs, in addition to:

- Dissolved metals by EPA Methods 6010A/6020/7470A
- Chloride by EPA Method 300.0 (Beach Area and Arkema Lots 1 and 2 only); and
- Ammonia by EPA Method 350.0 (Beach Area and Arkema Lots 1 and 2 only).

All samples will be collected and submitted to the contract laboratories following the procedures described in this Stage 1 SCE FSP, the QAPP, subsequent addendums and updates. Samples will be contained in the appropriate sampling containers for soil and groundwater, as listed within Table 2.

Soil and groundwater samples will be collected as described in Standard Operating Procedures (SOP) 12 and 23 (Appendix A-1), respectively. Sampling equipment will be decontaminated following sample collection at each location, according to the appropriate decontamination procedures described in SOP - 3 (Appendix A-1). Waste generated during the sampling procedure will be handled in accordance with the waste handling procedures described herein and in SOP - 13 (Appendix A-1).

2.1.2 Sonic Drilling

Sonic borings along the Beach Area and Siltronic Riverbank, as shown on Figure 1, will be advanced to confirm lithologic logging from the direct-push borings, to document the basalt surface elevation and surface condition (e.g., fracturing and weathering) and gravel thickness (if observed), and groundwater quality in the basalt zone. Borings will be drilled approximately 10 ft into the basalt. Soil sampling will be conducted continuously for lithologic logging and documentation of visually impacted soils. A field boring log (Appendix A-2) will be completed for each boring location and will be used to document sampling depths, sampling methods, sample recoveries, soil types and stratifications, any evidence of contamination as indicated through visual observation and the use of PID, and other pertinent information. Soil samples for laboratory analysis of chemical constituents will not be collected at these boring locations.

One reconnaissance groundwater sample will be collected from the basalt zone for laboratory analysis from each of the sonic boring locations. An additional groundwater sample will be collected if the gravel unit is encountered during drilling and if a groundwater sample was not obtained from a nearby direct-push boring from this unit. Groundwater samples will be analyzed for the following analytical methods:

- VOCs by EPA Method 8260B;
- SVOCs by EPA Method 8270C;
- Chlorinated herbicides by EPA Method 8151A;
- Organochlorine pesticides by EPA Method 8081A;
- Dioxins/furans by EPA Method 8290;
- TPH by NWTPH-Dx;
- Total and dissolved metals by EPA Methods 6010A/6020/7470A;
- Compound specific isotope;
- Chloride by EPA Method 300.0 (Beach Area only); and

- Ammonia by EPA Method 350.3 (Beach Area only).

All samples will be collected and submitted to the contract laboratories following the procedures described in this Stage 1 SCE FSP, the QAPP, subsequent addendums and updates. Samples will be contained in the appropriate sampling containers, as listed within Table 2.

Groundwater samples will be collected as described in the SOP - 24 (Appendix A-1). Sampling equipment will be decontaminated following sample collection at each location, according to the appropriate decontamination procedures described in SOP - 3 (Appendix A-1). Waste generated during the sampling procedure will be handled in accordance with the waste handling procedures described herein and in SOP - 13 (Appendix A-1).

2.2 Task 2 - Monitoring Well Installation

Task 2 consists of installation, construction, development, and surveying of up to four monitoring well clusters adjacent to the River and three monitoring well clusters located on Arkema Lots 1 and 2. This section describes the installation procedures and construction design for the monitoring well clusters.

2.2.1 Monitoring Well Installation

Currently, it is anticipated that three well clusters will be installed in the Beach Area and one cluster will be installed on the Siltronic Riverbank, as shown on Figure 1. In addition, up to three monitoring well clusters will be installed in Arkema Lots 1 and 2, as shown on Figure 1. The final number of monitoring wells to be installed during Task 2, the completion depth of each well, and well locations will be determined based on evaluation of the combined hydrogeologic and analytical data obtained during the Task 1 reconnaissance field investigation activities.

Monitoring wells will be installed as a cluster of wells, with a minimum 10-foot separation between each monitoring well location. Monitoring well cluster designations have been temporarily assigned to the proposed wells for clarity during planning. These designations (RP-08-S, RP-08-A, RP-08-B for the first cluster and RP-09-S, RP-09-A, and RP-09-B, etc.) will be changed to include the actual completion depths of each well. For example, if the monitoring well currently designated as RP-08-A were to be completed to a depth of 84 feet, its final designation would be RP-08-84. Monitoring well construction field forms are located in Appendix A-2.

The monitoring well clusters will be completed approximately as follows:

- Monitoring well RP-08-S will be screened within the first water-bearing zone;
- Monitoring well RP-08-A will be screened within the alluvium zone; and
- Monitoring well RP-08-B will be screened within the basalt zone.

Monitoring well clusters will be installed using track-mounted sonic drilling methods. Borings for the monitoring well installations would include continuous soil sampling to confirm lithologic logging from the direct-push borings, to document the basalt surface elevation and gravel thickness (if observed), and to document visually impacted soils. No soil samples from these borings are planned to be collected for laboratory analysis.

Prior to drilling, as part of setup activities, plastic sheeting will be laid out in the work area. Incidental spills of soil or water will be contained on the sheeting with a low berm under the sheeting.

Monitoring wells will be installed using the following completion materials, unless field observations necessitate otherwise. A schematic representation of monitoring well construction is presented in Figure 2. The monitoring well will be surged after the installation of the filter pack to prevent additional settlement of the filter pack material. Any changes to the monitoring well construction materials will be approved by the Project Manager, who may consult with SLLI, DEQ, and/or OWRD, as appropriate.

Casing and Screen:

- A sump consisting of a 0.5-foot threaded cap at the bottom of the well (included with the pre-pack well screen);
- A screened interval consisting of a 5-foot length of 2-inch diameter 0.010-inch slotted PVC casing, with a pre-pack filter of #10/20 silica sand;
- For RP-08-B (and corresponding B wells), a centralizer will be placed approximately 5 feet above the well screen; and
- A blank casing to the top of the well consisting of 2-inch diameter Schedule 40 PVC threaded well casing, and a locking waterproof well cap.

Annulus:

- Supplementary silica sand filter pack (in addition to the pre-pack filter), #10/20 grain size, to approximately 2 feet above the screened interval;
- If grout is used, 2 feet of bentonite chips will be placed above the filter pack;

- The seal installed at monitoring well RP-08-S (and corresponding S wells) will consist of bentonite chips from the top of the filter pack to within 3 feet of the ground surface;
- The seal installed at monitoring wells RP-08-A and RP-08-B (and corresponding A and B wells) will consist of a bentonite grout seal (30% solids) from the top of the bentonite chips to within 3 feet of the ground surface; and
- The surface of each well will be completed with a concrete seal at least 3 ft thick and a concrete surface pad.

Well Head Completion:

- All monitoring wells will be installed with above ground monuments unless traffic patterns require flush-mount monuments;
- A 2x2 ft concrete pad with a minimum thickness of 4 inches will be constructed around each monument at the ground surface to divert rainfall away from the well casing; and
- Above ground monuments will extend 3 ft above ground surface with hollow steel casing around the monitoring well for protection and a steel locking cover. In addition, three 6 ft tall steel bollards filled with concrete will extend 3 ft above ground surface surrounding each well for protection.

Following well installation, the work area will be cleaned and all wastes generated will be contained and removed from BNSF, Siltronic, and Arkema properties in accordance with the waste handling procedures described herein and in SOP - 13 (Appendix A-1). Drilling equipment will be decontaminated at the RP property in a designated bermed area. Decontamination procedures will follow those outlined in SOP - 3 (Appendix A-1).

2.2.2 Monitoring Well Development

Monitoring wells will be developed following installation to flush out particles that may remain in the filter pack material after installation and to ensure that the monitoring well is in hydraulic connection with the surrounding formation. Newly installed monitoring wells will be developed after the final grout or bentonite chips have set in the well annulus for a minimum of 24 hours.

The newly installed monitoring wells will be developed according to SOP - 14, Methodology for Monitoring Well Development (Appendix A-1). Procedures will include surging each monitoring well with a surge block, and purging five to eight well volumes of water. Well development activities will be recorded on the Well Development Log included in Appendix A-2.

2.2.3 Surveying

Following completion of well installation, the location and elevation of each newly installed monitoring well will be surveyed by a licensed surveyor. The survey data will be collected in a coordinate system consistent with other RP Site wells. The survey data will be entered into the project database and quality checked.

2.3 Task 3 - Groundwater Monitoring

Task 3 consists of groundwater sampling and water elevation monitoring of newly installed monitoring wells and selected existing monitoring well clusters to evaluate groundwater quality and vertical and lateral hydraulic gradients near the RP Site.

2.3.1 Water level Monitoring

Water level measurements will be collected and used to evaluate the general direction of groundwater flow, vertical hydraulic gradients, and other hydraulic characteristics of the hydrogeologic units.

Groundwater elevations and non-aqueous phase liquid (NAPL) thickness measurements will be collected from the 123 existing monitoring wells and the additional monitoring wells installed as part of Task 2. Surface water elevations will be collected at three staff gauges in North Doane Lake, West Doane Lake, and the Northwest Drainage Pond. All depth to water measurements will be conducted in accordance with the SOP - 1 located in Appendix A-1. Water level measurements will be collected during the second groundwater sampling event discussed in further detail below.

2.3.2 Groundwater Sampling

The groundwater monitoring has been divided into two separate events based on the overall project schedule as discussed in Section 8.0 of the Stage 1 SCE WP. The first groundwater monitoring event will be conducted following the installation of the monitoring well clusters on Arkema Lots 1 and 2 and will include sampling of these wells in addition to RP monitoring well clusters MW-05, RP-01, RP-02, and W-19 and Arkema monitoring wells MWA-3, MWA-5, MWA-9i, MWA-13d, MWA-14i, MWA-17si, and MWA-21b. The second groundwater monitoring event will occur following the installation of monitoring wells at the Beach Area and Siltronic Riverbank. This event will include the wells sampled during the first event in addition to RP monitoring well cluster RP-07 and Siltronic monitoring well pairs WS-11 and WS-12. Groundwater monitoring locations are shown on Figure 3. All groundwater sampling will be conducted in accordance with SOP - 2 (Appendix A-1) and in general accordance with applicable portions of AMEC's Final Post-Characterization Groundwater Monitoring Plan dated February 17, 2004.

Groundwater samples will be analyzed for the following analytical methods and are summarized in Table 1:

- VOCs by EPA Method 8260B;
- SVOCs by EPA Method 8270C;
- Chlorinated herbicides by EPA Method 8151A;
- Organochlorine pesticides by EPA Method 8081A;
- Dioxins/furans by EPA Method 8290;
- TPH by NWTPH-Dx;
- Total and dissolved metals by EPA Methods 6010A/6020/7470A;
- Compound specific stable isotope analysis; and
- Natural attenuation parameters.

All samples will be collected and submitted to the contract laboratories following the procedures described in this Stage 1 SCE FSP, the QAPP, subsequent addendums, and updates. Samples will be contained in the appropriate sampling containers, as listed within Table 2.

2.4 Task 4 - Transducer Study

Immediately following the groundwater sampling events, a transducer study will be conducted within selected newly installed monitoring well clusters and selected existing monitoring well clusters to evaluate hydraulic gradients and tidal influence on the water-bearing zones near the River. A pressure transducer will be installed in each monitoring well in well clusters W-19, RP-02, and in each well of two of the newly installed Beach Area and/or Arkema Lot 1 and 2 monitoring well clusters. Final study locations will be determined following the evaluation of hydrogeologic data collected from Tasks 1 through 3 of this Stage 1 SCE.

Transducers will be installed and data loggers programmed as outlined in SOP - 22. Data loggers will be programmed to start simultaneously and will record pressure data at 15 minute intervals for a period of 30 days. Following the completion of the 30 day study period, data loggers will be downloaded and the data will be processed for evaluation of hydraulic gradients and tidal influence.

2.5 Sample Designation and Handling

Sample handling and designation procedures were developed to provide sufficient project-specific QA and quality control (QC) measures. Specific QA/QC requirements and procedures are described in this section and in SOP - 2 and SOP - 12, and include:

- QC sample collection requirements;
- Sample container requirements and preservation;
- Sample documentation and handling; and
- Chain-of-custody documentation.

2.5.1 QC Sample Collection Requirements

A variety of QC samples are required in order to assess performance of the project team in collection and analysis of the groundwater and soil samples. QC samples required for this sampling and analysis program include the following where applicable:

Field Duplicate Samples:	One duplicate per 20 requests for each analytical procedure, with a minimum of one per procedure (with the exception of most inorganic and physical parameters).
Interlaboratory Split Samples:	One split sample per 20 requests for each analytical procedure, with a minimum of one per procedure (with the exception of most inorganic and physical parameters).
Rinsate Blanks:	One rinsate blank per 20 samples when disposable or dedicated sampling equipment is used; otherwise, 1/day/media, to be analyzed for all parameters except physical parameters.
Trip Blanks:	One trip blank per cooler containing vials for VOC analysis.

Laboratory QC Samples:	One laboratory QC sample per 20 requests for each analytical procedure, with a minimum of one per procedure (with the exception of most inorganic and physical parameters).

Field duplicates are replicate samples collected at the same location during the same sampling session (roughly at the same time) and submitted in blind form to the contract laboratory. Field duplicates provide an indication of the reproducibility of the sampling and analysis procedures for a given sample matrix, including heterogeneity of the sample itself. Field duplicate samples will be collected by alternating between the sample and the replicate as each container is filled simultaneously with equal volumes. The field duplicates will be collected in the same container types and handled and analyzed in the same manner as all other samples of like media.

Inter-laboratory split samples are field duplicates that are shipped to both the primary laboratory and a QC laboratory. They are collected in a manner identical to that described for field duplicates.

A rinsate blank serves as an indicator of potential contamination resulting from inadequate decontamination of sampling equipment. Laboratory supplied deionized water or distilled deionized water is passed through (or across) the sampling equipment after the decontamination procedure is complete, and collected in the appropriate sample containers.

A trip blank is a container filled by the laboratory with analyte free water and never opened in the field. It is used to assess possible contamination during transport and storage of sample containers. Trip blanks and associated sample containers should remain in the same cooler the laboratory shipped them in or in the on-site refrigerator and not be intermingled with bottles from different batches. The trip blank will be kept with samples planned for VOC analysis and will be analyzed for VOCs only.

Laboratory QC samples are field samples that are designated for laboratory QC procedures such as duplicate analysis or matrix spike analysis. Extra volume must be collected for laboratory QC samples to ensure the laboratory has sufficient volume to perform all required analyses.

2.5.2 Sample Containers

The contract laboratory will supply pre-cleaned, certified bottles appropriate for the required analysis. Sample container quality protocols will be strictly enforced and assured by the laboratory. The laboratory shall retain certificates of analysis from each lot of bottles for a period of at least five years. Bottles supplied by the laboratory shall contain any required chemical preservative, except when necessary to field preserve. Field preservation will be conducted under specific direction from the laboratory. Sample containers will be kept closed until used. Required sample containers, preservation, and holding time requirements for this project are described in Table 2.

2.5.3 Sample Designation and Labeling

The purpose of sample designation and labeling is to enable discrete sample tracking. Each sample will be given a discreet sample identification number (ID). All samples will be tracked on the appropriate field form and a Sample Identification Matrix form (Appendix A-2) by sampling location and sample ID. Each sample ID will be designated by the following identification system:

- Each sample location will have a three-digit number that will be in sequence with the previous sample collected. For example, a soil sample collected at sampling location SCE-001-S would have a sample ID of 001. A groundwater sample collected from SCE-001-GW would be designated as 002 and so on.
- A QA/QC designation will be assigned to the sample as follows:

-01 Primary Sample

-02 Field Duplicate

-03 Trip Blank

-04 Rinsate Sample

-05 Interlaboratory Duplicate

For example, a primary soil sample collected at SCE-001-S would be designated 001-01 and the field duplicate would be assigned a sample ID of 001-02. A rinsate sample collected after sampling would have a sample ID of 001-04.

