Lower Duwamish Waterway Group

Port of Seattle / City of Seattle / King County / The Boeing Company

Lower Duwamish Waterway Remedial Investigation

APPENDIX G:
GROUNDWATER PATHWAY ASSESSMENT

For submittal to

The U.S. Environmental Protection Agency
Region 10
Seattle, WA

The Washington State Department of Ecology
Northwest Field Office
Bellevue, WA

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Prepared by: Windward environmental LLC

200 West Mercer Street, Suite 401 ♦ Seattle, Washington ♦ 98119

Table of Contents

INTRODUCTION 1
G.1. ADVANCE ELECTROPLATING 3
G.1.1 Summary of available data 4
G.1.2 Analysis of groundwater COCs in LDW sediment 5
TABLE G-1. SELECTED GROUNDWATER COCS ANALYZED AND DETECTED IN LDW SEDIMENT DOWNGRADIENT FROM THE ADVANCED ELECTROPLATING SITE 6
TABLE G-2. SELECTED GROUNDWATER COCS ANALYZED AND NOT DETECTED IN LDW SEDIMENT DOWNGRADIENT FROM THE ADVANCE ELECTROPLATING SITE[A] 6
G.1.3 Relevance to LDW 6
G.2 BOEING DEVELOPMENTAL CENTER 7
G.2.1 Summary of available data 8
TABLE G-3. MAXIMUM CONCENTRATIONS OF CHEMICALS[A] EXCEEDING PRELIMINARY CLEANUP LEVELS SINCE 1998 IN SWMU-17 MONITORING WELLS 9
G.2.2 Analysis of groundwater COCs in LDW sediment 11
TABLE G-4. SELECTED GROUNDWATER COCS DETECTED IN LDW SEDIMENT DOWNGRADIENT FROM THE BOEING DEVELOPMENTAL CENTER SITE 11
TABLE G-5. SELECTED GROUNDWATER COCS ANALYZED AND NOT DETECTED IN LDW SEDIMENT DOWNGRADIENT FROM THE BOEING DEVELOPMENTAL CENTER SITE 11
G.2.3 Relevance to the LDW 12
G.3 BOEING ISAACSON 12
G.3.1 Summary of available data 13
TABLE G-6. ARSENIC CONCENTRATIONS IN SHORELINE MONITORING WELLS SAMPLED IN 2000 AT THE BOEING ISAACSON SITE 14
G.3.2 Analysis of groundwater COCs in LDW sediment 14
TABLE G-7. SELECTED GROUNDWATER COCS ANALYZED AND DETECTED IN LDW SEDIMENT DOWNGRADIENT FROM THE BOEING ISAACSON SITE 15
G.3.3 Relevance to LDW 15
G.4 BOEING PLANT 2 15
G.4.1 Summary of available data 16
G.4.2 ANALYSIS OF GROUNDWATER COCS IN LDW SEDIMENT 20
TABLE G-8. SELECTED GROUNDWATER COCS ANALYZED AND DETECTED IN LDW SEDIMENT DOWNGRADIENT FROM THE BOEING PLANT 2 SITE 20
TABLE G-9. SELECTED GROUNDWATER COCS ANALYZED AND NOT DETECTED IN LDW SEDIMENT DOWNGRADIENT FROM THE BOEING PLANT 2 SITE 21
G.4.3 Relevance to LDW 21
G.5. GREAT WESTERN INTERNATIONAL 22
G.5.1 Summary of available data 22
TABLE G-10. GROUNDWATER FLOW RATES AT THE GREAT WESTERN SITE 23
TABLE G-11. MAXIMUM CONCENTRATIONS OF CHEMICALS DETECTED IN GROUNDWATER SEEPS AT THE GREAT WESTERN SITE 24
G.5.2 Analysis of groundwater COCs in LDW sediment 25
TABLE G-12. SELECTED GROUNDWATER COCS ANALYZED AND NOT DETECTED IN GREAT WESTERN SEDIMENT[A] 26

G.5.3 Relevance to the LDW 26
TABLE G-13. CHEMICALS IDENTIFIED IN THE SUPPLEMENTAL RI AS POTENTIAL COCS *27*
G.6 LONG PAINTING 27
G.6.1 Summary of available data 27
G.6.2 Analysis of groundwater COCs in LDW sediment 28
TABLE G-14. SELECTED GROUNDWATER COCS ANALYZED AND DETECTED IN LDW SEDIMENTS DOWNGRADIENT FROM THE LONG PAINTING SITE *29*
TABLE G-15. SELECTED GROUNDWATER COCS ANALYZED AND NOT DETECTED IN LDW SEDIMENT DOWNGRADIENT FROM THE LONG PAINTING SITE *29*
G.6.3 Relevance to the LDW 29
G.7 MALARKEY ASPHALT 30
G.7.1 Summary of available data 30
G.7.2 Analysis of groundwater COCs in LDW sediment 32
TABLE G-16. SELECTED GROUNDWATER COCS ANALYZED AND DETECTED IN LDW SEDIMENTS DOWNGRADIENT OF THE MALARKEY ASPHALT SITE[A] *32*
G.7.3 Relevance to the LDW 32
G.8 PACCAR (KENWORTH TRUCK) 33
G.8.1 Summary of available data 33
G.8.2 Analysis of groundwater COCs in LDW sediment 35
TABLE G-17. GROUNDWATER COCS ANALYZED AND DETECTED IN LDW SEDIMENT DOWNGRADIENT FROM THE PACCAR SITE[A] *35*
G.8.3 Relevance to the LDW 36
G.9 PHILIP SERVICES CORPORATION (BURLINGTON ENVIRONMENTAL) 37
G.9.1 Summary of available data 37
TABLE G-18. ESTIMATED AVERAGE GROUNDWATER FLOW RATES, PSC GEORGETOWN FACILITY *38*
G.9.2 Analysis of groundwater COCs in LDW sediment 40
TABLE G-19. SELECTED GROUNDWATER COCS ANALYZED AND DETECTED IN LDW SEDIMENT DOWNGRADIENT FROM THE PSC SITE *40*
TABLE G-20. SELECTED GROUNDWATER COCS ANALYZED AND NOT DETECTED IN LDW SEDIMENT DOWNGRADIENT FROM THE PSC SITE *41*
G.9.3 Relevance to the LDW 41
G.10 RHÔNE-POULENC 42
G.10.1 Summary of available data 42
TABLE G-21. CONCENTRATIONS OF CHEMICALS DETECTED IN INTERTIDAL SEEPS ADJACENT TO THE RHÔNE-POULENC SITE *45*
G.10.2 Analysis of groundwater COCs in LDW sediment 45
TABLE G-22. GROUNDWATER COCS SITE DETECTED IN LDW SEDIMENT DOWNGRADIENT FROM THE RHÔNE-POULENC SITE *46*
TABLE G-23. GROUNDWATER COCS ANALYZED AND NOT DETECTED IN LDW SEDIMENTS DOWNGRADIENT FROM THE RHÔNE-POULENC SITE *46*
G.10.3 Relevance to the LDW 46
G.11 SOUTH PARK LANDFILL 47
G.11.1 Summary of available data 47
FIGURE G-1. TIME SERIES FOR VINYL CHLORIDE, SOUTH PARK CUSTODIAL LANDFILL, KING COUNTY, WA *49*

G.11.2 Analysis of groundwater COCs in LDW sediment 49
G.11.3 Relevance to the LDW 50
G.12 TERMINAL 108/CHIYODA SITE 50
G.12.1 Summary of available data 51
G.12.2 Analysis of groundwater COCs in LDW sediment 53
TABLE G-24. GROUNDWATER COCS ANALYZED AND DETECTED IN SEDIMENT DOWNGRADIENT FROM THE T108/CHIYODA SITE 54
G.12.3 Relevance to the LDW 54

SUMMARY 55
TABLE G-25. SUMMARY OF GROUNDWATER SITES EVALUATED IN THIS APPENDIX 58

REFERENCES 61

ATTACHMENT G-1. DATA TABLES 65
DATA TABLE 1. ADVANCE ELECTROPLATING GROUNDWATER DATA 65
DATA TABLE 2. BOEING DEVELOPMENTAL CENTER GROUNDWATER MONITORING, SWMU-17 (FORMER DC-05 WASTE OIL TANK), JUNE 2002 66
DATA TABLE 3. BOEING DEVELOPMENTAL CENTER GROUNDWATER MONITORING, SWMU-20 (BUILDING 9-101), JUNE 2002 69
DATA TABLE 4. BOEING DEVELOPMENTAL CENTER GROUNDWATER MONITORING, AOC-03/04, JUNE 2002 79
DATA TABLE 5. BOEING DEVELOPMENTAL CENTER GROUNDWATER MONITORING, AOC-05 (FORMERLY DC-01 GASOLINE TANK), JUNE 2002 79
DATA TABLE 6. BOEING ISAACSON GROUNDWATER DATA 79
DATA TABLE 7. BOEING PLANT 2 GROUNDWATER DATA FROM THE LAST FOUR QUARTERS OF SHORELINE MONITORING IN 2001/2002 80
DATA TABLE 8. COMPARISON OF FACILITY BOUNDARY MONITORING WELL DATA TO PROPOSED MEDIA CLEANUP LEVELS (µG/L) AT THE BOEING PLANT 2 SITE (WESTON 1998) 84
DATA TABLE 9. COMPARISON OF SEEP DATA (MARCH-JUNE 1995) TO PROPOSED MEDIA CLEANUP LEVELS AT BOEING PLANT 2 (WESTON 1998) 86
DATA TABLE 10. GREAT WESTERN GROUNDWATER DATA FOR WELLS LOCATED CLOSEST TO THE LDW 88
DATA TABLE 11. LONG PAINTING GROUNDWATER DATA FOR MW-5 92
DATA TABLE 12. MALARKEY ASPHALT GROUNDWATER DATA FOR WELLS LOCATED CLOSEST TO THE LDW[A] 94
DATA TABLE 13. PACCAR GROUNDWATER DATA FOR WELLS LOCATED CLOSEST TO THE LDW 95
DATA TABLE 14. PHILIP SERVICES GROUNDWATER DATA FOR WELLS LOCATED CLOSEST TO THE LDW 96
DATA TABLE 15. RHÔNE-POULENC GROUNDWATER DATA FOR WELLS LOCATED CLOSEST TO THE LDW 101
DATA TABLE 16. KING COUNTY SOUTH PARK CUSTODIAL LANDFILL GROUNDWATER DATA FOR WELLS LOCATED CLOSEST TO THE LDW 104
DATA TABLE 17. TERMINAL 108 /CHIYODA GROUNDWATER DATA FOR WELLS LOCATED CLOSEST TO THE LDW 110

