Reichhold/SSA Containers Facility
Tacoma, Washington

Compliance Monitoring and Contingency Plan

Prepared for

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A Carrix Enterprise

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December 2008

FINAL

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List of Abbreviations and Acronyms

Acronym/Abbreviation	Definition
CAP	Cleanup Action Plan
CDA	Construction Debris Area
CMCP	Compliance Monitoring and Contingency Plan
COC	Constituent of concern
EIM	Environmental Information Management
FFS	Focused Feasibility Study
MNA	Monitored natural attenuation
MTCA	Model Toxics Control Act
ORP	Oxidation-reduction potential
PPA	Pentachlorophenol Plant Area
QAPP	Quality Assurance Project Plan
QC	Quality control
RAO	Remedial action objective
RBC	Risk-based calculation
SAP	Sampling and Analysis Plan
SID	Shallow Interceptor Drain
SVOC	Semivolatile organic compound
USEPA	U.S. Environmental Protection Agency
WAC	Washington Administrative Code

1.0 Introduction

This Compliance Monitoring and Contingency Plan (CMCP) for the Reichhold/SSA Containers Facility (the Facility), located at 3320 Lincoln Avenue in Tacoma, Washington (Figure 1.1) accompanies the Cleanup Action Plan (CAP), which describes the final remedial actions to be implemented at the Facility. The CAP was developed based on the preferred remedial alternatives selected in the Focused Feasibility Study (FFS; Floyd|Snider Team 2008). This CMCP has been prepared in accordance with the Model Toxics Control Act (MTCA) requirements for compliance monitoring contained in WAC 173-340-410.

This CMCP presents compliance monitoring requirements and contingency plans that address the soil-to-groundwater leaching and the groundwater transport exposure pathways at the Facility. Following implementation of the remedial actions as defined in the CAP, soil on-site will meet requirements for direct contact and will not require monitoring. The groundwater monitoring activities outlined in this CMCP are designed to ensure that the proposed soil and groundwater remedial actions are protective of the adjacent surface water bodies. Discharge to surface water is the highest beneficial use of groundwater at the Facility. The monitoring activities in this CMCP are intended to address the performance of the remedial actions, confirm continued natural recovery, and confirm the long-term effectiveness of the remedy following the completion of remedial activities and the operation of the site as a container terminal.

This CMCP also sets forth a clear process by which monitoring may trigger contingency responses, and establishes a framework for implementing contingency actions.

1.1 SUMMARY OF GROUNDWATER REMEDIAL ACTION

In this section, an overview of the groundwater remedial action is provided. The groundwater remedial action is intended to confirm that off-site migration of groundwater constituents of concern (COCs) is not occurring at concentrations greater than source area target concentrations. Source area target concentrations are back calculated from the nearest receptor to the Facility property boundary to be protective of Washington State Department of Ecology (Ecology) MTCA surface water cleanup levels.

Groundwater data from the most recent 4 years of monitoring indicate that the Shallow Aquifer is in compliance with these source area target concentrations due to the effectiveness of the corrective actions implemented to date. All available groundwater data from the Intermediate Aquifer indicates compliance with source area target concentrations. The final groundwater remedial action will ensure that the groundwater remains in compliance as the Facility is developed into a marine cargo terminal.

As defined in the CAP, the following steps comprise the final groundwater remedial action:

- Discontinuation of hydraulic control through shutdown of the Shallow Interceptor Drain (SID) and Intermediate Aquifer extraction well pumps
- Implementation of the proposed compliance monitoring program for both Shallow and Intermediate Aquifers

- Demonstration of natural attenuation through monitoring in the Shallow and Intermediate Aquifers
- Implementation of a contingency plan to address potential concerns if identified through compliance monitoring

Additional details on the groundwater remedial action, including its relationship to the site-wide comprehensive remedial actions, are provided in the CAP.

1.1.1 Discontinuation of Hydraulic Control

Active pumping for both the SID and Intermediate Aquifer extraction wells will be discontinued following installation of the compliance monitoring well network, which is planned for 2008, as described in Section 4.0. Groundwater in both aquifers will be allowed to resume its normal flow pattern. The SID, Intermediate Aquifer extraction wells, and water treatment system will remain in place and will be maintained as potential contingency measures until the property is developed, estimated to be in 2010-2011. In late 2010 or early 2011, depending on other remedial objectives and site development progress, it is anticipated that the water treatment system will be permanently decommissioned. Potential contingency actions following decommissioning of the water treatment system are described in Section 8.0.

1.1.2 Monitored Natural Attenuation and Compliance Monitoring

monitored natural attenuation (MNA) will be used to evaluate the effects of natural attenuation processes that have been demonstrated to be biodegrading the groundwater COCs and reducing their concentrations over time, primarily through anaerobic processes. MNA will also serve to validate the predictions from attenuation modeling, which was used to develop source area target concentrations. To demonstrate continued natural attenuation, the remedial action will include groundwater sampling designed to provide data to track the concentration trends of primary contaminants (pentachlorophenol and tetrachloroethene) and their biodegradation daughter products (tetra-, tri-, di- and monochlorinated phenols, trichloroethene, and vinyl chloride). These data will also provide demonstrations that natural attenuation processes result in continued declining concentrations and contaminant mass reduction. Natural attenuation monitoring will also include measurement of oxidation-reduction potential (ORP) to confirm that groundwater redox conditions remain conducive to reductive dechlorination. Additional details on MNA monitoring are provided in Section 3.1.4.

Compliance monitoring, which will include MNA monitoring, will be a central component of the remedial action for both the Shallow and Intermediate Aquifers. The compliance monitoring network, described in Section 4.0, will be installed prior to the discontinuation of hydraulic controls as noted in Section 1.1.1. The compliance monitoring network and program will be designed to confirm that groundwater concentrations leaving the property are protective of an off-property conditional point of compliance at the point of discharge to the Blair Waterway and to the associated ditches that drain to the Blair Waterway, in accordance with WAC 173-340-720(8)(d)(ii)).

Continued compliance with groundwater quality objectives will be confirmed by the compliance monitoring program. While the conditional point of compliance is in place, compliance monitoring will confirm that groundwater concentrations leaving the source area (the Facility boundary, or property owned by SSA Containers, Inc. [SSA]) are less than source area target concentrations, and that COC concentrations in groundwater reaching the point of discharge, Blair Waterway for the Intermediate Aquifer or associated ditches for the Shallow Aquifer, are less than surface water criteria.

If the compliance monitoring indicates non-compliance with the groundwater quality objectives, the contingency plan will be implemented as described in Section 8.0.

2.0 Facility Description

In this section, relevant Facility conditions are presented to provide context and rationale for compliance monitoring and the contingency plan.

2.1 OVERVIEW OF FACILITY CONDITIONS

The hydrogeologic conditions relevant to compliance monitoring and contingency planning are briefly summarized here. Additional information on Facility conditions, land use, and geologic setting are summarized in the FFS (Floyd|Snider Team 2008).

2.1.1 Summary of Hydrogeologic Units and Groundwater Flow Directions

The Facility is underlain by three near-surface aquifers and two near-surface aquitards, or confining layers. The three aquifers, which are brackish and non-potable, are referred to as the Shallow, Intermediate, and Deep Aquifers. The two aquitards are referred to as the upper and lower aquitards.

The Facility is located within the Tacoma tideflats, which is a regional groundwater discharge area. Groundwater flows from recharge areas at higher elevations toward discharge areas along Commencement Bay and its adjacent waterways, such as the Blair Waterway to the southwest of the Facility. Because of this situation, the vertical groundwater gradient direction is typically upward from the Deep Aquifer to the Intermediate Aquifer.

- The Shallow Aquifer consists of fine to medium sand and silty sand that is primarily dredge spoils from the Hylebos and Blair Waterways, which were hydraulically emplaced in the 1950s. The Shallow Aquifer is unconfined and seasonally ranges in saturated thickness from 0 to approximately 10 feet. Groundwater flow direction is generally radial from the interior of the Facility toward the perimeter drainage ditches and SID that currently surrounds the former process area of the Facility. The Shallow Aquifer is not tidally-influenced.
- The upper aquitard is the uppermost native formation, considered to represent the former ground surface of the salt marsh that existed prior to filling. The unit ranges from approximately 1 to 20 feet thick and consists primarily of silt, organic silt, and clayey silt, with zones of peat.
- The Intermediate Aquifer consists primarily of fine to medium sand and silty sand, with zones of interbedded sand, silty sand, and silt. The Intermediate Aquifer ranges in thickness from approximately 4 to 31.5 feet. Groundwater elevation data indicate that groundwater in the Intermediate Aquifer generally flows from east to west across the eastern portion of the Facility, toward the Blair Waterway. The Intermediate Aquifer is tidally-influenced and experiences transient reversals in the groundwater flow direction in areas near the Blair Waterway. However, the net groundwater flow direction is toward the waterway and the transient reversals in the groundwater flow direction do not prevent groundwater discharge to the waterway. The groundwater flow patterns for the remainder of the Facility are currently dominated by the influence of the groundwater extraction system. Prior to installation and startup of the

extraction system, the general groundwater flow pattern across the Facility was east to west toward the Blair Waterway, becoming more southwesterly in the off-site area, closer to the Blair Waterway.

- The lower aquitard separates the Intermediate and Deep Aquifers at the Facility. This unit consists of silt, organic silt, and clayey silt, with occasional very fine sandy silt and peat interbeds and zones of organic material. The lower aquitard ranges in thickness from approximately 5.5 to 18 feet.
- The Deep Aquifer consists primarily of alternating fine to medium sand and silty sand, with occasional silt interbeds. The total thickness of the Deep Aquifer is not known; regional studies indicate that the sand might reach a thickness of 80 feet or more in the vicinity of the Facility (Walters and Kimmel 1968). Groundwater flow in the Deep Aquifer occurs under confined conditions, with the potentiometric surface approximately 20 to 30 feet above the top of the unit. Groundwater flow in the Deep Aquifer is generally to the southwest toward the Blair Waterway. The Deep Aquifer is tidally-influenced like the Intermediate Aquifer and also experiences transient, localized reversals in the groundwater flow direction, however, the net groundwater flow direction in the Deep Aquifer is westward, toward the Blair Waterway.

Underlying the three uppermost aquifers is up to 400 feet of generally fine-grained marine sediments. These fine-grained sediments provide a low-permeability base that separates the three uppermost aquifers beneath the Facility from the underlying deep regional aquifer, a glacially derived unit of alternating layers of fine- and coarse-grained materials (Walters and Kimmel 1968).

2.1.2 Surface Water Features

The surface water features in the immediate vicinity of the Facility are the Blair Waterway, the Lincoln Avenue Ditch, the North Ditch, and the South Ditch (Figure 2.1). The Facility is currently located approximately 800 feet northeast of the Blair Waterway, which was excavated from the sediment of the Puyallup River Delta at the head of Commencement Bay. According to Attachment 2 to Agreed Order No. 1577, the North Ditch is a man-made industrial drainage ditch that runs along the northern SSA property boundary and carries stormwater runoff from SSA and other adjacent properties to the Lincoln Avenue Ditch, which runs along the northwestern property boundary. The Lincoln Avenue Ditch, which receives runoff from several industrial and urban properties northeast of the Facility, enters a concrete culvert adjacent to the Facility that conveys runoff to the Blair Waterway. The South Ditch is located along a portion of the southern property boundary. The North and South Ditches flow only when precipitation runoff or high groundwater levels discharge into them, and typically either go dry or cease to flow and become stagnant during dry summer conditions.

In 2007, a portion of the Blair Waterway was widened by the Port of Tacoma in the vicinity of the Facility. It is expected that during future terminal development along the waterway this cutback will be continued farther to the northwest. This planned future cutback will decrease the distance from the Facility to the Blair Waterway by approximately 200 feet. This new distance of 600 feet was used in the FFS to update the source area target concentrations for the Facility and is shown on Figure 2.1.

3.0 Compliance Criteria and Monitoring Requirements

This section briefly summarizes the development of compliance criteria and defines the proposed methods of compliance monitoring in the context of MTCA requirements (WAC 173-340-410). The approved groundwater COCs and groundwater compliance criteria described in the FFS are summarized for clarity. In addition, MNA monitoring is described, the process for evaluating compliance is outlined, and other monitoring requirements are presented.

3.1 COMPLIANCE CRITERIA DEVELOPMENT AND ROLE OF GROUNDWATER MONITORING

Groundwater COCs and the source area target concentrations for groundwater were defined in the FFS to ensure that the cleanup goals used at the Facility are protective of human health and remain protective of surface water in the nearby ditches and the Blair Waterway. Similarly, in-situ soil COCs and soil cleanup levels were defined in the FFS to be protective of these nearby surface water bodies and human health by addressing the leaching pathway and the groundwater transport pathway. As a result, monitoring of the groundwater pathway is an effective approach to overall compliance monitoring at the Facility.

3.1.1 Source Area Target Concentrations

Source area target concentrations are concentrations in groundwater that are protective of the nearest surface water receptors based on modeled attenuation rates, groundwater flow velocities, and relevant surface water criteria. Because groundwater at the Facility is non-potable, the risk of exposure to constituents in groundwater is limited to discharge into surface water within the perimeter ditches and the Blair Waterway. Therefore, as the groundwater enters the surface water, it must meet relevant surface water criteria.

The cleanup standards for groundwater are the surface water criteria, to be met at the off-property conditional points of compliance—those locations where groundwater enters adjacent surface water. The groundwater cleanup levels, equivalent to surface water criteria, were used as attenuation endpoints in the development of source area target concentrations as part of the FFS. Using the Ecology-approved BIOSCREEN model, these endpoints were back-calculated to determine a maximum concentration in groundwater at the Facility's boundary that will naturally attenuate to be in compliance with surface water criteria as groundwater enters the respective surface water receptors. Source area target concentrations calculated using the distance to the property boundary are appropriate for assessing compliance in on-site monitoring wells. For off-site groundwater monitoring wells between the Facility boundary and the Blair Waterway, location-specific target concentrations have been calculated relative to the specific distance from the well to the Blair Waterway.

3.1.2 Soil Cleanup Levels

Soil cleanup levels were developed by using the lower, more protective of either the risk-based concentrations (RBCs) protective of human and ecological exposure pathways (calculated according to WAC 173-340-745, 7491-7494) or the soil leaching-to-groundwater pathway by the

MTCA Three-phase Leaching Model (WAC 173-340-747; CH2M HILL 2006). Soil cleanup levels are modeled to not exceed the source area target concentration in groundwater through the soil to groundwater leaching pathway.

In-situ vadose zone soil with COC concentrations that exceed cleanup levels is planned to be excavated as part of the remedial action, which will result in compliance for all in-situ soil at the Facility. Therefore, no direct soil compliance monitoring is necessary following implementation of the remedial action. Additionally, soil within the saturated zone containing soil COCs with concentrations exceeding the cleanup level will be excavated to limits determined in conjunction with Ecology. Compliance monitoring for groundwater will evaluate the effectiveness of soil cleanup actions indirectly, by focusing on confirming that groundwater concentrations continue to naturally recover and remain less than levels of concern.

3.1.3 List of Groundwater Constituents of Concern

The following constituents are included in the final COC list for groundwater, as defined in the FFS (Floyd|Snider Team 2008):

- 2-Chlorophenol
- 2,3,4,6-Tetrachlorophenol
- 2,4-Dichlorophenol
- 2,4,6-Trichlorophenol
- Pentachlorophenol
- Tetrachloroethene
- Trichloroethene
- Vinyl chloride

3.1.4 MNA Monitoring Indicators

Relevant guidance documents that describe the objectives of MNA groundwater monitoring (e.g., DOE 2001, USEPA 2004) draw on eight goals from the 1999 USEPA OSWER Directive 9200.4-17P (USEPA 1999a). Monitoring conducted to support MNA should:

- demonstrate that natural attenuation is occurring according to expectations,
- detect changes in environmental conditions (e.g., hydrogeologic, geochemical, microbiological, or other changes) that may reduce the efficacy of any of the natural attenuation processes,
- identify any potentially toxic and/or mobile transformation products,
- verify that groundwater contamination is not expanding downgradient, laterally, or vertically,
- verify no unacceptable impact to downgradient receptors,

- detect new releases of contaminants to the environment that could impact the effectiveness of the natural attenuation remedy,
- demonstrate the efficacy of institutional controls that were put in place to protect potential receptors, and
- verify attainment of remediation objectives.

According to U.S. Environmental Protection Agency (USEPA) guidance documents, these objectives are commonly met by implementing a performance monitoring program that measures contaminant concentrations, geochemical parameters, and hydrologic parameters (USEPA 2004). The nature of the monitoring program depends on the site-specific monitoring objectives for MNA, which are derived from site-specific remedial action objectives (RAOs) and other remediation goals. Site-specific monitoring objectives are used to develop site-specific MNA performance indicators for assessing MNA effectiveness.

As described in the FFS (Floyd|Snider Team 2008) and CAP, groundwater RAOs for the Facility are to prevent COCs in Shallow Aquifer and Intermediate Aquifer groundwater from reaching the Blair Waterway and surface water in the ditch system that drains to the Blair Waterway at concentrations greater than or equal to surface water criteria. The groundwater remedial action will accomplish this through a compliance and MNA monitoring program, by ensuring that groundwater concentrations leaving the source area remain less than source area target concentrations.

In conjunction with the compliance monitoring objective of ensuring that groundwater remains in compliance with source area target concentrations following the discontinuation of hydraulic control, the site-specific monitoring objective for MNA is to confirm that natural attenuation processes continue to occur in groundwater as demonstrated by decreasing COC concentrations over time, the presence of daughter products, and geochemical conditions.

Three key site-specific MNA performance indicators will be:

1. Measured decreasing trends in compliance monitoring wells of COC concentrations based on annual running averages (averages of two consecutive semiannual monitoring events, during semiannual performance monitoring, or annual results during annual confirmational monitoring). Exceptions to this indicator will be made for biodegradation daughter product COCs (lesser chlorinated phenols, trichloroethene, and vinyl chloride) if the absence of a decreasing trend is the result of degradation of primary contaminants (pentachlorophenol and tetrachloroethene).
2. Demonstration of a decreasing trend in chlorinated semivolatile organic compound (SVOC) concentrations with respect to distance from the Pentachlorophenol Plant Area (PPA), as measured based on annual running averages (averages of two consecutive semiannual monitoring events during semiannual performance monitoring) in the line of three monitoring wells proposed for this demonstration. Refer to Figure 2.1. The highest concentrations of the three should be measured at the well closest to the PPA, MW-14(I) (or Location A, a new informational monitoring well in this vicinity). The next highest concentrations of the three should be measured at Location B, a new informational monitoring well between the PPA and the Facility boundary. The lowest concentration of the three should be measured at the farthest

distance from the PPA, MW-13I (or Location C, a new compliance well in this vicinity).

3. Consistency with geochemical conditions suitable for anaerobic degradation, as indicated by negative ORP measurements in areas with groundwater impacted by chlorinated phenols.