No indication of QA/QC designation will be provided to the lab, with the exception of additional quantities of sample for the laboratory matrix spike (MS) and matrix spike duplicate (MSD). The sample location or well number will not be recorded on the sample label or chain-of-custody form. The sample containers designated for MS and MSD analysis will be labeled the same as the primary sample. However, on the chain-of-custody form the extra quantity for the MS/MSD will be identified. This will assist the laboratory in reporting MS/MSD results as associated with the correct primary field sample results.

All samples will be tracked in the Sample Identification Matrix form, Appendix A-2, ensuring to note the media type for each sample. This procedure will aid in cross-referencing of sample locations with their respective sample ID. Duplicates and blanks will also be noted on the form with their respective sample IDs. This form will also serve as a cross-checking mechanism to ensure sampling is not unnecessarily duplicated.

Sample labels will be preprinted with project name and number. Items including sample ID, date and time of collection, and sample collector will be indicated on the sample label and will be filled out in the field. In addition, the analysis method and/or analyte(s) will be specified on the label for each container.

2.5.4 Sample Preservation and Holding Times

Field personnel will verify that the correct laboratory-supplied bottles are used for each sample and labeled with the corresponding intended analysis.

All samples will be placed in a cooler with blue ice or double-bagged wet ice immediately after collection. The target temperature for the cooler is 4 degrees Celsius (°C) or less. Samples will be transported to the contract laboratory as soon as possible after collection. This will allow rapid transfer of the samples into controlled, refrigerated storage, and allow the contract laboratory adequate time to meet required analytical holding times as described in Table 2. A temperature blank, when provided by the laboratory with the sample bottles, will be included in each cooler so the laboratory can verify sample temperature upon receipt.

2.5.5 Sample Storage, Packaging, and Transport

Sample Storage

All samples will be in possession of an AMEC field representative or designated AMEC staff member at all times until custody is relinquished to the laboratory (in person or through shipment), or until the samples are placed in a secure storage location. Samples will be placed into metal or plastic picnic coolers at a target temperature of 4°C, or in a refrigerator designated for sample storage. Ice will be added, as necessary, to maintain the target temperature.

Sample Packaging

Samples will be transported in the same coolers used for sample storage. Each cooler or daily set of coolers will be accompanied by a chain-of-custody form. The chain-of-custody form will be completed, sealed in a resealable bag to prevent damage to the document, and taped to the top of the cooler (or one of the coolers if there are multiple coolers for a sample set). Each cooler will then be sealed with signed, self-adhesive chain-of-custody seals prior to transport.

Sample Transport

Sample coolers will be placed into the back of a field vehicle for transport to the contract laboratory or to the AMEC office. All samples collected for VOC analysis will be transported in the same cooler with the trip blank.

Individual glass sample containers will be wrapped in bubble wrap bags or placed in closed-cell foam packaging. Samples with numerous aliquots per sample set will be placed in resealable bags to help keep sets together. Plastic sample containers will be placed in resealable bags, but not bubble wrap.

Samples designated to be analyzed at out-of-area laboratories will be repackaged (as necessary) at the AMEC office for shipping. Bubble wrap and foam may be used to help prevent sample breakage during shipping. Samples will be packed into coolers with blue ice and labeled appropriately for shipping. Common carriers may be used for shipping. A chain-of-custody form will accompany all coolers during shipment. Although common carriers do not typically sign chain-of-custody forms, the receipt for shipment will be retained as evidence of sample transport.

2.5.6 Chain-of-Custody Procedures

The chain-of-custody is an integral component of the sampling process as it stands as a permanent record of sample holding and shipment. Sample custody is documented from collection through transport, analysis, and reporting.

Samples will remain in the custody of field personnel or appropriate AMEC staff until receipt by the laboratory. The corresponding chain-of-custody form is in plain view at all times, in physical possession, or in a locked location where no tampering will occur. The chain-of-custody form will be cross-checked for errors and signed. Any errors will not be erased, but will have a single strikethrough, with the change dated and initialed.

All samples will be hand-delivered to a laboratory representative or shipped according to the procedures described in Section 2.5.5. Coolers with their respective chain-of-custody form(s) will be checked into the laboratory by a laboratory representative, and the chain-of-custody form will be signed and dated appropriately. The field representative or AMEC staff member will retain one copy of the signed chain-of-custody form for the project files. The laboratory representative will verify cooler temperature, sample designation, and other relevant sample conditions. The original chain-of-custody form or a photocopy will be returned to the project manager with the analytical results to go into the project files.

2.6 Documentation

Verifiable sample custody is of primary importance during field and laboratory procedures. Such practices ensure all samples have been properly acquired, preserved, and identified. This information will be collected in a variety of formats that will all be specific to the function they perform in the sampling procedure (e.g., field logbooks, groundwater sampling forms, sample labels, chain-of-custody forms). Accurate sampling records create a complete record of all field procedures, including circumstances of collection and integrity of the given sample. This will also allow for detailed tracking of all samples from collection through transport and laboratory analysis. This will also facilitate the import of field data and laboratory analyses into the database system. The following information outlines specific procedures that will be implemented during field water sampling activities.

2.6.1 Field Logbooks

Field logbooks will be the main source of field documentation for all field activities. The books will be permanently bound, with waterproof pages, chosen for their secure binding and durability in adverse field conditions. All pages will be numbered consecutively. All pages will remain intact and no page will be removed for any reason. Notes will be taken in indelible, waterproof, blue or black ink. The front and inside of each field logbook will be marked with the project name, number, logbook number and AMEC's address and phone number. The field logbooks will be stored in the project files when not in use and upon completion of each sampling event.The first entry at the beginning of each day will include the date and time, project number, names of all field personnel on-site (including subcontractors and the company for which they work), weather conditions, and the purpose of fieldwork. Each subsequent page will be started with the project number and the date. The bottom of each page will have the date and the initials of all personnel entering information onto that page. Any remaining unused lines will be crossed through. Errors will not be erased. All errors will have a single strikethrough with an initial and date next to the strikethrough and the subsequent change made.

Information included in the field logbooks may include, but not be limited to, the following items:

- Reasons for collecting samples (e.g., annual sampling event).
- Field observations relevant to the sampling event, including weather (wind direction and approximate speed, air temperature, sky cover) and any events that may have occurred previous to sampling which may influence the integrity or the representative nature of the sample.
- Observations of site activities not covered under regular activities, including presence of persons on-site not related to the sampling activities (subcontractors, DEQ, and others), and actions by those people affecting task performance.
- Sketches of relevant information.
- Information relevant to a change in scope or change in Stage 1 SCE FSP procedure, with documentation of subsequent AMEC and/or SLLI approval.
- Type and/or level of health and safety equipment used.
- References to information on other field forms, such as the Soil and/or Groundwater Sampling Field Form (discussed below).

All information compiled in the field logbook, will be written legibly in language that is clear and concise, without interpretation.

2.6.2 Field Sampling Forms

A separate and complete Soil Sampling Form, or Groundwater Sampling Form (Appendix A-2), will be created for each soil or groundwater sample location respectively. Errors will not be erased. All errors will have a single strikethrough with an initial and date next to the strikethrough and the subsequent change made. Information collected during sampling will be marked on the form, in addition to notes taken in the field logbook.

Information may include, but will not be limited to:

- Date and time of sampling for each sample, field sample collection, and laboratory sample collection;
- Boring or well identification;
- Sample media type and description of sample location;
- Sample identification or naming system, including each unique sample name/number;

- Method of sampling, including procedures and equipment, as well as any variance from the methods in this Stage 1 SCE FSP;
- Volume of sample collected per sample container, type of sample container, and number of aliquots per sample;
- Sample preservation techniques and analyses requested;
- Results of field measurements (i.e., headspace readings, temperature, pH etc.);
- Information relevant to quality control (i.e., sampling discrepancies or difficulties; unexpected conditions or abnormal sampling procedures);
- Weather conditions;
- Laboratory samples collected, specifically sample identification and QA/QC samples identification, if applicable;
- Depth to water and depth to bottom including depth to water measurements made while purging and sampling;
- Purge method, time, and volume;
- Waste disposal method; and
- Decontamination method.

The fields within the form will help ensure that pertinent information will be documented appropriately.

2.6.3 Well Construction/Boring Log Form

In a drilling investigation, a boring log should be completed by the site geologist. A standard boring log form will be used to record the following information, as applicable:

- The boring number and/or monitoring well number;
- Drilling method and borehole diameter;
- Dates of start and completion of boring/well;
- Weather conditions;
- Sampling methods;
- Depths to water while drilling;
- Total depth of boring;
- Drilling characteristics (e.g., penetration rates, voids encountered);
- Drilling contractor and names of drillers and helpers;

- Geologist name and affiliation;
- Lithologic description of collected samples and cuttings, as appropriate, such as: density, moisture, color, modifier, soil classification including percentages of granular constituents, other macroscopic characteristics including structures, organic materials, oxidation mottling, etc.;
- Sample recovery, identification, and time;
- Number of containers collected and volume of each container;
- Obvious staining or contamination, or anything that could influence sample results;
- Breathing zone PID readings, field volatile (headspace) PID readings obtained from closed-bag samples, as well as borehole PID readings;
- Monitoring well "as-built" information (construction details); and
- Start card number if applicable.

2.6.4 Well Development Log Form

The Well Development Log form (Appendix A-2) will be used to record the following information, as applicable:

- The monitoring well number;
- Well development method;
- Volume of water removed from well;
- Sediment in well bottom;
- Water clarity;
- Results of field measurements (i.e., turbidity); and
- Dates and time of start and completion

2.6.5 Water Level and NAPL Thickness Measurement Form

A separate Groundwater Level and NAPL Thickness Measurement Form will be used to record water levels, NAPL thicknesses, well total depth, and date and time of measurement (Appendix A-2). Staff gauge outfall discharge levels, as appropriate, will also be entered on this form. Errors will not be erased. All errors will have a single strikethrough with an initial and date next to the strikethrough and the subsequent change made.

2.6.6 Photographs

Photographs will be taken for the purpose of documenting data collection location, location appearance, proximity to RP Site facilities, proximity to topographic features, field activities, or other relevant field observations for which notes or sketches are inadequate. Each photograph will be documented in the field logbook. This documentation will include, but is not limited to, the photographer, date and time of photograph (if not automatically imprinted on the photograph), and sample subject.

2.7 Decontamination

All equipment used to collect down-hole measurements that may come into contact with sample water (e.g., water level probe) will be decontaminated between each use. This will not be the case for disposable equipment (e.g., bailers and sample tubing). Decontamination procedures will help to eliminate cross-contamination between samples, a situation that leads to analytical results that may misrepresent the natural subsurface conditions. Equipment will be decontaminated as follows:

- Soap wash (dilute solution of Alconox or equivalent in potable water solution);
- Potable water rinse;
- Solvent rinse (methanol or similar solvent); and
- Rinse with distilled or deionized water.

The casing, drill rods, bits, and other drilling equipment will be steamed cleaned prior to arrival at the site and between borings. Further details regarding decontamination procedures are provided as SOP - 3 in Appendix A-1.

3.0 WASTE DISPOSAL AND HANDLING PROCEDURES

All IDW generated during the investigation will be handled in such a way as to prevent or minimize the potential for the spread of contamination, the creation of a sanitary hazard, or visual degradation of the Site through the spread of litter. The IDW will remain under the control of SLLI and its contractor at all times during its generation, containerization, and transport to the RP facility for consolidation and shipment.

Wastes generated during the field investigations covered by this Stage 1 SCE FSP will include soil cuttings, decontamination fluids, purge water, personal protective equipment, disposable sampling equipment, and miscellaneous solid waste. Waste will be handled according to procedures specified in SOP - 13, Waste Handling and Disposal Procedure (Appendix A-1).

REFERENCES

AMEC, 2001. *Revised Quality Assurance Project Plan, RPAC - Portland Site*, prepared for Aventis CropScience, prepared by AMEC Earth & Environmental, submitted to Oregon Department of Environmental Quality, June 13, 2001.

AMEC, 2002. *Draft Quality Assurance Project Plan Addendum No. 1, RPAC - Portland Site*, prepared for RPAC, prepared by AMEC Earth & Environmental, Inc. submitted to Oregon Department of Environmental Quality, August 1, 2002.

AMEC, 2005. *Site-Specific Health and Safety Plan, RP - Portland Site*, prepared by AMEC Earth & Environmental, Inc. submitted to Oregon Department of Environmental Quality, June 24, 2005.

DEQ 2005. Letter from Thomas E. Roick, *Source Control Evaluation, Rhone Poulenc Portland Site*. February 22.

LIMITATIONS

This report was prepared exclusively for SLLI by AMEC Earth & Environmental, Inc. The quality of information, conclusions, and estimates contained herein is consistent with the level of effort involved in AMEC services and based on: i) information available at the time of preparation, ii) data supplied by outside sources, and iii) the assumptions, conditions, and qualifications set forth in this report. This Stage 1 Source Control Evaluation Field Sampling Plan is intended to be used by SLLI for the RP Portland Site, 6200 N.W. St. Helens Road, Portland, Oregon only, subject to the terms and conditions of its contract with AMEC. Any other use of, or reliance on, this report by any third party is at that party's sole risk.