ATTACHMENT G-2. FIGURES AND MAPS (PUBLISHED AS A SEPARATE 11 X 17" VOLUME, HARD COPY ONLY)

Map G-1 *Groundwater flow contours and sediment samples associated with groundwater sites*

Advance Electroplating (G.1)

Figure 4 *Well locations (Brincefield 2002)*
Figure a *Well monitoring results for inorganics (Cutler 1999)*
Figure b *Well monitoring results for inorganics (except Ni and Zn) (Cutler 1999)*
Figure c *Well monitoring results for organics (Cutler 1999)*
Figure d *Well monitoring results for organics (excluding trichloroethene) (Cutler 1999)*

Boeing Developmental Center (G.2)

Figure 1a *August 1989, January 1994, and December 2000- PCE, A horizon groundwater (Landau 2001)*
Figure 1c *August 1989, January 1994, and December 2000- PCE, C horizon groundwater (Landau 2001)*
Figure 4 *Cross section locations (Landau 2001)*
Figure 5 *Cross section A-A' (Landau 2001)*
Figure 6 *Cross section B-B' (Landau 2001)*
Figure 7 *Facility-wide groundwater elevation contours, June 2002 (Landau 2001)*
Figure 8 *Facility-wide groundwater elevation contours, June 2001 (Landau 2001)*
Figure 9 *SWMU and AOC locations (Landau 2001)*

Boeing Isaacson (G.3)

Figure 4 *Geologic cross-section A-A' (ERM and Exponent 2000)*
Figure 5 *Dissolved arsenic concentrations detected in groundwater and surface water samples, Boeing Isaacson property, Seattle, Washington (ERM and Exponent 2000)*
Figure 7 *Mean groundwater elevations, Boeing Isaacson property, Seattle, Washington (ERM and Exponent 2000)*
Figure 8 *Groundwater elevations- high tide, 28 August 2000, Boeing Isaacson property, Seattle, Washington (ERM and Exponent 2000)*
Figure 9 *Groundwater elevations- low tide, 28 August 2000, Boeing Isaacson property, Seattle, Washington (ERM and Exponent 2000)*
Figure 10 *Arsenic concentrations in Duwamish River shallow sediment, Boeing Isaacson property, Seattle, Washington (ERM and Exponent 2000)*

Boeing Plant 2 (G.4)

Figure 1 *Shoreline well locations (Weston 2002b)*
Figure 1a *Boeing Plant 2 historical and RFI soil, groundwater, seep, and sediment sample locations (Weston 1998)*
Figure 1b *Boeing Plant 2 historical and RFI soil, groundwater, seep, and sediment sample locations (Weston 1998)*
Figure 1 *Trichloroethene and vinyl chloride in A-horizon wells at Boeing Plant 2 quarterly groundwater monitoring in 2001/2002 (Weston Solutions 2002b)*

Boeing Plant 2 (G.4), continued

Figure 2 *Trichloroethene and vinyl chloride in A-horizon wells at Boeing Plant 2 quarterly groundwater monitoring in 2001/2002 (Weston Solutions 2002b)*
Figure 3 *Arsenic and copper in A-horizon wells at Boeing Plant 2 quarterly groundwater monitoring in 2001/2002 (Weston Solutions 2002b)*
Figure 4 *Arsenic and copper in A-horizon wells at Boeing Plant 2 quarterly groundwater monitoring in 2001/2002 (Weston Solutions 2002b)*
Figure 5 *Thallium and selenium in A-horizon wells at Boeing Plant 2 quarterly groundwater monitoring in 2001/2002 (Weston Solutions 2002b)*
Figure 6 *Nickel and zinc in A-horizon wells at Boeing Plant 2 quarterly groundwater monitoring in 2001/2002 (Weston Solutions 2002b)*
Figure 15 *Mean groundwater elevation contour map for "A" level monitoring wells, August 1995 (Weston 1996)*

Great Western Chemical (G.5)

Figure 2.12 *Cross section locations (Terra Vac and Floyd & Snider 2000)*
Figure 2.16 *Cross section D-D' (Terra Vac and Floyd & Snider 2000)*
Figure 2.20 *Potentiometric map, low tide first water bearing zone (Terra Vac and Floyd & Snider 2000)*
Figure 2.21 *Potentiometric map, high tide first water bearing zone (Terra Vac and Floyd & Snider 2000)*
Figure 2.22 *Potentiometric map, low tide second water bearing zone (Terra Vac and Floyd & Snider 2000)*
Figure 2.23 *Potentiometric map, high tide second water bearing zone (Terra Vac and Floyd & Snider 2000)*
Figure 4.3 *Surface water, sediment, and mussel sample stations (Terra Vac and Floyd & Snider 2000)*
Figure 5-1 *Tetrachloroethene contours in first water bearing zone,1999 sampling event (Terra Vac and Floyd & Snider 2000)*
Figure 5-2 *Tetrachloroethene contours in second water bearing zone,1999 sampling event (Terra Vac and Floyd & Snider 2000)*
Figure 5-3 *Trichloroethene contours in first water bearing zone,1999 sampling event (Terra Vac and Floyd & Snider 2000)*
Figure 5-4 *Trichloroethene contours in second water bearing zone,1999 sampling event (Terra Vac and Floyd & Snider 2000)*
Figure 5-5 *1,2-dichloroethene (total) contours in first water bearing zone,1999 sampling event (Terra Vac and Floyd & Snider 2000)*
Figure 5-6 *1,2-dichloroethene (total) contours in second water bearing zone,1999 sampling event (Terra Vac and Floyd & Snider 2000)*
Figure 5-7 *Vinyl chloride contours in first water bearing zone,1999 sampling event (Terra Vac and Floyd & Snider 2000)*
Figure 5-8 *Vinyl chloride contours in second water bearing zone,1999 sampling event (Terra Vac and Floyd & Snider 2000)*

Long Painting (G.6)

Figure 2 *Potentiometric map and MW locations, including 10th Ave S (Kleinfelder 2000)*

Malarkey Asphalt (G.7)

Figure 3.1 *Soil removal grids and sampling locations (Onsite 2000)*
Figure 4 *Groundwater elevation contour map, April 29,1998 (SECOR 1998)*
Figure 6 *Alternative 3: Surface remediation, soil excavation, cap and cap repair areas (SECOR 1998)*

PACCAR (G.8)

Figure a *Potentiometric surface contour map (Kennedy/Jenks 1999)*
Figure C-7 *Groundwater monitoring results, tetrachloroethene, Kenworth Truck Company, north fire aisle (Kennedy/Jenks 1996)*
Figure C-8 *Groundwater monitoring results, vinyl chloride, Kenworth Truck Company, north fire aisle (Kennedy/Jenks 1996)*

Philip Services Corporation (G.9)

Figure 2 *Groundwater elevations, June 24, 2002: shallow aquifer (wells screened through the water table) Georgetown Facility (PSC 2002a)*
Figure 3 *Groundwater elevations, June 24, 2002: intermediate aquifer (wells screened through the water table) Georgetown Facility (PSC 2002a)*
Figure 4 *Department to Ecology, Site locations near PSC facilities (PSC 2002a)*
Figure 5 *On-site and off-site groundwater concentrations trichloroethene (PSC 2002a)*
Figure 6 *On-site and off-site groundwater concentrations cis-1,2-dichloroethene (PSC 2002a)*
Figure 7 *On-site and off-site groundwater concentrations vinyl chloride (PSC 2002a)*
Figure 8 *Vertical cross-section groundwater concentrations (PSC 2002a)*

Rhône-Poulenc (G.10)

Figure 2-2 *Locations of round 3 groundwater sampling wells and seep and surface water sampling (Rhône Poulenc 1996)*
Figure 3 *Potentiometric map (GeoEngineers 2002)*
Figure 4-1 *Upper aquifer toluene concentration contour map for Round 3 groundwater data (Rhône-Poulenc 1995)*
Figure 4-2 *Cross-section C-C' of vertical extent of toluene contamination – Round 3 (Rhône-Poulenc 1995)*
Figure 4-3 *Cross-section D-D' of vertical extent of toluene contamination – Round 3 (Rhône-Poulenc 1995)*
Figure 6 *Toluene concentrations- Round 15 upper aquifer, upper interval wells (GeoEngineers 2002)*
Figure 7 *Toluene concentrations- Round 15 upper aquifer, intermediate and lower interval wells (GeoEngineers 2002)*
Figure 12a *Upper aquifer-upper interval: toluene concentration vs. time- Round 15 groundwater monitoring (GeoEngineers 2002)*
Figure 12b *Upper aquifer-upper interval: toluene concentration vs. time- Round 15 groundwater monitoring (GeoEngineers 2002)*
Figure 12c *Upper aquifer-upper interval: toluene concentration vs. time- Round 15 groundwater monitoring (GeoEngineers 2002)*
Figure 13 *Upper aquifer-intermediate interval: toluene concentration vs. time- Round 15 groundwater monitoring (GeoEngineers 2002)*

Rhône-Poulenc (G.10), continued

Figure 14 *Upper aquifer-intermediate and lower intervals: toluene concentration vs. time- Round 15 groundwater monitoring (GeoEngineers 2002)*
Figure 15a *Upper aquifer-upper interval: arsenic concentration vs. time- Round 15 groundwater monitoring (GeoEngineers 2002)*
Figure 15b *Upper aquifer-upper interval: arsenic concentration vs. time- Round 15 groundwater monitoring (GeoEngineers 2002)*
Figure 16a *Upper aquifer-intermediate interval: arsenic concentration vs. time- Round 15 groundwater monitoring (GeoEngineers 2002)*
Figure 16b *Upper aquifer-intermediate interval: arsenic concentration vs. time- Round 15 groundwater monitoring (GeoEngineers 2002)*
Figure 17a *Upper aquifer-upper interval: copper concentration vs. time- Round 15 groundwater monitoring (GeoEngineers 2002)*
Figure 17b *Upper aquifer-upper interval: copper concentration vs. time- Round 15 groundwater monitoring (GeoEngineers 2002)*
Figure 17c *Upper aquifer-upper interval: copper concentration vs. time- Round 15 groundwater monitoring (GeoEngineers 2002)*
Figure 18 *Upper aquifer-intermediate interval: copper concentration vs. time- Round 15 groundwater monitoring (GeoEngineers 2002)*
Figure 19a *Upper aquifer-intermediate and lower intervals: copper concentration vs. time- Round 15 groundwater monitoring (GeoEngineers 2002)*
Figure 19b *Upper aquifer-intermediate and lower intervals: copper concentration vs. time- Round 15 groundwater monitoring (GeoEngineers 2002)*