To demonstrate continued natural attenuation and validate the results of BIOSCREEN modeling, the proposed remedy will involve collecting data to track the concentration trends of primary contaminants (pentachlorophenol and tetrachloroethene) and their biodegradation daughter products (lesser-chlorinated phenols, trichloroethene, and vinyl chloride). These measurements will provide confirmation of the natural attenuation process, continuing declining concentrations, and contaminant mass reduction. Natural attenuation monitoring will also include measurement of ORP to confirm that groundwater redox conditions remain conducive to reductive dechlorination. These data will be used to evaluate MNA with respect to the groundwater RAOs and evaluate the dynamic behavior of the contaminant concentrations in groundwater over time.

This CMCP sets forth site-specific indicators for MNA. These indicators and the associated compliance monitoring program together meet the objectives for MNA monitoring, to demonstrate the effectiveness of MNA with respect to remedial objectives, as described below. According to USEPA guidance, the design of a specific MNA monitoring program depends on site conditions and the site-specific limits on decision errors. The ways in which the site-specific MNA indicators meet the objectives provided in the guidance documents are described below, listed in the same order:

- The monitoring program will demonstrate that natural attenuation is occurring according to expectations. Evaluation of temporal trends in contaminant concentrations, measurement of biodegradation daughter products, and confirmation of redox conditions will be used to verify the occurrence of natural attenuation. Because the degradation of chlorinated volatile organic compounds and SVOCs is influenced by redox conditions, assessment of ambient redox conditions is an important component of any MNA monitoring program for these contaminants. The appropriate level of monitoring can only be determined on a site-by-site basis. Measurement of ORP in Facility groundwater is deemed a sufficient parameter to monitor redox conditions. According to USEPA, the production of daughter products from parent contaminants is considered primary evidence of biotransformation processes that may be used to evaluate progress toward achieving contamination reduction objectives.

- The monitoring program will support detection of changes in environmental conditions that may reduce the efficacy of any of the natural attenuation processes. The monitoring program will detect changes in hydrogeological conditions, in particular:

    * the expected changes in groundwater flow direction and flow velocity following the discontinuation of hydraulic control,

    * changes associated with other remedial actions, namely the source control activities planned for the PPA, and

   * changes in the redox conditions that would indicate that anaerobic degradation may no longer be an effective process.

- The monitoring program will identify any potentially toxic and/or mobile transformation products. As indicated above, the biodegradation daughter products of both pentachlorophenol and tetrachloroethene are included as COCs that will be monitored at the same frequency as the primary contaminants.
- The monitoring program will verify that the extent of groundwater contamination is not expanding downgradient, laterally, or vertically. The compliance monitoring well network, described in Section 4.0, is designed in accordance with USEPA guidance (USEPA 2004) to detect such an expansion of contamination extents, by locating wells along the transport pathway from the PPA, along transects at the Facility boundaries adjacent to Shallow Aquifer groundwater ditch receptor points, and in the downgradient off-site area between the Facility and the Intermediate Aquifer groundwater receptor point at the Blair Waterway.
- The monitoring program will verify that negative impacts are not occurring to downgradient receptors by monitoring at the property boundary and off-site to confirm that concentrations are less than levels of concern and continue to decline.
- The monitoring program will detect potential new releases of contaminants by detecting increases in contaminant concentrations at monitoring points located within and immediately downgradient of source areas.
- The remedy will include assurances to demonstrate the efficacy of institutional controls. Other than deed restrictions preventing withdrawal of Facility groundwater for drinking water or other beneficial uses, institutional controls are not required for the remedial action. The monitoring program will verify the attainment of remedial objectives by monitoring the concentrations of COCs in groundwater until the RAOs have been met. Facility groundwater is currently in compliance with the applicable cleanup criteria, the source area target concentrations (and target concentrations for the off-site monitoring well), for both the Shallow and Intermediate Aquifers. The RAOs are based on confirming that these cleanup objectives are sufficient to protect adjacent surface water bodies, and that natural attenuation continues as predicted. According to the USEPA guidance the demonstration of attainment of cleanup objectives should include sufficient monitoring, approximately 3 to 5 years, once the standards have been met to evaluate the effects of natural variations in site conditions, based on statistical analyses of the data (USEPA 2004). The monitoring program provides for 8 years of monitoring to evaluate the effects of discontinuing hydraulic controls and natural variations. In addition, the monitoring program applies the recommended statistical methods of temporal trend analysis of contaminant concentrations and comparisons with specified compliance standards.

3.2 COMPLIANCE CRITERIA: CONSTITUENT OF CONCERN CONCENTRATIONS

The source area target concentrations and groundwater COC list defined in the FFS and CAP are presented in Table 3.1 for monitoring wells located in the source area (within Facility property boundaries) and a single monitoring well located downgradient of the source area.

These values will be used to assess compliance in groundwater sampling of these monitoring wells as described in this CMCP. Additional details are given below.

3.2.1 Shallow Aquifer

Shallow Aquifer monitoring wells are all planned to be located at the Facility perimeter (refer to Section 4.0). As a result, the source area target concentrations listed in Table 3.1, which were calculated based on the minimum distance of 40 feet from the Facility property boundary to the North Ditch, South Ditch, and Lincoln Ave Ditch are suitable as compliance criteria for assessing compliance and protecting these water bodies.

3.2.2 Intermediate Aquifer

Intermediate Aquifer source area target concentrations for on-site monitoring wells are based on the location of the projected Blair Waterway cutback, which reduces the distance from the Facility property boundary to the Blair Waterway from 800 feet to 600 feet. The planned locations for the majority of Intermediate Aquifer compliance wells are along the southwestern perimeter of the Facility, at a distance of 600 feet. The source area target concentrations for the Intermediate Aquifer presented in Table 3.1 are based on this 600-foot distance and are therefore suitable as compliance criteria for compliance monitoring and protection of the quality of the Blair Waterway (Section 4.0).

One off-site compliance monitoring well is additionally proposed and will be located approximately equidistant between the Facility perimeter and the projected Blair Waterway cutback, near the location of existing Well MW-46(I). The approximate distance to the projected Blair Waterway cutback from this location is 300 feet. The target concentrations presented in Table 3.1 for this off-site compliance monitoring well have been calculated for groundwater COCs using this approximate distance to the Blair Waterway.

Compliance monitoring wells will be installed as close as possible to the identified locations, while ensuring that they are in appropriate locations relative to the proposed container terminal development. If compliance monitoring wells are significantly relocated, the target concentrations for the off-site compliance monitoring well will be recalculated according to the procedures described in the FFS to calculate source area target concentrations for on-site monitoring wells. These new concentrations would replace the target concentrations in Table 3.1 and be used as the compliance criteria.

3.2.3 Deep Aquifer

No Deep Aquifer compliance monitoring is proposed. This is based on the results of the sampling history for the Deep Aquifer wells, and the consistent upward gradients from the Deep Aquifer to the Intermediate Aquifer that are associated with the Facility location in a regional discharge area.

In 2007, SSA performed quarterly sampling in six Deep Aquifer wells following an Ecology-approved monitoring program designed to confirm the status of Deep Aquifer groundwater quality. These six Deep Aquifer wells have been sampled for four consecutive quarters for site-specific COCs, and this monitoring program has been successfully completed to the satisfaction of Ecology. Concentrations of COCs in the Deep Aquifer wells have all been less than surface water criteria. Four other Deep Aquifer wells, MW-7(D), MW-22(D), MW-49(D), and MW-53(D), have already been decommissioned, as approved by Ecology. The remaining Deep Aquifer wells will be decommissioned and will not be part of the compliance monitoring network (Snider 2007).

3.3 COMPLIANCE CRITERIA: PROCESS FOR ASSESSING COMPLIANCE

For monitoring wells in the Shallow or Intermediate Aquifer compliance networks, the following process will be used to assess compliance and continued natural attenuation. Unless otherwise noted, this process will be used during the entire compliance monitoring period.

Compliance monitoring wells will be considered in compliance if the concentrations of COCs in groundwater are less than the compliance criteria—equivalent to the applicable source area target concentration.

If a COC concentration measured in groundwater is equal to or greater than its compliance criteria, it will be considered an exceedance. The compliance well will be re-sampled for confirmation within 4 weeks of receipt of laboratory results and the new sample will be tested for the analyte that exceeded compliance criteria. If the new sample result is not an exceedance, the well will be considered in compliance and regularly-scheduled monitoring will continue at the well (refer to Section 8.1.1).

If the new sample result exceeds the compliance criteria, the contingency plan will be implemented, as described in Section 8.0. The contingency plan may also be triggered by an increasing trend in a compliance well with elevated concentrations, as defined in Section 8.1.2. Triggering the contingency plan without a confirmed exceedance will not constitute a lack of compliance.

In addition, monitoring results will be compared to the three MNA indicators listed in Section 3.1.4. Because compliance criteria include provisions to address increasing concentrations of COCs, meeting the three MNA indicators is not necessary for compliance. Failure to meet any one of the three MNA indicators, however, will result in a review of available groundwater quality and elevation data to evaluate natural attenuation conditions. The requirement for this evaluation, described in Section 8.2.1 as part of contingency monitoring, will not trigger the contingency plan or the other requirements associated with contingency monitoring. Based on the results of this evaluation, SSA may elect to increase sampling frequency or add constituents for wells not meeting MNA indicators to provide data necessary for additional MNA evaluations.

3.4 MONITORING TYPES AND OBJECTIVES

In this section, the proposed methods of compliance and MNA monitoring described in this plan are defined and placed in the context of the MTCA requirements for compliance monitoring (WAC 173-340-410). MTCA requirements for compliance monitoring consist of evaluation monitoring, protection monitoring, performance monitoring, and confirmational monitoring. Evaluation monitoring will not be conducted at the Facility. Because the Facility has been the subject of decades of groundwater monitoring, the data needs commonly filled by evaluation monitoring have been thoroughly addressed. The groundwater COCs have been identified and an existing monitoring well network and baseline chemical and hydrogeologic conditions have been well established.

3.4.1 Protection Monitoring

According to the MTCA requirements for compliance monitoring, the goal of protection monitoring is to confirm that human health and the environment are adequately protected during construction and the operation and maintenance period of a remedial action. Remedial actions include removal of in-situ soil at concentrations greater than cleanup levels, cessation of groundwater extraction and treatment, and groundwater monitoring to confirm continued compliance and predicted natural attenuation. The groundwater remedial action, however, will not require construction activities beyond the installation of additional monitoring wells, and will require limited operation and maintenance in the traditional sense beyond performance monitoring activities.

The requirements for protection monitoring, therefore, will be met through performance monitoring activities and procedures established in the sampling and analysis plans and health and safety plans associated with implementation of the groundwater remedial action, such as monitoring well installation, groundwater sampling activities, and disposal of investigation-derived waste.

3.4.2 Performance Monitoring

According to MTCA requirements, performance monitoring should confirm that the cleanup action has attained cleanup standards or other performance standards. Source area target concentrations at the Facility's boundary and target concentrations for monitoring in the off-site area have been calculated to be protective of the nearby surface water bodies. Because groundwater at the Facility is already in compliance with these approved target concentrations, performance monitoring will be utilized to ensure continued natural attenuation and compliance with source area and other target concentrations in the first 3 years of monitoring following the discontinuation of hydraulic controls.

In addition to this purpose, performance monitoring will be used to track changes in the groundwater flow regime associated with shutting down the extraction wells and SID pumps. This groundwater cleanup action and the site development that will follow are expected to result in significant changes in the groundwater flow regimes in both the Shallow and Intermediate Aquifers, as groundwater flow patterns return to conditions uninfluenced by the extraction wells and SID systems.

Performance monitoring will be conducted and reported semiannually during the 3-year performance monitoring phase and is discussed in further detail in Section 5.0.

3.4.3 Confirmational Monitoring

According to MTCA requirements, the purpose of confirmational monitoring is to confirm the long-term effectiveness of the action once cleanup standards or other performance standards have been met. Groundwater at the Facility is already in compliance with source area target concentrations. Prior to the initiation of confirmational monitoring, 3 years of performance monitoring is expected to confirm that natural attenuation continued to occur and that the discontinuation of hydraulic control has not adversely affected the ability to meet the Facility source area target concentrations. In this context, confirmational monitoring at the Facility will address the long-term effectiveness of the remedy by continuing to evaluate natural attenuation and compliance for 5 years following successful completion of performance monitoring.

Because 3 years of semiannual monitoring data will be available to assess changes in groundwater quality and flow regime associated with discontinuation of hydraulic control and/or development of the Facility, confirmational monitoring will be conducted on an annual basis.

Confirmational monitoring is discussed in further detail in Section 6.0.

4.0 Compliance Monitoring Well Network

Monitoring wells and piezometers that are not included in the Compliance Monitoring Well Network will be decommissioned with Ecology approval. However, because the SID and Intermediate Aquifer extraction wells are part of the contingency plan, they will be left in place and will be maintained in working order for as long as practical, given site development requirements. New monitoring wells will be added for long-term compliance groundwater monitoring as described in the following sections.

4.1 EXISTING NETWORK AND WELL DECOMMISSIONING

As of June 2008, 97 monitoring wells, extraction wells and piezometers are located throughout the Facility. The Shallow Aquifer contains 30 monitoring wells and 18 piezometers for 48 Shallow Aquifer locations. The Intermediate Aquifer contains 34 monitoring wells[1] and 8 extraction wells for 42 Intermediate Aquifer locations. The Deep Aquifer contains 8 monitoring wells. Figure 2.1 shows the existing monitoring well network at the Facility. Of the remaining 97 wells, extraction wells, and piezometers on-site, 8 Shallow Aquifer wells, 14 Intermediate Aquifer wells, and 6 Deep Aquifer wells are proposed for decommissioning in Phase II of the decommissioning program scheduled to occur in 2008.

4.3 NEW COMPLIANCE MONITORING WELL NETWORK

Depending on the specific redevelopment plans, the Compliance Monitoring Well Network may include some existing monitoring wells or may be entirely composed of new monitoring wells. Final proposed locations of monitoring wells will be determined based on compatibility with the proposed redevelopment plan. Wells will be located in areas that are expected to allow consistent access for monitoring and protection of the wells within the layout of the marine cargo handling facility development, as described below.

Although existing monitoring wells will be used when locations are appropriate, the installation of new monitoring wells will be necessary for the Compliance Monitoring Well Network for the Shallow and Intermediate Aquifers at the Facility. The future container terminal will provide temporary storage for large shipping containers that cannot be easily moved to gain access for groundwater sampling. In order to ensure access to wells sampled during monitoring events, the locations of monitoring wells in the Compliance Monitoring Well Network will be coordinated with the redevelopment design.

Because the location of containers on the property will change, the following priority will be considered in determining locations of wells in the Compliance Monitoring Well Network. The most desirable locations are next to light poles, fire hydrants or other non-moveable structures where containers cannot be stacked. Secondary locations are in the aisles between stacks of containers. Any new wells that are added to the network will be installed with aboveground monuments set in concrete. The Compliance Monitoring Well Network wells may later be modified to flush monuments when the final grade of the Facility is constructed, if appropriate.

[1] This total includes EHC-1, installed for pilot study activities.

Refer to Figure 4.1 for a generalized Shallow Aquifer well construction diagram and Figure 4.2 for a generalized Intermediate Aquifer well construction diagram.

4.3.1 Shallow Aquifer

The Shallow Aquifer groundwater flow pattern is generally radial and currently from the center of the Facility toward the SID system. Prior to installation of the SID, the groundwater flow pattern was similar but directed toward perimeter ditches. Because the natural Shallow Aquifer groundwater flow pattern is toward perimeter ditches, the Shallow Aquifer Compliance Monitoring Well Network will be primarily composed of perimeter wells along the North Ditch and Lincoln Avenue Ditch. Refer to Figure 2.1, which illustrates the proposed Shallow Aquifer Monitoring Well Network Zone.

Six monitoring wells are proposed to be located in the primary monitoring zone (along the North Ditch and the Lincoln Avenue Ditch) for the Shallow Aquifer Compliance Monitoring Well Network and may include existing wells as appropriate (e.g., MW-56(S), MW-2(S)2, MW-4(S)). The remaining wells in the network will be newly installed at locations determined to provide effective groundwater monitoring and to provide year-round access and protection given the planned site development. The monitoring well network along the North Ditch will include at least two of the monitoring wells to be installed between the SID and the North Ditch, as requested by Ecology. Final proposed locations of monitoring wells will be determined based on groundwater flow directions and compatibility with the proposed redevelopment plan. Wells will be located in areas that can enable consistent access for monitoring within the layout of the container terminal.

In addition to the primary monitoring zone, the proposed Shallow Aquifer Compliance Monitoring Well Network includes three monitoring wells along the southern and southwestern sections of the property perimeter. SSA anticipates that property redevelopment activities will eliminate the South Ditch between the Facility and Tribal properties to the south, and install a tight-lined stormwater conveyance system in its place, such that shallow groundwater will no longer flow to the South Ditch. Proposed monitoring wells will then be evaluated relative to potential Shallow Aquifer flow towards the Blair Waterway. It may be possible to use existing Wells MW-27(S)2, MW-42(S)2, and MW-25(S)2 for this purpose if they are in locations that will be consistently accessible and protected relative to the site development plan, otherwise new monitoring wells will be installed.

Shallow Aquifer groundwater monitoring is not proposed for the eastern section of the Facility because without the SID in operation, there are no ditches or other features to induce groundwater flow from the Facility interior toward that direction and pre-SID groundwater flow patterns indicate that groundwater did not flow in that direction under natural conditions. The lack of ditches in the eastern section of the Facility provides no pathway for Shallow Aquifer groundwater to reach the Blair Waterway or other receptors.

4.3.2 Intermediate Aquifer

Groundwater flow in the Intermediate Aquifer is generally toward the south to the Blair Waterway, even under current conditions with the influence of an active extraction well system. Following shutdown of the extraction well system, groundwater flow is expected to continue toward the Blair Waterway. The Intermediate Aquifer Compliance Monitoring Well Network is therefore proposed to be located on the southwestern, downgradient perimeter of the property and in the off-site area downgradient of the former Construction Debris Area (CDA). Refer to Figure 2.1, which illustrates the proposed Intermediate Aquifer Compliance Monitoring Well Network.

The proposed Intermediate Aquifer Compliance Monitoring Well Network will extend from approximately MW-60(I) in the west to MW-29(I) in the east and will include seven evenly-spaced monitoring wells along the property line with approximately 200 feet between wells, and one additional well in the off-site area downgradient of the former CDA. Existing off-site well MW-46(I) might be used for this purpose or a new well might be installed depending on site development plans.

In addition, Ecology requested two monitoring wells downgradient of the PPA, between the property boundary and the PPA. These two monitoring wells (Locations A and B), along with a third monitoring well located at the property line (Location C), are intended to provide data to evaluate groundwater quality downgradient of the PPA for several quarters following planned excavation activities. These monitoring wells interior to the property are not compliance wells, but are informational wells to assist with demonstration of natural attenuation. The excavation work proposed for the PPA is designed to remove source material. Existing Well MW-14(I), or a new well in its vicinity, and one additional well between the PPA and the property line will be used for downgradient water quality evaluation.