TABLES

TABLE 1
Investigation Locations and Analytical Methods
Stage 1 Source Control Evaluation Field Sampling Plan
RP - Portland Site

Task	Study Area	Investigation Method	Sampling Media	Analytical Requirements												
				Proposed Analytical Sampling Depth [(A)]	VOCs by EPA Method 8260B	SVOCs by EPA Method 8270C	Herbicides by EPA Method 8151A	Pesticides by EPA Method 8081A	Dioxins/ Furans by EPA Method 8290	PCBs by EPA Method 8082A	TPH Diesel Range by NWTPH-Dx	Metals by EPA Method 6010A/6020/7470A [(B)]	Compound Specific Isotope Analysis (GC/C/IRMS)	Chloride by EPA Method 300.0	Ammonia by EPA Method 350.3	Natural Attenuation Parameters [(C)]	Hydrogeologic Parameters [(E)]
Task 1 - Reconnaissance Activities	Arkema Lots 1 and 2	Direct-Push	Soil [(F)]	0-0.5 ft bgs	A	A	A	A	A	A	A	A	A				X [(D)]
				5-5.5 ft bgs	A	A	A	A	A		A	A	A				X [(D)]
				Capillary Fringe	A	A	A	A	A		A	A	A				X [(D)]
				30-30.5 ft bgs	A	A	A	A	A		A	A	A				X [(D)]
				Refusal Depth	A	A	A	A	A		A	A	A				X [(D)]
			Groundwater	First WBZ	X	X	X	X	X		X	X	X	X	X		
				40 ft bgs	X	X	X	X	X		X	X	X	X	X		
				Refusal Depth	X	X	X	X	X		X	X	X	X	X		
		Sonic	Soil	No Samples Planned													
			Groundwater	Gravel WBZ	X	X	X	X	X		X	X	X	X	X		
				Basalt WBZ	X	X	X	X	X		X	X	X	X	X		
	Beach Area	Direct Push	Soil [(F)]	0-0.5 ft bgs	A	A	A	A	A	A	A	A	A				X [(D)]
				5-5.5 ft bgs	A	A	A	A	A		A	A	A				X [(D)]
				Capillary Fringe	A	A	A	A	A		A	A	A				X [(D)]
				20-20.5 ft bgs	A	A	A	A	A		A	A	A				X [(D)]
				Refusal Depth	A	A	A	A	A		A	A	A				X [(D)]
			Groundwater	First WBZ	X	X	X	X	X		X	X	X	X	X		
				30 ft bgs	X	X	X	X	X		X	X	X	X	X		
				Refusal Depth	X	X	X	X	X		X	X	X	X	X		
		Sonic	Soil	No Samples Planned													
			Groundwater	Gravel WBZ	X	X	X	X	X		X	X	X	X	X		
				Basalt WBZ	X	X	X	X	X		X	X	X	X	X		
	Siltronic Riverbank	Direct-Push	Soil	No Samples Planned													X [(D)]
			Groundwater	First WBZ	X	X	X	X	X		X	X	X				
				100 ft bgs	X	X	X	X	X		X	X	X				
				130 ft bgs	X												
				160 ft bgs	X												
				190 ft bgs	X												
				Refusal Depth	X	X	X	X	X		X	X	X				
		Sonic	Soil	No Samples Planned													
			Groundwater	Gravel WBZ	X	X	X	X	X		X	X	X				
				Basalt WBZ	X	X	X	X	X		X	X	X				
Task 2 - Monitoring Well Installation	Various	Sonic	Soil	No Samples Planned													
			Groundwater	No Samples Planned													
Task 3 - Groundwater Monitoring	Various	NA	Groundwater	Various	X	X	X	X	X		X	X	X	X	X	X	
Task 4 - Transducer Study	Various	NA	NA	NA													

Notes:
(A) Sampling depths may be adjusted based on field observations.
(B) Total and dissolved metals analysis for groundwater samples. Metals include: aluminum, calcium, iron, magnesium, potassium, sodium, arsenic, cadmium, chromium, copper, lead, manganese, nickel, vanadium, zinc, and mercury.
(C) Natural attenuation parameters include: ferrous iron, microbial enumerations, nutrients, total organic carbon, chemical oxygen demand, sulfate, sulfide, total alkalinity, major cations, and methane.
(D) Discrete soil samples will be analyzed for hydrogeologic parameters. Sampling depths will include planned groundwater sample intervals and depths based on field observations.
(E) Hydrogeologic parameters include: total organic carbon, mechanical sieve and 200 wash.
(F) Ten soil samples will be analyzed for VOCs, SVOCs, herbicides, pesticides, dioxins/furans, PCBs, TPH diesel range, metals and compound specific isotope analysis. Additional soil samples will be analyzed for chemical constituent analysis if visual and/or photoionization detector evidence during sample collection indicates potential soil impact.

A = Archive, analyze only if evidence of contamination
bgs = below ground surface
CF = capillary fringe
EPA = United States Environmental Protection Agency
ft = feet
GC/C/IRMS = Gas Chromatography/Combustion Interface/Isotope Ratio Mass Spectrometer
NA = Not applicable
PCBs = Polychlorinated biphenyls
SVOCs = Semivolatile organic compounds
TPH = Total Petroleum Hydrocarbons
VOCs = Volatile organic compounds
WBZ = Water-bearing zone

TABLE 2
Laboratory Container, Preservation, and Holding Times
Stage 1 Source Contral Evaluation Field Sampling Plan
RP - Portland Site

Method	Analysis	Container	Preservation	Holding Time
Soil Media				
EPA 8081A	Organochlorine Pesticides	8 oz Glass Jar[1]	Cool to 4°C	14/40 days[2]
EPA 8151A	Chlorinated Herbicides	8 oz Glass Jar[1]	Cool to 4°C	14/40 days[2]
EPA 8260B	VOC	4 oz Glass Jar	Cool to 4°C (no headspace)	14 days
EPA 8270C	SVOC	8 oz Glass Jar[1]	Cool to 4°C	14/40 days[2]
EPA 8290	Dioxins/Furans	4 oz Glass Jar	Cool to 4°C	30/45 days[2]
EPA 6010B/6020	Total Recoverable Metals	8 oz Glass Jar[1]	Cool to 4°C	6 months
EPA 7471A	Total Recoverable Mercury	8 oz Glass Jar[1]	Cool to 4°C	28 days
EPA Method 8082A	PCB	8 oz Glass Jar[1]	Cool to 4°C	14/40 days[2]
NWTPH-Dx	TPH Diesel Range	8 oz Glass Jar[1]	Cool to 4°C	14 days
Compound Specific Isotope	GC/C/IRMS	2 oz Glass Jar	Cool to 4°C Methanol	None
Groundwater Media				
EPA 8260B	VOC	4 - 40 mL Glass Vials	4°C, HCl to pH < 2 (no headspace)	14 days
EPA 8270C	SVOC	2 - 1L Amber Glass Bottles	Cool to 4°C	7/40 days[2]
EPA 8151A	Chlorinated Herbicides	2 - 1L Amber Glass Bottles	Cool to 4°C	7/40 days[2]
EPA 8081A	Organochlorine Pesticides	2 -1L Amber Glass Botlles	Cool to 4°C	7/40 days[2]
EPA 8290	Dioxins/Furans	2 - 1L Amber Glass Bottles	Cool to 4°C	30/45 days[2]
NWTPH-Dx	TPH Diesel Range	2 - 1L Amber Glass Bottles	4°C, HCl to pH < 2	7 days
EPA 6010B/6020 7470A	Total Recoverable Metals Total Recoverable Mercury	1 - 500 mL or 250 mL HDPE	Cool to 4°C, HNO_3 to pH < 2	180 days 28 days
EPA 6010B/6020 7470A	Dissolved Metals Dissolved Mercury	1 - 500 mL or 250 mL HDPE	Field Filter, HNO_3 to pH < 2, Cool to 4°C	180 days 28 days
Compound Specific Isotope	GC/C/IRMS	3 - 40 mL Vials	Cool to 4°C Trisodium phosphate	None
EPA Method 300.0	Anions (Chloride, Sulfate) (Nitrate, Nitrite, Orthophosphate)	1 L HDPE*	Cool to 4°C	28 days 48 hours
EPA Method 350.3	Ammonia	500 mL HDPE**	4°C, H_2SO_4, to pH < 2	28 days
EPA 376.2	Sulfide	500 mL HDPE	4°C, ZnAc and NaOH to pH > 9	7 days
EPA Method 310.1	Alkalinity (Total)	250mL HDPE	Cool to 4°C	14 days
EPA 415.2	Total Organic Carbon (TOC)	500 mL HDPE**	4°C, H_2SO_4, to pH < 2	28 days
GC/FID-RSK 175	Methane	4 - 40 mL Glass Vials	4°C, HCl to pH < 2	14 days

TABLE 2
Laboratory Container, Preservation, and Holding Times
Stage 1 Source Contral Evaluation Field Sampling Plan
RP - Portland Site

Method	Analysis	Container	Preservation	Holding Time
EPA 410.4	Chemical Oxgen Demand (COD)	500 mL HDPE**	4°C, H_2SO_4, to pH < 2	28 days
EPA 405.1	Biological Oxygen Demand (BOD)	1 L HDPE	Cool to 4°C	48 hours
SM 9215[3]	Total Heterotrophic Plate Count, Diesel Degrading Bacteria	125 mL plastic Sterile Collection Vessel	4°C, $Na_2S_2O_3$	24 hours
EPA 160.2	Total Suspended Solids (TSS)	1 L HDPE	Cool to 4°C	7 days

Note:

1 Multiple tests may be performed from the same 8 oz. jar, a jar is not required for each individual test.

2 Number of days from time of collection until extraction/number of days from time of extraction until analysis.

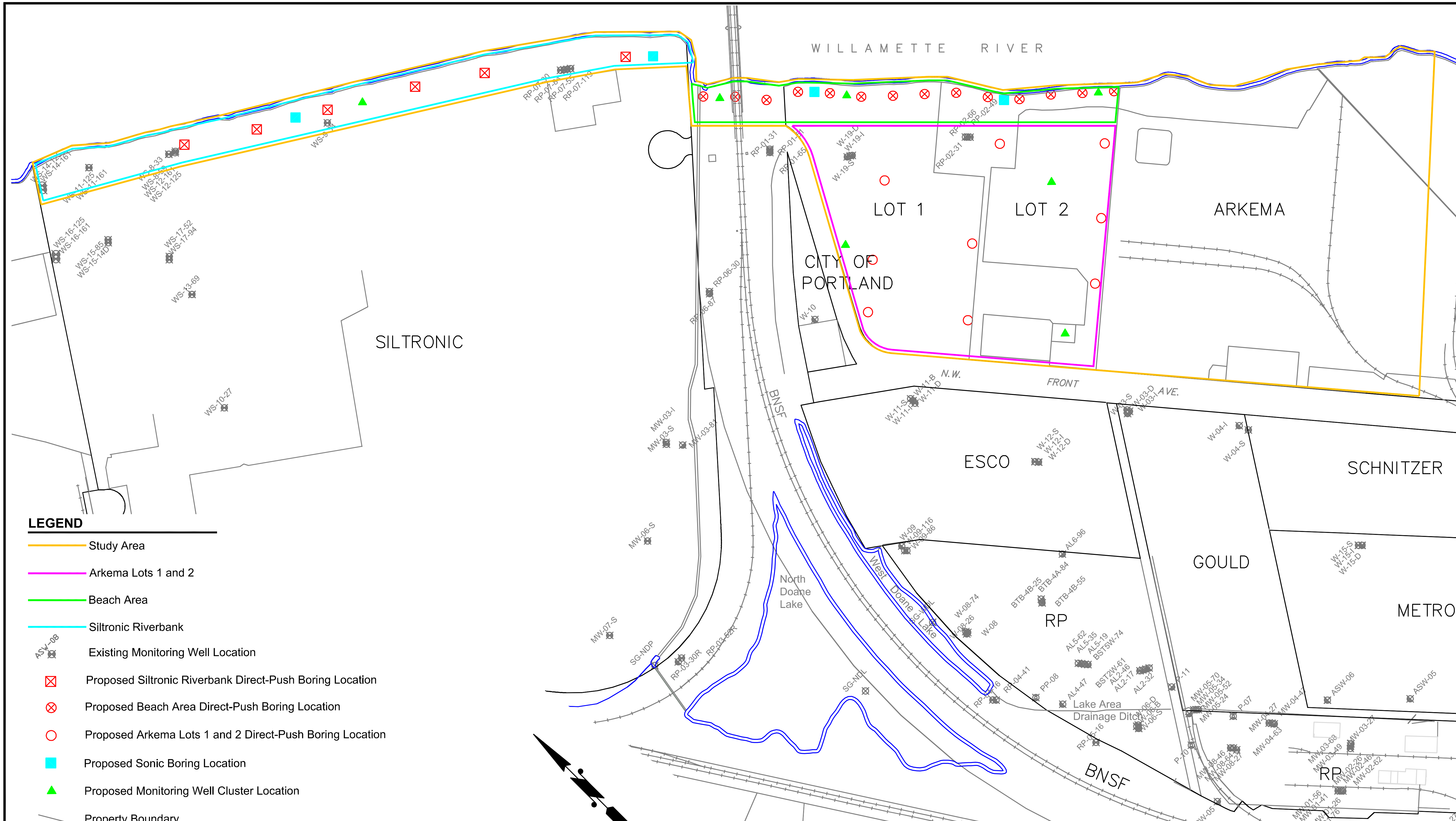
3 Diesel degrading bacteria are determined using a modified procedure.

* Alkalinity and anions can be extracted from the same container.

** Ammonia, total organic carbon, and COD can be extracted from the same container.

EPA	United States Environmental Protection Agency
GC/C/IRMS	Gas Chromatography/Combustion Interface/Isotope Ratio Mass Spectrometer
PCB	polychlorinated biphenols
SVOC	semivolatile organic compound
TPH	Total Petroleum Hydrocarbons
VOC	volatile organic compound

FIGURES



NOTE:

1. Boring locations are approximated. Final boring locations will depend upon drill rig site access.
2. Final monitoring well locations will be based on results from the reconnaissance borings.

amec

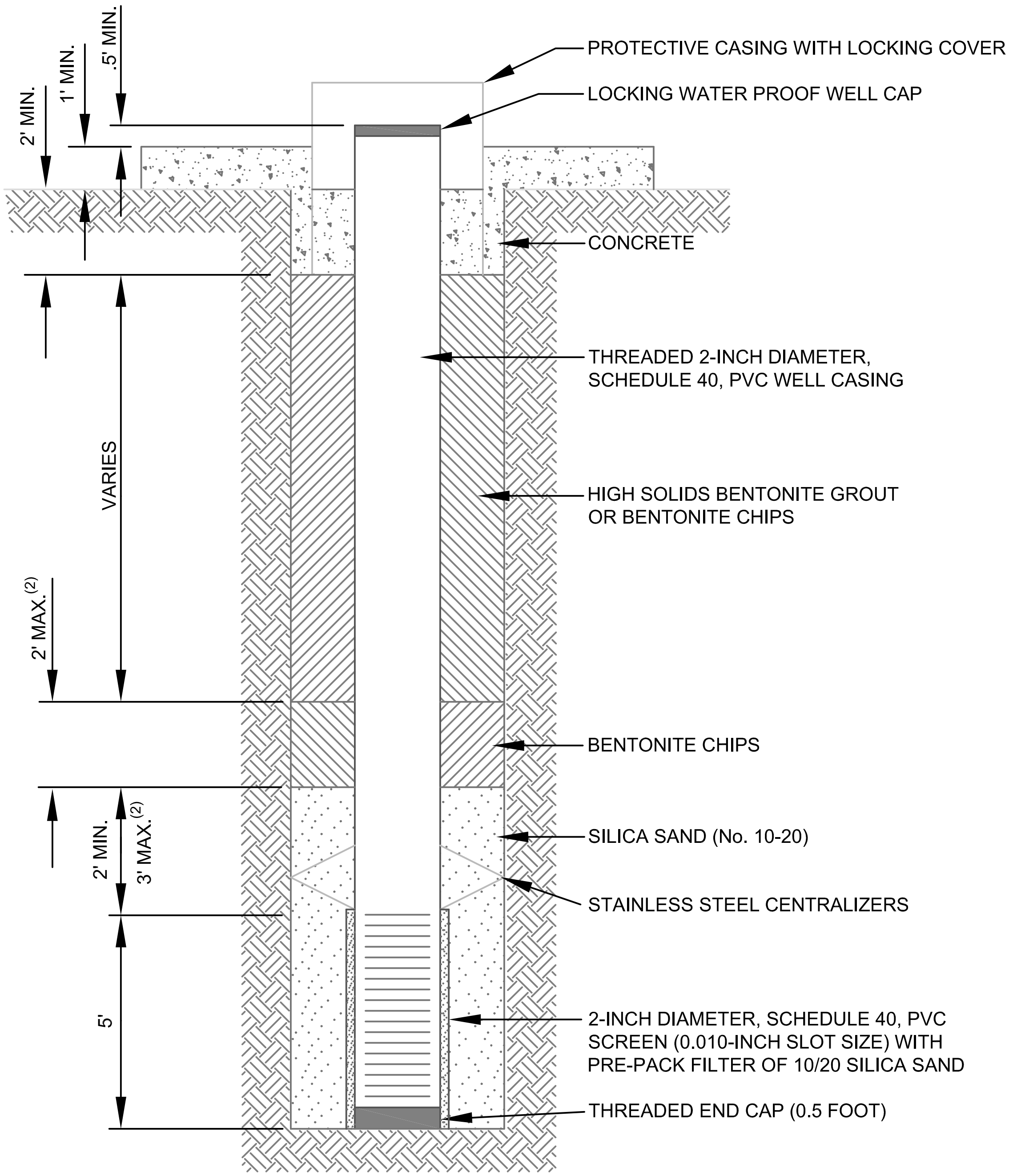
7376 SW Durham Road
Portland, OR, U.S.A. 97224-7307

W.O.	0-61M-10703-0 P-69
DESIGN	CJ
DRAWN	DD
DATE	JUNE 2005
SCALE	1"=300'

FIGURE 1
PROPOSED INVESTIGATION LOCATIONS
STAGE I SOURCE CONTROL EVALUATION

RP - PORTLAND SITE

AMEC DRAWING NO. K:\ 10000 \ 10700 \ 10703 \ PHASE 69 SOURCE CONTROL EVALUATION \ STAGE 1 SCE WP \ APP A - STAGE 1 SCE FSP - DRAFT \ DWG \ FIGURE 1.dwg



TYPICAL MONITORING WELL CONSTRUCTION WITH ABOVEGROUND MONUMENT [(1)]

NOTES

1. THE MONUMENT TYPE (FLUSH-MOUNTED AR ABOVE GROUND) TO BE USED WILL DEPEND ON TRAFFIC PATTERNS.
2. IF GROUT IS USED, 2 FEET OF BENTONITE CHIPS WILL BE PLACED ABOVE FILTER PACK.