South Park Landfill (G.11)

Figure 3-5 *Groundwater flow direction map – 3/20/99 (King County 2000)*
Figure 3-6 *Groundwater flow direction map – 10/14/99 (King County 2000)*

T-108/Chiyoda (G.12)

Figure 3 *Groundwater elevation contour map, November 6, 1991 (AGI 1992)*
Figure 4 *Groundwater elevation contour map, January 17-18, 1992 (AGI 1992)*
Plate 1 *Location map (Dames & Moore 1981)*

INTRODUCTION

This appendix summarizes the most recent groundwater data collected for upland sites identified as preliminary sites of interest for the Phase 1 RI by EPA and Ecology (in RI Section 4.3.1.1). The purpose of this appendix is to evaluate the potential for chemicals of concern (COCs) in groundwater associated with specific upland sites to reach sediment in the LDW through the groundwater pathway. This Phase 1 analysis is based on recent groundwater chemistry data, existing information on aquifer characteristics, fate and transport analyses that have been conducted at these sites, and an analysis of groundwater COCs in downgradient LDW sediment. The sites reviewed and summarized include:

- Advance Electroplating
- Boeing Developmental Center
- Boeing Isaacson
- Boeing Plant 2
- Great Western International
- Long Painting
- Malarkey Asphalt
- PACCAR (Kenworth Truck Co.)
- Philip Services (Burlington Environmental)
- Rhône-Poulenc
- South Park Landfill
- T108/Chiyoda Property

Although the Puget Park/McFarland site was identified by Ecology as a site of interest for Phase 1, groundwater data have not been collected at this site. Therefore, this site is not discussed further in this appendix.

A summary of the Duwamish basin hydrogeology is presented in Section 2.2.4 of the RI. Transport of COCs in groundwater is discussed in Section 4.3.2.4. The location of all sites is shown in Map G-1 in Attachment G-2. All data tables are presented in Attachment G-1. Figures excerpted directly from site reports are referred to in this appendix by their original figure numbers. Figures for all sites are presented in Attachment G-2.

The most recent reports containing groundwater information were reviewed for each of the sites. The following types of information were included in this summary, as available:

- Site operations and regulatory status
- Information on the affected aquifer, its characteristics, and the groundwater flow direction and rates
- Concentrations of COCs in samples from groundwater monitoring wells located closest to the LDW during the most recent sampling events, summary of COCs in groundwater, and chemical contour or plume maps, as available
- Concentrations of COCs in groundwater seeps or sediment in the LDW in relation to potential groundwater discharge, as available
- Summary of fate and transport analyses, if conducted

In addition to the review and summary of data in available documents, an analysis was conducted to evaluate whether COCs identified in groundwater were present in LDW sediment at concentrations exceeding the sediment quality standards (SQS) or cleanup sediment levels (CSLs) in Washington's Sediment Management Standards (SMS).[1] If SMS standards were not available for a chemical, the Dredged Material Management Program (DMMP) screening levels (SLs) or maximum levels (MLs) were used. This type of analysis does not necessarily link these sediment in potential discharge zones to groundwater contamination because it does not take into account other factors that may influence the transport of groundwater COCs to sediment, such as natural attenuation, dilution upon discharge, and sediment transport.[2] Instead, it serves as a rough preliminary assessment that would require additional analyses to assess potential pathways of contamination. Site-specific fate and transport analyses, conducted for many of the sites, provide more definitive information regarding the groundwater pathway. The following steps were used in this preliminary analysis:

1. The chemicals selected for analysis were based on screening summaries presented in the referenced reports.[3] At most sites, referenced reports summarized exceedances of screening criteria in all site wells instead of only downgradient wells closest to the LDW. For those sites, the chemicals chosen for the sediment analysis were those exceeding criteria in any on-site wells, but only if they were also detected in downgradient wells at any concentration.[4] At some sites, screening was not conducted in the referenced reports; selection of chemicals at those sites was done on a site-specific basis, as described in each site's section of this appendix.

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[1] These standards are described in Section 5.2 of the RI.

[2] See Section 4.4 of the RI for a discussion of fate and transport of sediment-associated chemicals.

[3] For this preliminary analysis, no attempt was made to determine whether the screening criteria used in the reference reports were appropriate.

[4] Chemicals were only selected if detected at any concentration in downgradient wells because information was generally not available to determine if concentrations exceeded screening levels.

2. The potential zone of groundwater discharge was identified on a qualitative basis for each site. This zone was estimated based on potential onsite source areas and direction of groundwater flow from the site to the LDW. It was assumed that the potential discharge zone extended to the middle of the LDW channel.
3. The LDW sediment database was searched for detections of groundwater COCs in sediment samples located within the qualitative potential zone of groundwater discharge. If chemicals were detected, the number of detections above SMS standards was noted. If chemicals were not detected, the detection limit was compared to SMS standards. If SMS standards were not available, detected values or detection limits were compared to DMMP guidelines.
4. If there were no exceedances of SMS standards or DMMP guidelines, this analysis concludes there is no evidence to indicate that groundwater COCs have migrated to LDW sediments and accumulated[5] at concentrations of concern (depending upon the extent of sampling coverage for each COC; also note uncertainties in this analysis, as discussed in the Summary section). If SQS criteria were exceeded, the potential source of these chemicals may require additional assessment as part of source control activities. For chlorinated solvents, volatile organic compounds (VOCs), petroleum hydrocarbons, and other low molecular weight organic compounds that are not expected to accumulate in sediment due to their relatively low affinity for sediment and/or their potential for biodegradation. For these chemicals, groundwater and seep data, along with fate and transport considerations, are more definitive in assessing the completeness of the groundwater pathway.

As a final section for each site, the groundwater flow system and chemical data, fate and transport, and sediment analysis are summarized within the context of the potential for migration of COCs to the LDW.

G.1. ADVANCE ELECTROPLATING

The Advance Electroplating site is located approximately 325 ft[6] from North Fork Hamm Creek and approximately 3,300 ft west of the LDW near RM 4. The site was the location of chrome plating operations for truck, auto, and airplane parts from 1964 to 1992. Trichloroethene and tetrachloroethene were used to clean metal parts prior to electroplating. Known areas of soil contamination on the site appear to have resulted

[5] Note it is the accumulation in sediment that is of concern with respect to potential recontamination following sediment remediation. For groundwater COCs that do not persist in sediments, source control activities are more relevant to water quality considerations.

[6] All distances in the appendix are represented as feet, consistent with standard practice in hydrogeology.

from waste disposal, spillage, and leaking pipes and containers. EPA initiated a time-critical removal action under RCRA in 1995 and 1996, which involved the removal of over 500 drums containing liquid and solid hazardous waste. Approximately 1,500 tons of soil with chemicals exceeding site-specific removal action levels of 100 mg/kg for trichloroethene and 300 mg/kg for chromium were excavated and treated and/or disposed of offsite (Ecology and Environment 1997).

G.1.1 Summary of available data

Information on this site was obtained from an EPA Removal Report (Ecology and Environment 1997) and from EPA groundwater monitoring data collected from 1995 through 1998 (Cutler 1999). In addition, unpublished background information on the site was provided by EPA (Sanga 2002). This information indicated that Hart Crowser collected groundwater samples from seven onsite wells in 2000, but the data set was not available for review.

Groundwater flow system

Three geologic units identified beneath the site include a 4-to 10-ft thick fill unit consisting of silty fine to medium sand with occasional gravel. Underlying this unit is an inorganic clay that ranges from 1.5 to 4.5 ft in thickness. This clay layer dips to the southeast occurring at about 4 ft in depth in the northwest corner of the site, and about 10 ft in depth at the southeast corner of the site (Ecology and Environment 1997).

A saturated, fine-to-medium sand alluvium is located beneath the clay layer that makes up the local shallow aquifer. Groundwater is encountered at 9 to 15 ft below ground surface (bgs) at the site, primarily within the alluvium. A few inches of water were reportedly observed perched within the fill on top of the clay layer during drilling. The monitoring well logs were not available to assess the continuity of the clay layer, the well screen interval, or the nature of the underlying aquifer. No investigation of the deeper portions of the alluvium was completed or available.

The groundwater flow from the site is to the east toward the LDW, although locally the shallow groundwater may discharge to the Hamm Creek drainage system. Figure 4 in the Advance Electroplating section of Attachment G-2 indicates a slight southeast component to the groundwater flow beneath the site. This figure also shows the location of MW-1, the downgradient well that was monitored annually between 1995 (following the soil removal cleanup action) and 1998.

COCs in groundwater

The primary COCs have been identified as trichloroethene, tetrachloroethene, cadmium, chromium, nickel, and total petroleum hydrocarbons (TPH) (Ecology and Environment 1997). In addition, the high concentrations of trichloroethene (200,000 µg/L) in one of the site wells suggest that NAPL may be present beneath the site, although it was not detected in the 104 borings drilled to 13 ft by Ecology &

Environment, or in the seven monitoring wells installed by Hart Crowser (Sanga 2002).

The available groundwater data from the site include groundwater quality analyses for organic compounds and inorganic chemicals in samples collected by EPA on nine occasions from 1995 through 1998 from monitoring well MW-1 located at the southeast corner of the property (EPA 2002). The depth to the screened interval is not available, but EPA has assumed the well was screened in the upper aquifer (<15 ft bgs; Sanga 2002). The data collected are presented graphically in four unnumbered figures from Cutler (1999) included in the Advance Electroplating section of Attachment G-2.

Maximum concentrations of chemicals detected in MW-1 are presented in Data Table 1 in Attachment G-1. Organic compounds detected at the highest concentrations were trichloroethene (2,600 µg/L), tetrachloroethene (84 µg/L), and cis- and trans-1,2-dichloroethene (180 µg/L). According to EPA's summary of other data collected from seven onsite wells by Hart Crowser in 2000 (Sanga 2002), concentrations of trichloroethene ranged from 95 to 200,000 µg/L, and tetrachloroethene ranged from 15 to 6,800 µg/L (Sanga 2002). Trichloroethene concentrations increased toward the east side of the site (Sanga 2002).

Chromium, copper, nickel, and zinc were detected in groundwater samples collected by EPA at maximum concentrations of 1,930, 2,240, 4,410 and 34,600 µg/L, respectively. According to EPA's summary of data collected by Hart Crowser in 2000, the concentration of total chromium ranged from 7.4 to 2,100 µg/L (Sanga 2002). The highest chromium concentrations occurred at the northeast side of the site, with a general increase in metals concentrations toward the east side of the site (Sanga 2002). In general, groundwater concentrations within site boundaries did not show clearly-defined plumes (Sanga 2002).