To confirm that the two informational monitoring wells downgradient of the PPA at Locations A and B are in locations appropriate for assessing natural attenution, additional investigation of COC concentrations in the Intermediate Aquifer in the vicinity of MW-14(I) and MW-19(I) will be conducted. This additional investigation will be performed using direct-push groundwater screening samples to evaluate the extent of chlorinated SVOCs in the Intermediate Aquifer in the vicinity of the PPA. This additional investigation will take place directly following the soil removal actions in this area, to be able to take into account observations from the soil removal in the design of the investigation program. This is expected to occur in fall 2009, after the compliance monitoring program has been initiated. If it is deemed necessary for MNA monitoring, based on the results of the additional investigation, the locations of the interior informational monitoring wells will be adjusted by installing additional monitoring wells and decommissioning the old monitoring wells.

4.4 SCHEDULE FOR INSTALLATION OF THE COMPLIANCE MONITORING NETWORK

New monitoring wells will be installed in 2008. Installation of new wells in the Shallow and Intermediate Aquifer Compliance Monitoring Well Network will be complete prior to the shutdown of the SID and extraction wells.

4.5 COMPLIANCE MONITORING SCHEDULE

The compliance monitoring schedule is intended to provide more frequent sampling in the initial 3 years following cessation of hydraulic controls (SID and extraction wells) during performance monitoring, followed by an annual sampling interval for 5 additional years during confirmational monitoring to ensure evaluation of the continued effectiveness of the remedy and protection of surface water receptors.

Compliance monitoring is designed to provide data that allow determination of whether COC concentrations exceed compliance criteria or demonstrate an increasing trend in compliance wells that have elevated COC concentrations. If either of these conditions occurs, they would trigger a contingency process designed to bring Facility groundwater back into compliance. Refer to Section 3.3 for a description of the compliance evaluation process and Section 8.1 for a discussion of how compliance monitoring results may trigger the contingency plan.

Compliance monitoring for the Shallow Aquifer and the Intermediate Aquifer Monitoring Well Networks is described in the following sections.

4.5.1 Shallow Aquifer

SSA will sample Shallow Aquifer wells semiannually for the first 3 years of compliance monitoring following cessation of groundwater pumping in the SID. Following this initial period, and with favorable analytical results, compliance monitoring will then be extended to an annual sampling schedule for the next 5 years. Analytical data will be evaluated throughout this 8-year compliance monitoring period to determine if compliance criteria have been exceeded or the contingency plan has been triggered by increasing trends in monitoring wells with elevated concentrations. Refer to Sections 3.3 and 8.1.

A comprehensive evaluation of the analytical monitoring data from the 8-year compliance monitoring period will be performed. If those data demonstrate that Shallow Aquifer groundwater has remained in compliance throughout the monitoring events, that natural attenuation continues to occur based on a review of results with respect to MNA indicators, and contingency monitoring has not otherwise been triggered, Shallow Aquifer groundwater monitoring will be discontinued.

4.5.2 Intermediate Aquifer

SSA will sample Intermediate Aquifer wells semiannually for the first 3 years of compliance monitoring following cessation of groundwater pumping in Intermediate Aquifer extraction wells. Following this initial period, and with favorable analytical results, compliance monitoring will then be extended to an annual sampling schedule for the next 5 years. Analytical data will be evaluated throughout this 8-year monitoring period to determine if compliance criteria have been exceeded or the contingency plan has been triggered by increasing trends in monitoring wells with elevated concentrations. Refer to Sections 3.3 and 8.1.

A comprehensive evaluation of the analytical monitoring data from the 8-year compliance monitoring period will be performed. If those data demonstrate that Intermediate Aquifer groundwater has remained in compliance throughout the monitoring events, that natural attenuation has continued to occur based on a review of results with respect to MNA indicators, and contingency monitoring has not otherwise been triggered, Intermediate Aquifer groundwater monitoring will be discontinued.

4.6 MONITORING WELL INSPECTION, MAINTENANCE PROCEDURES, AND SCHEDULE

All Compliance Monitoring Well Network wells will be inspected and maintained on an annual schedule as defined in Appendix A. If, during the annual well inspection, it is determined that more than one foot of sediment has accumulated in a well, the well will be redeveloped.

SID sumps and pumps, as well as Intermediate Aquifer extraction wells and associated operating systems, will be maintained in operating condition and inspected annually, at a minimum, until the water treatment system is decommissioned. This will maintain the viability of the groundwater extraction system for use as a potential contingency action for as long as reasonably possible given site development (refer to Section 8.2.1).

5.0 Performance Monitoring

As described in Section 4.0, the Compliance Monitoring Well Network will be designed and installed for long-term (at least 8 years) Shallow and Intermediate Aquifer groundwater quality monitoring at the Facility. Performance monitoring data will determine if, following the shutdown of the SID and Intermediate Aquifer extraction wells, Shallow and Intermediate Aquifer groundwater samples from compliance monitoring wells at the Facility boundaries and in the off-site area maintain groundwater COC concentrations at levels less than source area and off-site target concentrations. Results will also indicate whether natural attenuation processes continue to occur in groundwater. In the event that concentrations greater than compliance criteria are detected or an increasing trend is apparent in a compliance well with an elevated COC concentration, the contingency plan will be triggered, as described in Section 8.0.

Refer to the Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP) in Appendix B for sample collection details.

5.1 PERFORMANCE MONITORING PLAN COMPONENTS

Semiannual performance monitoring of the Shallow and Intermediate Aquifer compliance monitoring wells will consist of measuring groundwater levels, sampling for groundwater COCs, measuring ORP in groundwater as part of field parameter measurements during normal low-flow sampling procedures, and evaluating the laboratory analytical data and field ORP measurements with respect to compliance criteria, MNA indicators, and other criteria for triggering the contingency plan in semiannual reports.

5.1.1 Water Level Measurements

Water levels will be measured in all Shallow and Intermediate Aquifer wells at the Facility to provide an indication of groundwater flow directions following cessation of hydraulic control. Semiannual water levels will be measured no more than 7 calendar days prior to beginning each sampling event. Water levels in all tidally-influenced wells (Intermediate Aquifer) will be measured within 60 minutes of low tide (beginning 30 minutes before and ending no later than 30 minutes after low tide). Water level measurements will begin with the off-site well closest to the Blair Waterway and will proceed inland. Shallow Aquifer wells are not tidally-influenced and will be measured the same day as the Intermediate Aquifer wells.

Specific water level measurement and equipment decontamination procedures are presented in the SAP/QAPP in Appendix B.

5.1.2 Sampling Methods

Following water level measurement, monitoring wells will be purged according to procedures in USEPA's Low-Flow (Minimal Drawdown) Groundwater Sampling Procedures until field parameter equilibrium is demonstrated (Puls and Barcelona 1996). The volume purged will be determined in the field based on stabilization of field parameters for specific conductance, temperature, and pH. The parameters ORP and dissolved oxygen will also be measured during purging but because of their inherent sensitivity, their use as stabilization parameters will be optional. Groundwater samples will be taken after the stabilization criteria are met. Refer to the SAP/QAPP in Appendix B for specific stabilization criteria.

5.1.3 Sampling Parameters

Groundwater from each well will be sampled for the eight groundwater COCs, which include three chlorinated volatile organic compounds (tetrachloroethene, trichloroethene, and vinyl chloride), and five chlorinated semivolatile organic compounds (2-chlorophenol, 2,3,4,6-tetrachlorophenol, 2,4-dichlorophenol, 2,4,6-trichlorophenol, and pentachlorophenol). Refer to Section 3.1.3. As noted above, ORP will be measured as part of normal low-flow sampling procedures. A summary of specific compounds and analytical testing methodology is included in the SAP/QAPP presented in Appendix B.

5.2 PERFORMANCE MONITORING SCHEDULE

Performance monitoring will be conducted semiannually for 3 years following cessation of pumping in the Shallow and Intermediate Aquifer groundwater extraction systems. The semiannual monitoring schedule is intended to quickly identify any potential issues that might result in the need to add wells to the monitoring network or restart portions of the extraction system. If no compliance criteria are exceeded, natural attenuation has continued to occur based on a review of results with respect to MNA indicators, and contingency monitoring has not otherwise been triggered during the first 3 years of monitoring groundwater, the sampling frequency will be reduced to an annual schedule for 5 additional years of confirmational monitoring, as described in Section 6.0.

If COC concentrations exceed compliance criteria or otherwise trigger the contingency plan at any time during the 3-year performance monitoring period, contingency monitoring will be implemented, as described in Section 8.0. In the event that contingency monitoring is halted because COC concentrations or concentrations trends stabilize and satisfy contingency monitoring requirements without a contingency action, regularly scheduled semiannual performance monitoring for the analyte at the affected well(s) will resume. In the event that a contingency action is implemented, performance monitoring will resume in the area affected with a revised schedule to be negotiated between SSA and Ecology.

5.3 PERFORMANCE MONITORING REPORTING REQUIREMENTS

During the first 3 years of performance monitoring, groundwater monitoring reports will be submitted to Ecology on a semiannual basis. Each semiannual report will contain groundwater elevation measurement results, laboratory data reports validated at Level 1 (refer to Section 7.0), and a summary evaluation of groundwater monitoring results compared to compliance criteria, MNA indicators, and other contingency plan triggers. Data will also be submitted to Ecology's Environmental Information Management (EIM) database in the appropriate EIM format.

At the end of the third year of monitoring, a single performance monitoring report will be prepared and submitted to Ecology. This final performance monitoring report will summarize the results of the semiannual monitoring events for the entire 3 years. The performance monitoring report will include the following components:

- A summary of performance monitoring laboratory results (with comparisons to compliance criteria, MNA indicators, and other contingency plan triggers) and discussion of significant findings and conclusions, including a comparison of COC data before and after shutdown of the SID and extraction wells.
- A summary of groundwater elevation data, including water level elevation contour maps and a discussion of any notable changes in groundwater flow velocity or direction.

6.0 Confirmational Monitoring

Following the successful completion of performance monitoring, the Compliance Monitoring Well Network will be sampled during the confirmational monitoring phase. The objective of the confirmational monitoring is to demonstrate the long-term effectiveness of the cleanup action once all the compliance and MNA indicators and other contingency triggers have been met for the 3-year performance monitoring period following cessation of hydraulic control.

6.1 CONFIRMATIONAL MONITORING PLAN COMPONENTS

As with performance monitoring at the Facility, confirmational monitoring will consist of measuring groundwater levels, sampling for groundwater COCs in the groundwater, measuring ORP in groundwater as a field parameter during normal low-flow sampling procedures, and evaluating the laboratory analytical data and field ORP measurements with respect to compliance criteria, MNA indicators, and other criteria for triggering the contingency plan to confirm continued compliance and attainment of RAOs. Confirmational monitoring reports will be submitted annually as described in Section 6.3.

6.1.1 Water Level Measurements

Groundwater level measurements will be performed as described in Section 5.1.1 of performance monitoring.

6.1.2 Sampling Methods

Groundwater sampling will be performed following the methods described in Section 5.1.2 of performance monitoring.

6.1.3 Sampling Parameters

Sampling parameters will continue as described in Section 5.1.3 of performance monitoring.

6.2 CONFIRMATIONAL MONITORING SCHEDULE

The confirmational monitoring sampling frequency will be annually for five years after successful completion of 3 years of performance monitoring for a total of 8 years of monitoring following the shutdown of the SID and Intermediate Aquifer extraction wells.

If COC concentrations exceed compliance criteria or otherwise trigger the contingency plan at any time during the 5-year confirmational monitoring period, contingency monitoring will be implemented as described in Section 8.0. In the event that contingency monitoring is halted because COC concentrations or concentrations trends stabilize and satisfy contingency monitoring requirements without a contingency action, regularly-scheduled annual confirmational monitoring sampling for the analyte at the affected well(s) will resume. In the event that a contingency action is implemented, confirmational monitoring will resume in the area affected with a revised schedule to be negotiated between SSA and Ecology.

6.3 CONFIRMATIONAL MONITORING REPORTING REQUIREMENTS

During the 5 years of confirmational monitoring, groundwater monitoring reports will be submitted to Ecology on an annual basis. Each annual report will contain groundwater elevation contour maps and a summary table, laboratory data reports validated at Level 2 (refer to Section 7.0), and a summary evaluation of groundwater monitoring results relative to compliance criteria, MNA indicators, and other contingency plan triggers. Results will be submitted to Ecology's EIM database.

If, after 5 years of annual confirmational monitoring with no COCs detected at concentrations greater than compliance criteria, attenuation has continued to occur based on a review of results with respect to MNA indicators, and contingency monitoring has not otherwise been triggered, annual confirmational monitoring will be discontinued at the Facility. The fifth annual report will contain a summary of all 8 years of compliance and MNA monitoring data, a summary of groundwater elevation data, and conclusions regarding discontinuing monitoring.

7.0 Data Evaluation and Management

7.1 DATA VALIDATION

Performance and confirmational monitoring analytical reports from the laboratory will be accompanied by sufficient backup data and quality control (QC) results to enable reviewers to perform a comprehensive Level 2 verification and review in accordance with the USEPA functional guidelines for data validation, if necessary, to determine data quality (USEPA 1999b). At a minimum, the Floyd|Snider Team will review the laboratory reports for internal consistency, transmittal errors, laboratory protocols, and for adherence to the QC elements specified in the SAP/QAPP (Appendix B) at a Level 1 (basic) review. The Level 1 data validation will include the following actions:

- Review of sample holding times
- Verification of laboratory sample identification, chain of custody records, and proper analytical methods
- Verification of attainment of specified reporting limits
- Verification of the frequency of analysis of field duplicate, matrix spikes/matrix spike duplicates, and lab control samples
- Verification of surrogate compound analyses performance and attainment of QC criteria
- Verification that laboratory blanks are free of contaminants

The results of the Level 1 data validation will be submitted with the regular performance monitoring reports. Items of concern will be noted. If jointly decided upon by Ecology and SSA, data that appear to have significant deficiencies will be validated using the more comprehensive Level 2 Data Validation and review. Following this review, data qualifiers assigned by the laboratory may be amended, as necessary.

Confirmational monitoring results will automatically be subjected to a third-party data validation using the more comprehensive Level 2 verification and review, as described in Section 7.2.

7.2 DATA MANAGEMENT AND EVALUATION

At least six sampling events will be conducted during the 3-year performance monitoring period, and at least five sampling events will be conducted during the 5-year confirmational monitoring period. All performance and confirmational monitoring groundwater quality results will be managed in an electronic database and submitted to Ecology's EIM database.

Analytical data from performance monitoring activities will be subjected to the Level 1 internal data validation review described above. The results will be reported for each event with regular monitoring reports. Data for each COC will be compared with previous results, compliance criteria, and MNA indicators described in Section 3.0, and contingency plan triggers described in Section 8.0.

Analytical data from confirmational monitoring activities will be subjected to Level 2 verification and review in accordance with the USEPA functional guidelines for data validation (USEPA 1999b). The goal of the more intensive data validation procedure is to provide more defensible monitoring results to support the planned cessation of compliance and MNA monitoring at the end of confirmational monitoring. The results will be reported for each event with regular monitoring reports. Each analyte will be compared with previous compliance criteria and MNA indicators described in Section 3.0, and contingency plan triggers described in Section 8.0.

8.0 Contingency Plan

In this section, the processes by which the contingency plan is engaged (or "triggered") and implemented are explained. Compliance monitoring results are evaluated relative to criteria that determine whether implementation of the contingency plan is warranted. The contingency plan, once triggered, begins with a period of quarterly contingency monitoring to assess the stability and implications of the COC concentration(s) in the affected groundwater, accompanied by an evaluation of the available water quality and water elevation data to identify potential causal factors. Failure to meet any of the three primary MNA indicators will also result in a requirement for a similar evaluation, but will not trigger the contingency plan.

If a contingency action is needed prior to decommissioning of the treatment system, existing hydraulic controls could be restarted as a contingency if appropriate to the concern. Contingency actions following treatment system shutdown will entail additional investigation, evaluation of approach, and focused remedial action in consultation with Ecology.

8.1 CONTINGENCY PLAN TRIGGERS

As described in Section 3.0, compliance monitoring results for both the Shallow and Intermediate Aquifer will be evaluated relative to compliance criteria that are protective of surface water, and MNA indicators to confirm the continued effectiveness of natural attenuation processes. For the off-site groundwater monitoring well between the Facility boundary and the Blair Waterway, well-specific compliance criteria concentrations have been calculated relative to the specific distance from the well to the Blair Waterway.

The process for triggering the contingency plan and evaluating contingency monitoring is presented in Figure 8.1. To evaluate the need for the contingency plan, compliance monitoring results will be evaluated relative to the following criteria. As described in greater detail below, the following indicators will trigger the contingency plan at the Facility based on compliance monitoring results:

- Confirmed COC in exceedance of the compliance criteria in a compliance monitoring well
- Increasing elevated COC concentration in a compliance monitoring well as described in Section 8.1.2

These criteria provide a system for identifying the potential for COCs at concentrations greater than surface water criteria to enter the nearby surface water bodies, and ensure appropriate measures are taken to prevent further migration.

8.1.1 Exceedance in a Compliance Monitoring Well

As described in Section 3.0, the contingency plan will be implemented in the event that a COC is measured at a concentration equal to or greater than its compliance criteria and this exceedance is confirmed by a re-sampling event for which the compliance well will be re-sampled within 4 weeks of laboratory confirmation and the sample tested for the analyte concentration.

8.1.2 Increasing Elevated Constituent of Concern Concentration in a Compliance Monitoring Well

To provide greater protectiveness, the contingency plan may also be triggered without exceeding compliance criteria. A contingency plan will also be triggered in the event that COC concentrations in a compliance well consecutively increase 10 percent or more over three consecutive events and the COC concentrations are greater than 75 percent of the applicable compliance criteria.

Limiting this criterion to compliance wells with generally elevated concentrations (operationally defined here as greater than 75 percent of the source area target concentration) is appropriate because COC concentrations that are not approaching the compliance criteria do not pose a potential risk to surface water receptors and this will account for increases in concentrations of breakdown products. In this way, the contingency plan is reserved for preventing migration of COCs in groundwater at concentrations greater than the compliance criteria, which would pose a potential risk to surface water receptors. Increasing COC concentrations in wells without elevated concentrations will be noted and future results evaluated for additional changes.

It should be noted that, although contingency monitoring can be triggered without exceeding compliance criteria, contingency action will not be implemented unless there are two consecutive quarters in which there are exceedances of compliance criteria.

8.2 CONTINGENCY PLAN

The intent of this section is to establish a framework for action in the event that the contingency plan is triggered based on the results of performance monitoring or confirmational monitoring. The contingency plan will begin with contingency monitoring—a more intensive monitoring schedule intended to assess the stability of the COC concentration(s) in the affected groundwater.

The nature of the contingency action that may follow contingency monitoring will depend on the timing with respect to the status of the treatment system. During the initial few years of compliance monitoring, while the Facility water treatment system is operational, contingency actions may involve restarting all or portions of the existing hydraulic controls (SID and Intermediate Aquifer extraction well system) and treatment of the captured groundwater. After the water treatment system is shut down, contingency actions, if necessary, would involve a process of additional investigation to identify and delineate the problem, evaluate potentially applicable technologies, consult with Ecology, implement the contingency action, and continue monitoring.