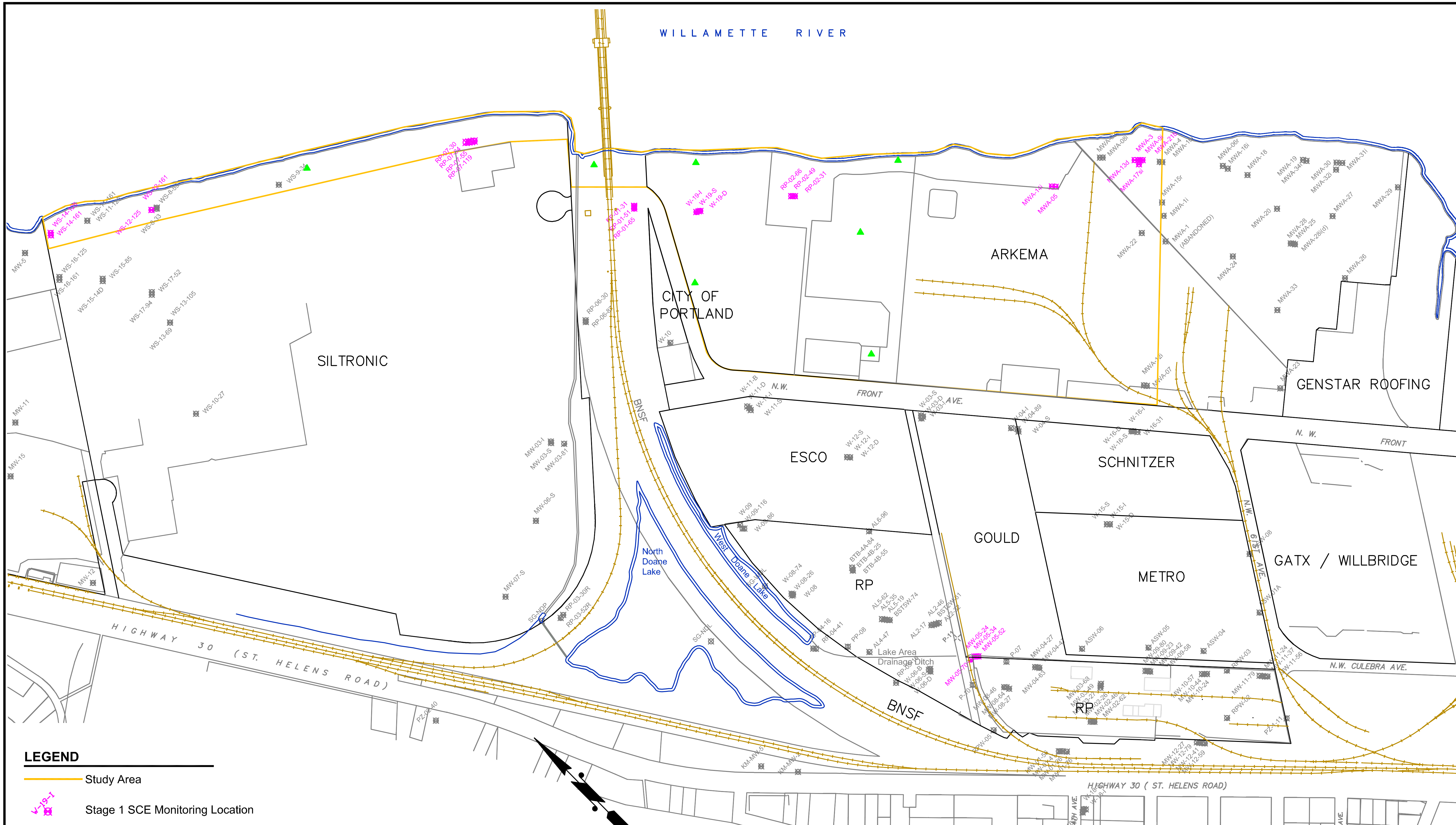
amec

7376 S.W. Durham Road
Portland, OR, U.S.A. 97224

W.O.	0-61M-10703-0 P-69
DESIGN	LG
DRAWN	DD
DATE	JUNE 2005
SCALE	NOT TO SCALE

FIGURE 2
PROPOSED MONITORING WELL CONSTRUCTION SCHEMATIC

RP - PORTLAND SITE



amec

7376 SW Durham Road
Portland, OR, U.S.A. 97224-7307

W.O.	0-61M-10703-0 P-69
DESIGN	CJ
DRAWN	DD
DATE	JUNE 2005
SCALE	1"=375'

FIGURE 3
PROPOSED GROUNDWATER MONITORING LOCATIONS
STAGE 1 SOURCE CONTROL EVALUATION

RP - PORTLAND SITE

AMEC DRAWING NO. K: \ 10000 \ 10700 \ 10703 \ Phase 69 SOURCE CONTROL EVALUATION \ STAGE 1 SCE WP \ APP A - STAGE 1 SCE FSP - DRAFT \ DWG \ FIGURE 3. DWG

APPENDIX A-1

Standard Operating Procedures

SOP - 1: Methodology for Water Level Determination

SOP - 2: Methodology for Groundwater Sampling

SOP - 3: Decontamination Procedure

SOP - 4: Field Measurement of Groundwater Parameters

SOP - 12 Methodology for Soil Sampling

SOP - 13: Waste Management Procedures

SOP - 14: Methodology for Monitoring Well Development

SOP - 22: Data Logger and Transducer Installation Procedures

SOP - 23: Groundwater Sampling, Direct-Push Method

SOP - 24: Discrete Groundwater Sampling During Drilling

RP - PORTLAND SITE
SOP - 1
METHODOLOGY FOR WATER LEVEL DETERMINATION

1.0 PURPOSE

Depth to water measurements are used to compute groundwater elevations. Water levels may be collected manually with an electronic water level probe or automatically with a pressure transducer and associated datalogger. This standard operating procedure (SOP) is specific to manual water level determination. Manual water level readings are the most common type of water level determination. Generally, this method is used if continuous water level data are not required, and at wells where non-aqueous phase liquid (NAPL) is suspected or present.

2.0 EQUIPMENT LIST

1) Photo-ionization detector (PID) for environmental sites
2) Well lock keys
3) Blank Water Level and NAPL Thickness Measurement Form, other site-specific form, and/or field logbook with indelible pens
4) Electronic water level probe
5) If NAPL is expected, interface probe and check-valve Teflon bailer with new cord
6) Knife or scissors
7) Decontamination equipment (see SOP - 3 Decontamination Procedure and sampling plan for additional site-specific requirements)
8) Site map and site health and safety plan (HASP)
9) PPE appropriate for site (see HASP if applicable)

3.0 PROCEDURE

Depth to groundwater and total well depth measurements will be made with an electronic well sounding (water level) probe. This probe is capable of measuring the depth from the top of the well casing to the nearest 0.01 foot.

1) Measurements are taken from cleanest to most heavily impacted wells, based on historic data where available.
2) Check well for security damage or evidence of tampering and record pertinent observations. Note any maintenance tasks that should be completed, such as well cap or padlock replacement.

3) Unlock and remove the cap from the well casing, allowing the pressure to equalize in well.

4) At sites with suspected environmental contamination, after removing the well cap immediately measure the air space in the well bore for the presence of volatile organic compound (VOC) vapors using a PID. The PID reading will aid in the determination of the appropriate level of personal protective equipment (PPE) at each well.

5) For wells where NAPL is not suspected, the water level probe sensor head is lowered into the well opening until an auditory or visual signal is obtained. The sensor is slightly raised and lowered to determine the strongest signal, indicating the top of the water level surface in the well casing. For wells where NAPL is suspected, use an interface probe and follow probe instructions to determine the type of signal for water versus product.

6) The measurement is read off the tape at the point that corresponds to the survey mark on top of the well casing and recorded on the Water Level and NAPL Thickness Measurement Form, other site-specific form, or the field logbook to nearest the 0.01 foot. The depth to fluid is measured from an established point on the well casing and is later subtracted from the elevation of that mark to calculate groundwater (or product) elevation at the well location. Record both depth to NAPL and depth to water, where applicable.

7) Measure a total depth of the well to the nearest 0.1-foot. If the well is deeper than 100 feet (the typical length of water level probes), a weighted tape may be used to determine total well depth. If free-phase product is suspected, use the interface probe to check for the possible presence of dense NAPL (DNAPL) near the well bottom.

8) Decontaminate the exposed tape and water level or interface probe sensor head prior to rolling it onto the equipment reel.

9) For wells with known NAPL or where evidence of NAPL is observed on the water level probe, a disposable, weighted bailer will be used to determine whether NAPL is present. If present, visually examine the NAPL for color, background odor, evidence of NAPL product sheen or droplets, etc. Record these observations and a NAPL thickness corresponding to the thickness observed in the bailer on the Water Level and NAPL Thickness Measurement Form, other site-specific form, or field logbook.

10) Contain and dispose of PPE, bailer and cord (if used), and decontamination water according to site-specific requirements.

RP - PORTLAND SITE
SOP - 2
METHODOLOGY FOR GROUNDWATER SAMPLING

1.0 PURPOSE

Groundwater samples are collected from monitoring wells for analysis of physical and chemical parameters, either using field observations and portable equipment or using off-Site laboratory analytical methods. Monitoring wells are purged or micro-purged prior to sample collection to ensure that water sampled is representative of the formation. The procedures in this standard operating procedure (SOP) are specific to standard monitoring wells with a single slotted interval. This method can be used when using bailers, dedicated pumps, or portable pumps.

2.0 EQUIPMENT LIST

1) Well lock keys
2) Groundwater Sampling Field Form, other appropriate Site-specific form(s), and field logbook with indelible pens
3) Electronic water level probe or interface probe
4) If dense non-aqueous phase liquid (DNAPL) is potentially present, interface probe and check-valve Teflon® bailer with new cord
5) Knife or scissors
6) Decontamination equipment (see RP SOP - 3 Decontamination Procedure, and sampling plan for additional Site-specific requirements)
7) Site map and Site health and safety plan (HASP), if applicable
8) PPE appropriate for Site (see HASP if applicable)
9) Submersible pump or bailer (for monitoring wells without dedicated pumps), and associated pump equipment (controller, connectors, power cord, etc.)
10) Compressed gas source or generator, air compressor, and fuel (if dual valve pump is used)
11) Disposable discharge tubing, if necessary
12) Field water quality monitoring equipment (see RP SOP - 4 Field Measurement of Groundwater Parameters) and flow-through cell, if appropriate
13) Buckets or other containers for purged water
14) Sample containers, labels, packaging material

3.0 PROCEDURE

Groundwater samples can be collected using low-flow purging and sampling or standard purging and sampling methods. Low-flow purging and sampling is the preferred sampling method, however both are presented here. Standard purging and sampling methods may be used at wells that are not amenable to low-flow purging, such as wells with short water columns and slow recharge.

Low-Flow Purging and Sampling

This SOP emphasizes the need to minimize stress by inducing low water level drawdowns and low pumping rates in order to collect samples with minimal alterations to water chemistry. While purging and sampling, accurate measurement of physical groundwater quality parameters in the field requires a closed system in which groundwater does not come in contact with air. Dissolved oxygen (DO), oxidation-reduction potential (ORP), and pH measurements in groundwater are sensitive to reactions with the atmosphere. The flow-through cell (flow cell) is used to measure field parameters when collecting groundwater water samples from a submersible or peristaltic pump. Stabilization of indicator field parameters is used to indicate that conditions are suitable for sampling to begin. A drawdown of less than 0.3 foot is desirable.

The following sequential steps are to be completed during groundwater sampling from monitoring wells:

1) Check well for security damage or evidence of tampering and record pertinent observations. Note any maintenance tasks that should be completed, such as well cap or padlock replacement.
2) Lay out a sheet of clean plastic sheeting (visqueen) around the well monument for monitoring and sampling equipment.
3) After removing the well cap, immediately measure the air space in the well bore for the presence of volatile organic compound (VOC) vapors using a photoionization detector.
4) Measure the depth to water and well total depth using an electronic water level indicator. All measurements should be referenced to a marked point on the well casing.
5) Using a safety cable, to minimize disturbance, slowly lower the pump (or intake of the disposable tubing if using a peristaltic pump) into the well to the midpoint of the zone to be sampled. Keep the pump at least 2 feet from the bottom of the well to minimize the mobilization of silt that may be present in the sump at the bottom of the well.
6) Start the pump at the lowest speed setting and slowly increase the speed until discharge occurs. Check the discharge rate. Pump rate should be reduced to the

minimum capability of the pump, which should be between 0.1 and 0.4 liters per minute (l/min). Do not allow the water level to fall below the pump intake or the pump may overheat.

7) During well purging, monitor the field parameters every three to five minutes. Purging is considered complete and sampling may begin when the field parameters have stabilized for three consecutive readings (taken at three to five minute intervals). These readings should be within the following limits:

Temperature:	3%
Conductance:	3%
pH:	+/- 0.1 pH units
DO	10% (or measurement <1 milligram per liter (mg/L)
ORP	+/- 10 millivolts

8) If after 30 minutes of purging indicator parameters have not stabilized, purging will be discontinued, and sample collection will proceed.

9) The water sample must be collected before the water passes through the flow cell. Disconnect the influent tubing from the flow cell and directly fill the sample containers. Turbidity of the sample water will be measured using field instruments prior to sample collection and upon obvious visual changes in turbidity during sample collection. Groundwater samples for dissolved metals analysis will be field-filtered with a 0.45-micron filter by placing the filter directly on the end of the discharge hose from the submersible or peristaltic pump. Alternatively, water will initially be collected in a poly bottle and then filtered using a peristaltic pump into the bottles that contain preservative. If multiple analytical tests are to be performed, collect samples in order of decreasing sensitivity to handling-introduced bias (i.e., VOCs, semivolatiles, and metals). Water should be directed down the inside walls of the bottles to minimize aeration.

10) All the sample bottles will be properly labeled, protected from breakage, placed in storage bags, and placed in a cooler on ice and packed for transport to the laboratory. Samples will be shipped to the laboratory within 48 hours of collection.

11) Discard the dedicated tubing as Investigation Derived Waste (IDW) after sampling.

12) Before securing the well, measure and record the water level.

13) Decontamination of sampling equipment is addressed in SOP - 3 Decontamination Procedure.