G.1.2 Analysis of groundwater COCs in LDW sediment

The documents reviewed did not conduct any screening of COCs. Therefore, chemicals selected for this analysis were those detected in groundwater for which SMS standards or DMMP guidelines are available. These COCs are listed in Tables G-1 and G-2, along with sediment data from the potential discharge zone. The potential discharge zone is from RM 4.1 to 4.2 in the LDW based on the discharge point of Hamm Creek to which shallow groundwater would be expected to discharge (Map G-1, Attachment G-2).

Table G-1. Selected groundwater COCs analyzed and detected in LDW sediment downgradient from the Advanced Electroplating site

Analyte[a]	# Sediment Samples	# Detects	# Detects > SQS	# Detects > CSL
Arsenic	5	5	0	0
Cadmium	5	4	0	0
Chromium	5	5	0	0
Copper	5	5	0	0
Lead	5	5	0	0
Mercury	5	5	0	0
Nickel	5	5	0 [a]	0 [a]
Silver	5	5	0	0
Zinc	5	5	0	0

[a] SQS and CSL were not available for nickel, so DMMP SL and ML were used instead.

Table G-2. Selected groundwater COCs analyzed and not detected in LDW sediment downgradient from the Advance Electroplating site[a]

Analyte	# Sediment Samples	# Detects	Detection Limit	DL>SL	DL>ML
Antimony	5	0	10 mg/kg dw	0	0
Tetrachloroethene	1	0	2.9 µg/kg dw	0	0
Trichloroethene	1	0	2.9 µg/kg dw	0	0

[a] SQS and CSL values were not available for antimony, tetrachloroethene, or trichloroethene, so DMMP SLs and MLs were used instead.

Nine metal COCs were detected in sediment in the LDW in all of the five samples analyzed in the potential groundwater discharge zone, but none of their concentrations exceeded the SQS or SL (Table G-1). Antimony, another metal COC, was not detected in these five samples at a detection limit less than its SL (Table G-2). These results suggest that these metals have not migrated to and accumulated in LDW sediments at concentrations of concern. The two chlorinated solvent COCs (tetrachloroethene and trichloroethene) were measured in one LDW sediment sample, but were not detected at detection limits less than their respective DMMP criteria (Table G-2). Based on these data, chlorinated solvents have not accumulated in sediment. Due to their low affinity to sediment, this type of analysis does not definitively indicate whether they have migrated to sediment. Fate and transport considerations, as summarized below, are more valuable in assessing their potential discharge in the LDW.

G.1.3 Relevance to LDW

Elevated concentrations of chlorinated solvents and metals have been detected at the downgradient boundary of the Advance Electroplating site. Although an offsite

chemical migration analysis has not been conducted, it is expected that the significant distance between the site and the LDW (over 2500 feet) would reduce the chemical concentrations and alter the specific chemical compounds (i.e., degrade tetrachloroethene and trichloroethene to dichloroethene and vinyl chloride) prior to discharge. Other sites closer to the river have shown significant biodegradation of chlorinated solvents as they migrate through the alluvial materials, which contain abundant natural organics (Terra Vac and Floyd & Snider 2000).

It is probable that the site's shallow groundwater discharges to a local ditch or other surface water drainage (e.g., Hamm Creek) before discharging to the LDW, given the relative elevation difference between the site and the LDW elevation, and the surface water drainage systems between the site and the LDW. Although the groundwater quality within the deeper alluvium has not been evaluated and can be important to the occurrence of chlorinated solvents within the alluvial aquifer flow system of the Duwamish basin, the clay layer identified above the alluvium by Ecology & Environment (1997) may have restricted significant downward COC migration. In addition, EPA's emergency action removed the most contaminated soils.

Nine COCs were detected in sediment in the LDW, but none of their concentrations exceeded SMS standards or DMMP guidelines (Table G-1). An additional three groundwater COCs were measured in LDW sediment, but were not detected at detection limits less than their respective DMMP guidelines (Table G-2). These results support the limited potential discussed above for direct migration to the LDW, and indicate that the Advance Electroplating groundwater COCs have not migrated to and accumulated in LDW sediments at concentrations of concern.

G.2 BOEING DEVELOPMENTAL CENTER

The Boeing Developmental Center (BDC) is located at 9725 East Marginal Way South, adjacent to the south side of Slip 6, on the east side of the LDW between RM 4.2 to 4.8. Under RCRA, EPA conducted a RCRA Facility Assessment (RFA) in 1994 to identify solid waste management units (SWMUs) and areas of concern (AOC). Ecology assumed the oversight role for the corrective action activities at the site. These cleanup activities are being conducted under the Model Toxics Control Act (MTCA) and Ecology's Voluntary Cleanup Program.

Investigation and remediation activities have been performed at a number of the SWMUs and areas of concern, primarily associated with former underground storage tanks (USTs) or sumps. In addition, several SWMUs have been clean-closed in accordance with RCRA requirements. The only SWMUs and areas of concern still requiring activity (Figure 9, Attachment G-2 in the BDC section) include :

- SWMU-17, former UST for waste hydraulic and engine oil, near Building 9-75

- SWMU-20, former degreaser pit where trichloroethene and tetrachloroethene were used as solvents for degreasing, at the northwest corner of Building 9-101
- AOC-03/04, former LUSTs for storage of No. 5 fuel oil, near Building 9-50
- AOC-05, former LUST for storage of unleaded gasoline, near Building 9-60

Groundwater remediation activities have included the operation of a pump and treat system at SWMU-20 from 1993-2001, and injection of an oxygen releasing compound into groundwater at AOC-05 in 2002 to promote aerobic biodegradation of residual petroleum hydrocarbon constituents. Groundwater monitoring is being conducted at the four sites listed above on a semi-annual basis.

G.2.1 Summary of available data

Information for this summary was obtained from the BDC Corrective Action Summary Report (Landau 2001) and from the most recent groundwater monitoring report submitted to Ecology in June 2002 (Landau 2002).

Groundwater flow system

Hydrogeology at the BDC site consists of two identified aquifer units separated by an aquitard consisting of the silt/clay layer at the top of the marine sediment sequence (Figures 4 through 6 in Attachment G-2, BDC section). The shallow aquifer is typically characterized as unconfined, saturated Duwamish alluvial sediments and generally occurs to a depth of approximately 50 feet. The shallow aquifer is underlain by a continuous silt/clay aquitard that is approximately 20 to 30 feet thick. Marine sands occur below this aquitard and comprise the deep aquifer identified at this site. There is an upward gradient between the deep and shallow aquifer. Given the upward gradient and the silt/clay aquitard beneath the site, only the shallow aquifer is of interest as a groundwater pathway for potential COC migration.

The shallow unconfined aquifer is encountered beneath the site at a depth of approximately 10 to 12 ft bgs. The shallow aquifer is about 40 ft thick and is segregated into three depth intervals (A, B, and C horizons). Groundwater level elevation contours, shown on Figures 7 and 8 (Attachment G-2, BDC section), indicate west to southwest horizontal groundwater flow toward the LDW in the shallow aquifer. The horizontal gradient is approximately 0.0004 to 0.0008 based on June 2001 water level data.

Groundwater level elevations in the shallow aquifer appear to vary approximately 1 to 2 ft in response to tides and seasonal precipitation changes. It appears that the tidal influence on groundwater levels at BDC does not extend appreciably east of SWMU-20 and AOC-03/04. At the north end of the site, tidally influenced groundwater level fluctuations have been observed in monitoring wells in the vicinity of Slip 6, but this effect does not appear to extend south of AOC-01/02.

Water levels in adjacent nested wells, which are screened at different depths within the unconfined aquifer, show minor head differences with no consistent trend. This indicates there are no strong vertical gradients within the unconfined aquifer in the vicinity of the site and groundwater flow can be expected to be primarily horizontal.

Horizontal groundwater velocity measurements were calculated from hydraulic gradient, hydraulic conductivity, and porosity estimates using Darcy's law. The hydraulic gradient at the site is approximately 0.0004 to 0.0008 ft/ft; the hydraulic conductivity has been estimated to be approximately 110 to 130 ft/day. Based on these parameter values and an assumed effective porosity of 0.25, the average groundwater flow velocity would be approximately 65 to 150 ft per year.

Chemicals of concern in groundwater

The most recent groundwater sampling at the four areas currently monitored on a semiannual basis (SWMU-17, SWMU-20, AOC-03/04, and AOC-05) was conducted in June 2002. As shown in Figure 9 (Attachment G-2, BDC section), AOC-03/04 is about 600 ft from the LDW and the other three sites range from about 800 to 1,400 ft from the LDW. Groundwater chemistry data from this sampling event are presented in Data Tables 2 through 5 in Attachment G-1 (Landau 2002). The following paragraphs summarize results for each unit or area. The preliminary groundwater cleanup levels for the site are MTCA Method B marine surface water cleanup levels (Landau 2001).

SWMU-17

SWMU-17 is the site of a former UST and sump used to store waste hydraulic and engine oil. The sump and UST were closed in 1986. At SWMU-17, groundwater is currently monitored for metals and VOCs. The only chemicals detected in groundwater at concentrations exceeding the preliminary cleanup levels since 1998 were arsenic, copper, lead, nickel, and tetrachloroethene (Landau 2001). The maximum concentrations of these chemicals detected in SWMU-17 monitoring wells since 1998 are presented in Table G-3. The complete data set for all wells sampled at SWMU-17 in June 2002 is presented in Data Table 2 in Attachment G-1.

Table G-3. Maximum concentrations of chemicals[a] exceeding preliminary cleanup levels since 1998 in SWMU-17 monitoring wells

Chemical	Maximum Concentration (µg/L)
Arsenic	47
Copper	44
Lead	42
Nickel	19
Tetrachloroethene	19.8

[a] Maximum concentration detected in monitoring wells from 1998 to 2002

In general, with the exception of copper, the metals only occasionally exceeded the preliminary cleanup levels (Landau 2001). The current status of this SWMU includes semi-annual monitoring for VOCs, diesel-range hydrocarbons, and metals.