8.2.1 Contingency Monitoring

Triggering of the contingency plan will result in contingency monitoring of the affected compliance well (Figure 8.1). Quarterly monitoring of the compliance well, and nearby compliance wells if appropriate, will begin with the goal of evaluating the stability and implications of the COC concentration. Specific criteria for determining whether a contingency action is warranted are described in the following subsections.

As part of contingency monitoring, the potential cause of the COC exceedance or increasing trend in COC concentration will be evaluated using the available water quality and water elevation data and additional data collection, if necessary. Potential causes may include a change in the groundwater flow direction, disruptions to the subsurface resulting from construction activities, leaching from residual contaminated soil, or production of chemical breakdown products from the degradation of chemicals in the groundwater.

The water quality and water elevation data set will be reviewed for changes in the site water balance, or other patterns that may suggest a potential source. In the event that contingency monitoring results in the need for a contingency action in the period following the shutdown of the water treatment system, this review will be used to develop a contingency investigation plan, as described in Section 8.2.3.

8.2.1.1 Criteria for Contingency Monitoring Triggered by Exceedance

If contingency monitoring was triggered by an exceedance of the compliance criteria, contingency monitoring may be halted when the COC concentration is less than the compliance criteria for 4 consecutive quarters. At this point, the COC concentration will be considered stable and regularly-scheduled sampling (performance monitoring or confirmational monitoring) for the analyte at that well will resume.

In the event that the COC concentration exceeds the compliance criteria for 2 consecutive quarters of contingency monitoring, a contingency action shall be implemented, as described in the following sections.

8.2.1.2 Criteria for Contingency Monitoring Triggered by Increasing Elevated Constituent of Concern Concentration

In the event that contingency monitoring is triggered by an increasing elevated COC concentration, contingency monitoring may be halted when the COC concentration has remained steady or declined for 4 consecutive quarters, or if the COC concentration decreases to less than 75 percent of the compliance criteria during any quarter (i.e., is no longer "elevated" according to the terminology in this CMCP). At this point, regularly-scheduled sampling (performance monitoring or confirmational monitoring) for the COC at that well will resume.

Contingency monitoring will continue until the elevated COC concentration remains less than compliance criteria for 4 consecutive quarters without an increasing trend. At this point, the COC concentration will be considered stable and regularly-scheduled sampling (performance monitoring or confirmational monitoring) for the analyte at that well will resume.

In the event that the COC concentration exceeds the compliance criteria for 2 consecutive quarters, a contingency action shall be implemented, as described in the following sections.

8.2.2 Contingency Actions Prior to Water Treatment System Shutdown

The SID and Intermediate Aquifer extraction well system are expected to remain in place approximately until property development, expected in 2010–2011. The Facility water treatment system is expected to remain operational and capable of treating SID or Intermediate Aquifer extraction well groundwater during this time. As a result, during the period when contingency action is most likely to occur, the initial months following the discontinuation of hydraulic controls, the ideal contingency action of resuming these controls will be available, if necessary. Restarting the SID or Intermediate Aquifer extraction well system would quickly begin to capture groundwater containing COC concentrations greater than compliance criteria to prevent off-site migration.

8.2.3 Contingency Actions Following Water Treatment System Shutdown

By the time the water treatment system is decomissioned, groundwater at the Facility will have had approximately 2 years to reach a new equilibrium following the discontinuation of hydraulic controls. As a result, it is not expected that contingency actions would be required beyond this point, given the many years of corrective actions—most importantly source removal—and monitoring that have taken place at the Facility.

In the event that a contingency action is necessary following shutdown of the water treatment system, the process will begin with an additional investigation. Based on the review of water quality and water elevation data conducted during contingency monitoring, a contingency investigation plan will be prepared and submitted to Ecology.

The goals of the contingency investigation plan will be to assess potential causes of the COC exceedances or increasing concentration trend, and to determine the source and scope of the problem, including whether it originates on- or off-site, unless this information is already established. The contingency investigation may include additional or more frequent water elevation or sampling at existing wells, the installation and sampling of new wells, a limited number of test pits, borings, discrete-depth groundwater samples, or other standard investigative methods depending on the nature of the groundwater exceedance or trend. The findings of the initial contingency investigation may lead to additional investigations to assess contaminant sources and migration.

Once the source and scope are sufficiently defined, a summary report will be prepared and submitted to Ecology explaining the results of the investigation, evaluating approaches for addressing the exceedance or trend, and providing the rationale for the selected action. Based on the COC, hydrogeologic setting, and results of additional characterization, a number of remedial technologies are potentially applicable. The aims of a contingency action may include removing a source area, containing an area of contaminated groundwater, treating groundwater in-situ, or extracting groundwater for ex-situ treatment.

After consultation with and approval from Ecology, the contingency action will be implemented and compliance monitoring resumed with a revised schedule to be negotiated.

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Reichhold/SSA Containers Facility
Tacoma, Washington

Compliance Monitoring and Contingency Plan

Tables

FINAL

Table 3.1
Target Concentrations for Constituents of Concern

Constituent[1]	Surface Water Criteria[2] 2008 FFS Surface Water Criteria	Target Concentrations [3]		
		2008 FFS Source Area Target Concentrations for On-site Monitoring Wells		Target Concentrations for Off-site Monitoring Well
		Shallow	Intermediate[4]	Intermediate[5]
	µg/L	µg/L	µg/L	µg/L
Volatile Organic Compounds				
Tetrachlorethene	3.9E-01	7.0E+02	1.5E+05	4.0E+02
Trichloroethene	1.5E+00	1.0E+02	2.4E+04	2.0E+02
Vinyl Chloride	2.4E+00	2.7E+02	1.9E+04	6.5E+03
Semivolatile Organic Compounds				
2-Chlorophenol	9.7E+01	1.2E+04	2.0E+04	6.8E+03
2,3,4,6-Tetrachlorophenol	5.5E+01	2.8E+03	2.0E+04	1.9E+03
2,4-Dichlorophenol	1.9E+02	2.1E+03	2.0E+04	2.3E+03
2,4,6-Trichlorophenol	2.4E+00	1.3E+04	2.0E+04	5.0E+03
Pentachlorophenol	3.0E+00	2.0E+04	2.0E+04	5.6E+03

Notes:

1 The list of groundwater constituents of concern used for compliance monitoring was revised in 2008 as described in the FFS (Floyd|Snider Team 2008).

2 These values, updated as described in the FFS, apply to groundwater only at the point of discharge to surface water. Surface water criteria are provided in this table for reference, and will not be used to assess compliance for the Facility.

3 These values, calculated using BIOSCREEN based on updated surface water criteria as described in the FFS, will be used to assess compliance in groundwater monitoring wells that make up the Facility Compliance Monitoring Well Network.

4 The 2008 FFS Intermediate Aquifer source area target concentrations for property line monitoring wells are based on the location of the projected Blair Waterway cutback, which reduces the distance from the property boundary to the Blair Waterway from 800 feet to 600 feet.

5 One off-site Intermediate Aquifer compliance monitoring well is proposed, to be located approximately equidistant between the Facility perimeter and the projected Blair Waterway cutback, near the location of existing Well MW-46(I). The approximate distance to the projected Blair Waterway cutback from this location is 300 feet. There are no off-site compliance monitoring wells proposed for the Shallow Aquifer, which generally discharges to ditches near the perimeter of the Facility.

FFS Focused Feasibility Study

Reichhold/SSA Containers Facility
Tacoma, Washington

Compliance Monitoring and Contingency Plan

Figures

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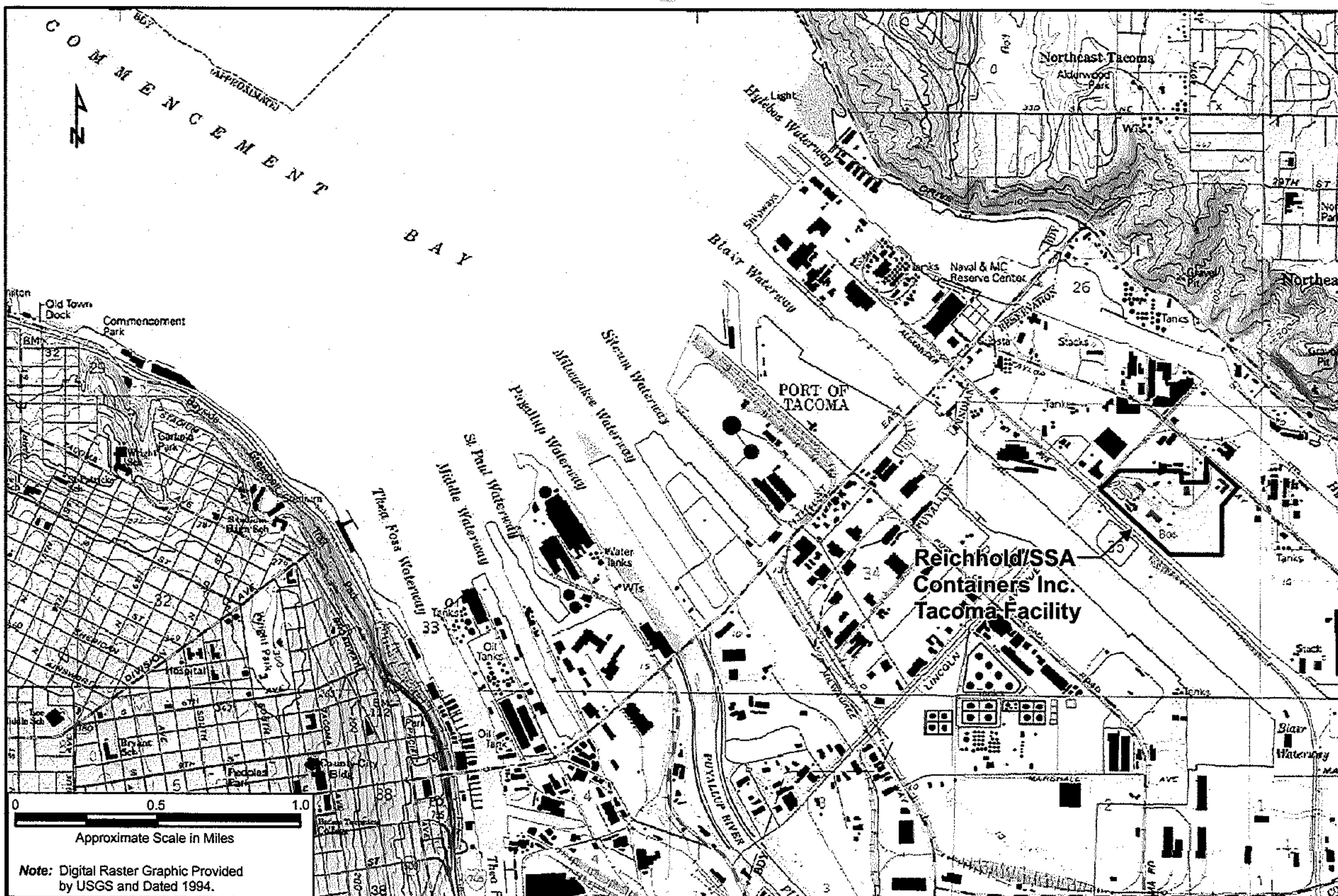

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Compliance Monitoring and Contingency Plan
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Tacoma, Washington

Figure 1.1
Vicinity Map

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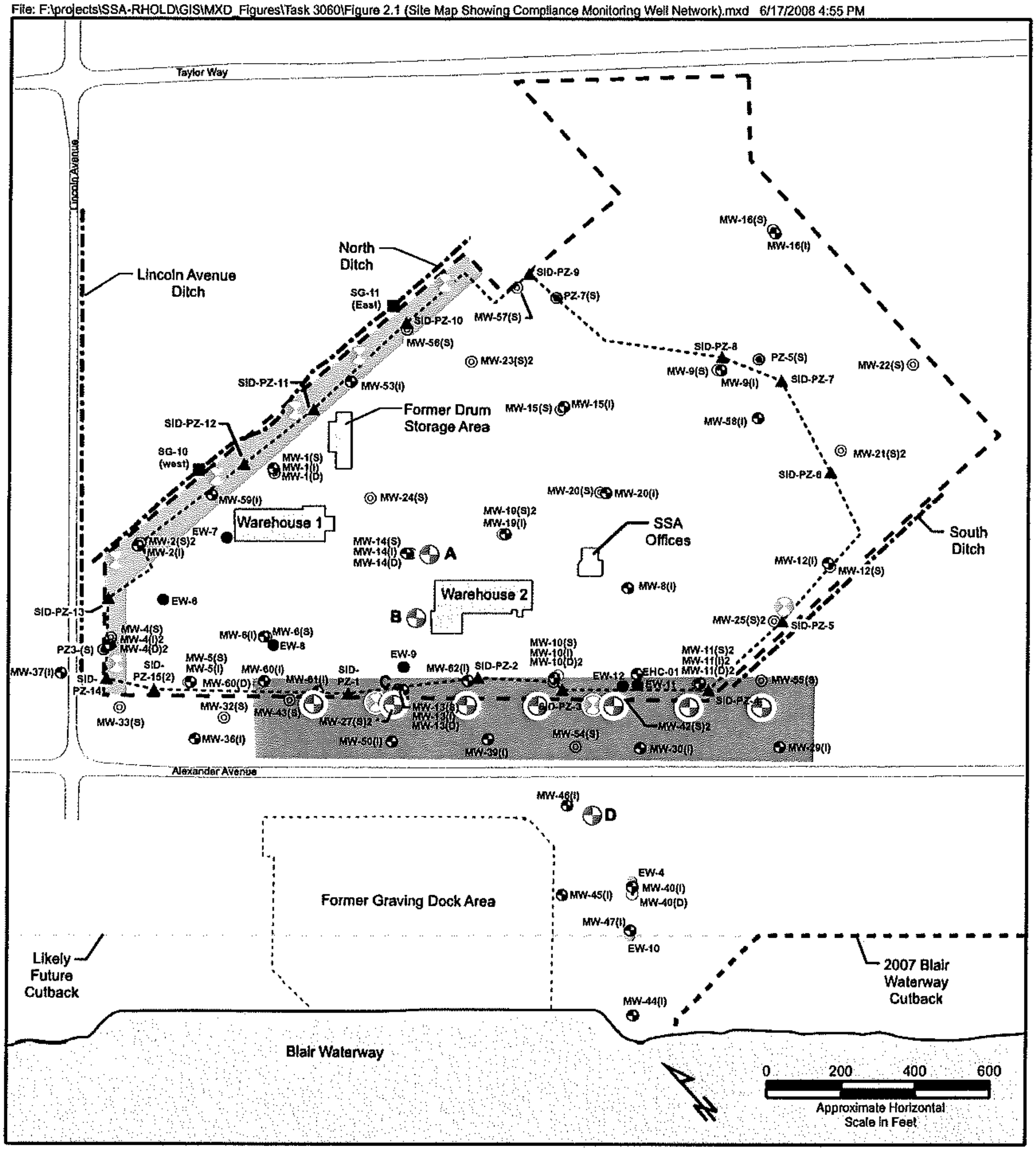
Date: 12/11/2008

December 2008

File: F:\projects\SSA-RHOLD\GIS\MXD_Figures\Task 3060\Figure 2.1 (Site Map Showing Compliance Monitoring Well Network).mxd 6/17/2008 4:55 PM



Notes:

- MW-27(S)2 is overlain by a proposed intermediate monitoring well location.
- Locations A and B are informational wells for monitoring natural attenuation and are not compliance wells.

Figure 2.1
Site Map Showing Compliance Monitoring Well Network

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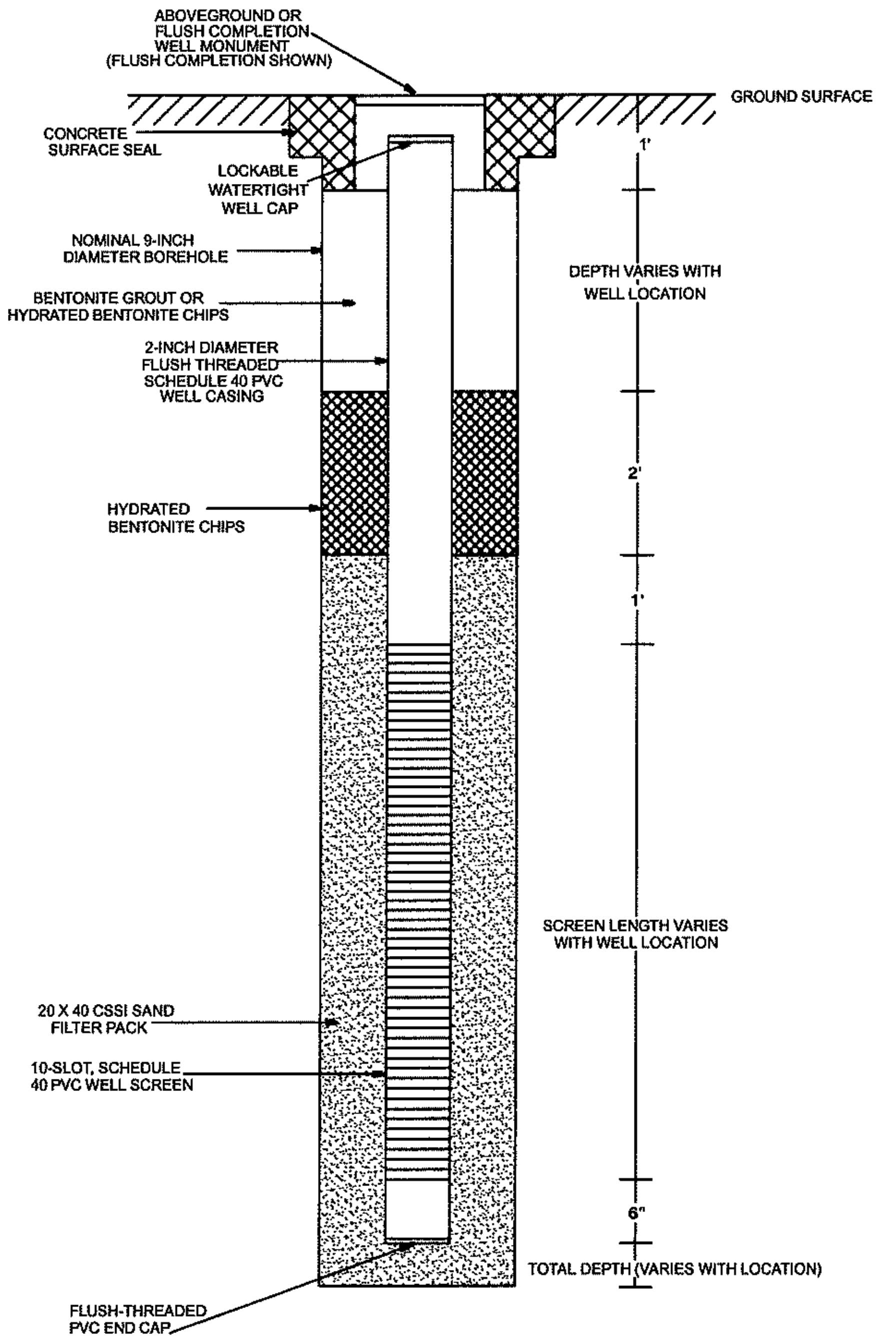
Shallow Aquifer Monitoring Well Network Zone
Intermediate Aquifer Monitoring Well Network Zone
Proposed Monitoring Well, Shallow Aquifer (Location Approximate)
Proposed Monitoring Well, Intermediate Aquifer (Location Approximate)
Monitoring Well, Shallow Aquifer
Monitoring Well, Intermediate Aquifer
Monitoring Well, Deep Aquifer
Piezometers
Shallow Intercept Drain (SID) Piezometers
Staff Gauges
Extraction Well
Inactive Extraction Well
Property Boundary
SID Location
Ditch Location
2007 Blair Waterway Cutback (Approximate)
Likely Future Cutback (Approximate)