14) All field observations made, and data generated in conjunction with the sample collection, will be entered on a well-specific Groundwater Sampling Field Form (see Appendix B), dated, and signed by the field personnel.

15) Complete the chain-of-custody documentation after samples are collected, and before moving to the next well.

Standard Purge and Sampling Methods

The composition of water within the well casing and in close proximity to the well may not be entirely representative of the overall groundwater quality at the site. This is due to differing permeabilities, temperatures, and pressures between the area adjacent to the well (filter pack) and the surrounding aquifer. For these reasons, it is necessary that a well be evacuated of standing water before sampling. Purging the well clears the stagnant water from the well and allows the well to be recharged with true formation water. The following are the procedures followed for purging a well using standard (not low-flow) methods:

1) Note general conditions of the well. Check for security damage and evidence of tampering, and record pertinent observations. Note any maintenance tasks that should be completed, such as well cap or padlock replacement.

2) Lay out a sheet of clean plastic sheeting (visqueen) around the well monument for monitoring and sampling equipment.

3) After removing the well cap, immediately measure the air space in the well bore for the presence of VOC vapors using a photoionization detector.

4) Measure the depth to water and well total depth using an electronic water level indicator. All measurements should be referenced to a marked point on the well casing.

5) Using information on the total depth (TD) of the well, the diameter of the well casing, and the depth to water (DTW), the amount of water in one casing volume is calculated. The information below is used to determine the well volume fraction (WVF) in gallons per linear foot for the appropriate casing diameter.

2-inch casing:	0.163 gal/foot
4-inch casing:	0.653 gal/foot
6-inch casing:	1.5 gal/foot

   The minimum purge volume = (TD-DTW) x WVF x 3 (no. of casing volumes).

6) An amount of water equivalent to three casing volumes is purged from the well with a clean bailer or a pump. The amount purged depends on the recharge rate in the well. If a well is bailed dry before the required purge volume has been removed, the well is allowed to recover and then bailed dry again. It can be assumed that water returning to the well after the second bailing is true formation water, and no further purging is necessary.

7) Monitor physical parameters (temperature, pH, and specific conductance) during purging (after removal of each sequential casing volume) with a pump, or once following purging for bailed wells.

8) Turbidity of the sample water will be measured using field instruments prior to sample collection and upon obvious visual changes in turbidity during sample collection. Groundwater samples for dissolved metals analysis will be field-filtered

with a 0.45-micron filter. Water will initially be collected in a poly bottle, and then it will be filtered using a peristaltic pump into the bottles that contain preservative. Alternatively, the filter may be placed directly on the end of the discharge hose from the submersible pump, if used. If the well is purged dry, a sample will be collected as soon as adequate water has returned to the well to make sampling feasible. If multiple analytical tests are to be performed, collect samples in order of decreasing sensitivity to handling-introduced bias (i.e., VOCs, semivolatiles, and metals). A low-turbulence discharge device will be used to elute VOC samples from bailer into sample container. Water should be directed down the inside walls of the bottles to minimize aeration.

9) All the sample bottles will be properly labeled, protected from breakage, placed in storage bags, and placed in a cooler on ice and packed for transport to the laboratory. Samples will be shipped to the laboratory within 48 hours of collection.

10) Discard the dedicated tubing as IDW after sampling.

11) Before securing the well, measure and record the water level.

12) Decontamination of sampling equipment is addressed in SOP - 3 Decontamination Procedure.

13) All field observations made and data generated in conjunction with the sample collection will be entered on a well-specific Groundwater Sampling Field Form, dated, and signed by the field personnel.

14) Complete the chain-of-custody documentation after samples are collected, and before moving to the next well.

Well purge water will be stored in an appropriately labeled poly tank and transported from the generation point to the RP wastewater treatment system for discharge in accordance with the NPDES permit dated September 15, 2003. This will occur on the day of generation. The quantity of water discharged to the RP wastewater treatment system will be recorded on the 90-Day Investigation Derived Waste Log.

RP - PORTLAND SITE
SOP - 3
DECONTAMINATION PROCEDURE

1.0 PURPOSE

Decontamination of non-disposable equipment is performed at sites where environmental contamination is known or suspected. This is done to minimize the potential for cross-contamination between sampling locations (potentially resulting in unrepresentative samples and/or causing the spread of contamination) and also to protect human health and safety.

2.0 EQUIPMENT LIST

1) Deionized water
2) Plastic buckets
3) Spray bottles
4) Disposable rags or paper towels
5) Alconox, methanol, hexane
6) Potable water (can be replaced by deionized water)
7) Site map and site health and safety plan (HASP)
8) PPE appropriate for site (see HASP if applicable)

3.0 PROCEDURE

Sampling equipment (e.g., water samplers, flow cells, pumps, water level meter, etc.) will be decontaminated as follows:

1) Soap wash (dilute solution of Alconox or equivalent in potable water solution);
2) Potable water rinse;
3) Solvent rinse (methanol, hexane, or similar); and
4) Distilled/deionized water rinse.

If non-aqueous-phase liquid (NAPL) is encountered, probes and sounding tape will be wiped with a solvent-soaked towel during retrieval, and the equipment will be decontaminated with a solvent rinse as described above. For locations with NAPL or suspected NAPL, the sampling equipment used will be washed with hexane prior to the soap wash.

Decontamination fluids will be stored in an appropriately labeled tank and transported from the generation point to the RP wastewater treatment system for discharge in accordance with the NPDES permit dated September 15, 2003. This will occur on the day of generation. All decontamination fluids will be discharged to the RP wastewater treatment system because both hazardous and non-hazardous waste can be disposed of in the RP wastewater treatment system. The quantity of water discharged to the RP wastewater treatment system will be recorded on the 90-Day Investigation Derived Waste Log.

RP - PORTLAND SITE
SOP - 4
FIELD MEASUREMENT OF GROUNDWATER PARAMETERS

1.0 PURPOSE

Measurements of pH, oxidation-reduction potential (ORP), air and water temperature, conductivity, turbidity, ferrous iron, and dissolved oxygen concentrations will be obtained with calibrated instruments at all sample sites prior to sample collection.

2.0 EQUIPMENT LIST

1) Portable, battery-powered multiprobe equipment (e.g., YSI 650 MDS or YSI 610) with calibration solutions and instructions
2) Ferrous iron field test kit, stocked with reagents
3) Turbidity meter
4) Appropriate field forms for recording readings and/or field logbook with indelible pens
5) Knife or scissors
6) Decontamination equipment (see SOP - 3 Decontamination Procedure and sampling plan for additional site-specific requirements)
7) Site map and site health and safety plan (HASP), if applicable
8) PPE appropriate for site (see HASP if applicable)

3.0 PROCEDURE

Procedures for collection of specific field parameters are provided in the sections below.

Temperature, pH, Specific Conductance, DO, and ORP

Field measurements for temperature, pH, specific conductance, dissolved oxygen (DO), and ORP will be measured with portable, battery-powered instruments (e.g., YSI 650 MDS or YSI 610 D multiprobes). Procedures for calibration and measurements are outlined in the user manuals included with these instruments. At a minimum, these instruments will be calibrated once each day before sampling activities begin.

Turbidity

Turbidity will be measured once per well immediately prior to filling sample bottles, and upon obvious visual changes in turbidity during sample collection. Turbidity will be measured using appropriate portable, battery-powered field equipment and results will be recorded in nephelometric turbidity units (NTU). Dilution of the sample may be required for water with high turbidity.

Ferrous Iron (Fe2+)

Field measurement of ferrous iron (Fe2+) will be conducted using a colormetric technique, and will be completed during post-development groundwater sample collection as outlined in this FSP.

Summary of procedures for Fe2+ measurement:

- Wash all lab ware between tests with a non-abrasive detergent or solvent. Do not use paper towels on the plastic tubes, as this may scratch them.
- Rinse all tubes thoroughly with the sample water prior to testing.
- Fill a viewing tube to the first 5-ml line to be used as a blank.
- Place the blank tube in the top left opening of the color comparator.
- Fill the measuring vial to the 25-ml mark with the sample water.
- Use the supplied clippers to open the powder pillow.
- Add the contents of the powder pillow to the measuring vial.
- Swirl to mix and allow 3 minutes for full color development. An orange color will develop if Fe2+ is present.
- Fill a second viewing tube with the prepared sample from the measuring vial to the first 5-ml mark.
- Place the second tube in the top right opening of the color comparator.
- Hold the comparator up to a light source and rotate the color disk until the color matches in the two openings.
- Read the mg/L Fe2+ result in the scale window.
- Place the tested water into the container of investigation derived waste (IDW) and rinse the viewing tubes and the measuring vial with clean (deionized) water.

RP - PORTLAND SITE
SOP - 12
SOIL SAMPLING METHODOLOGY

1.0 PURPOSE

This procedure describes the general instructions for sampling of soils for various analyses in support of investigative activities at the RP site. Samples will be collected in accordance with the applicable field sampling plans (FSPs).

2.0 EQUIPMENT LIST

1) Shovel and stainless steel spoons or trowels
2) Soil sampling equipment: direct-push rig or stainless steel hand auger assembly
3) Appropriate field sampling form, field logbook, soil boring log sheets, sample identification matrix log sheets, and indelible pens
4) Camera and film
5) Photoionization detector (PID)
6) Hand held GPS unit
7) Survey stakes and ribbon
8) Sample containers, labels, coolers, and ice
9) Resealable 1-2 gallon and smaller (sandwich-size) plastic bags
10) Ultraviolet (UV) light and appropriate power supply
11) Hydrophobic dye test kit (Oil-in-Soil™)
12) Decontamination equipment (see SOP - 3 Decontamination Procedure and sampling plan for additional site-specific requirements)
13) Site map and site health and safety plan (HASP)
14) PPE appropriate for site (see HASP)

3.0 PROCEDURES

Surface Soil Sample Collection

1) Obtain sampling supplies and equipment and ensure appropriate sample containers are prepared and ready for sample collection.
2) Mobilize sampling equipment to appropriate sampling location.
3) Label the outer surface of a 1-2 gallon, double-bagged plastic bag with the boring identification (ID), sample interval, date, and time.

4) Use shovel, stainless steel hand auger, or direct-push core methods to obtain surface soil samples (0-1 foot below ground surface [bgs]). Then place representative soil into a 1-2 gallon, double-bagged plastic bag. Fill additional plastic bags for adequate sample volume as needed.

5) Transfer the bagged surface soil samples to the designated sample processing area. Disposable surfaces (e.g., plastic sheeting and/or aluminum foil) will be used to prevent cross contamination when handling soil samples.

NOTE: For locations where volatile organic compound analyses are being performed, transfer the soil sample directly into the appropriate sample container(s), then proceed with the following procedure, for the sampling of other analytes.

6) Transfer a representative portion of the soil into a double-bagged sandwich-sized plastic bag, enclosing air while sealing, for organic vapor and NAPL screening.

7) Mix the contents of the sandwich-sized bag well and allow equilibration to ambient temperature.

8) Insert PID into an opened corner of the sandwich-sized bag. Record vapor concentrations into the field logbook and reseal bags.

9) Inspect contents of the sandwich-sized bag for NAPL presence both visually and using an ultraviolet (UV) light. Record all observations on soil boring log sheets and in the appropriate field logbook.

NOTE 1: Squeezing any fluids present against the wall of the bag and holding the UV lamp nearby may refine this process. The addition of approximately 10 milliliter (mL) of DI water may also increase the ability to detect the NAPL residual fluorescence.

NOTE 2: The visible fluorescence emitted from chlorobenzene, a primary constituent of NAPL residual, is expected to appear milky white in color.

NOTE 3: When the visual and UV light screening results are inconclusive and NAPL residual is expected to be present, perform the hydrophobic-dye shake test using the procedure outlined in Section 5.0 below.

10) Transfer the remainder of the soil into the appropriate pre-cleaned and certified soil sample containers provided by the contract laboratory.

11) Record sample date, time, and sampler name on sample label and record in the field logbook and on the sample identification matrix log sheets.

12) Record samples on chain-of-custody forms and place in coolers.

13) Coordinate transportation to appropriate analytical laboratory(ies).

Subsurface Soil Sample Collection

1) Obtain sampling supplies and equipment and ensure appropriate sample containers are prepared and ready for sample collection.
2) Mobilize sampling equipment to appropriate sampling location.
3) Subsurface soil samples will be collected using the direct-push method or a hand auger.

NOTE: More than one boring may be necessary at each sampling location to obtain sufficient sample volume for all required analyses.

4) The first boring will be cored continuously from ground surface to total depth.
5) Log lithologic characteristics and screen for the presence of NAPL residual with this first continuous core. Record all observations on soil boring log sheets and in the appropriate field logbook.

NOTE 1: If NAPL residual is encountered the soil boring will be advanced until NAPL residual is no longer determined to be present.

NOTE 2: The on-site geologist will log the soils in accordance with the American Society for Testing and Materials (ASTM) method D 2488-90, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).

6) Transfer the soil samples to the designated sample processing area. Disposable surfaces (e.g. plastic sheeting and/or aluminum foil) will be used to prevent cross contamination when handling soil samples.

NOTE: For locations where volatile organic compound analyses are being performed, transfer the soil sample directly into the appropriate sample container(s), then procedure with the following procedure, for the sampling of other analytes.

7) Transfer a representative portion of the soil into a double-bagged sandwich-sized plastic bag, enclosing air while sealing, for organic vapor and NAPL screening.
8) Mix the contents of the sandwich-sized bag well and allow equilibration to ambient temperature.
9) Insert PID into an opened corner of the sandwich-sized bag. Record vapor concentrations into the field logbook and reseal bags.

10) Inspect contents of the sandwich-sized bag for NAPL presence both visually and using a UV light. Record all observations on soil boring log sheets and in the appropriate field logbook.

11) Subsequent borings are then advanced to the specified depth using direct-push core sampling or stainless steel hand auger systems.

12) If direct-push polycarbonate core liners are used: cap both ends of the liner, label, and transfer to the sample processing area. Again, disposable surfaces (e.g., plastic sheeting and/or aluminum foil) will be used to prevent cross contamination when handling soil samples.

NOTE: Soil samples collected from different boreholes but at the same depth interval will be composited prior to transferring to individual sample containers. The soil samples will be placed into a double-bagged two-gallon plastic bag, sealed, and well mixed creating one representative sample.

13) Transfer the representative soil into the appropriate pre-cleaned and certified containers provided by the contract laboratory.

14) Record sample date, time, and sampler name on sample label and record in field logbook and on the sample identification matrix log sheets.

15) Coordinate transportation to appropriate analytical laboratory(ies).

16) Mark the top of the borehole with a labelled wooden lathe and flagging in order to facilitate surveying activities, or use hand-held GPS equipment to record the location of the sample.

4.0 HYDROPHOBIC-DYE SHAKE TEST (Oil-in-Soil™)

1) Transfer to test vial and fill to mark on test vial and break soil up if clayey;

2) Label the test vial with the boring ID, sample interval, date, and time;

3) Add water to mark on test vial;

4) Shake the contents of the tube for 10 to 30 seconds; and

5) Examine the tube for the presence of NAPL residual and record the results in the field logbook.

NOTE: The Sudan IV is expected to dye organic fluids or NAPL residual red upon contact. The bead will turn red or pink if hydrocarbons are present.

RP - PORTLAND SITE
SOP - 13
INVESTIGATION-DERIVED WASTE MANAGEMENT PROCEDURES

1.0 PURPOSE

To promote proper and consistent handling, storage, and disposal of waste generated during field investigations, and to prevent or minimize the potential for the spread of contamination, creation of sanitary hazards, or visual degradation of the RP site through the spread of litter.