SWMU-20

SWMU-20 was the site of a former degreaser pit where trichloroethene and tetrachloroethene were used as solvents for degreasing. At SWMU-20, groundwater is currently monitored for VOCs and TPH. Chemicals frequently detected in groundwater are benzene, trichloroethene, tetrachloroethene, cis-1,2-dichloroethene, vinyl chloride, and naphthalene. Since June 1999, the only chemical detected in SWMU-20 monitoring wells at a concentration exceeding its preliminary cleanup level was tetrachloroethene at a concentration of 121 µg/L. Concentrations of trichloroethene, tetrachloroethene, and cis-1,2-dichloroethene were greatest at shallow depths near MW-9A and decreased in the downgradient groundwater flow direction. Groundwater plume maps of tetrachloroethene in 1989, 1994, and 2000 in the A and C horizons (6.5-21.5 ft and 23.5-40.5 ft, respectively) are presented in Figures 1-A and 1-C (Attachment G-2, BDC section). The complete data set for all wells sampled at SWMU-17 in June 2002 is presented in Data Table 3 of Attachment G-1.

The distributions of the chlorinated VOCs, tetrachloroethene, trichloroethene, dichloroethene, and vinyl chloride, show similar patterns. The concentrations were greatest in the A Horizon near the former degreaser pit, and concentrations decreased in the downgradient flow direction. These chemicals also showed a general decreasing trend with depth (Landau 2001).

In 1993, a pump and treatment system was installed to remove the chlorinated VOCs from groundwater. In 2001, the pumping system was turned off as a result of low VOC concentrations to monitor and evaluate the effectiveness of the remediation.

AOC-03/04

AOC-03/04 was the site of USTs used for storage of No. 5 fuel oil. The leaking USTs were removed in 1992 and replaced. At the time of the tank removal, approximately 250 yds of contaminated soil and 200 to 500 gallons of free product were removed. Only occasional detections of diesel-range hydrocarbons have been observed in several rounds of groundwater sampling conducted in the area. Diesel range hydrocarbons and motor oil were the only chemicals monitored at AOC 03/04 in 2002. Only occasional detections of diesel-range hydrocarbons have been observed in several rounds of groundwater sampling conducted in the area. These chemicals were not detected during the 2002 sampling event (Data Table 4, Attachment G-1). Semi-annual monitoring will be conducted until four consecutive rounds of non-detects are obtained (Landau 2001).

AOC-05

AOC 05 is the site of a former leaking gasoline UST. The UST was removed in 1985 along with 500 to 600 gallons of floating product (Landau 2001). Benzene and gasoline-range petroleum hydrocarbons have been detected above preliminary groundwater cleanup levels in the vicinity of the former tank. The June 2002 data for this site indicated that benzene and gasoline-range hydrocarbons were the only chemicals exceeding MTCA Method B marine surface water cleanup levels, and only in one well, BDC-103 (Data Table 5, Attachment G-1). Benzene and gasoline-range hydrocarbons were detected at a maximum concentrations of 960 µg/L and 200 mg/L, respectively.

G.2.2 Analysis of groundwater COCs in LDW sediment

Chemicals were selected for this analysis if they exceeded MTCA Method B marine surface water cleanup levels since 1998; these chemicals are listed in Tables G-4 and G-5, along with sediment data from the potential discharge zone. The potential discharge zone was assumed to be from RM 4.4 to 4.8 on the east side of the channel, because this area is downgradient of sources based on groundwater flow from the site (Map G-1, Attachment G-2). Metals were detected in all 24 sediment samples analyzed but concentrations exceeded SMS standards or DMMP guidelines for only one metal (lead) in 1 of 24 samples. These results indicate that these metals have not migrated from site groundwater and into LDW sediment at concentrations of concern (Table G-4).

Table G-4. Selected groundwater COCs detected in LDW sediment downgradient from the Boeing Developmental Center site

Analyte	# Sediment Samples	# Detects	# Detects > SQS	# Detects > CSL
Arsenic	24	24	0	0
Copper	24	24	0	0
Lead	24	24	1	1
Nickel	24	24	0 [a]	0 [a]

[a] SQS and CSL were not available for nickel, so DMMP SL and ML were used instead.

Table G-5. Selected groundwater COCs analyzed and not detected in LDW sediment downgradient from the Boeing Developmental Center site

Analyte	# Sediment Samples	# Detects	Detection Limit	DL>SQS	DL>CSL
Benzene	1	0	2.4 – 3.4 µg/kg dw	na	na
Tetrachloroethene	1	0	2.4 – 3.4 µg/kg dw	0 [a]	0 [a]
TPH	0	0	na	na	na

na – not applicable or SMS and DMMP criteria not available

[a] SQS or CSL not available for tetrachloroethene, so DMMP SL and ML were used instead.

Benzene and tetrachloroethene were analyzed in only one sediment sample in the potential discharge zone and were not detected; TPH was not analyzed (Table G-5). Based on these data, benzene and tetrachloroethene have not accumulated in sediment. Due to their low affinity to sediment, this type of analysis does not definitively indicate whether they have migrated to sediment. Fate and transport considerations, as summarized below, are more valuable in assessing their potential discharge in the LDW.

G.2.3 Relevance to the LDW

The data reviewed for the BDC indicate the residual COC plumes are contained locally around the source areas. In the case of AOC 03/ 04 and AOC 05, the UST source has been removed, and the existing monitoring data indicate a very limited extent of residual hydrocarbon concentrations in groundwater (see Data Tables 4 and 5 in Attachment G-1). Given the cleanup activities, and the 600 feet and 1200 feet distance from AOC 03/ 04 and AOC 05 to the LDW, respectively, attenuation through biodegradation could be expected to significantly reduce the residual hydrocarbon constituent concentrations before discharge to the LDW. Once a petroleum source is removed, the passive bioremediation of subsurface microbes acts to naturally reduce the plume mass and eventually complete the cleanup process. As a result, benzene plumes tend to stabilize at relatively short distances away from the release site (Lawrence Livermore et al. 1995).

From 1993 to 2001, groundwater downgradient from SWMU 20 was treated through a pump and treat system. The groundwater monitoring data show containment of the downgradient extent of chlorinated solvent detection to within 200 feet of the original source area (for example, see Figures 1-A and 1-C, Attachment G-2, BDC Section). The LDW is another 500 feet from the downgradient extent of the detected VOC plumes, and thus any residual VOCs would be expected to undergo biodegradation and dilution prior to the LDW. Sediments offshore of the BDC property do not indicate any accumulation of groundwater COCs.

G.3 BOEING ISAACSON

The Boeing Isaacson facility is located adjacent to the east bank of the LDW from RM 3.7 to 3.8. The site was occupied by a saw/lumber mill from 1929 to 1949, and the Isaacson Steel plant was in operation at the property from the 1940s through the 1980s. A portion of the property occupies the area that formerly was the LDW Slip 5, before it was incrementally filled in response to the expansion of industrial activities. The fill material used in Slip 5 generally consisted of silty sand and sandy gravel with significant amounts of slag, fire brick, and miscellaneous construction debris. The fill is thought to be a contributing source of metal contamination to soil and groundwater at the property (ERM and Exponent 2000). Boeing purchased the property in 1984 in anticipation of expanding its adjacent Thompson Building.

Many investigations and several remedial actions were conducted at the site between 1983 and 1991 to address arsenic contamination in soil and groundwater. The largest remedial action was completed by Boeing in 1991, and involved chemical and physical stabilization of approximately 35,000 tons of soil and the placement of an asphalt cover above the stabilized soil. The remedial action was conducted voluntarily by Boeing under Ecology oversight.

G.3.1 Summary of available data

The data used in this summary were derived from the Request for Groundwater NFA Determination report (ERM and Exponent 2000).

Groundwater flow system

The fill within the former Slip 5 constitutes up to about 20 feet of fill in its central axis. The fill consists of silty sand and sandy gravel with abundant debris including slag, bricks, and wood. Groundwater is typically encountered at a depth of 10 to 12 feet, and thus occurs within the fill in the former Slip 5 area (See Figure 4, Isaacson section, Attachment G-2).

Native soils beneath the fill consist primarily of the Duwamish valley alluvial sands and silty sands. No deeper characterization of the stratigraphy or definition of hydrogeologic units has been developed for this site.

Groundwater flow across the site is generally from the east to the west-southwest, with some flow deflection toward the axis of the former Slip 5 area as shown in Figures 7 through 9 (Attachment G-2, Isaacson section; ERM and Exponent 2000). Tidal influence was observed during a tidal study conducted by ERM in 2000 to a distance of approximately 400 feet from the LDW. Rising head and falling head slug tests conducted in the PZ series wells indicated a range in hydraulic conductivity of 10^{-3} to 10^{-4} cm/sec. Groundwater flow rates were not estimated in the documents reviewed.

COCs in groundwater

Groundwater analyses have been conducted periodically in selected wells since site investigation activities began in 1983. The most consistent analyte detected is arsenic, and arsenic has been the focus of the most recent groundwater monitoring events (ERM and Exponent 2000). The groundwater quality data indicate that the maximum background arsenic concentration is 3 µg/L, based on groundwater data collected from upgradient wells.

Arsenic data collected in 2000 for six wells located within 150 ft of the LDW are included in Data Table 6 in Attachment G-1 (ERM and Exponent 2000). Locations of these wells and arsenic concentrations are shown in Figure 5 (Attachment G-2, Isaacson section). Groundwater samples were collected within the range of 15 to 30 ft

bgs. Maximum dissolved arsenic concentrations ranged from 2.8 to 1,600 µg/L in these monitoring wells (Table G-6).

Table G-6. Arsenic concentrations in shoreline monitoring wells sampled in 2000 at the Boeing Isaacson site

Monitoring Well	Dissolved Arsenic (µg/L)	
	8/24/00	10/25/00
MW I-104	1,600	810
MW I-203	1,200	98
MW I-205	27	112
MW I-206	1,100	1.35
PZ-7	9	3.7
PZ-8	2	2.8

In 1988, Landau conducted an investigation at the site to provide information regarding soil and groundwater quality prior to the Isaacson building demolition and anticipated new Boeing construction (ERM and Exponent 2000). Groundwater samples were collected from on-site wells including four shoreline wells (I-104, I-203, I-205, and I-206). Of the metals detected in these groundwater samples, four (arsenic, cadmium, copper, and lead) were detected at concentrations exceeding either freshwater or marine chronic AWQC (Landau 1988a,b,c). Metals other than arsenic have not been sampled in groundwater since 1988.

Chemicals in seeps and sediment

In addition to the groundwater data discussed above, a surface water sample was collected at a seep (SEEP-1) located along the shoreline of the LDW (Figure 5 in Attachment G-2, Isaacson section). Dissolved arsenic was initially not detected in the seep sample at a reporting limit of 5 µg/L. The sample was reanalyzed because the original aliquot had been diluted during sampling. The second analysis detected arsenic at 7 µg/L.