(NOT TO SCALE)

epi ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

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Compliance Monitoring and
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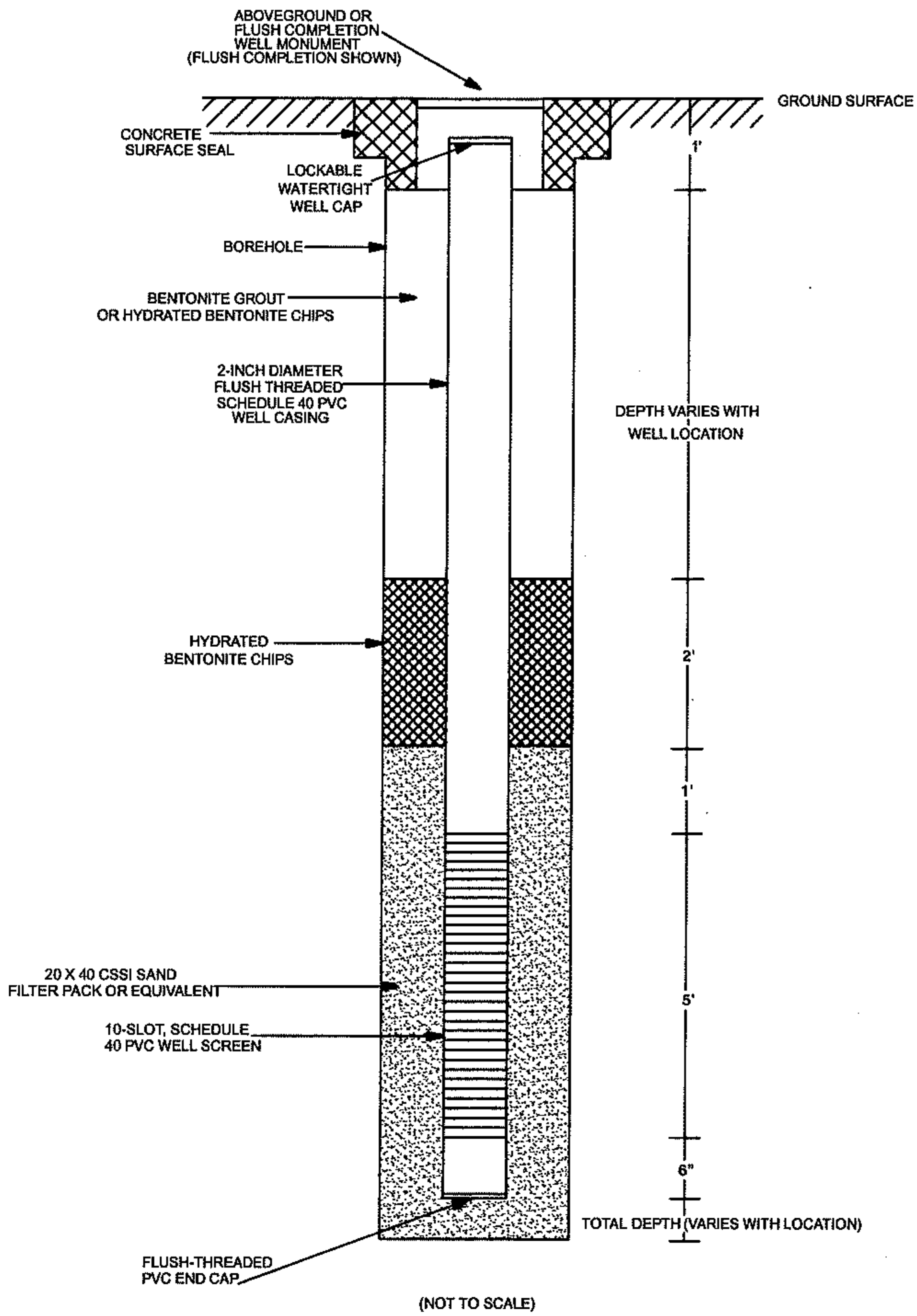
Tacoma, Washington

Figure 4.1
Generalized Shallow Aquifer
Monitoring Well
Construction Drawing



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Compliance Monitoring and Contingency Plan
Reichhold/SSA Containers Facility
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Figure 4.2
Generalized Intermediate Aquifer Monitoring Well Construction Drawing

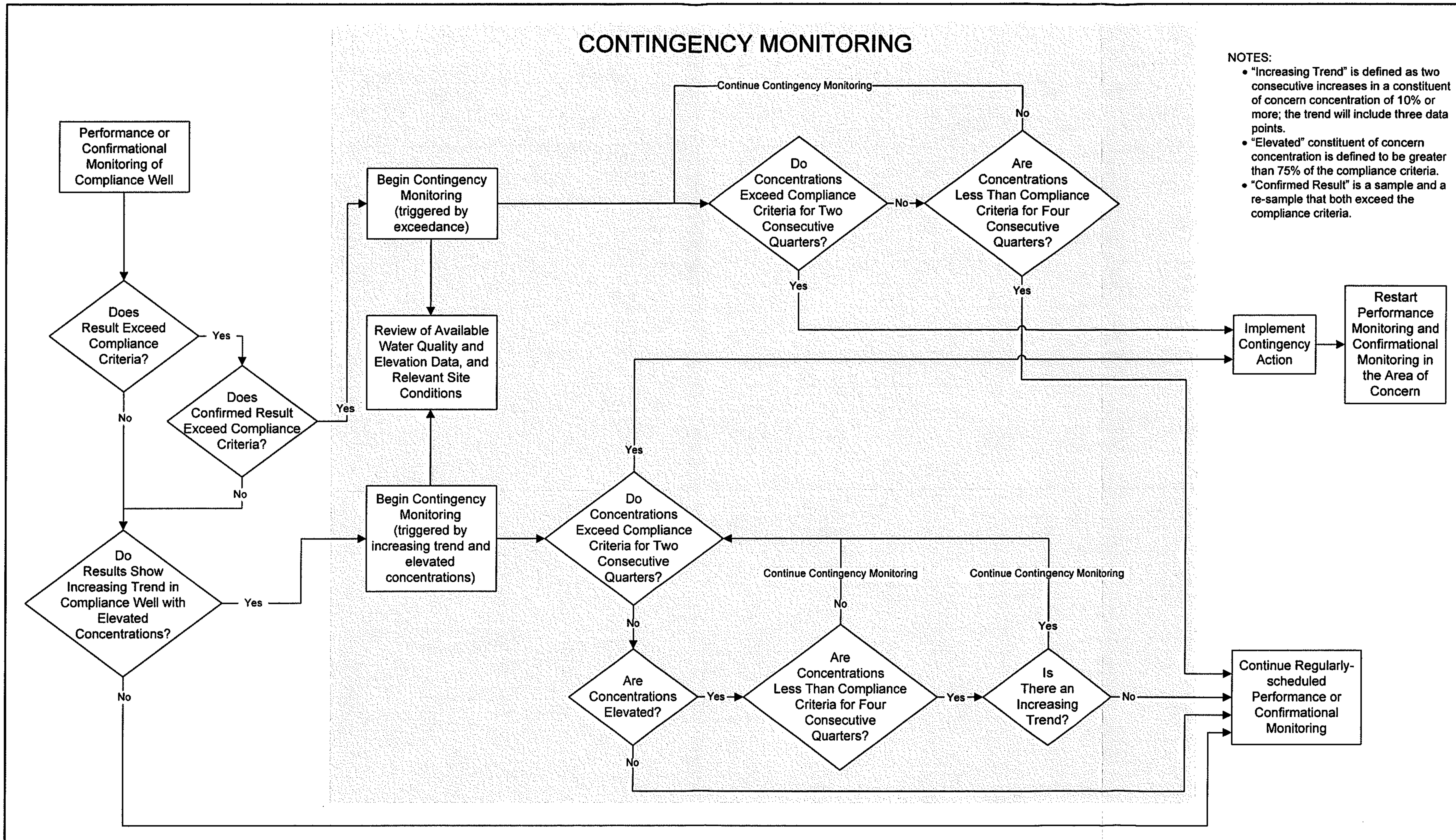

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Figure 8.1
Summary of Contingency Plan Triggers and Contingency Monitoring for Compliance Wells

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Compliance Monitoring and Contingency Plan

Appendix A
Well Maintenance Procedures

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Annual Well Sounding and Inspection

Monitoring well sounding, inspection, and routine maintenance will be performed annually at the Reichhold/SSA Containers Facility (the Facility). The inspection and maintenance procedures summarized below will be performed to maintain the monitoring well network in good operating condition and limit the potential for biased groundwater data resulting from poor well maintenance.

WELL REDEVELOPMENT CRITERION

A best management practice for monitoring well construction is that any well should be redeveloped when it is determined to have accumulated silt or sediment in excess of 1 foot of depth. This well redevelopment criterion will be implemented at the Facility throughout the term of the compliance monitoring program.

Measured well total depths will be compared annually to as-built total depths measured at the time of well construction. If the well is determined to have greater than 1 foot of silt or sediment, the well will be redeveloped by surging and pumping, or equivalent well development method, to remove sediment in the well and in the sand filter pack surrounding the screened interval.

WELL INSPECTION AND MAINTENANCE

Inspection steps and routine maintenance items that will be performed annually at each of the monitoring wells at the Facility are listed below:

- Limited brush clearing to access wells, if applicable
- Inspect protective casing
- Inspect surface seal
- Inspect bollards if present
- Inspect well identification tags (required by Washington State Department of Ecology [Ecology]), replace as needed
- Inspect padlock, lubricate with graphite or replace as needed
- Inspect well cap, clean, or replace as needed
- Remove and inspect dedicated pump and tubing, if applicable
- Measure static water level
- Measure total well depth
- Lubricate hinges on protective casing using vegetable oil, if applicable
- Paint protective well casing, well cover, and bollards as needed.
- Re-mark measuring points as needed
- Re-mark well identification number as needed

Routine maintenance items, such as the installation of new well caps and locks, and re-marking well identification numbers will be resolved in the field during the well inspection.

If a well is damaged, the well protection measures and casing will be repaired to meet requirements of WAC 173-160-400. Significant repairs or repairs or modifications to the well seals will be performed by a driller licensed in Washington State as required by WAC 173-160-420 (10)(a) and WAC 173-160-450.

If a well is damaged beyond repair, Ecology will be consulted. If Ecology determines that it is appropriate to decommission the well it will be decommissioned in accordance with WAC 173-160-460. A replacement well will be installed at an appropriate location and with Ecology approval. Replacement wells will be drilled and constructed to meet the requirements of WAC 173-160-400.

Reichhold/SSA Containers Facility
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Compliance Monitoring and Contingency Plan

Appendix B
Sampling and Analysis Plan/ Quality Assurance Project Plan

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1.0 Introduction

This Sampling and Analysis Plan and Quality Assurance Project Plan (SAP/QAPP) has been prepared for the Reichhold/SSA Containers Facility (Facility), a former chemical manufacturing plant located at 3320 Lincoln Avenue East in Tacoma, Washington (the Facility). This SAP/QAPP is presented as Appendix B of the Compliance Monitoring and Contingency Plan (CMCP) and has been prepared in accordance with Model Toxics Control Act (MTCA) compliance monitoring requirements (WAC 173-340-410). The SAP/QAPP reflects future site conditions and proposed monitoring well networks that are scheduled to be installed at the Facility.

A general vicinity map of the Facility is presented in Figure 1.1 of the CMCP. The proposed monitoring well sampling locations along with site features are shown in Figure 2.1 of the CMCP.

The compliance monitoring fieldwork consists of protection monitoring, performance monitoring, and confirmational monitoring, as specified in Section 5.0 of the CMCP. As described in the CMCP, the requirements for protection monitoring, will be met through the performance monitoring activities and procedures established in this SAP and health and safety plans (HASPs) associated with implementation of the groundwater remedial action.

The procedures for performance monitoring and confirmational monitoring are identical, as described in the CMCP, and the procedures defined in this SAP/QAPP will be used for both periods. The SAP/QAPP has been organized for use as a reference for field personnel to conduct compliance monitoring.

1.1 SAMPLING PURPOSE AND OBJECTIVES

This document is intended to provide guidance on achieving the specific objectives of the CMCP, which are presented below:

- Address the performance of the remedial actions to be performed at the Facility
- Confirm continued natural recovery
- Confirm the long-term effectiveness of the remedy following the completion of remedial activities and the future operation of the site as a container terminal

In order to accomplish these objectives, the CMCP will evaluate groundwater quality at the Facility following discontinuation of hydraulic control through shutdown of the Shallow Interceptor Drain (SID) and Intermediate Aquifer extraction well pumps by conducting compliance monitoring of groundwater semi-annually for 3 years under the performance monitoring program and annually for 5 additional years under the confirmational monitoring program. In the event that compliance monitoring results exceed site-specific criteria (constituent of concern source area target concentrations, concentration trends, etc.) contingency action may be taken, if appropriate. Compliance criteria are defined in Section 3.0 of the CMCP and contingency actions are further defined in Section 8.0 of the CMCP.

Groundwater samples will be analyzed for the volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) and compared to the source area target concentrations identified in Table B.1.

This SAP/QAPP presents the field sampling and analytical methods and associated Quality Assurance/Quality Control (QA/QC) procedures selected to meet the Data Quality Objectives (DQOs) defined in Section 3.0.

1.2 SAMPLING SCHEDULE

CMCP sampling will commence after the shutdown of the SID and the extraction wells and the installation of any new compliance monitoring wells, if necessary. This is anticipated to be in the third quarter of 2008.

Groundwater samples will initially be collected from compliance monitoring wells semi-annually for 3 years under the performance monitoring program and annually 5 years thereafter under the confirmational monitoring program. If constituents of concern (COCs) are not detected at concentrations greater than source area target concentrations and trigger criteria are not exceeded at the end of the 5-year confirmational monitoring period, groundwater monitoring will be discontinued at the Facility. In the event that compliance monitoring wells exceed source area target concentrations or exhibit increasing trends, the contingency plan and monitoring will be implemented, as described in Section 8.0 of the CMCP.

2.0 Project Organization and Responsibilities

SSA Containers, Inc. (SSA) has overall responsibility for the implementation of the CMCP. Project management, quality assurance, laboratory, and field responsibilities of essential project personnel are defined below. Project management organization defining the roles is depicted on Figure B.1.

2.1 SUMMARY OF PROJECT PARTICIPANTS AND RESPONSIBILITIES

Mr. Stan Leja is the Project Manager for the Washington State Department of Ecology (Ecology), and is responsible for review and approval of this SAP/QAPP and all other related documents. Mr. Skip Sahlin is the SSA Project Coordinator. Mr. Alan Jeroue, P.E., of SSA is responsible for management of all Facility and compliance activities. Floyd|Snider is SSA's technical consultant responsible for technical analysis, authorship, and Ecology coordination to produce the CMCP in a manner consistent with the Ecology Agreed Orders. Ms. Kate Snider, P.E., is the Floyd|Snider Principal in Charge. Mr. Stephen Bentsen, P.E., is Floyd|Snider's Project Manager. Environmental Partners, Inc. (EPI) provides subcontracted assistance to Floyd|Snider for hydrogeology and related document preparation. The lead contact for EPI is Mr. Doug Kunkel, L.H.G.

Analytical Resources, Incorporated (ARI) of Tukwila, Washington has been selected to perform all laboratory analyses. Ms. Susan Dunnihoo is ARI's Project Manager for this project. Mr. David Mitchell is the laboratory Quality Assurance Officer.

The following sections describe individual responsibilities for key team members.

- The CMCP Principal in Charge (Ms. Kate Snider, Floyd|Snider) provides technical oversight of project activities and senior review of project submittals. The Floyd|Snider Principal in Charge serves as liaison between agencies, the client, the laboratory, and contract personnel.
- The CMCP Project Manager (Mr. Stephen Bentsen, Floyd|Snider) provides technical oversight of project activities and review of project submittals and serves as liaison between agencies, the client, the laboratory, and contract personnel.
- The EPI Project Manager (Mr. Doug Kunkel, EPI) provides technical oversight of project activities and review of project submittals. Additionally, EPI, as a subcontractor to Floyd|Snider, is responsible for overseeing project performance to ensure contract compliance and for implementing all necessary actions and adjustments to accomplish program objectives. The EPI team lead may also serve as liaison between agencies, the client, the laboratory, and contract personnel.
- The CMCP Health and Safety Manager (Mr. Josh Bernthal, EPI) is responsible for evaluating risks associated with the CMCP and preparing a site-specific HASP compliant to applicable laws and regulations related to health and safety. CMCP Managers and Health and Safety Manager are responsible for implementing the HASP.

- The Project QA Officer (TBD) is responsible for overall implementation of the QAPP. Duties include overseeing all contractor activities to ensure compliance with the QAPP, including field and laboratory activities, and project work products. The QA Officer will work closely with the other QA Managers, will be immediately notified if problems occur, and will approve changes to the CMCP if such changes are warranted. In the event that changes are needed, the QA Officer will immediately notify the Floyd|Snider Project Manager, who will discuss the proposed changes with the SSA Containers Project Manager prior to implementing those changes.
- The Project Chemist (Project QA Officer or qualified representative, TBD) will remain independent of direct project involvement and day-to-day operations, is responsible for coordinating with the laboratory to obtain required analyses, sample tracking, and chain-of-custody. The Project Chemist is also responsible for review and validation of laboratory analysis reports and resolving any analytical data quality issues.
- The Site Manager (Mr. Josh Bernthal, EPI) will support the CMCP Project Manager and is responsible for day to day coordination with the CMCP Project Manager on technical issues, coordinating and managing field staff, implementing QC procedures for field measurements, for monitoring and documenting all work performed by EPI for this project.
- The Laboratory Project Manager (Ms. Susan Dunnihoo, ARI) is the primary ARI contact for EPI, and is responsible for sample tracking and analysis at the analytical laboratory.
- The Laboratory QA Officer (Mr. David Mitchell, ARI) is responsible for monitoring and documenting the quality of all work produced by the laboratory for this project, and for implementing corrective action should the need arise.

2.2 PERSONNEL TRAINING REQUIREMENTS AND CERTIFICATIONS

All field personnel must be OSHA-HAZWOPER trained. As described above, a site-specific HASP will be developed prior to implementing compliance monitoring.

3.0 Data Quality Objectives

The overall objective of the DQOs is to ensure that data are of known and defensible quality. This SAP/QAPP provides procedures to implement field sampling, chain-of-custody, laboratory analysis, and reporting that provides results that meet these objectives. The DQOs of the CMCP are to:

- collect high quality and verifiable data,
- use resources cost-effectively, and
- collect data that are suitable for their intended use by SSA and Ecology.