2.0 EQUIPMENT LIST

1) Site-specific Health and Safety Plan (HASP), including site map
2) Personal Protective Equipment (PPE) appropriate for the tasks to be performed, and material to which contact will occur (see HASP)
3) 90-Day Investigation-Derived Waste Log form (attached)
4) Daily Water Disposal Log form (attached)
5) Field notebook
6) Waste labels
7) Indelible ink pens
8) Heavy duty plastic sacks
9) Plastic film bags
10) Portable water storage tank
11) Department of Transportation (DOT)-approved, removable head, 55-gallon steel drums
12) Drum liners
13) On-site, chemical-resistant container with secondary containment (e.g., 30-gallon, Teflon®-bonded, hard-top steel drum with volumetric gauge contained with secondary containment and cover, and large dedicated funnel), capable of storing non-aqueous phase liquid (NAPL)
14) A portable, chemical-resistant container with secondary containment (e.g., 3-gallon Teflon®-bonded steel container within a 5-gallon bucket), capable of storing NAPL
15) Manifest forms appropriate for oversight of waste transport

3.0 PROCEDURES

Wastes generated during field investigations may include decontamination fluid, purged groundwater, PPE, soil, disposable sampling equipment, NAPL, and/or other hazardous and non-hazardous wastes. Generated waste, other than decontamination fluid and purge water, will be sorted by media type, boring or excavation location, investigation area, and/or investigation event, then packaged in drums and stored in the RP waste storage facility (WSF). A temporary label will be affixed to each container of waste (see Section 3.7). If any field tests are run and/or free water is removed, a description of the tasks performed will be recorded in a field logbook to aid in the safe packaging, handling, and storage of wastes.

3.1 Decontamination Fluid and Purge Water

Decontamination fluid and purge water generated during decontamination or sampling activities will be contained in 5-gallon buckets that are placed on a plastic liner and transferred to an appropriately labeled portable tank located in the back of a field truck for transport to the RP wastewater treatment plant (WTP). Decontamination fluids and purge water, hazardous and non-hazardous, will be transported from the generation point to the RP WTP for discharge in accordance with the NPDES permit renewal granted to RP on September 15, 2003. This will occur on the day of generation. The quantity of water discharged to the WTP will be recorded on the Daily Water Disposal Log.

3.2 Personal Protective Equipment

All disposable health and safety PPE (Tyvek® suits, Nitrile gloves, etc.) will be collected and stored in heavy-duty, plastic sacks and transported to the WSF on the same day it was generated. The sacks with discarded PPE will be placed in DOT-approved UN-1A2 removable head steel drums, lined with plastic film bags, for storage. The quantity and origin of PPE placed in the WSF will be recorded daily on the 90-Day Investigation-Derived Waste Log. Following waste characterization, the PPE will be transported to an off-site treatment, storage, and disposal facility (TSDF) for treatment, as necessary, and for final disposition of the waste according to applicable state and federal laws.

3.3 Soil Cuttings and Core Liners

Soil cuttings and associated disposable sampling equipment (e.g., core liners) generated during sampling activities will be packaged in DOT-approved UN-1A2 removable head steel drums, lined with plastic film bags. Soil generated from boring operations typically contains free water at the time of generation. Immediately following initial placement of the soil cuttings and/or core liners in drums, free water often ponds on top of the waste material. The free water will be removed and disposed of, at the WTP. Drums containing soil cuttings and core liners will be transported from the generation point to the WSF during the day of generation. The approximate percentages of soil versus debris, and types of debris material in each drum receiving waste, will be recorded, on a daily basis, as field notes for each container. The quantity (estimated weight and percent of drum capacity remaining) of soil cuttings and core liners placed in the WSF will be recorded daily on the 90-Day Investigation-Derived Waste Log.

Free water may separate from the soil cuttings upon standing in drum during storage. Prior to shipping the investigation-derived waste off-site for treatment and/or disposal, free water will be removed and transferred to the WTP, and /or an appropriate absorbent material (e.g., vermiculite) will be added. Following waste characterization, the soil cuttings and core liners will be transported to an off-site TSDF for treatment, as necessary, and for final disposition of the waste according to applicable state and federal laws.

3.4 NAPL and NAPL/Fluid Mixtures

NAPL and NAPL/fluid mixtures generated during field activities will be placed in a portable, chemical-resistant container within secondary containment for transport from the area of generation to the WSF. Inside the WSF, the contents of the portable container will be transferred to a stationary 55-gallon chemical-resistant container with secondary containment using a dedicated, industrial-sized funnel with a flip-top reclosable lid. Transport of NAPL and/or NAPL/fluid mixture to the WSF will occur on the day of generation. The quantity of NAPL and NAPL/fluid mixture placed in the WSF will be recorded daily on the 90-Day Investigation-Derived Waste Log.

3.5 Disposable Sampling Equipment

Disposable sampling equipment (disposable bailers, plastic tubing, etc.) to which little or no soil is adhered, will be collected and placed in plastic film bags and transported to the WSF on the day of generation. The bags will be placed in DOT approved UN 1A2 removable head steel drums. The quantity of disposable sampling equipment placed in the WSF will be recorded daily on the 90-Day Investigation-Derived Waste Log. Following waste characterization, the disposable sampling equipment will be transported to an off-site TSDF for treatment, as necessary, and for final disposition of the waste according to applicable state and federal laws.

3.6 Miscellaneous Solid Wastes

Non-hazardous wastes that may be generated during field activities include paper, food containers and wrapping, aluminum cans, bottles, plastic bags, and other miscellaneous debris. This material will be contained in heavy duty plastic sacks for daily disposal in approved sanitary waste receptacles.

3.7 Temporary Container Labeling

Immediately upon placement of waste in a drum, a temporary label with the language, "This container on hold pending analysis. Do not tamper with container. Authorized personnel only," will be applied. Information that will be added to the temporary label will include:

1) The accumulation start date;

2) The event name;

3) Waste origin (i.e., boring or excavation location, investigation area, etc.);

4) Media type (e.g., PPE and debris, soil, etc.); and

5) A unique identification (ID) number. **NOTE*** the unique ID number should be obtained from the Task Leader, who is responsible for maintaining the waste management records, including an inventory of the hazardous wastes stored in the WSF.

3.8 Waste Characterization

Wastes are characterized in accordance with the RP Waste Analysis Plan. Collection of additional samples for use in waste characterization depends on the availability of analytical results. If samples appropriate to characterize the waste stream were collected during investigation activities, then additional samples of the waste will not be collected. If no samples, or insufficient samples, were collected during investigation activities, then a representative sample will be collected from the drum(s) of the affected waste stream. Efforts should be made to schedule sample collection activities to occur at the time the waste is placed in the WSF, before field investigation activities are completed.

3.9 Record-Keeping and Labeling

Upon transfer of waste to the hazardous waste storage area within the WSF, a 90-Day Investigation-Derived Waste Log will be initiated. At the end of each day, for each drum receiving waste that day, a record that includes the area/location of waste, type of waste, amount of waste added, and the remaining capacity in each drum will be entered into the log. An adhesive, temporary label completed using an indelible marker, as described in Section 3.7, will be affixed to the upper 1/3 side of the container, such that the label can be read without moving the container.

If, using analytical results and process knowledge, a waste is characterized as hazardous, then a hazardous waste label will be applied to the packaging in which the waste is contained. The temporary label will be removed or covered. If it is not possible to remove the temporary label, it will be rendered illegible with spray paint. SOP - 21 provides further instruction.

90-DAY INVESTIGATION-DERIVED WASTE LOG
RP - Portland Site

Container Number	Accum. Start Date	Area/location(s)		Types of Waste[1]	Field Event	Samples Collected from Waste? (Yes or No)	% Volume by Waste Type	Remaining Capacity of Container (%)[2]
Example: 204	*4/22/2002*	*NRA*	*RP-07-S*	*drill cuttings*	*Spring 2005 GW*	*N*	*20% soil, 80% PPE and/or debris*	*50%*

Notes:

LA = Lake Area

IA = Insecticide Area

HA = Herbicide Area

NRA = Non-RP – Portland Site Area

[1] Waste types fall into the following three categories: soil (silt, sand, gravel, etc), PPE (gloves, tyvek suits, respirator filters), and debris (wood, paper, plastic, broken sample bottles)

2

DAILY WATER DISPOSAL LOG
RI/FS
RP - Portland Site

Date	Area/Location(s)		Type of Waste	Activity Description	Volume Generated/Transferred* (Give Units of Measure)
Example: 4/22/2002	***LA***	***RP-04-16***	***Purge Water***	***Fall 2001 GW***	***15 gallons***

Notes:

LA = Lake Area
IA = Insecticide Area
HA = Herbicide Area
NRA = Non-RP – Portland Site Area

RP - PORTLAND SITE
SOP - 14
METHODOLOGY FOR MONITORING WELL DEVELOPMENT

1.0 PURPOSE

Monitoring wells are constructed in a manner to minimize infiltration of silt or other particles from entering the well, and to minimize the creation of subsurface conduits to groundwater. Monitoring wells are developed following installation to flush out particles that may remain after installation and to ensure that the well is in communication with the surrounding formation.

2.0 EQUIPMENT LIST

1) Photo-ionization detector (PID)
2) Blank Well Development Log form, other site-specific form (as appropriate), and field logbook with indelible pens
3) Electronic water level probe
4) Well construction details
5) Surge block
6) Submersible pump, pump controller, and power source (e.g., generator)
7) Portable turbidity meter and power source (e.g., charged batteries)
8) Containers for containing purged well development water
9) Site map and site health and safety plan (HASP), if applicable
10) PPE appropriate for site (see HASP if applicable)

3.0 PROCEDURE

Well development should accomplish the following objectives: 1) removal of fine materials from the well (both the filter pack and the casing); 2) removal of smeared formation mud on the sides of the bore hole from drilling augers; 3) removal of drilling fluids or surface contamination that may have been introduced during drilling; and 4) removal of water introduced into the boring to aid in drilling, cuttings removal, or monitoring well installation.

1) Surge the well vigorously with a surge block over the entire length of the well screen. The purpose of the surging is to: 1) break up accumulations of fine materials in the bottom of well casing, and 2) force water back and forth to settle the sand pack.

2) Place a submersible pump or other appropriate pump in the well, near the bottom of the well. The well should be pumped aggressively until well is pumped dry or until discharge is clear. The drawdown of the groundwater and an approximate average pumping rate are noted during and at the completion of the development. Repeat steps 1 and 2 about 3 times or until no further improvement in water clarity is visible.

   A well volume is calculated by adding the volume of water in the casing to the volume of water in the filter pack. Filter pack volume is calculated by multiplying the volume of the annulus between the casing and the borehole by (0.3). This value (0.3) allows for the space occupied by the sand (8-12 and 10-20 grain sizes) in the annulus. A minimum of five well volumes of water should be removed from the well. If water was added to the well during installation, that amount of water should be removed from the well in addition to the five well volumes.

3) The most obvious indication of well development is the clarity of the discharge water. Ideally, the groundwater turbidity should be reduced to 5 nephelometric turbidity units (NTUs) upon completion of development.

4) Monitoring well development activities should be recorded on the Well Development Log and the field logbook. Information recorded should include methods used, volume of water removed, and turbidity readings.

5) Purge water will be stored in an appropriately labeled tank and transported from the generation point to the RP wastewater treatment system for discharge in accordance with the NPDES permit modification granted to RP on September 15, 2003. This will occur on the day of generation. All purge water will be discharged to the RP wastewater treatment system because both hazardous and non-hazardous waste can be disposed of in the RP wastewater treatment system. The quantity of water discharged to the RP wastewater treatment system will be recorded on the 90-Day Investigation Derived Waste Log.

RP - PORTLAND SITE
SOP - 14
METHODOLOGY FOR MONITORING WELL DEVELOPMENT

1.0 PURPOSE

Monitoring wells are constructed in a manner to minimize infiltration of silt or other particles from entering the well, and to minimize the creation of subsurface conduits to groundwater. Monitoring wells are developed following installation to flush out particles that may remain after installation and to ensure that the well is in communication with the surrounding formation.

2.0 EQUIPMENT LIST

1) Photo-ionization detector (PID)
2) Blank Well Development Log form, other site-specific form (as appropriate), and field logbook with indelible pens
3) Electronic water level probe
4) Well construction details
5) Surge block
6) Submersible pump, pump controller, and power source (e.g., generator)
7) Portable turbidity meter and power source (e.g., charged batteries)
8) Containers for containing purged well development water
9) Site map and site health and safety plan (HASP), if applicable
10) PPE appropriate for site (see HASP if applicable)

3.0 PROCEDURE

Well development should accomplish the following objectives: 1) removal of fine materials from the well (both the filter pack and the casing); 2) removal of smeared formation mud on the sides of the bore hole from drilling augers; 3) removal of drilling fluids or surface contamination that may have been introduced during drilling; and 4) removal of water introduced into the boring to aid in drilling, cuttings removal, or monitoring well installation.

1) Surge the well vigorously with a surge block over the entire length of the well screen. The purpose of the surging is to: 1) break up accumulations of fine materials in the bottom of well casing, and 2) force water back and forth to settle the sand pack.

2) Place a submersible pump or other appropriate pump in the well, near the bottom of the well. The well should be pumped aggressively until well is pumped dry or until discharge is clear. The drawdown of the groundwater and an approximate average pumping rate are noted during and at the completion of the development. Repeat steps 1 and 2 about 3 times or until no further improvement in water clarity is visible.

   A well volume is calculated by adding the volume of water in the casing to the volume of water in the filter pack. Filter pack volume is calculated by multiplying the volume of the annulus between the casing and the borehole by (0.3). This value (0.3) allows for the space occupied by the sand (8-12 and 10-20 grain sizes) in the annulus. A minimum of five well volumes of water should be removed from the well. If water was added to the well during installation, that amount of water should be removed from the well in addition to the five well volumes.

3) The most obvious indication of well development is the clarity of the discharge water. Ideally, the groundwater turbidity should be reduced to 5 nephelometric turbidity units (NTUs) upon completion of development.

4) Monitoring well development activities should be recorded on the Well Development Log and the field logbook. Information recorded should include methods used, volume of water removed, and turbidity readings.

5) Purge water will be stored in an appropriately labeled tank and transported from the generation point to the RP wastewater treatment system for discharge in accordance with the NPDES permit modification granted to RP on September 15, 2003. This will occur on the day of generation. All purge water will be discharged to the RP wastewater treatment system because both hazardous and non-hazardous waste can be disposed of in the RP wastewater treatment system. The quantity of water discharged to the RP wastewater treatment system will be recorded on the 90-Day Investigation Derived Waste Log.

RP - PORTLAND SITE
SOP - 22
DATA LOGGER AND TRANSDUCER INSTALLATION PROCEDURES

1.0 PURPOSE

To collect water pressure data from monitoring well locations that can be used to compute groundwater elevations. Water levels may be collected manually with an electronic water level probe or automatically with a pressure transducer and associated data logger. This standard operating procedure (SOP) is specific to pressure transducers and associated data logger. Generally, this method is used if continuous water level data is required, and at wells where non-aqueous phase liquid (NAPL) is suspected or present.

2.0 EQUIPMENT LIST

1) Photo-ionization detector (PID) for environmental sites
2) Well lock keys
3) Blank Data Logging Worksheet Form, other site-specific form, and/or field logbook with indelible pens
4) Electronic water level probe
5) Pressure transducer
6) Data logger with charged batteries
7) Laptop computer, software, and charged battery with accessories (i.e., disks, power inverter, etc.)
8) Duct tape and/or zip ties
9) Knife or scissors
10) Decontamination equipment (see SOP - 3 Decontamination Procedure and sampling plan for additional site-specific requirements)
11) Site map and site health and safety plan (HASP)
12) Personal protective equipment appropriate for site (see HASP if applicable)

3.0 PROCEDURE

Pressure transducers and data loggers should be installed based on manufacture’s recommendations. Basic pressure transducer installation procedures are discussed below. Specific data logger programming requirements should follow manufacture’s directions.