In the Request for Groundwater NFA Determination report, accumulation of arsenic in sediment was evaluated by comparing arsenic concentrations in surface sediment with the Washington SMS for arsenic (ERM and Exponent 2000). Arsenic concentrations were available for 23 stations in the LDW adjacent to the Isaacson and Thompson properties; these samples were collected across the width of the river channel from RM 3.7 to RM 3.9 (Figure 10 in Attachment G-2, Isaacson section). Only one station, with a concentration of 79.4 mg/kg dw, exceeded the SQS (57 mg/kg dw) and no stations exceeded the CSL (93 mg/kg dw).

G.3.2 Analysis of groundwater COCs in LDW sediment

Chemicals were selected for this analysis if they exceeded either freshwater or marine AWQC in the 1988 sampling event. These chemicals are listed in Table G-7, along with

sediment data from the potential discharge zone. The potential discharge zone was assumed to be from RM 3.7 to 3.9 on the east side of the channel, because this area is downgradient of sources based on groundwater flow from the site (Map G-1, Attachment G-2). Metals were detected in all 9 sediment samples analyzed but concentrations did not exceed SMS standards or DMMP guidelines, except for a single SQS exceedance by arsenic. These results indicate that these metals have not migrated from site groundwater and into LDW sediment at concentrations of concern (Table G-7).

Table G-7. Selected groundwater COCs analyzed and detected in LDW sediment downgradient from the Boeing Isaacson site

Analyte	# Sediment Samples	# Detects	# Detects > SQS	# Detects > CSL
Arsenic	9	9	1	0
Chromium	9	9	0	0
Lead	9	9	0	0
Zinc	9	9	0	0

G.3.3 Relevance to LDW

Arsenic is the primary COC identified on the Boeing Isaacson site in monitoring wells near the LDW. Following identification of arsenic as a COC in site soils, several source control remedial actions were accomplished. The most recent groundwater data show some consistent trends in groundwater quality. Most notable is an apparent attenuation between the well pairs I-203 and PZ-7, and I-206 and PZ-8. These wells are screened within the same aquifer zone and indicate at least an order of magnitude reduction in arsenic concentration within 100 feet of downgradient flow (See Figure 5, Attachment G-2, Isaacson Section). A seep sample obtained in the same general area had an arsenic concentration of 7 µg/L, similar to the most-downgradient wells PZ-7 and PZ-8. Nine sediment samples were obtained in the LDW offshore from the site. Arsenic concentrations in sediment exceeded the SQS at only one station, indicating minimal accumulation in sediment at concentrations of concern. Concentrations of chromium, lead, and zinc did not exceed SQS criteria at any of the sites sampled in the potential discharge zone.

G.4 Boeing Plant 2

The Boeing Company's Plant 2 facility is located along the east side of the LDW from Slip 4 (approximate RM 2.9) south to about RM 3.6. Plant 2 formerly manufactured aluminum alloy, steel alloy, and titanium alloy parts using a range of processes. These processes included the use of chemicals such as coolants, alkaline cleaners, chlorinated solvents, metal coatings, chromic and other acids, lubricating oils, and photographic

fixer containing silver. Transformers containing PCB-bearing fluids were used as part of the power supply system.

An Administrative Order on Consent (Order) was issued to Boeing in 1994 by EPA under the authority of Section 3008(h) of the Resource Conservation and Recovery Act (RCRA), as amended [42 USC 6928(h)]. An RFI was performed at the facility, which included extensive soil, groundwater, and LDW sediment characterization and analyses for determining areas of contamination and developing appropriate cleanup actions for those areas. The RFI identified and focused on SWMUs, areas of concern (AOCs), and other areas (OAs) (referred to as units where solid waste or hazardous waste has been managed at the facility). These areas are shown on Figure 1 (Shoreline well locations, Attachment G-2, Boeing Plant 2 section).

Remedial activities include numerous interim corrective measures, including the installation of sheet pile containment structures in three areas to confine VOCs (Figures 1a and 1b, Attachment G-2, Boeing Plant 2 section). The sheet pile structures are state-of-the-art "hanging" containment that restrict groundwater flow. There is residual saturation in the Building 2-66 containment structure, but no DNAPL was discovered in the RFI. Boeing recently completed a groundwater sampling program to evaluate the effectiveness of the sheet pile containment cells and confirmed that VOCs are not migrating from the containment cells.

Other cleanup actions have included local soil and sediment excavation and treatment, and installation of a floating diesel product recovery system. As part of future interim measures, a portion of the waterway bank in the southwest portion of the facility, west of Building 2-66, will be excavated. This portion of the bank was constructed from unsuitable fill in the early history of the facility. The unsuitable fill contains elevated metals and other chemicals. Groundwater in this fill (PL2-013A, -015A, -015B, and -036A) has shown elevated concentrations of metals near the shoreline (see Data Table 7, Attachment G-1). PCBs were occasionally detected in one well.

In addition to the interim corrective measures, Boeing conducted quarterly groundwater sampling in 1996 and 2001 of shoreline wells to evaluate potential groundwater discharge effects on the LDW. A corrective measures study is in process to evaluate and select the final cleanup action for the facility. The study will define cleanup goals; develop site-specific cleanup levels for soil and groundwater, and evaluate potential cleanup technologies and alternatives.

G.4.1 Summary of available data

Data for this groundwater summary were obtained from the RCRA Facility Investigation Groundwater Investigation Interim Report, Volumes 1 and 5 (Weston 1996), Comprehensive RCRA Facility Investigation (RFI) Report (Weston 1998) Upland Area Groundwater Sampling Report (Weston Solutions 2002a) and the CMS Phase Quarterly Groundwater Monitoring Reports for 2001 and January/February 2002

containing the last four quarters of groundwater quality monitoring data from the shoreline monitoring wells (Weston 2001b,c,d, 2002a). Information is also summarized from the Initial CMS Phase Effectiveness of Buildings 2-10 and 2-66 Interim Measures Monitoring Report (Weston 2001a).

Groundwater flow system

The hydrogeologic units beneath the facility include a fill unit to a depth of 3 to 8 feet, underlain discontinuously by an upper silt unit that was the former ground surface and is rich in organic matter. Beneath the upper silt, or fill where the silt is absent, lies the aquifer; 70 to 80 feet of sand, which grades at depth to a silty sand. This alluvial aquifer is underlain by a lower silt unit, which ranges in thickness from 3 to 29 feet and consists of sandy to clayey silt with organic matter and shells. The contact between the silty sand aquifer and the lower silt is sharp and the silt appears to be continuous across the facility. This silt unit and an underlying low permeability till unit effectively act as the bottom of the valley groundwater flow system.

The aquifer is generally encountered at a depth of 10 to 12 feet and is generally unconfined. The aquifer was divided into two parts for the facility investigation: the upper aquifer, which consists of the sand portion, and the lower aquifer, which consists of the lower silty sand portion of the aquifer. The upper aquifer is equivalent to the "A" and "B" well depth zones; "A" wells were generally completed between 0 and 30 feet in depth, and "B" zone wells were completed between 30 and 60 feet in depth. The "C" level wells were completed between 60 and 90 feet in depth. Fresh groundwater occurs above brackish connate groundwater, which occurs in the lower silty sand aquifer (Zone "C") (Weston 1996).

Groundwater beneath the facility migrates from the east to west, ultimately discharging to the LDW. Several groundwater tidal studies were performed during the RFI investigations to determine the extent of tidal influence and to evaluate mean groundwater elevations. These data were then used to produce a series of groundwater elevation contour maps depicting groundwater flow conditions during seasonal and tidal variations. The groundwater elevations recorded at the facility ranged from 0.4 to 4.0 feet (National Geodetic Vertical Datum 29), with the highest water elevations located in the eastern portion of the facility, and the lowest elevations located in wells adjacent to the LDW. The mean groundwater elevation contour map constructed for the facility in August 1995 is presented in Figure 15 (Attachment G-2, Boeing Plant 2 section). The extent of tidal influence was roughly between 300 and 600 feet from the LDW.

Calculated horizontal gradients observed in "A" level wells ranged from 0.0002 to 0.0029, with an average of 0.002. Calculated horizontal gradients in "B" and "C" level wells were similar to those in the "A" level wells. The average linear flow velocities in

the "A" and "B" zones were 25-26 ft/yr. The average flow velocity in the "C" zone was 4.2 ft/yr.

Vertical gradients were calculated from mean water level measurements and density-corrected to account for the brackish water found in the "C" level zone. The vertical gradients indicated a downward gradient between "A" and "B" level wells. Correcting for density effects in the deeper groundwater resulted in upward vertical gradients between the "A" and "B" level wells and the "A" and "C" level wells.

Groundwater discharge rates

Groundwater from the upper and lower aquifers is believed to discharge to the LDW. Estimates of groundwater discharge rates calculated using site-specific measures of hydraulic conductivity, gradients, and discharge areas indicated the following:

- Discharge from the upper aquifer ("A" and "B" zones) occurs at an estimated average rate of 2,892 ft^3/day [15 gallons per minute (gpm)]; the lower 5th percentile and upper 95th percentile groundwater discharge rates were calculated to be 222 ft^3/day (1.2 gpm) and 9,585 ft^3/day (50 gpm), respectively.
- Discharge from the lower aquifer ("C" zone) occurs at an estimated average rate of 2,146 ft^3/day (11 gpm); the lower 5th percentile and upper 95th percentile groundwater discharge rates were calculated to be 137 ft^3/day (0.7 gpm) and 6,962 ft^3/day (36 gpm), respectively.

Individual seeps that discharge from the bank along the LDW at low tide were generally characterized by flow rates of 5 gpm or less. The sum of all measured seep discharges was approximately 40 gpm as measured at low tide.

COCs in groundwater at facility boundary

This section summarizes COCs in groundwater based on an extensive investigation, including groundwater sampling and analyses conducted for the RFI (Weston 1996, 1998[7]) as well as review of the groundwater quality data from the most recent quarterly monitoring (April/May 2001 to January/February 2002; Weston 2001b,c,d, 2002a). For the purpose of evaluating the groundwater pathway to the LDW and consideration of sediment recontamination, only those COCs detected in the facility boundary wells above screening levels are discussed in this section. Elsewhere at the facility, COCs may have been identified in groundwater, but they are not discussed here if investigation and groundwater quality monitoring have not identified a plume to the LDW.