3.1 DATA QUALITY

Data must be of sufficient quality to meet the DQOs noted above. Two levels of data quality and analysis are applicable for this project:

- Screening Level Data
- Definitive Data

3.1.1 Screening Level Data

Field screening measurements are performed using portable instruments. Field screening measurement results are used to evaluate groundwater conditions. Field screening methods are summarized in Section 5.3.

3.1.2 Definitive Data

Fixed laboratory data meet a higher level of stringency and are used to monitor groundwater performance and confirmational monitoring samples. To generate data of sufficient quality, the following approach for analytical laboratory data for groundwater samples is followed:

- The laboratory is accredited by Ecology
- Applicable analytical test methods (e.g., SW846 methods) will be used
- Quality control samples and procedures are used by the laboratory for analysis
- Data summary packages will be generated and documentation provided are sufficient to perform a Level I data quality review
- Data quality review will be performed on the analytical data according to the procedures specified in Section 10

Groundwater samples will be analyzed using the following methods:

- VOCs by SW-846 8260B
- SVOCs by SW-846 8270D

Laboratory QA will be implemented and maintained as described in this plan and according to the ARI's Laboratory Quality Assurance Plan and standard operating procedures (SOPs). Field quality control samples are described in Section 5.4. Laboratory quality control samples are described in Section 8.2.

The methods selected are sufficient to meet the project DQOs. While a best effort will be made to achieve the project DQOs, there may be cases in which it is not possible to meet the specified goals. Any limitation in data quality due to analytical problems (e.g., elevated detection limits due to matrix effect) will be identified within 48 hours and brought to the attention of the Floyd|Snider Project Manager. If necessary, corrective measures will be determined and implemented. ARI will document the problem, the correction, and the results. In addition, this information will be discussed in the data validation report.

3.2 DATA QUALITY INDICATORS

To achieve the CMCP objectives, data quality indicators (DQIs) of precision, accuracy (bias), comparability, completeness, representativeness, and sensitivity are used to assess DQOs. Data quality indicators and associated types of samples are shown in Table B.2. Definitions for each of these indicators are provided below.

3.2.1 Precision

Precision is a measure of the reproducibility of an analytical result (i.e., to obtain the same or similar results on replicate measurements of the same sample or of duplicate samples). Reproducibility is affected by matrix variations, the extraction procedure, and the analytical method used. For duplicate samples, precision is expressed as the relative percent difference (RPD). Precision will be evaluated for two components:

- Analytical method precision will be evaluated using matrix spike duplicates or laboratory duplicates, depending on the analytical method requirements
- Analytical and field sampling precision will be evaluated using field duplicates

The RPD (field or laboratory duplicates) will be reviewed during data quality review, and deviations from the specified limits will be noted and the effect on reported data commented upon by the data reviewer. Precision goals are presented in Table B.3.

3.2.2 Accuracy

Accuracy is assessed by determining how close a measured value lies to its true value. Field accuracy is obtained through evaluation of trip blanks, proper sample handling, preservation, and compliance with holding times. Primary indicators of laboratory accuracy are with blank, matrix spike, or laboratory control samples. A sample is spiked with an analyte of known concentration and the average percent recovery (%R) value is calculated. This can be a surrogate compound in organics methods, a blank, or matrix spike. Accuracy goals are presented in Table B.3.

Percent recovery values will be reviewed during data quality review, and deviations from the specified limits will be noted and the effect on reported data commented upon by the data reviewer.

3.2.3 Representativeness

Representativeness is a measure of how closely analytical results reflect the actual concentration or distribution of chemical compounds in a sampled media. Monitoring well locations for sampling are placed to evaluate compliance. The number, location, and frequency of samples influence representativeness; these factors are addressed in the CMCP. Standard procedures for sample collection and handling have been developed to provide data that are representative of each sampling event.

3.2.4 Comparability

Data comparability expresses the confidence with which each sampling event can be compared to another. Comparability will be maintained by use of consistent sampling procedures, approved analytical methods, consistent detection limits, and consistent units.

3.2.5 Completeness

Completeness for usable data is defined as the percentage of usable data out of the total amount of data generated. Specifically, the basis is the total number of scoped samples collected relative to the total number of valid results generated. To avoid potential conditions where monitoring wells may not be accessible due to staging of shipping containers within the planned site development, the client will be given ample notice of scheduled monitoring events. When feasible, the amount of sample collected will be sufficient for reanalysis, should the initial results not meet QC requirements. Less than 100 percent completeness could result if sufficient chemical contamination exists to require sample dilutions, resulting in an increase in the project-required detection/quantitation limits for some parameters. Highly contaminated environments can also be sufficiently heterogeneous to prevent the achievement of specified precision and accuracy criteria. The target goal for completeness will be 90 percent for laboratory analytical methods as shown in Table B.3.

3.2.6 Sensitivity

The sensitivity of the analytical methods (i.e., method reporting limits) identified for this project are sufficient to allow comparison of project results to decision criteria. Project decision criteria and analytical method quantitation limits for the project COCs are listed in Table B.4. Analytical method detection and reporting limits for all requested analytes are listed in Table B.4. It should be noted that ARI periodically updates the method limits; however, this project has specific method reporting criteria. Updated limits will be reviewed to ensure that project DQOs are achieved. Method detection limits (MDLs), and reporting limits (MRLs) are defined below.

3.2.6.1 Method Detection Limit

The MDL is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte (Appendix B of 40 CFR 136). Method detection limit studies have been performed by the laboratory and are acceptable for this project. MDLs are listed in Table B.4.

3.2.6.2 Method Reporting Limit

The MRL is the lowest quantitative value. Any sample result less than the MRL is routinely reported by the laboratory as not detected. It may be based on project-specific concentrations of concern, regulatory action levels, or sensitivity capability of methods and instrument. The MRLs are adjusted based on the sample matrix and any necessary sample dilutions. Dilutions will only be performed after method-required cleanup procedures and where target analyte concentrations exceed the highest calibration standard. Project-specific laboratory MRLs for target analytes are listed in Table B.4.

4.0 Groundwater Level Monitoring

Water levels will be measured in all Shallow and Intermediate Aquifer wells at the Facility to provide an indication of groundwater flow directions following cessation of hydraulic control.

Water levels will be measured no more than 7 calendar days prior to beginning each sampling event. Water levels in all tidally-influenced wells (Intermediate Aquifer) will be measured within 60 minutes of low tide (beginning 30 minutes before and ending no later than 30 minutes after low tide). Water level measurements will begin with the off-site well closest to the Blair Waterway and will proceed inland. Shallow Aquifer wells are not tidally-influenced and will be measured the same day as the Intermediate Aquifer wells.

4.1 GROUNDWATER LEVEL MONITORING PROCEDURES

A Little Dipper (or equivalent) electronic water level indicator will be used to measure the depth to water (DTW) to the nearest 0.01 foot. The water level indicator will be decontaminated prior to use by washing the probe and the first 20 to 30 feet of cable in a solution of Liquinox™ (or equivalent) and potable water, then rinsing with distilled water. The water level indicator will be decontaminated between wells by spray rinsing the probe and any portion of the tape that was submerged in the groundwater with distilled water.

Nitrile gloves (or equivalent) should be worn when unlocking the protective well casing. A clean, unused pair of nitrile gloves must be donned prior to measuring the water level in order to avoid contaminating the well or water level indicator. The DTW is measured from a marked measuring point on the north side of the casing to the static water level inside the well casing. Sufficient time will be allowed for the water level to equilibrate prior to taking the measurement.

The DTW measurement will be recorded to the nearest 0.01 foot along with the time to the nearest minute in the field logbook. Any notable well maintenance issues will also be recorded in the field logbook so that these issues can be evaluated by the Floyd|Snider Project Manager and addressed as warranted.

At all measurement locations, the water level indicator probe and the portion of the cable that entered the well will be thoroughly decontaminated by using a spray rinse of distilled water after the DTW measurement is performed. After completing the measurement and recording the DTW in the field logbook, the well cap will be re-locked, and used gloves will be discarded before proceeding to the next well.

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5.0 Groundwater Sampling

Groundwater samples will be collected from Shallow and Intermediate Aquifer Compliance Monitoring Well Network monitoring wells at the Facility to fulfill monitoring requirements under the CMCP.

5.1 COMPLIANCE MONITORING WELL NETWORK

The approximate locations of the Shallow and Intermediate Aquifer Compliance Monitoring Network wells and informational wells are shown in Figure 8.1 of the CMCP; actual well locations will be adjusted as necessary in areas that will be accessible after planned site development. Existing monitoring wells may be incorporated into the Compliance Monitoring Well Network if they are appropriately located and constructed for compliance monitoring.

Although existing monitoring wells will be used when locations are appropriate, the installation of new monitoring wells will be necessary for the Shallow Aquifer and Intermediate Aquifer Compliance Monitoring Well Networks at the Facility. The future container terminal will provide temporary storage for large shipping containers that cannot be easily moved to gain access for groundwater sampling. In order to ensure access to wells sampled during monitoring events, the locations of monitoring wells in the Compliance Monitoring Well Network will be coordinated with the redevelopment design.

Because the location of containers on the property will change, the most desireable locations of the wells in the Compliance Monitoring Well Network will be next to light poles, fire hydrants or other non-moveable structures where containers cannot be stacked. Secondary locations would be in the aisles between stacks of containers. Any new wells added to the network will be installed with aboveground monuments set in concrete. The Compliance Monitoring Well Network wells may later be modified to flush monuments, if necessary, when the final grade of the container terminal is constructed.

5.1.1 Shallow Aquifer Monitoring Wells

Six monitoring wells are proposed to be located in the primary monitoring zone (along the North Ditch and the Lincoln Avenue Ditch) for the Shallow Aquifer Compliance Monitoring Well Network and may include existing wells as appropriate (e.g., MW-56(S), MW-2(S)2, MW-4(S)). The remaining wells in the network will be newly installed at locations determined to provide effective groundwater monitoring and to provide year-round access and protection, given the planned site development. The monitoring well network along the North Ditch will include at least two of the monitoring wells to be installed between the SID and the North Ditch, as requested by Ecology. Final proposed locations of monitoring wells will be determined based on groundwater flow directions and compatibility with the proposed redevelopment plan. Wells will be located in areas that can enable consistent access for monitoring within the layout of the container terminal.

In addition to the primary monitoring zone, the proposed Shallow Aquifer Compliance Monitoring Well Network includes three monitoring wells along the southern and southwestern sections of the property perimeter. SSA anticipates that property redevelopment activities will eliminate the

South Ditch between the Facility and Tribal properties to the south. A tight-lined stormwater conveyance system will likely be installed so that shallow groundwater will no longer flow to the South Ditch. Proposed monitoring wells will then be evaluated relative to potential Shallow Aquifer flow towards the Blair Waterway. It may be possible to use existing Wells MW-27(S)2, MW-42(S)2, and MW-25(S)2 for this purpose if they are in locations that will be consistently accessible and protected relative to the site development plan, otherwise new monitoring wells will be installed.

5.1.2 Intermediate Aquifer Monitoring Wells

The proposed Intermediate Aquifer Compliance Monitoring Well Network will extend from approximately MW-60(I) in the west to MW-29(I) in the east and will include seven evenly-spaced monitoring wells along the property line with approximately 200 feet between wells, and one additional well in the off-site area downgradient of the former Construction Debris Area. Existing off-site Well MW-46(I) might be used for this purpose or a new well might be installed depending on site development plans.

In addition, Ecology requested two monitoring wells downgradient of the Pentachlorophenol Plant Area (PPA), between the property boundary and the PPA. These two monitoring wells (Locations A and B), along with a third monitoring well located at the property line (Location C), are intended to provide data to evaluate groundwater quality downgradient of the PPA for several quarters following planned excavation activities. These monitoring wells interior to the property are not compliance wells, but are informational wells to assist with demonstration of natural attenuation. The excavation work proposed for the PPA in 2009 is designed to remove source material. Existing Well MW-14(I), or a new well in its vicinity, and one additional well between the PPA and the property line will be used for downgradient water quality evaluation.

5.1.3 Deep Aquifer Monitoring Wells

No Deep Aquifer compliance monitoring is proposed. This is based on the results of the sampling history for Deep Aquifer wells, and the consistent upward gradients from the Deep Aquifer to the Intermediate Aquifer that are associated with the Facility location in a regional discharge area.

5.1.4 Monitoring Well Construction

New monitoring wells will be drilled and installed to meet resource protection well construction standards found in WAC 173-160-420, Minimum Standards for Construction and Maintenance of Wells.

Monitoring wells will be constructed of 2-inch-diameter, flush-threaded, Schedule 40 PVC well casing and screen in conformance with WAC 173-160-430. Well screen assemblies will consist of 0.010-inch (10 slot), flush-threaded, machine-slotted, Schedule 40 PVC set in a 20x40 CSSI, 2/12 Monterey, or equivalent silica sand filter pack. The well design includes a 0.5 foot-long flush-threaded, Schedule 40 PVC sump with a flush-threaded end cap, or equivalent. Flush-threaded, Schedule 40 PVC well casing extends from the top of the screened interval to approximately 6 inches below ground surface. A 2-inch-diameter, locking, watertight PVC well cap will be installed to secure the well casing.

The sand filter pack will extend from below the screened interval to 1 foot above the top of the screened interval. A minimum 2-foot-thick seal of hydrated bentonite chips will be installed in the annular space immediately above the sand filter pack. The remainder of the annular space will be sealed with hydrated bentonite chips or bentonite grout to within approximately 1 foot of the ground surface.

A generalized construction diagram for Shallow Aquifer wells is presented in Figure 4.1 of the CMCP and a generalized well construction diagram for Intermediate Aquifer wells is presented in Figure 4.2 of the CMCP.

5.2 COMPLIANCE MONITORING SCHEDULE

Compliance monitoring for groundwater will begin following the discontinuation of hydraulic control at the Facility. Compliance monitoring consists of semi-annual performance monitoring for 3 years followed by annual confirmational monitoring for an additional 5 years.

The compliance monitoring results for wells along the property boundary will be evaluated relative to source area target concentrations. The results from the off-site well between the Facility boundary and the Blair Waterway will be evaluated relative to the target concentration calculated specifically for that well. The target concentrations for these wells are shown in Table 3.1 of the CMCP. Analytical results for the interior informational wells will be used to demonstrate natural attenuation, but will not be used to determine compliance.

The compliance monitoring results will be evaluated relative to specific criteria (COC concentrations, concentration trends, etc.) that would trigger contingency action at the Facility in the event that compliance monitoring wells exceed these thresholds. The criteria that serve as triggers for contingency actions are defined in Section 8.0 of the CMCP.

If the results of compliance monitoring indicate exceedances of target concentrations or increasing trends, additional contingency monitoring will be implemented as shown in Figure 8.1 of the CMCP.

5.3 GROUNDWATER SAMPLING PROCEDURES

Groundwater sampling consists of field instrument calibration, static water level measurement, well purging, field parameter measurements, sample collection, sample identification and handling, and sample shipping. Procedures for each of these groundwater sampling steps are presented in the following sections.

5.3.1 Field Instrument Calibration

Instruments are used during purging to measure field parameters that will determine when a well is ready for sampling. The field parameters, pH, temperature, conductivity, dissolved oxygen, and oxidation-reduction potential (ORP), are measured and compared to stabilization criteria, as noted in Section 5.3.5. A Yellow Springs Instrument Model 556 multiparameter meter, or equivalent, will be used to obtain field parameter measurements.

Field instruments must be calibrated prior to use, and any time that measurements appear to be anomalous, or if readings drift excessively. Instruments will be calibrated according to manufacturer's instructions.

5.3.2 Water Level Measurement

The DTW of each well will be measured prior to sampling to provide a static DTW measurement, which will be used as a baseline measurement for evaluating and adjusting pumping rates during low-flow purging. The DTW also provides the data necessary to calculate one casing volume, which is the minimum volume of water to be purged from the well before collecting a groundwater sample. The procedures for measuring DTW are described in Section 4.0, Groundwater Level Monitoring.

5.3.3 Purge Volume Calculation

The DTW and total well depth of each well will be used to compute one wetted casing volume, which is the minimum volume of water to be purged prior to sampling. The minimum volume of water purged from each well (assuming the casing diameter is 2 inches) prior to sampling will be calculated using the following equation.

$$\text{Wetted Casing Volume} = (TD - DTW) \times 0.16 \text{ gal/ft.}$$

Where:

TD = total depth of well in feet (measured in field)
DTW = depth to water in feet (measured in field)
0.16 = gallons of water per foot of wetted casing in a 2-inch diameter well

5.3.4 Purging Procedures

After completing the static water level measurement, monitoring wells will be purged following procedures in U.S. Environmental Protection Agency's (USEPA's) Low-Flow (Minimal Drawdown) Groundwater Sampling Procedures (USEPA 1996) until field parameter equilibrium is demonstrated. The well will be purged at a pumping rate that will not cause excessive drawdown. The pumping rate should be controlled as needed using the pump's variable speed flow controller. DTW will be measured in the well during purging to evaluate if the well is being drawn down excessively. Excessive drawdown is defined as greater than 0.3 feet of drawdown relative to the pre-purging static water level. Ideally, the pumping rate should cause less than 0.3 feet of water level drawdown and should stabilize over time. Water level measurements to monitor drawdown should be taken periodically during purging, generally at the same time as field parameter measurements.

If needed, pumping rates should be reduced to avoid pumping the well dry and ensure stabilization of the indicator parameters as noted in the following section.

The following purging procedures will be followed during sampling:

1. Check static water level and calculate purge volumes, as discussed above.

2. Purge water will be removed from each well using a dedicated bladder pump, submersible pump, or equivalent.
3. Purge water will be checked for the presence of immiscible (floating or sinking) contaminants during well purging. Observation of floating or sinking contaminants will be documented in the field logbook, including any other observable features such as color or odor—without intentionally sniffing the sample.
4. Purge water will be measured in graduated 5-gallon buckets. Purge water will then be transferred from the buckets to a waste tank that can be emptied at the Facility decontamination pad for treatment at the on-site water treatment plant. Purge water disposal methods will be modified following shutdown of the on-site water treatment plant.

5.3.5 Field Parameter Measurements

Purge water will be discharged through a flow cell for field parameter measurements and will be contained in graduated 5-gallon buckets or equivalent. Temperature, pH, conductivity, dissolved oxygen, and ORP will be measured approximately every 3 to 5 minutes. If at least one wetted casing volume has been purged and field parameters have stabilized for three consecutive measurements, the well is considered to contain representative formation water, and no further purging is required. Stabilization criteria are:

- pH ± 0.1 pH units
- Specific conductance ± 3%
- Temperature ± 0.1 °C
- ORP ± 10 millivolts (optional)
- Dissolved oxygen ± 0.3 mg/L (optional)

Dissolved oxygen and ORP are very sensitive parameters and are affected by exposure to air. Attaining stabilization for dissolved oxygen and ORP may not be possible in low-yield wells and therefore meeting stabilization criteria for these two parameters is optional. When the above stabilization criteria have been met the water in the well casing is stabilized and sample collection can begin. The total volume of water purged from each well will be recorded in the field logbook.