1) Record the pressure transducer and data logger serial number and well identification on the Data Logging Worksheet Form.

2) Measure the static water level to the nearest 0.01-foot using the electronic water level indicator before installing the pressure transducer following the Water Level Determination provided in SOP - 1.

3) Confirm that the pressure rating for the transducer is appropriate for the planned installation conditions. As a rule, the water column above the transducer (in feet) should not exceed two times the transducer pressure rating (in pounds per square inch [psi]) (e.g., a 30 psi transducer should not be installed in more than 60 feet of water). Consider the magnitude of the groundwater level fluctuations when evaluating the transducer installation depth.

4) Install the pressure transducer in the well.

5) Secure the pressure transducer cable to the outside of the well with duct tape or zip ties in a manner that will ensure the pressure transducer position in the well will not change. Note that the water level will rise in the well with insertion of the pressure transducers components. Allow the water level to return to static conditions, and confirm this using the electronic water level indicator.

6) Program the data logger to collect measurements at the appropriate intervals for the appropriate amount of time. Record the static water level, sensor reading, and time of the readings on the Data Logging Worksheet Form following start up of the data logging process.

7) Once the recording period has been completed, record the static water level, sensor reading, and time of the readings on the Data Logging Worksheet Form.

8) Download the sensor readings according to manufacture's instructions. Record the file name on the Data Logging Worksheet Form.

9) Once the data logger has successfully been downloaded, remove the pressure transducer and secure the well.

RP - Portland Site
SOP - 23
GROUNDWATER SAMPLING, DIRECT-PUSH METHOD

1.0 PURPOSE

Direct-push groundwater sampling methods are used to obtain one-time groundwater samples from very specific depths. Analytical data from direct-push groundwater samples are used to characterize groundwater quality at a point in time, and often are used to determine future monitoring well locations. A mobile direct-push rig is used to advance sampling equipment and retrieve samples.

2.0 EQUIPMENT LIST

1) Photo-ionization detector (PID)
2) Blank Boring Log Form, other site-specific form, and/or field logbook with indelible pens
3) Electronic water level probe
4) Decontamination equipment (SOP - 3, Decontamination Procedure, and sampling plan for additional Site-specific requirements)
5) Site map and Site health and safety plan (HASP), if applicable
6) Personal protective equipment (PPE) appropriate for Site (see HASP if applicable)
7) Sample containers, labels, packaging material

3.0 PROCEDURE

The direct-push groundwater sampling performed during the investigation is accomplished using a direct-push rig (e.g., Geoprobe®). The tool used for direct-push groundwater sampling is a 4-foot section of slotted stainless steel screen. The sampler is pushed/hammered to the desired sampling depth with a disposable point at the base of the rod. The screen is inside the steel drive rods and does not contact soil or groundwater while it is being driven. After the base of the desired sampling interval is reached, the drive rods are pulled back 4 feet. The screen is then pushed out below the base of the drive rods into the sampling interval. A groundwater sample is collected using a section of disposable polyethylene tubing equipped with a contained check ball assembly as described below.

Prior to sampling, the direct-push screen and rod “temporary well” may be developed using a peristaltic or vacuum pump in an effort to clear out some of the fine material in the screened interval. The amount of groundwater purged prior to sampling is dependent on aquifer and field conditions. When sampling for volatile organic compounds (VOCs), the pump is disconnected and the sample is collected using a check ball as described below.

The following procedures are adhered to during direct-push groundwater sampling operations:

1. Attach a contained check ball assembly to the end of the polyethylene tubing. Slowly lower the tubing until it contacts the water surface. Slowly push the tubing into the water column, allowing it to fill with a minimum of surface disturbance.
2. Connect the tubing to the peristaltic pump and purge the desired amount of groundwater. To collect a VOC groundwater sample, disconnect the tubing from the pump and raise it to the surface. The tubing should not come into contact with the ground or other potentially contaminated area. The check ball assembly should keep the water in the tubing.
3. Carefully fill each VOC sample container, making an effort to minimize sample turbulence. Water should be directed down the inside walls of the bottles to minimize aeration. Repeat the sample retrieval procedure until a sufficient sample volume for VOC analysis is acquired.
4. After completing VOC sample collection, place the tubing back in the boring. Sufficient sample volume to fill all other sample containers is then pumped from the boring using a vacuum or peristaltic pump.
5. Handle samples according to procedures in the project specific Field Sampling Plan. All the sample bottles will be properly labeled, protected from breakage, placed in storage bags, and placed in a cooler on ice and packed for transport to the laboratory. Ship samples to the laboratory within 48 hours of collection.
6. Discard the disposable sample tubing after sampling.
7. Decontaminate sampling equipment as described in SOP - 3, Decontamination Procedures.
8. Complete field documentation according to procedures in the project specific Field Sampling Plan. All field observations made and data generated in conjunction with the sample collection will be entered on a Boring Log Form and field logbook, dated, and signed by the field personnel. Complete the chain-of-custody documentation after samples are collected, and before moving to the next location.

RP - Portland Site
SOP - 24
DISCRETE GROUNDWATER SAMPLING DURING DRILLING

1.0 PURPOSE

Discrete groundwater sampling methods are used to obtain one-time groundwater samples from a specific depth during drilling activities. Analytical data from these discrete groundwater samples are used to characterize groundwater quality at a point in time. A mobile hollow-stem auger, air rotary rig, or sonic rig is used to drill to the desired sampling depth.

2.0 EQUIPMENT LIST

1) Photo-ionization detector (PID)
2) Blank Boring Log Form, other site-specific form, and/or field logbook with indelible pens
3) Electronic water level probe
4) Knife or scissors
5) Decontamination equipment (SOP - 3, Decontamination Procedures, and sampling plan for additional Site-specific requirements)
6) Site map and Site health and safety plan (HASP)
7) Personal protective equipment appropriate for Site (see HASP if applicable)
8) Submersible pump, well point, and inflatable packer assembly, and associated pump equipment (controller, connectors, power cord, etc.)
9) Generator and fuel (if electric pump is used)
10) Air compressor or manual pump (for inflating packer)
11) Disposable discharge tubing
12) Buckets or other containers for purged water
13) Sample containers, labels, packaging material

3.0 PROCEDURE

Discrete groundwater samples are collected using a modified stainless steel well point, submersible pump, and inflatable packer assembly. The submersible pump and well point screen extend through the middle and beyond the base of the inflatable packer. The packer provides a watertight seal. This groundwater sample method allows groundwater to be drawn from the bottom of a selected interval, while sealing off water from above, providing a discrete groundwater sample from the bottom of the auger or casing. The auger/casing is pulled up approximately 1 foot and the exposed portion of the boring is where a discrete groundwater sample is collected. In some cases, the auger/casing cannot be pulled up and the groundwater is sampled from the bottom of the open auger/casing.

1. At each selected groundwater sampling interval, lower the packer/pump/well assembly to the bottom of the boring through the center of the auger or casing. Place it in the exposed portion of the boring or just at the bottom of the auger/casing.

2. Once the assembly is at the bottom of the boring, inflate the packer inside the auger flight or casing to prevent water above the packer assembly from commingling with water below the packer assembly.

3. Purge the water from the bottom of the boring below the inflatable packer assembly using the submersible pump situated inside the stainless steel well point at the base of the packer assembly. As the pump is purging, lower a water level probe to measure the depth of the water above the packer, to make sure that there is a seal and that the water from above is not being drawn down by the pump.

   Calculate the purge amount using the distance between the bottom of the packer and the bottom of the boring and the diameter of the boring. This should be a minimal distance of approximately 3 to 5 feet. Three borehole volumes will be purged plus any additional water that has been introduced into the boring during drilling.

   1 borehole volume = linear feet 3 conversion factor

Borehole Diameter	Conversion Factor
7.25	2.14 gallons/foot
8.25	2.78 gallons/foot
10.25	4.29 gallons/foot
12.25	6.13 gallons/foot

4. Following purging, collect groundwater samples using the submersible pump and disposable discharge tubing.

   If multiple analytical tests are to be performed, collect samples in order of decreasing sensitivity to handling-introduced bias (i.e., volatile organic compounds, semivolatiles, and metals). Water should be directed down the inside walls of the bottles to minimize aeration.

   Groundwater samples for dissolved metals analysis will be field-filtered with a 0.45-micron filter by placing the filter directly on the end of the discharge hose from the submersible or peristaltic pump. Alternatively, water will initially be collected in a disposable plastic sample bottle and then filtered using a peristaltic pump into the bottles that contain preservative.

5. Handle samples according to procedures in the project specific Field Sampling Plan. All the sample bottles will be properly labeled, protected from breakage, placed in storage bags, and placed in a cooler on ice and packed for transport to the laboratory. Ship samples to the laboratory within 48 hours of collection.

6. Following completion of groundwater sampling at each discrete interval, deflate the packer and retract the sampling apparatus from the inside of the augers. Resume drilling until the next discrete sampling interval is reached.

7. Decontaminate sampling equipment as described in SOP - 3, Decontamination Procedures. Decontaminate the pump and packer assembly between each sampling location and sampling interval and install new tubing.

8. Complete field documentation according to procedures in the project specific Field Sampling Plan. All field observations made and data generated in conjunction with the sample collection will be entered on the Boring Log Form and field logbook, dated, and signed by the field personnel. Complete the chain-of-custody documentation after samples are collected, and before moving to the next location.

APPENDIX A-2

Forms

Test Boring Log Form

Well Development Log

Water Level and NAPL Thickness Measurement Form

Soil Sampling Field Form

Groundwater Sampling Field Form

Sample Identification Matrix Form

Data Logging Worksheet Form

LOCATION

WEATHER

amec Earth & Environmental

TEST BORING LOG

HOLE NO.

SHEET ____ OF ____

TOTAL DEPTH

DATE BEGUN

DATE COMPLETED

SAMPLING

GROUNDWATER TABLE

ATD=AT TIME OF DRILLING AB=AFTER BORING

DEPTH IN FEET

TIME

DATE

PROJECT NAME

PROJECT NUMBER

GEOLOGIST/ENGINEER

DRILLING CONTACTOR/CREW

METHOD USED

SAMPLING METHOD: SPT=STANDARD PENETRATION TEST T=TUBE R=RING

SAMPLING METHOD	SAMPLE NUMBER	BLOW COUNT	DEPTH SAMPLED	RECOVERY	DEPTH IN FEET	SOIL DESCRIPTION
					0	
					1	
					2	
					3	
					4	
					5	
					6	
					7	
					8	
					9	
					0	
					1	
					2	
					3	
					4	
					5	
					6	
					7	
					8	
					9	
					0	

BORING LOG SUMMARY

amec
Earth & Environmental

MONITORING WELL AS-BUILT REPORT

PROJECT No. ____________________

LOCATION ____________________

PROJECT NAME ____________________

OBSERVED BY ____________________

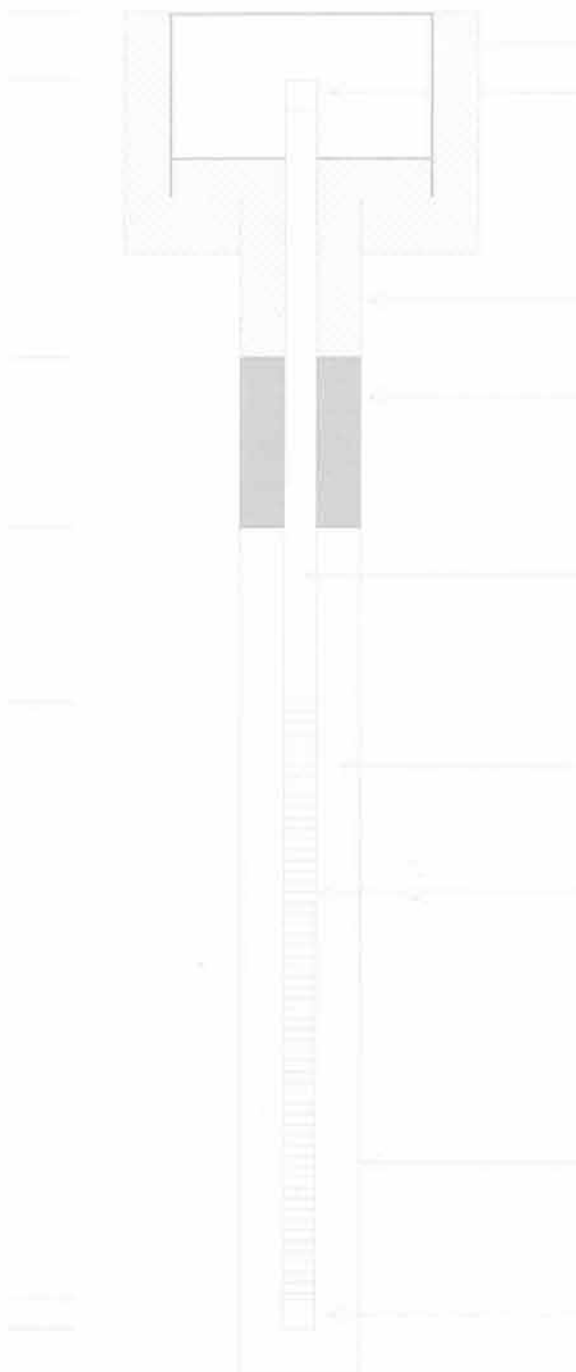
BORING/WELL I.D. ____________________

DRILLER/INSTALLER ____________________

DATE ____________________

START CARD#/ WELL TAG I.D.# ____________________

SOIL TYPE **DEPTH**



ABOVE GROUND RISER HEIGHT (IF APPLICABLE) ____________________

MONUMENT TYPE (IF APPLICABLE) ____________________

WELL CAP TYPE ____________________

GROUT TYPE/#SACKS ____________________

BENTONITE SEAL /#SACKS ____________________

WELL CASING I.D. ____________________

TYPE OF CASING ____________________

TYPE OF CONNECTION ____________________

FILTER PACK / SIZE/ #SACKS ____________________

WELL SCREEN I.D. ____________________

TYPE OF SCREEN ____________________

SLOT SIZE ____________________

DIAMETER OF BOREHOLE ____________________

ENDCAP TYPE ____________________

REMARKS ____________________

amec

WELL DEVELOPMENT LOG

Project Name: ______________________ Project Number: ____________

Date: __________ Completed By: ________________

Well Name: ______________ ____

Well Development Method: ____

Contractor Name: ______________________________

Static Water Level Before Development (ft): ____________ Depth of Well (toc): ________________

Inside Diameter (in): ____________ Volume of Water in Filter Pack and Well (gal): __________

Time Start Development: ____________

Sediment in Well Bottom (in): Start: ________ Finish: ________

Time Start Development: ______________

Time	Pumping Rate	Surveyed (Y/N)	Total Volume	Turbidity (NTU)	Notes

Volume of Water Removed from Well (gal): ____________

Time Complete Development: ____________

Static Water Level After Development (ft): ____________

Notes:

Water Level and NAPL Thickness Measurement Form
RP - Portland

Monitoring Well	%LEL		PID (ppm)		Depth to Water Level (TOC-ft)	Observation of LNAPL or Sheen Detected	Depth to LNAPL (TOC-ft)	LNAPL Thickness (ft)	Total Depth (TOC-ft)	Observation of DNAPL	Depth to DNAPL (TOC-ft)	DNAPL Thickness (ft)	Date and Time of Measurement	Recorded by
	Back-ground	In Well Casing	Back-ground	In Well Casing										
AL2-17														
AL2-32														
AL2-46														
AL4-47														
AL5-19														
AL5-35														
AL5-62														
AL6-96														
ASW-01A														
ASW-04														
ASW-05														
ASW-06														
ASW-08														
BST2W-61														
BST5W-74														
BTB-4A-84														
BTB-4B-25														
BTB-4B-55														
KM-MW-2														
KM-MW-5														

Water Level and NAPL Thickness Measurement Form
RP - Portland

Monitoring Well	%LEL		PID (ppm)		Depth to Water Level (TOC-ft)	Observation of LNAPL or Sheen Detected	Depth to LNAPL (TOC-ft)	LNAPL Thickness (ft)	Total Depth (TOC-ft)	Observation of DNAPL	Depth to DNAPL (TOC-ft)	DNAPL Thickness (ft)	Date and Time of Measurement	Recorded by
	Back-ground	In Well Casing	Back-ground	In Well Casing										
MW-01-26														
MW-01-41														
MW-01-56														
MW-01-76														
MW-02-26														
MW-02-46														
MW-02-62														
MW-03-27														
MW-03-49														
MW-03-68														
MW-03-S														
MW-03-I														
MW-03-81														
MW-04-27														
MW-04-47														
MW-04-63														
MW-05-24														
MW-05-34														
MW-05-52														
MW-05-70														
MW-06-S														

Water Level and NAPL Thickness Measurement Form
RP - Portland

Monitoring Well	%LEL		PID (ppm)		Depth to Water Level (TOC-ft)	Observation of LNAPL or Sheen Detected	Depth to LNAPL (TOC-ft)	LNAPL Thickness (ft)	Total Depth (TOC-ft)	Observation of DNAPL	Depth to DNAPL (TOC-ft)	DNAPL Thickness (ft)	Date and Time of Measurement	Recorded by
	Back-ground	In Well Casing	Back-ground	In Well Casing										
MW-07-S														
MW-08-27														
MW-08-46														
MW-08-64														
MW-09-23														
MW-09-42														
MW-09-58														
MW-09-80														
MW-10-24														
MW-10-44														
MW-10-57														
MW-11-24														
MW-11-37														
MW-11-56														
MW-11-79														
MW-12-27														
MW-12-41														
MW-12-59														
MW-12-79														
MWA-3														
MWA-5														
MWA-9i														
MWA-13d														
MWA-14i														

Water Level and NAPL Thickness Measurement Form
RP - Portland

Monitoring Well	%LEL		PID (ppm)		Depth to Water Level (TOC-ft)	Observation of LNAPL or Sheen Detected	Depth to LNAPL (TOC-ft)	LNAPL Thickness (ft)	Total Depth (TOC-ft)	Observation of DNAPL	Depth to DNAPL (TOC-ft)	DNAPL Thickness (ft)	Date and Time of Measurement	Recorded by
	Back-ground	In Well Casing	Back-ground	In Well Casing										
MWA-17si														
MWA-21b														
P-07														
P-10														
P-11														
PP-08														
PP-11														
PZ-02-40														
PZ-1-11														
RP-01-31														
RP-01-51														
RP-01-65														
RP-02-31														
RP-02-49														
RP-02-66														
RP-03-30R														
RP-03-52R														
RP-04-16														
RP-04-41														
RP-05-16														
RP-06-30														
RP-06-87														

Water Level and NAPL Thickness Measurement Form
RP - Portland

Monitoring Well	%LEL		PID (ppm)		Depth to Water Level (TOC-ft)	Observation of LNAPL or Sheen Detected	Depth to LNAPL (TOC-ft)	LNAPL Thickness (ft)	Total Depth (TOC-ft)	Observation of DNAPL	Depth to DNAPL (TOC-ft)	DNAPL Thickness (ft)	Date and Time of Measurement	Recorded by
	Back-ground	In Well Casing	Back-ground	In Well Casing										
RP-07-30														
RP-07-55														
RP-07-84														
RP-07-119														
RP-08-A														
RP-08-B														
RP-08-S														
RP-09-A														
RP-09-B														
RP-09-S														
RP-10-A														
RP-10-B														
RP-10-S														
RP-11-A														
RP-11-B														
RP-11-S														
RP-12-A														
RP-12-B														
RP-12-S														
RP-13-A														
RP-13-B														
RP-13-S														
RP-14-A														
RP-14-B														

Water Level and NAPL Thickness Measurement Form
RP - Portland

Monitoring Well	%LEL		PID (ppm)		Depth to Water Level (TOC-ft)	Observation of LNAPL or Sheen Detected	Depth to LNAPL (TOC-ft)	LNAPL Thickness (ft)	Total Depth (TOC-ft)	Observation of DNAPL	Depth to DNAPL (TOC-ft)	DNAPL Thickness (ft)	Date and Time of Measurement	Recorded by
	Back-ground	In Well Casing	Back-ground	In Well Casing										
RP-14-S														
RPW-02														
RPW-03														
RPW-05														
W-03-D														
W-03-I														
W-03-S														
W-04-89														
W-04-I														
W-04-S														
W-06-D														
W-06-B														
W-06-S														
W-08-26														
W-08														
W-08-74														
W-09														
W-09-86														
W-09-116														
W-10														
W-11-B														
W-11-D														
W-11-I														
W-11-S														

Water Level and NAPL Thickness Measurement Form
RP - Portland

Monitoring Well	%LEL		PID (ppm)		Depth to Water Level (TOC-ft)	Observation of LNAPL or Sheen Detected	Depth to LNAPL (TOC-ft)	LNAPL Thickness (ft)	Total Depth (TOC-ft)	Observation of DNAPL	Depth to DNAPL (TOC-ft)	DNAPL Thickness (ft)	Date and Time of Measurement	Recorded by
	Back-ground	In Well Casing	Back-ground	In Well Casing										
W-12-D														
W-12-I														
W-12-S														
W-15-D														
W-15-I														
W-15-S														
W-16-31														
W-16-S														
W-16-D														
W-16-I														
W-18-D														
W-18-I														
W-18-S														
W-19-D														
W-19-I														
W-19-S														
WS-11-125														
WS-11-161														
WS-12-125														
WS-12-161														
SG-NDL*	**Direct gauge reading:**					**Top of gauge reading:**			**Depth to water (TOG - DGR):**					
SG-NDP*	**Direct gauge reading:**					**Top of gauge reading:**			**Depth to water (TOG - DGR):**					
SG-WDL*	**Direct gauge reading:**					**Top of gauge reading:**			**Depth to water (TOG - DGR):**					

* Staff gauges: Record the direct gauge reading (above or below zero on gauge), and top of gauge reading (e.g., 6.66 ft).

Then subtract direct gauge reading from top of gauge reading to get depth to water.

0-61M-107030 - RP SOIL SAMPLING FORM

SAMPLE LOCATION: ____ DATE:__________________ START TIME:____________
PERSONNEL:____ WEATHER: ____

OBSERVATIONS/FIELD MEASUREMENTS

MEASUREMENT TYPE	VALUE / UNITS	INSTRUMENT	COMMENTS
AIR TEMP (°C)			
SOIL GRAIN SIZE DESCRIPTION			
SAMPLE DEPTH (FT)			
SOIL COLOR			
SOIL TYPE DESCRIPTION			
MOISTURE CONTENT (%)			
ANIMALS/PLANTS IN MEDIA			
VOC HEADSPACE READING			
UVLIGHT READING			
OBSERVATION OF CONTAMINATION			

(FT=DEPTH IN FEET)

COMMENTS/OBSERVATIONS
(GPS OR SURVEYED

____
____
____
____
____

SAMPLE COLLECTION

SAMPLE NUMBER: [ ] QA/QC NUMBER (S): [ ] TIME:____________

DESCRIPTION: [ ]

LABORATORY (1) [ ] COC # [ ]
LABORATORY (2) [ ] COC # [ ]
LABORATORY (3) [ ] COC # [ ]
LABORATORY (4) [ ] COC # [ ]

PARAMETER(S)	PRESERVATION/ SIZE	NUMBER/ VOLUME	LABORATORY	ICED (Y/N)	COMMENTS
Volatile Organic Compounds (VOCs) by EPA Method 8260B	Cool to 4°C (no headspace)/ 4 oz Glass Jar				
Organochlorine Pesticides by EPA Method 8081A	Cool to 4°C/ 1- 9 oz Glass Jar				
Chlorinated Herbicides by EPA Method 8151A					
Semivolatile Organic Compounds (SVOCs), including phenols, by EPA Method 8270C					
Polychlorinated Biphenyls (PCBs) by EPA Method 80802A					
Metals by EPA Methods 6010A, 6020, 7471A					
Total Organic Carbon (TOC) by EPA Method 9060 Modified	Cool to 4°C/ 4 oz Glass Jar				
Total Petroleum Hydrocarbons (TPH) by NWTPH-Dx	Cool to 4°C/ 4 oz Glass Jar				
Dioxins/Furans (PCDD/PCDF) by EPA Method 8290	Cool to 4°C/ 4 oz Glass Jar				

SOP - 3: DECONTAMINATION PROCEDURES FOLLOWED? YES / NO
QA/QC SAMPLE COLLECTED? YES / NO DESCRIBE:______________________
CHAIN OF CUSTODY COMPLETED? YES/NO
WASTE DISPOSAL:____

SAMPLING METHOD USED______________________________
SAMPLE TYPE (IE: GRAB, SPLIT, ETC.)____________________
INSTRUMENT CALIBRATION: (Date/Time)__________________
INSTRUMENT CALIBRATION STANDARD:___________________

ADDITIONAL COMMENTS:

____
____
____

SIGNATURE

AMEC Earth & Environmental, Inc.
GROUNDWATER SAMPLING FIELD FORM

Project Name:
Project #:
Monitoring/Sampling Date:

Monitoring Well ID: | Field Personnel:
Start Time: | Weather Conditions: | Approx. Air Temp (F):

INITIAL WELL DATA & WELL PURGING INFORMATION

PID (ppm) Background: In well Casing: | PID Calibration Standard:
%LEL Background: In well Casing: | PID Calibration Date:

Date/Time of Measurement: / | Depth to Water Measuring Technique:
Depth Well Bottom (TOC - ft.): | Detection Method of Free Product:
Depth to Water Level (TOC - ft.): | Conversions Factors (casing dia. = gallons/linear ft.) Circle One
Depth to Free Product (TOC - ft.): | 0.75" = 0.02 1" = 0.04 2" = 0.17 3" = 0.37
Calculated Column Height (ft.): | 4" = 0.66 6" = 1.47 8" = 2.61 12" = 5.88
Casing Diameter (in.): | Three Well Purge Volumes (gallons) = 3 x _______ = __________
Quantity of Free Product Collected (gal.): | Method of Collecting Free Product:
Obsevation of sheen or LNAPL: | Observation of DNAPL:

Casing Volumes (#)	Volume Purged (liters)	Water Temperature (degree C)	Water pH (S.U.)	Specific Conductivity (ms)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	ORP (mV)	Time (0:00 - 23:59)

Total Purged = | Purge Pumping Rate (approx. L/m): | Well Yield: High / Moderate / Low
Purge Method (circle one): PVC Bailer / Poly Bailer / SS Bailer / Peristalic Pump / Grunfos Pump / Other =
Ferrous Iron (ppm): | Decontamination Method:
Instrument Type & Number: | Water Disposal:
Instrument Calibration Date & Time: | Approx. Pump/Intake Depth:

WELL CONDITION

Casing (circle one): Stainless Steel Carbon Steel PVC Other:
Casing Condition: OK / NA / Needs Repairs / Repaired | Lock Condition: OK / NA / Needs Repairs / Replaced
Cap Condition: OK / NA / Needs Repairs / Repaired | Inner Casing Condition: OK / NA / Needs Repairs / Repaired
Paint Condition: OK / NA / Needs Repairs / Repaired | Monument Condition: OK / NA / Needs Repairs / Repaired
Recommended Well Repairs:

SAMPLING INFORMATION / DATA

Date Sampled: | QA/QC Sample (circle one): YES / NO | Water Chemistry Sample: YES / NO
Time Sampled: | Sampling Method (circle one): SS Bailer Poly Bailer Grunfos Pump
Chain-of-Custody #s: | Teflon Bailer Peristaltic Pump Other:

Sample ID	Bottles (total)	Bottles (size)	Preservative	Destination Laboratory	Sample Transporter	Analytical Parameters

All samples were immediately placed into a cooler and packed with ice or "Blue Ice", unless otherwise noted: YES / NO

Field Observations/Notes of Sampling Event: ____________________________

CERTIFICATION STATEMENT

By signing below, the listed AMEC sampler states that the information provided on this page is accurate.

Sampler (Print): Sampler Signature: Date Signed:

	AMEC Earth & Environmental, Inc. GROUNDWATER SAMPLING FIELD FORM	Project Name: Project #: Monitoring/Sampling Date:

Monitoring Well ID: | Field Personnel:

INITIAL WELL DATA & WELL PURGING INFORMATION

Casing Volumes (#)	Volume Purged (liters)	Water Temperature (degree C)	Water pH (S.U.)	Specific Conductivity (ms)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	ORP (mV)	Time (0:00 - 23:59)

WELL CONDITION

Recommended Well Repairs/Additional Notes:

SAMPLING INFORMATION / DATA

Date Sampled: | Additional Chain-of-Custody #s:

Time Sampled:

Sample ID	Bottles (total)	Bottles (size)	Preservative	Destination Laboratory	Sample Transporter	Analytical Parameters

Field Observations/Notes of Sampling Event: ____________________

CERTIFICATION STATEMENT

By signing below, the listed AMEC sampler states that the information provided on this page is accurate.

Sampler (Print): Sampler Signature: Date Signed:

AMEC EARTH & ENVIRONMENTAL, INC
SAMPLE IDENTIFICATION MATRIX

By: ______________________ Date: ________ Project No. ______________

Site: ____

Activity: ____

Sample Location	Lab ID	Date Sampled	Time Sampled	Sample Type	Analysis Code	Container Type	Preserve Added	Comments

Chain of Custody Nos. ______________________
Analytical Lab: ______________________
Date Shipped: ______________________
Carrier: ______________________
Airbill Number: ______________________

Sample ID qualifier
01 Primary Sample
02 Field Duplicate
03 Trip Blank
04 Rinsate Blank
05 Performance Evaluation Sample
06 Interlaboratory Duplicate

Preservatives
HNO_3 - Nitric Acid
H_2SO_4 - Sulfuric Acid
HCl - Hydrochloric Acid
ZnAc - Zinc Acetate
NaOH - Sodium Hydroxide
$Na_2S_2O_3$ - Sodium Thiosulfate

Data Logging Worksheet

Project Name ______________________________ Project No. ______________________________

Location ______________________________ Date ______________________________

______________________________ Personnel ______________________________

Client ______________________________ Weather ______________________________

Data Logger Model/Serial Number ____________________ Filename ______________________________

Transducer Model//Serial Number ____________________ Transducer PSI Rating ______________________________

Well / Sensor Number	Computer Real Time	Data Logger Time	Depth to Water (ft)/ Time	Sensor Reading/Time	Current Depth to Probe (ft)	Previous Depth to Probe (ft)/Date	Change in Depth to Probe (BTC)*

*BTC = Below Top of Casing.
Depth to Probe = depth to water + sensor reading

Comments: (e.g., calibration factors, change of batteries, change of set-up, field observations):

____

____

____

____