COCs are identified as those presented in Data Table 7 (Attachment G-1) that exceed Proposed Media Cleanup Levels (PMCLs). In addition, COCs are identified as those

[7] Over 1,000 groundwater samples were collected in Phase 1 and Phase 2 of the RFI (Weston 1998).

presented in Data Table 8 (Attachment G-1) from the RFI report (Weston 1998), which are chemicals that exceeded at least one of the facility PMCLs for groundwater. The data in Data Tables 7 and 8 (Attachment G-1) indicate that potential groundwater COCs that may be discharging to the LDW include chlorinated solvents (trichloroethene, cis-1,2-dichloroethene, 1,1-dichloroethene, and vinyl chloride) the PCB Aroclor 1260, and metals (arsenic, cadmium, copper, lead, nickel, zinc, selenium, silver, and thallium). It should be noted, however, that trichloroethene and Aroclor 1260 were not detected above PMCLs in 2001 and 2002 (Data Table 7, Attachment G-1). In the earlier RFI sampling, these two chemicals were each detected at a concentration exceeding the PMCL in only one shoreline monitoring well on one occasion. Therefore, these chemicals are not discussed further as COCs in groundwater in this section.

The most recent data from the shoreline wells are shown in the statistical summary of the last four quarters of shoreline monitoring (Data Table 7, Attachment G-1). These data are reflected in groundwater constituent distribution maps presented in Figures 1 through 6 (Attachment G-2, Boeing Plant 2 section) for vinyl chloride and metals.[8] These maps indicate groundwater areas of concern as follows:

- Vinyl chloride plumes in the shoreline area west of Building 2-66 (Figure 1)
- Building 2-10 north degreaser (Figures 1 2)
- Elevated arsenic concentrations in the groundwater beneath Building 2-66 (Figure 3) and beneath the northwest corner of Building 2-10 (Figures 3 and 4). Arsenic is likely elevated in the groundwater due to reducing conditions associated with the co-located solvents in this area.
- Metals in groundwater within the fill area along the bank adjacent the west side of Building 2-66 (Figures 5 and 6)

These areas of elevated constituents were identified based on the maximum concentrations of the shoreline COCs that exceeded PMCLs.

Chemicals in seeps

As part of the RFI, 21 water samples were collected from 18 groundwater seeps[9] located within the intertidal zone of the east bank of the LDW adjacent to the facility (Weston 1998). VOCs detected in seep samples were trichloroethene, cis-1,2-

[8] These maps are preliminary groundwater area of concern maps that were prepared by Weston Solutions (2003) for a meeting with the EPA RCRA group on Jan 8, 2003. Data from the shoreline monitoring are reflected, as well as recently collected upland groundwater data (Weston Solutions 2002).

[9] Seep data do not necessarily correlate with groundwater data because seep water is influenced by surface water, groundwater, soil, and sediment quality. Also, water samples obtained for organic chemical analyses are typically not filtered.

dichloroethene, vinyl chloride, and benzene at maximum concentrations of 13, 40, 36, and 2.2 µg/L, respectively. VOCs did not exceed marine or acute chronic AWQC concentrations in seep samples.

Phenanthrene and fluoranthene were the only BNAs detected in seep samples. These compounds were detected in two samples at concentrations of 1 and 1.3 µg/L respectively, both below the marine chronic AWQC values.

PCBs were detected in 11 seep samples, at a maximum concentration of 6.1 µg/L total PCBs. The freshwater chronic AWQC for PCBs (0.014 µg/L), which is lower than the marine AWQC of 0.03 µg/L, was exceeded at three seep locations.

Four metals (arsenic, copper, selenium, and zinc) were detected in their dissolved form in seep samples. Maximum concentrations of copper, selenium, and zinc exceeded marine AWQC concentrations in one to three samples.

Data Table 9 (Attachment G-1) presents data on those COCs detected in the seeps that exceeded a PMCL.

G.4.2 Analysis of groundwater COCs in LDW sediment

Chemicals selected for this analysis were those identified in Data Tables 7 and 8 (Attachment G-1) as exceeding PMCLs in shoreline monitoring wells. These chemicals are listed in Tables G-8 and G-9 along with sediment data from the potential discharge zone. The potential discharge zone was assumed to be from RM 2.8 to 3.6 on the east side of the channel, because this area is downgradient of source areas based on groundwater flow (Map G-1, Attachment G-2).

Table G-8. Selected groundwater COCs analyzed and detected in LDW sediment downgradient from the Boeing Plant 2 site

Analyte	# Sediment Samples	# Detects	# Detects > SQS	# Detects > CSL
PCBs	196	195	175	101
Arsenic	101	63	0	0
Cadmium	101	92	10	9
Chromium	101	101	6	5
Copper	101	101	6	6
Lead	101	101	11	10
Nickel	101	101	7 [a]	3 [a]
Selenium	94	21	na	na
Silver	101	77	7	7
Thallium	94	31	na	na
Zinc	101	101	20	10

na - SMS and DMMP criteria not available

[a] SQS and CSL were not available for nickel, so DMMP SL and ML were used instead.

Table G-9. Selected groundwater COCs analyzed and not detected in LDW sediment downgradient from the Boeing Plant 2 site

ANALYTE	# SEDIMENT SAMPLES	# DETECTS	DETECTION LIMIT	DL>SQS	DL>CSL
Trichloroethene	6	0	1.4 – 3.3 µg/kg dw	0 [a]	0 [a]
cis-1,2-Dichloroethene	6	0	1.4 – 3.3 µg/kg dw	na	na
1,1-Dichloroethene	6	0	1.4 – 5.1 µg/kg dw	na	na
Vinyl chloride	6	0	2.3 – 12.8 µg/kg dw	na	na

na - SMS and DMMP criteria not available

[a] SQS and CSLs were not available for trichloroethene, so DMMP SLs and MLs were used instead.

PCBs and metals were frequently analyzed and detected in sediment samples (Table G-8). PCB concentrations exceeded the SQS in 89% of the samples and the CSL in 52% of the samples. Metals, with the exception of arsenic, were detected at concentrations above the SQS or SL in 6 to 20% of samples and above the CSL or ML in 3-10% of samples. Arsenic was not detected above the SQS or CSL in any sediment samples. A discussion of whether groundwater is a potentially significant source of PCBs and metals (other than arsenic) in sediment is presented in Section G.4.3.

Organic compounds discussed above were analyzed in six sediment samples in the potential discharge zone and were not detected in any of these samples (Table G-9). Based on these data, chlorinated solvents have not accumulated in sediment. Due to their low affinity to sediment, this type of analysis does not definitively indicate whether they have migrated to sediment. As discussed above, concentrations of these COCs were below AWQC in seep samples.

G.4.3 Relevance to LDW

Early action measures planned at Plant 2 include the removal of contaminated sediments and the unsuitable fill from the bank west of Building 2-66. The majority of the metals contamination identified in groundwater in this area will be removed as part of the cleanup action. The cleanup action also encompasses the area where PCBs were detected in a seep sample and where they were occasionally detected in one groundwater well. This cleanup removal action is expected to eliminate many of the groundwater quality concerns identified in the RFI and indicated by the shoreline well sampling in this area.

Weston (2002b) evaluated the potential for select metals in groundwater to re-contaminate sediment fill that will be installed in the LDW along the Plant 2 shoreline as part of this proposed focused corrective measure. A mass loading analysis was conducted that indicated groundwater from the facility will not contaminate the sediment fill with metals in excess of SQSs within any reasonable time frame (i.e., hundreds of years). A second evaluation using the equilibrium-partitioning model indicated that SQSs would not be exceeded at any time. Based on these screening

approaches, no impacts to the sediment cap/fill are expected to occur for metals (Weston 2002b).

VOCs were not included in the sediment fill recontamination evaluation conducted by Weston (2002b) because they are generally considered non-persistent in sediment. Most notably, vinyl chloride was not included because it is highly volatile and is not expected to partition to sediment (Weston 2002b).

G.5. GREAT WESTERN INTERNATIONAL

The Great Western International (GWI) site is located at 6900 Fox Avenue S, approximately 400 ft from the S. Myrtle Street embayment of the LDW. GWI entered into an Agreed Order with Ecology in 1991 to conduct an RI/FS to address contamination on its property. GWI's operations on the site date to 1956 and include storage, repackaging, and distribution of chemicals and petroleum products.

Soil and groundwater contamination was found in 1989 and 1990 during removal and replacement of USTs. Since that time, a substantial amount of soil and groundwater sampling has been conducted on and adjacent to the GWI site.

G.5.1 Summary of available data

The data included in this summary were obtained from the Supplemental RI/FS (Terra Vac and Floyd & Snider 2000).

Groundwater flow system

Two affected aquifer zones have been identified beneath the site. They are referred to as the first and second water-bearing zones (WBZs). The first WBZ is interpreted to lie within the Younger Alluvium (Qyal) at depths of between 7 and 10 ft (water table) to roughly 15 ft. Near the GWI site, the first WBZ is bounded below by a silt horizon (SH), referred to as the first SH. This silt is discontinuous to the west of the site, and in this area, chemicals have migrated downward to the second WBZ. The second WBZ is interpreted to lie within the Older Alluvium (Qoal) and to occur to a depth of about 45 ft. The second WBZ is underlain by a silt deposit referred to as the second SH. The location and elevation of these hydrogeologic units are shown in cross-section along the groundwater flow pathline from the site to the S. Myrtle Street embayment in Figures 2.12 and 2.16 (Attachment G-2, GWI Section) from the Supplemental RI Report (Terra Vac and Floyd & Snyder 2000).

Groundwater flows from the site to the southwest toward the S. Myrtle Street embayment of the LDW. As is typical along the LDW, a flow reversal occurs at high tide (Booth and Herman 1998), which results in groundwater movement away from the LDW and back toward the GWI site. The distance to which this flow reversal and tidal influence occurs at the GWI site is approximately 400 ft. Potentiometric maps showing the groundwater flow direction between the GWI site and the LDW for both

the first and second WBZs are provided in Figures 2-20 through 2-23 (Attachment G-2, GWI section). These groundwater flow data indicate that the potential zone of groundwater discharge from the GWI site is between RM 2.3 and 2.4 (Map G-1, Attachment G-2).

Table G-10 presents a summary of the groundwater flow rates measured at low and high tide in both aquifer zones.

Table G-10. Groundwater flow rates at the Great Western site

Groundwater Unit	Groundwater Velocity (ft/day)[a]	
	At the Facility	Within Zone of Tidal Influence
High Tide		
First water bearing zone	0.80	0.93 (away from LDW)
Second water bearing zone	0.75	0.25 (away from LDW)
Low Tide		
First water bearing zone	0.47	1.25
Second water bearing zone	0.75	0.32

[a] Groundwater flow direction is toward the LDW except where noted

COCs in groundwater

Chemicals identified in Terra Vac and Floyd & Snider (2000) as COCs in groundwater at the site based on a comparison to MTCA Method B cleanup levels included nine chlorinated ethenes and ethanes (tetrachloroethene, trichloroethene, 1,1-dichloroethene, *cis*-1,2-dichloroethene, *trans*-1,2-dichloroethene, vinyl chloride, 1,1,1-trichloroethane, 1,1-dichloroethane, and methylene chloride), benzene, toluene, ethyl benzene, 1,4-dichlorobenzene, pentachlorophenol, and total petroleum hydrocarbons.