If the field parameters do not meet the above stabilization criteria, purging and measurement of parameters will continue until stabilization is obtained. Refer to the procedures in Section 5.3.6 for purging low-yield wells.

5.3.6 Purging Procedures for Low-yield Wells

Because low well yields are common for Shallow Aquifer monitoring wells, it may not be possible to meet stabilization criteria before evacuating the well to dryness. To the extent possible, wells will not be purged to dryness. When purging monitor wells of this type, the following procedures will be used.

If the purge process results in a dry well, the well will be evacuated to dryness only once (one well casing volume) prior to sampling. Any water entering the well after purging to dryness is representative formation water and may be sampled within 24 hours without further purging. Samples may be collected at that well upon sufficient recovery, which is defined as water level recovery to at least 80 percent of the original static water level prior to purging. If the purging process does not result in a dry well after one casing volume, an attempt to achieve field parameter stabilization will be performed, as described above.

At no time should the well be purged to dryness if the recharge rate causes formation water to cascade vigorously down the sides of the well screen. Cascading is likely to occur if the well is purged to dryness and the water level fully recovers within several minutes. If this happens, the purging rate will be decreased and field parameters wil be monitored until stabilization criteria are met.

Wells in which the static water level is at or below the bottom of the well screen will be considered as dry and will not be purged and sampled.

5.3.7 Sample Collection

Samples will be collected from each well immediately after purging is completed, except as previously described for low-yield wells. The time of sample collection should be recorded and marked on the sample label. If two or more bottles from the same well are filled consecutively and without interruption, the bottles may be labeled with the same sampling time. Additional samples will be collected for field and laboratory QA/QC, as designated on the sample matrix.

Groundwater samples will be collected into laboratory-cleaned, pre-labeled sample bottles. Sample bottles should be filled starting with the most sensitive aliquot and ending with the least sensitive aliquot.

Sample aliquots will be collected in the order of volatilization sensitivity as follows:

- Volatile organic compounds
- Semivolatile organic compounds

5.3.8 Sample Containers, Preservation, and Handling

Samples will be collected at each monitoring well location, as indicated on the sample matrix in Table B.5. The sample matrix specifies analyses, sample containers, preservation methods, and holding times. Sample bottles are to be placed in iced coolers containing bagged ice, or equivalent, immediately after sample collection.

Some sample types require preservation to retard biological action, retard hydrolysis, and reduce sorption effects. Preservation methods include pH control through chemical addition, cooling, and protection from light. The laboratory will provide bottles with appropriate preservatives already added. Preserved bottles will be pre-labeled and identified as "preserved" by the laboratory in order to distinguish them from non-preserved bottles. Safety glasses and nitrile or equivalent gloves should be worn whenever handling sample bottles, especially those containing preservatives.

The laboratory might pre-treat bottles used for VOC samples with hydrochloric acid (HCl) to extend the holding time for this aliquot. The sample bottles should be filled slowly to minimize volatilization due to agitation. VOC sample containers should be filled so that no headspace (air bubbles) remains in the container. Avoid overfilling the VOC bottles (overfilling will dilute the HCl preservative). Each VOC container must be checked for the presence of air bubbles using the following procedure:

1. Turn the container upside down so the bottom of the container is slightly tilted.
2. Flick the side of the inverted container with a finger or strike container on an open palm and observe for air bubbles.
3. If air bubbles appear, turn the container with the right side up and flick or strike the container again to move air bubbles back to the top.
4. Remove the cap and add water from the sampling pump to the container or cap and carefully place cap back on container.
5. Observe container again in the same manner for air bubbles. Repeat procedure as necessary until no air bubbles appear.

Bottles used for SVOC samples will contain no preservatives. Bottles should be filled to the shoulder.

5.3.9 Sample Collection Procedures for Low-yield Wells

For wells with slow recovery rates, samples should be collected as soon as sufficient water level recovery is achieved (at least 80 percent of the static water level prior to purging). The well should be allowed to recover until a sufficient volume of water is available to collect all VOC sample containers. Completely collected aliquots will be shipped to ARI on the day of collection.

Aliquots for SVOC analyses may be collected on subsequent visits to the well and may be partially filled on each visit. More than 1 day may be required to collect the full SVOC sample in a well with very low yields. To achieve SVOC project-specific reporting limits, ARI needs a minimum volume of 500 ml. No further purging will be necessary if the well is sampled within 24 hours of purging or pumping to dryness during sampling.

5.4 FIELD QUALITY CONTROL SAMPLES

QC measurements will be collected to evaluate laboratory precision, potential matrix interferences, and potential contamination from ambient air.

Field duplicate samples, trip blank samples, and matrix spike/matrix spike duplicate (MS/MSD) samples will be the only types of QC samples collected as part of the field QC program. Table B.6 summarizes the number of samples that will be analyzed to evaluate data quality. Equipment blank samples will not be obtained because groundwater sampling equipment will be either dedicated or disposable single-use devices.

A sample matrix will be prepared prior to each sampling event to inform the sampling personnel of the specific wells, analyses, and sample container types as well as locations to collect QA/QC samples. Duplicate samples will be collected at 10 percent of the wells. Trip blank samples originating at ARI will accompany one cooler of samples during each day of the sampling event.

5.4.1 Trip Blank Samples

The potential for contamination from ambient air and air in sample coolers or on-site sample refrigerators will be evaluated using trip blank samples. One set of trip blanks is required for each day of sample collection during the sampling event. The trip blank will originate at the contract laboratory and be re-labeled prior to submittal at the analytical laboratory following the sample identification procedures noted in Section 5.5. Trip blanks will accompany the sampling team into the field and will be handled along with field samples. The trip blank samples will be analyzed for VOCs only.

5.4.2 Field Duplicate Samples

Laboratory and field sampling precision will be evaluated by collecting blind field duplicate samples. Field duplicate samples will be collected at a rate of 10 percent of the total number of samples per sampling event, exclusive of other QC samples. Field duplicate samples will be collected under conditions as identical as reasonably possible to the original sample and will be analyzed for all COCs. Field duplicate samples will be labeled as noted in Section 5.5.

5.4.3 Matrix Spike/Matrix Spike Duplicate Samples

Triplicate volumes of sample will be collected at a rate of 5 percent of the total number of samples per sampling event, exclusive of other QC samples. The additional volume of sample will be used by the laboratory for MS/MSDs for all COCs. MS/MSD samples will be labeled like original samples, as noted in Section 5.5.

5.5 SAMPLE IDENTIFICATION

Samples will be given unique identifiers using the following system for designation.

SSA-GW - ##S - mm/yy

Where:

- SSA Identifies the sample as originating from the SSA.
- GW Identifies the sample as groundwater.
- ##S Identifies the monitoring well number (e.g., 13S or 13I). Upper case letters without parentheses will be used for aquifer designation (e.g., S or I).
- mm/yy Indicates month and year sample was collected (e.g., 06/09 for June 2009).

In addition to the sample identification, spaces will also be provided on the sample identification label to record the following information at the time of actual sample collection:

- Initials of personnel collecting samples
- Date and time of sample collection to the nearest minute (record the initial sample start time if all aliquots are collected consecutively)

- Requested analyses

A fictitious identification number and sample will be assigned to the two types of QA/QC samples (field duplicate, and trip blank samples), using the following sample number ranges. Consecutive numbers will be required beginning with the lower limit of the range for each QA/QC sample type.

QA/QC Sample Type	Sample Number Range
Field duplicate	160-169
Trip blank	180-189

Laboratory MS/MSD samples will be labeled in the same manner as the aliquots collected for standard analyses. The additional aliquots for MS/MSD samples will be documented in the field logbook and on the sample chain-of-custody form.

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6.0 Sample Documentation and Delivery

6.1 SAMPLE DOCUMENTATION

Information for each sampling location that will be documented in the groundwater sampling field logbook includes:

- Sampling personnel
- Equipment calibration (at least once per day and as needed)
- Equipment decontamination steps (if not dedicated or single use)
- Weather conditions
- Static water level
- Purging data
- Field parameter measurements
- Purge volume
- Sample times, bottle types, preservation
- Physical appearance and odor (if any) of the sample
- Presence of free product

Additional information that may be recorded in groundwater sampling field logbook on a case-by-case basis includes:

- Well condition (if noteworthy)
- Repairs made to well or sampling equipment
- Health and safety monitoring data (if required)
- Visitors to the site including arrival and departure times

6.2 SAMPLE CHAIN OF CUSTODY

The management of samples collected in the field must follow specific procedures to ensure sample integrity. The possession of samples must be traceable from the time they are collected through the time they are analyzed by the contract laboratory.

Chain-of-custody of a sample is defined by the following criteria:

- The sample is in a person's possession or in his/her view after being in his/her possession.
- The sample was in a person's possession and was locked up or transferred to a designated secure area by him/her.

Samples will be logged onto a chain-of-custody form after they are collected and before leaving the Facility. Each time the samples change hands, both the sender and the receiver will sign and date the chain-of-custody form. When a sample shipment is delivered to ARI, the samples must be relinquished to a representative of ARI. The top signature copy of the signed chain-of-custody form will be retained by ARI. The second copy of the chain-of-custody form will be retained by the sampling personnel and will be delivered to the Floyd|Snider Project Manager for inclusion in the project files. A chain-of-custody form will be completed for each sample shipment and the information on the record must be consistent with the sample matrix.

The following information is included in the chain-of custody form:

- Project number
- Sample number
- Signature of sampler
- Date and time of collection
- Place of collection
- Type of sample
- Number of containers
- Date and time when sample possession was relinquished
- Signature of person relinquishing samples
- Signature of receiver at laboratory

Additionally, field personnel are to include on the chain-of-custody form within the Comments/Special Instructions portion of the form: *"SEE ARI PM—REQUEST SSA PROJECT DQOs"* to ensure that project objectives are consistently met.

6.3 SAMPLE PACKAGING

Before packaging samples, clean and dry the exterior of the sample container and make certain that the sample label is correct, complete, and legible.

The sample packaging and shipping containers will be constructed and packed to meet the following requirements:

- There will be no release of materials to people or the environment.
- Inner containers that are breakable must be packaged to prevent breakage and leakage. The cushioning material must not be reactive with the sample contents.

Only waterproof ice chests or coolers will be considered acceptable shipping containers. Coolers will be provided by the contracted laboratory.

Samples that will be hand-delivered to the analytical laboratory will be handled as follows:

- Seal drain plug in cooler and place bubble-wrap or equivalent in bottom of cooler

- Place bottles inside Ziploc®-type plastic bags
- Place bagged, sample bottles in cooler
- Add double-bagged ice and packing material such as bubble wrap or equivalent to coolers

Samples that will be shipped to the analytical laboratory will be handled as follows:

- Seal drain plug in cooler and place bubble-wrap or equivalent in bottom of cooler.
- Wrap glass bottles with bubble wrap or equivalent.
- Place wrapped bottles inside Ziploc®-type plastic bags.
- Place wrapped, bagged, sample bottles in cooler.
- Add double-bagged ice and packing material such as bubble wrap to coolers.
- Place shipping list chain-of-custody form in plastic bag attached to inside of cooler lid.
- If shipping via courier attach two custody seals (front and back of container) so that the seals must be broken if the cooler is opened. Tape over custody seals with fiber tape.
- Place name and address of receiving laboratory in a position clearly visible on the outside of the cooler.
- Secure the cooler lid with fiber tape.
- Typically samples for this project are hand delivered to the laboratory. If samples are shipped via courier notify the laboratory, provide an airbill tracking number for each cooler shipped, and an estimated time of arrival.

Samples will be delivered to ARI for analysis after each day of sampling. ARI's address and contact person information is given below:

Analytical Resources, Inc.
4611 South 134th Place, Suite 100
Tukwila, WA 98168
Contact: Susan Dunihoo (206) 695-6207

6.4 SAMPLE DOCUMENTATION

All original field record and laboratory data reports will be stored in a project file at EPI's, Issaquah, Washington office. EPI will file and maintain records, reports, field logbooks, subcontractor reports and at minimum, records will include:

- Field logbooks
- Drawings
- Photographs
- Calculations

- Sampling Records
- Chain of custody
- Laboratory data
- Data validation reports
- Data assessment reports
- Interim project reports, progress reports, QA reports, etc.

6.5 DATA MANAGEMENT

CMCP data generation includes groundwater elevation measurement data and analytical data. Additionally project-related information such as (corrective action reports, field records etc) will be stored per data management procedures specified by Floyd|Snider. Data management will consist of database generation, data receipt and input of field and analytical data, and other data generated during the CMCP, and finally data presentation. ARI will provide an electronic data deliverable in the format specified by Floyd|Snider.

7.0 Sampling Equipment Decontamination

Sampling equipment generally used at the Facility will be dedicated or single-use disposable equipment. However, it may become necessary to decontaminate dedicated equipment should it become dirty or accidentally contaminated by improper handling. If groundwater sampling equipment requires decontamination, use the following procedures:

- Set up a decontamination station on the Facility decontamination pad or equivalent area.
- Disassemble the equipment as thoroughly as practical.
- Wash in a solution of tap water and Liquinox™ or equivalent detergent. Use a brush to wash the outside surfaces of the sampling device.
- Rinse thoroughly with tap water.
- Rinse with distilled water.
- Spray-rinse with reagent grade isopropyl alcohol.
- Spray-rinse with n-hexane and allow to evaporate.
- Spray-rinse with deionized water or ASTM Type II water.
- Place sampling device back into service or wrap in aluminum foil until placed back into service.

Upon completion of decontamination, pour rinsate into the Facility decontamination pad drain for treatment in the on-site water treatment plant. Rinsate disposal methods will be modified following shutdown of the on-site water treatment plant.

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8.0 Instrument Calibration and Maintenance

Analytical instrument calibration and maintenance is conducted in accordance with the QC requirements identified in each laboratory SOP and QA plan, and the manufacturer's instructions. General requirements are discussed below.

8.1 FIELD MEASUREMENT INSTRUMENT CALIBRATION PROCEDURES

Field instruments must be calibrated prior to use, and any time that measurements appear to be anomalous, or if readings drift excessively. Instruments will be calibrated according to manufacturer's instructions.

8.2 LABORATORY INSTRUMENT CALIBRATION PROCEDURES

As stated in SW846 and applicable laboratory SOPs, calibration of all analytical instrumentation is required to ensure that the analytical system is operating correctly and functioning at the sensitivity required to meet project-specific DQOs. Each instrument will be calibrated with standard solutions appropriate to the instrument and analytical method, in accordance with the methodology specified and at the QC frequency specified in the project laboratory SOPs.

All laboratory instruments will be calibrated according to manufacturers' instructions, as specified in ARI's Quality Assurance Plan dated January 4, 2008.

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9.0 Internal Quality Control Samples

This section describes field and laboratory QC checks.

9.1 FIELD QUALITY CONTROL CHECK

Assessment of field sampling precision and bias will be made by collecting field duplicates for laboratory analysis. Collection of these samples will be in accordance with the applicable procedures and frequency described in Section 5.4 of this SAP/QAPP.

9.2 LABORATORY QUALITY CONTROL CHECKS

Laboratory QC checks are accomplished through analyzing initial and continuing calibration samples, method blanks, surrogate spikes, laboratory control samples (LCS), and laboratory duplicate samples. Method-specific QC samples are described in the laboratory SOPs and summarized in Table B.7.

9.2.1 Initial and Continuing Calibration

Laboratory instrument calibration and maintenance requirements are discussed in Section 8.2.

9.2.2 Method Blanks

Method blanks are used to check for laboratory contamination and instrument bias. Laboratory method blanks will be analyzed at a minimum frequency of 5 percent or one per analytical batch for all chemical parameter groups.

Quality control criteria require that no contaminants be detected in the blank(s) at concentrations greater than or equal to the method reporting level. If a chemical is detected, the action taken will follow the laboratory SOPs as modified with project-specific procedures. Blank samples will be analyzed for the same parameters as the associated field samples.

9.2.3 Surrogate Spikes

Accuracy of an analytical measurement is evaluated by using surrogate spikes. Surrogate compounds are compounds not expected to be found in environmental samples; however, they are chemically similar to several compounds analyzed in the methods and behave similarly in extracting solvents. Samples for organics analysis will be spiked with surrogate compounds consistent with the requirements described in the laboratory SOPs.

Percent recovery values of surrogates are calculated concurrently with the analytes of interest. Since sample characteristics will affect the percent recovery, the percent recovery value is a measure of accuracy of the overall analytical method on each individual sample.

9.2.4 Laboratory Control Samples

LCS are used to monitor the laboratory's day-to-day performance of routine analytical methods, independent of matrix effects. The LCS is prepared by spiking reagent water with standard solutions prepared independently of those used in establishing instrument calibration. The LCS are extracted and analyzed with each batch of samples. Results are compared on a per-batch basis to established control limits and are used to evaluate laboratory performance for precision and accuracy. Laboratory control samples may also be used to identify any background contamination of the analytical system that may lead to the reporting of elevated concentration levels or false-positive measurements.

9.2.5 Laboratory Duplicate Samples

Precision of the analytical system is evaluated by using laboratory duplicates. Laboratory duplicates are two portions of a single homogeneous sample analyzed for the same parameter. Laboratory duplicates are prepared and analyzed with project samples.

10.0 Data Reduction, Validation, and Reporting Methods

The process of data reduction, review, and reporting is applicable to all aspects of the project (field activities, laboratory analyses, and analytical data review) and is required for both technical and managerial data. All data generated through field activities, or by the laboratory operation shall be reduced and validated prior to reporting. The following sections describe the process of handling data in terms of data generation, checking, and formatted reports for both field sampling and laboratory analysis data.

10.1 DATA REDUCTION

Data, both field and laboratory generated, are reduced either manually on calculation sheets or by computer on formatted printouts. Responsibilities for the data reduction process are delegated as follows:

- Technical personnel will document and review their own work and are responsible for the correctness of the work.
- Major calculations will receive a method and calculation check by a secondary reviewer prior to reporting (peer review).
- The Laboratory QA Officer will be responsible for ensuring that data reduction is performed according to protocols discussed in this SAP/QAPP.

10.2 IN-LABORATORY DATA REDUCTION AND VERIFICATION

All data generated by the laboratory will be reviewed prior to data release. ARI Laboratory Quality Assurance Program indicates that 100 percent of the data generated by ARI undergo four levels of review. The levels of review consist of analyst, peer, supervisory, and administrative review. Additionally Quality Assurance Personnel review 10 percent or more of the completed packages for accuracy, overall compliance, and completeness.

10.3 LABORATORY DATA REPORTING

Data deliverables will be submitted to Floyd Snider for verification and validation, as appropriate. A summary laboratory data package along with data available electronically will be submitted to Floyd Snider for each analytical batch. Data deliverables will include:

- Cover letter/case narrative which identifies the laboratory analytical batch number; matrix and number of samples included, analyses performed, and analytical methods used. Cover letter will also summarize any anomalies or discrepancies with the analytical data.
- Holding time (dates sampled, received, extracted, and analyzed) will be clearly specified.
- Tabulated sample analytical results with units, data qualifiers, sample volume, dilution factor, laboratory batch and sample number, and sample identification.
- Compound quantitation and reported detection limits.

- Blank summary results.
- MS/MSD result summaries with calculated percent recovery and relative percent difference values.
- LCS results when performed, with calculated percent recovery value.
- Duplicate analyses (laboratory duplicates).
- Data qualifiers assigned by the laboratory.

ARI will provide an electronic data deliverable in the format specified by Floyd|Snider.

10.4 DATA REVIEW

The QA Officer or designated representative will perform a Level I data review on all analytical data reports. A Level I data review process includes a review of sample analysis using USEPA's Functional Guidelines for Organic Data Review (USEPA 1999 and 2007) as guidance, specific method criteria, and professional judgment to assess that data quality objectives are met.

Technical review requires comparison of quality control (QC) to the required control limits. The following QC elements will be reviewed (as appropriate):

- Compliance with the SAP/QAPP
- Proper sample collection and handling procedures
- Holding times and sample receipt conditions
- Reviewing the laboratory data package for transcription errors, misidentifications, or miscalculations
- Cover letter
- Chain-of-custody and cooler receipt forms.
- Compound quantitation and reported detection limits.
- Blank summary results (e.g., method or trip)
- Surrogate percent recovery values
- Duplicate analyses (laboratory duplicates and MS/MSDs)
- Matrix spike and matrix spike duplicate
- Field QC results
- Assessing the reliability of data based on quality control sample results.
- Data qualifiers assigned by the laboratory
- Data completeness and format
- Overall assessment of data for the project.

The data quality review process for this project will follow the procedures in USEPA's Functional Guidelines (USEPA 1999 and 2007), as appropriate, but applicable to SW846, this QAPP, method SOPs, and professional judgment.

Qualifiers applied to the data as a result of the independent review will be limited to:

- U The analyte was analyzed for but was not detected above the sample-specific reporting limit.
- J The analyte was positively identified; the associated numerical value is an estimate of the concentration of the analyte in the sample.
- UJ The analyte was not detected above the sample reporting limit. However, the reporting limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- R The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

10.5 DATA REVIEW REPORTING

Results of the QA review and/or validation will be included in a data quality review report, which will provide a basis for meaningful interpretation of the data quality and evaluate the need for corrective actions and/or comprehensive data validation. This report will be used to generate the quality control summary report. The QA review reports will be submitted to the Floyd|Snider Project Manager 30 days after receipt of all laboratory data.

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11.0 Performance and System Audits

Performance and systems audits may be conducted to determine that sampling and analysis are performed in accordance with SAP/QAPP-specified requirements. The project QA/QC Officer is responsible for initiating audits and overseeing audit implementation and, if necessary, corrective actions.

11.1 DATA QUALITY AUDITS (INDEPENDENT DATA VALIDATION)

Data generated by the laboratory undergoes a Level I verification by the QA Officer, designated staff, or consultant. Laboratory data will be evaluated for compliance with data quality objectives, and with procedural requirements contained in this QAPP. The detailed scope of this validation is presented in Section 10.0, Data Reduction, Validation, and Reporting Methods.

11.2 LABORATORY AUDITS

ARI Laboratory is certified by Ecology and the State of Washington Department of Health to perform the methods listed in this QAPP. ARI also participates in the USEPA Contract Laboratory Program (CLP), and multiple performance evaluation programs and is subject to the quality control requirements and audits of these programs. For this reason, no laboratory audit is currently planned. If a problem is identified, a systems or performance audit of the laboratory will be conducted, if warranted, in order to identify and correct specific problems.

11.3 FIELD AUDITS

Field audits will be conducted if the Project QA Officer identifies the need.

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12.0 Preventative Maintenance

Field and laboratory instrumentation are examined and tested prior to being put into service and are to be maintained according to the manufacturer's instructions. Sampling personnel will maintain a supply of typical maintenance replacement items available in the field to help prevent downtime because of equipment malfunctions. Examples of typical equipment maintenance items may include but not be limited to batteries, filters, tubing, fittings, sample containers, and calibration standards.

12.1 FIELD INSTRUMENTS

All instruments will be maintained according to manufacturer's instructions.

12.2 LABORATORY INSTRUMENTS

All laboratory instruments will be maintained according to manufacturers' instructions as specified in ARI's Quality Assurance Plan dated January 4, 2008.

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13.0 Corrective Actions

The Floyd|Snider and EPI Project Managers are responsible for maintaining quality throughout the compliance monitoring. The day-to-day responsibility for assuring the quality of field and laboratory data rests with the Field Investigation Manager, project QA/QC Officer, and the Laboratory Quality Assurance Officer.

Any nonconformances with the established QC procedures will be expeditiously identified and controlled. Where procedures are not in compliance with the established protocol, corrective actions will be taken immediately. Subsequent work which depends on the nonconforming activity will not be performed until the identified nonconformance is corrected.

Analytical and equipment problems may occur during sampling and sample handling, sample preparation, laboratory analysis, and data review. For noncompliance problems, a formal corrective action program is determined and implemented at the time the problem is identified. Corrective actions will be implemented and documented accordingly.

13.1 FIELD CORRECTIONS

The initial responsibility for monitoring the quality of field measurements lies with the field personnel. Each technical staff member is responsible for verifying that all QC procedures are followed. The technical staff member assesses the correctness of the field methods and the ability to meet QA objectives. If a problem occurs that might jeopardize the integrity of the project or cause some quality assurance objective not to be met, the technical staff member will notify the QA Officer. The QA Officer will notify the Project Manager or the analytical laboratory QA Officer, as appropriate. Corrective measures will be determined and implemented. The technical staff member will document the problem, the correction, and the results.

13.2 LABORATORY CORRECTIONS

The need for correction(s) in the analytical laboratory may come from several sources: equipment malfunction, failure of internal QA/QC checks, method blank contamination, or failure of performance or system audits; and/or noncompliance with QA requirements. When measurement equipment or analytical methods fail QA/QC checks, the problem should be immediately brought to the attention of the appropriate Laboratory QA Officer and other persons in the laboratory in accordance with the laboratory's SOP. Any limitation in data quality due to analytical problems will be identified within 48 hours and brought to the attention of the EPI or Floyd|Snider Project Manager. The laboratory will demonstrate that they tried corrective actions, as recommended in the applicable methods, to deal with non-conformance. Corrective actions will be discussed in the cover letter and data validation report.

13.3 RECONCILIATION WITH USER REQUIREMENTS

The project QC Officer and EPI or Floyd|Snider Project Manager review the field and laboratory data generated for this project to ensure that all project quality assurance objectives are met. If any nonconformances are found in the field procedures, sample collection procedures, field documentation procedures, laboratory analytical and documentation procedures, and data evaluation and quality review procedures, the impact of those nonconformances on the overall project QA objectives will be assessed. Appropriate actions, including resampling and reanalysis, may be recommended to the Floyd|Snider, EPI, SSA, and Ecology Project Managers so that the project objectives can be accomplished.

14.0 Quality Control Reports

After the field work and the final analyses have been completed and reviewed, a final quality control summary report is prepared by the project QA Officer. The report summarizes the QA and audit information, indicating any corrective actions taken and the overall results of SAP/QAPP compliance. Analytical data quality review involves checking the laboratory data package against criteria established in the SAP/QAPP as described in Section 10.0. The quality control summary report is to be included in the central project file and incorporated as part of the semi-annual or final report.

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15.0 References

U.S. Environmental Protection Agency (USEPA). 1999. *USEPA Contract Laboratory Program, National Functional Guidelines for Organic Data Review.* EPA-540/R-99/008. October.

U.S. Environmental Protection Agency (USEPA). 2003. National Environmental Laboratory Accredidation Conference (NELAC) Standard. EPA/600/R-04/003. 1 July.

U.S. Environmental Protection Agency (USEPA). 2007. *USEPA Contract Laboratory Program, National Functional Guidelines for Organic Data Review.* EPA-540/R-07/003. July.

Tables

Table B.1
Screening Levels for Volatile Organic Compounds and Semivolatile Organic Compounds in Groundwater

Constituent	CAS Number	Method	Shallow Aquifer Monitoring Well Target Concentrations[1] (µg/L)	Intermediate Aquifer Target Concentrations for On-site Monitoring Wells[1] (µg/L)	Intermediate Aquifer Target Concentrations for Off-site Monitoring Well[1] (µg/L)
Volatile Organic Compounds					
Tetrachloroethene	127-18-4	USEPA 8260B	7.0E+02	1.5E+05	4.0E+02
Trichloroethene	79-01-6		1.0E+02	2.4E+04	2.0E+02
Vinyl Chloride	75-01-4		2.7E+02	1.9E+04	6.5E+03
Semivolatile Organic Compounds					
2-Chlorophenol	95-57-8	USEPA 8270D	1.2E+04	2.0E+04	6.8E+03
2,3,4,6-Tetrachlorophenol	58-90-2		2.8E+03	2.0E+04	1.9E+03
2,4-Dichlorophenol	120-83-2		2.1E+03	2.0E+04	2.3E+03
2,4,6-Trichlorophenol	88-06-2		1.3E+04	2.0E+04	5.0E+03
Pentachlorophenol	87-86-5		2.0E+04	2.0E+04	5.6E+03

Notes:

1 Refer to Compliance Monitoring and Contingency Plan for further information on target concentrations.

MTCA Model Toxics Control Act

Table B.2
Sample Types Used to Evaluate Data Quality

Data Quality Indicator	Field and Laboratory Quality Assurance Sample Type
Precision	Field Duplicate
	Laboratory Duplicate
	Matrix Spike Duplicate
Accuracy	Matrix Spike
	Surrogate Spike
	Laboratory Control Sample
	Trip Blank
	Method Blank
Representativeness	Trip Blank
	Method Blank
	Chain of Custody
	Holding Times
Comparability	Method Detection Limits
	Method Reporting Limits
	Sample Collection Methods
	Laboratory Analytical Methods
Completeness	Data Qualifiers
	Laboratory Deliverables
	Requested / Reported Results

Table B.3
Accuracy, Precision, and Completeness Guide

Constituent	Method	Laboratory Control Sample Accuracy[1,2] (% Recovery)	Matrix Spike Sample Accuracy[3] (% Recovery)	Precision (Duplicate or MS/MSD)	Completeness
Volatile Organic Compounds[1]					
Tetrachloroethene	USEPA 8260B	80-124	80-124	30%	90%
Trichloroethene		80-117	80-117	30%	90%
Vinyl Chloride		53-132	53-132	30%	90%
Semivolatile Organic Compounds[1]					
2-Chlorophenol	USEPA 8270D	54-102	54-102	30%	90%
2,3,4,6-Tetrachlorophenol		30-160	30-160	30%	90%
2,4-Dichlorophenol		50-112	50-112	30%	90%
2,4,6-Trichlorophenol		44-116	44-116	30%	90%
Pentachlorophenol		34-126	34-126	30%	90%

Notes:

Accuracy data for VOCs and SVOCs obtained from ARI website, March 2008. ARI uses default limits of 30-160% recovery and 30% RPD for all organic non-Contract Laboratory Program analyses. Accuracy data (i.e., LCS, surrogates) are subject to periodic updates.

1 VOC LCS data collected between 8/1/07 and 11/15/07. SVOC LCS data (liquid-liquid extract) collected between 1/1/07 and 12/1/07 . VOC and SVOC LCS control limits were effective 1/3/08 and 1/24/08 respectively and are subject to periodic updates.

2 Marginal exceedances as defined in the NELAC Standard (USEPA 2003) where percent recovery values are outside LCS control limits but within marginal exceedance limits (3 or 4 standard deviations around the mean). Three marginal exceedances are considered acceptable.

3 Use LCS data for evaluating matrix spike percent recovery values. The LCS criteria should be used as advisory control limits.

ARI Analytical Resources, Inc.
LCS Laboratory control sample
MS/MSD Matrix spike/matrix spike duplicate
NELAC National Environmental Laboratory Accreditation Conference
RPD Relative percent difference
SVOC Semivolatile organic compound
USEPA U.S. Environmental Protection Agency
VOC Volatile organic compound

Table B.4
Method Detection Limits and Method Reporting Limits

Constituent	Method	Method Detection Limit[1] (µg/L)	Method Reporting Limit[1] (µg/L)
Volatile Organic Compounds			
Tetrachloroethene	USEPA 8260B	0.053	0.2
Trichloroethene		0.043	0.2
Vinyl Chloride		0.119	0.2
Semivolatile Organic Compounds			
2-Chlorophenol	USEPA 8270D	0.324	1
2,3,4,6-Tetrachlorophenol		NA	5
2,4-Dichlorophenol		1.661	5
2,4,6-Trichlorophenol		1.65	5
Pentachlorophenol		0.497	3

Notes:

1 Detection limit data for analytical parameters obtained from ARI website, June 2008. MDLs and MRLs are updated periodically. MDL studies are performed in accordaince with 40 CFR Part 136, Appendix B, using seven degrees of freedom.

ARI Analytical Resources, Inc.

MDL Method detection limit

MRL Method reporting limit

NA Not analyzed

USEPA U.S. Environmental Protection Agency

Table B.5
Container, Preservation, and Holding Time Requirements

Parameter	Matrix	Method	Container	Preservation	Maximum Holding Time
Field Screening					
pH	Water	Refer to Section 5.3	Field analysis	None	Analyze immediately
Temperature				None	
Specific Conductance				None	
Dissolved Oxygen				Avoid contact with air	
Oxidation-reduction Potential				Avoid contact with air	
Fixed Laboratory Analysis					
Volailte organic compounds	Water	USEPA 8260B	(3) 40-ml VOA vials with Teflon-lined septa without headspace	Cool to 4°C, HCl to pH < 2	14 days with pH ≤ 2[1]
Semivolatile organic compounds		USEPA 8270D	(2) 500-ml amber glass jars	Cool to 4°C	7 days to extraction, 40 days to analyze extract

Notes:

1 7 days without preservative.
HCl Hydrochloric acid
USEPA U.S. Environmental Protection Agency
VOA Volatile organic analysis

Table B.6
Estimated Number of Groundwater Samples per Sampling Event

Parameter	Method	Shallow Aquifer Primary Samples	Intermediate Aquifer Primary Samples	Field Duplicate (10%)	MS/MSD (5%)	Trip Blank (5%)[1]	Estimated Total
Volatile organic compounds	USEPA 8260B	12	10	2	1	2 to 3	27 to 28
Semivolatile organic compounds	USEPA 8270D	12	10	2	1	0	25

Notes:

1 One set of trip blanks is required for each day of sampling during the sampling event. Estimated sampling event duration is 2 to 3 days.

MS/MSD Matrix spike/matrix spike duplicate

USEPA U.S. Environmental Protection Agency

Table B.7
Laboratory Quality Assurance/Quality Control Sample Summary

Parameter	Method	Method Blanks	MS/MSD	LCS	Surrogate
Volatile organic compounds	USEPA 8260B	1/batch	5%	1/batch	All samples
Semivolatile organic compounds	USEPA 8270D	1/batch	5%	1/batch	All samples

Notes:

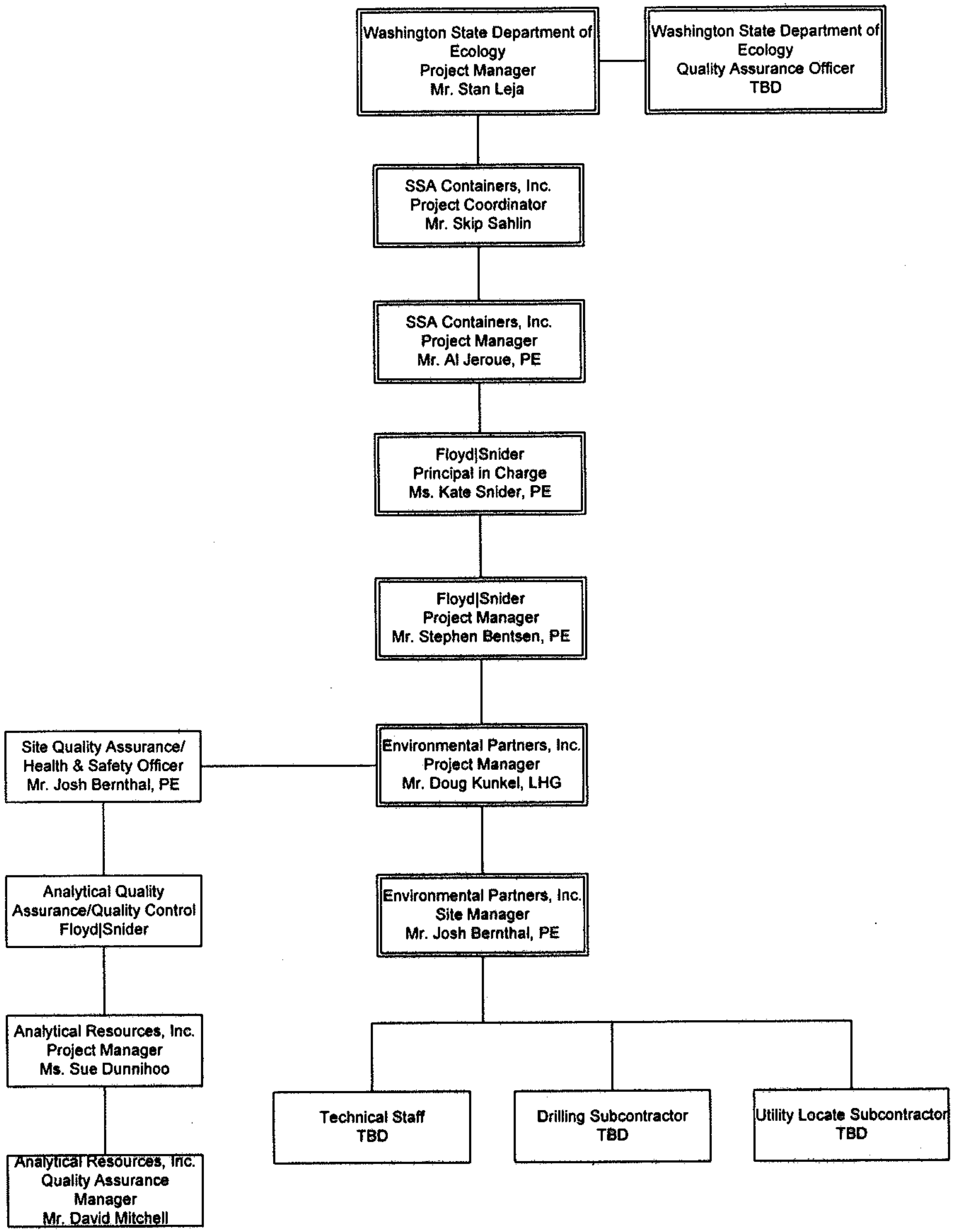
1 Blank spike may substitute for matrix spike data.

LCS Laboratory control sample

MS/MSD Matrix spike/matrix spike duplicate

USEPA U.S. Environmental Protection Agency

Figures



FLOYD | SNIDER strategy • science • engineering	**Compliance Monitoring and Contingency Plan Reichhold/SSA Containers Facility Tacoma, Washington**	Figure B.1 Organizational Chart