Groundwater contamination at the GWI site has been found to extend to the S. Myrtle Street embayment of the LDW. The more mobile and volatile chemicals, the chlorinated ethenes and ethanes, and in particular tetrachloroethene and its breakdown products, have migrated to the LDW (Terra Vac and Floyd & Snider 2000). Other chemicals detected in groundwater at the GWI site have not been identified in groundwater discharging to the LDW.

Figures 5.1 through 5.8 (Attachment G-2, GWI section) present contour maps of the concentrations of tetrachloroethene and its degradation products identified in the first and second WBZs between the site and the LDW. The maximum concentrations detected in the two groundwater monitoring wells located adjacent to the S. Myrtle Street embayment in the most recent sampling, October 1999, were as follows:

- tetrachloroethene at 130 µg/L
- trichloroethene at 5.7 µg/L

- *cis*-1,2-dichloroethene at 21,000 µg/L
- *trans*-1,2-dichloroethene at 100 µg/L
- vinyl chloride at 23,000 µg/L

One of these wells (B-34) was screened within the first WBZ and the other (B-33A) within the second WBZ (see Figures 2.12, 2.16, and 5.1 through 5.8 in Attachment G-2, GWI section). The October 1999 groundwater sampling data for these two wells are presented in Data Table 10 (Attachment G-1).

Chemicals in seeps, sediment, and mussel tissue

In addition to extensive groundwater sampling, the potential for migration of site-related chemicals to the LDW was evaluated by sampling groundwater seeps, sediment, and mussel tissue from areas along the shoreline and within the LDW. Figure 4.3 (Attachment G-2, GWI section) identifies the shoreline sampling locations.

Approximately 16 seeps have been identified as groundwater discharge points for the first and second WBZs downgradient of the GWI site. The majority of the discharge appears to be through the first WBZ because of the low permeability, and possibly saline water density of the LDW at the elevation of the second WBZ. Many of the seeps have been sampled every year since 1995. Of the 12 seeps monitored in 1998 and 1999, five (S-1, S-2, S-6, S-8, and S-13) contained detectable concentrations of chlorinated ethenes and ethanes. The maximum concentrations of chemicals detected in seep samples during the last groundwater seep sampling (October and November 1999) are presented in Table G-11. These concentrations did not exceed available AWQC.

Table G-11. Maximum concentrations of chemicals detected in groundwater seeps at the Great Western site

CHEMICAL	MAXIMUM CONCENTRATION (µg/L)
1,1-Dichloroethane	58
1,2-Dichlorobenzene	1
cis-1,2-Dichloroethene	3,200
trans-1,2-Dichloroethene	27
Benzene	28
Tetrachloroethene	190
Trichloroethene	270
Vinyl chloride	3,500

Four intertidal sediment samples were collected in or adjacent to the S. Myrtle Street embayment as part of an EPA Site Investigation. No groundwater COCs were detected in these sediment samples. Results from this sediment sampling were presented in the Supplemental RI/FS (Terra Vac and Floyd & Snider 2000). Mussels were collected

annually from the S. Myrtle Street embayment from 1994 to 1999. Chlorinated ethenes and ethanes were not detected in these mussel samples (Terra Vac and Floyd & Snider 2000).

As an additional evaluation of the presence of chemicals at the point of groundwater discharge to surface water, 43 Gore-Sorber® screening modules were installed throughout the S. Myrtle Street embayment and along several transects across the LDW in 1998 (Terra Vac and Floyd & Snider 2000). These modules are passive sampling devices consisting of sorbant material surrounded by GORE-TEX® tubing that prevents water from contact with the sorbant material. The modules were installed into the sediment and allowed to absorb any compounds present. Of the 43 Gore-Sorber® samples obtained, only two contained detectable quantities of tetrachloroethene breakdown products; these chemicals were detected in the same location where they were detected in seep samples.

G.5.2 Analysis of groundwater COCs in LDW sediment

The chemicals detected in groundwater above the MTCA Method B cleanup levels[10] in onsite monitoring wells were used for this analysis if they were detected in monitoring wells (B-33A and B-34) located closest to the LDW. These chemicals are listed in Table G-12 along with sediment data from the potential discharge zone. The potential discharge zone was identified as the area from RM 2.3 to 2.4 based on the groundwater flow direction from the site (Map G-1, Attachment G-2). None of the groundwater COCs were detected in sediment in the potential discharge zone, and SMS standards or DMMP guidelines were available for only two of the COCs for comparison to detection limits (Table G-12).

[10] Comparison to MTCA levels was conducted by Terra Vac and Floyd & Snider (2000); MTCA levels were Method B cleanup levels from Ecology CLARC 11 database.

Table G-12. Selected groundwater COCs analyzed and not detected in Great Western sediment [a]

Analyte	# Sediment Samples	# Detects	Detection limit	DL>SQS	DL>CSL
Tetrachloroethene	3	0	2.8-3.4 µg/kg dw	0 [b]	0 [b]
Trichloroethene	3	0	2.8-3.4 µg/kg dw	0 [b]	0 [b]
cis-1,2-Dichloroethene	3	0	2.8-3.4 µg/kg dw	na	na
trans-1,2-Dichloroethene	3	0	2.8-3.4 µg/kg dw	na	na
Vinyl chloride	3	0	3.3-17 µg/kg dw	na	na
1,1-Dichloroethane	3	0	2.8-3.4 µg/kg dw	na	na
Methylene chloride[c]	0	0	na	na	na

[a] Additional chemicals were detected at other onsite monitoring wells at concentrations exceeding MTCA Method B cleanup levels, but were not detected in the wells closest to the LDW; these include 1,1,1-trichloroethane, 1,1-dichloroethene, benzene, toluene, ethyl benzene, 1,4-dichlorobenzene, pentachlorophenol, and total petroleum hydrocarbons

[b] SQS and CSL were not available for tetrachloroethene and trichloroethene, so DMMP SLs and MLs were used instead.

[c] Methylene chloride was not analyzed in monitoring wells closest to the LDW

na: not applicable or SMS and DMMP criteria were not available

G.5.3 Relevance to the LDW

A summary of the chemicals identified as COCs detected in groundwater at the site, and in seeps and sediment in the S. Myrtle Street embayment, is provided in Table G-13 (from Terra Vac and Floyd & Snider 2000).

The sampling data collected for the GWI site indicate that only chlorinated ethenes (tetrachloroethene, trichloroethene and its breakdown products dichloroethene and vinyl chloride) were detected at the point of groundwater discharge to the LDW. These chemicals were detected in a few locations in seeps and Gore-Sorbers, as discussed above, but were not detected in sediment or mussel tissue, as expected based on their low affinity to these matrices. Based on these data, only chlorinated ethenes and ethanes were identified by Terra Vac and Floyd & Snider (2000) as potential COCs in the S. Myrtle Street embayment (Table G-13).

Detailed analyses conducted on the fate and transport of the groundwater contamination from the GWI site (Terra Vac and Floyd & Snider 2000) indicated that extensive degradation of the COCs occurs through reductive dechlorination under primarily anaerobic conditions in migration from the site toward the LDW. Near the LDW, tidal fluctuations increase residence times, oxygen concentrations, and chemical dispersion, further reducing constituent concentrations prior to discharge to the LDW.

Table G-13. Chemicals identified in the Supplemental RI as potential COCs

COC	GROUNDWATER	SEEPS	SEDIMENT
Chlorinated ethenes and ethanes	Yes[1]	Yes[2]	No
Pentachlorophenol	Yes	No	No
TPH solvent-range	Yes	No	No
BTEX chemicals	Yes[3]	No	No
Methylene chloride	Yes	No	No
1,4 Dichlorobenzene	Yes[4]	No	No

Source: Terra Vac and Floyd & Snyder (2000)

1 Specific COCs for groundwater were tetrachloroethene, trichloroethene, 1,2-dichloroethene, 1,3-dichloroethene, vinyl chloride, 1,1,1-trichloroethane, and 1,2-dichloroethane.

2 Specific COCs for seeps were tetrachloroethene, trichloroethene, 1,1-dichloroethane, and vinyl chloride.

3 Specific COCs for groundwater were benzene, toluene, and ethylbenzene.

4 1,4-Dichlorobenzene exceedances were in central area wells only.

G.6 LONG PAINTING

The Long Painting facility is located on the west side of the LDW at RM 3.0. The property has been used as a commercial and industrial painting facility since the 1960s; Long Painting has been in operation since 1973. Potential sources of contamination to soil and groundwater at the site are chemicals used in painting, sandblasting, and the maintenance of motor vehicles. These chemicals include metals (arsenic, cadmium, chromium, lead and mercury), chlorinated and petroleum-based solvents, and petroleum hydrocarbons (Kleinfelder 2000). Groundwater data were collected at the Long Painting site as part of a Phase II environmental assessment in 1997 (AGRA 1997, as cited in Kleinfelder 2000) and more recently for a site investigation (SI) conducted in July 2000 (Kleinfelder 2000).[11] The SI report was prepared for Ecology in pursuit of a voluntary cleanup under MTCA. Long Painting conducted the voluntary investigation in an effort to receive a "no further action" determination and removal from Ecology's contaminated sites list.

G.6.1 Summary of available data

This site summary was prepared using data from the SI report (Kleinfelder 2000).

Groundwater flow system

As part of the SI, 15 borings were drilled to a depth of 10 to 15 ft. The boring logs indicated fine sand and silty fine sand in the property parcel east of 10th Avenue South. Silt and silty sand were identified in the borings west of 10th Avenue South. Groundwater was typically encountered at the bottom of the borings. Six monitoring wells were installed prior to the SI, but the logs and any information on the screened

[11] The Phase II environmental assessment prepared by AGRA in 1977 was not available for review.

intervals were not available. The SI report indicates the wells were approximately 14.5 ft deep except for MW-6, which was 10.5 ft deep and dry at the time of the groundwater sampling.

There were few data on groundwater levels, top of casing elevations, or tide stage available to construct a groundwater elevation contour map. The data suggest that some component of easterly flow toward the LDW is likely, and the flow direction may vary between the property parcels west and east of 10th Ave. S. Figure 2 (Attachment G-2, Long Painting section) provides information on well locations and groundwater levels at the site. Data on aquifer material, hydraulic conductivity, gradients, and groundwater flow rates were not available.

COCs in groundwater

The most recent groundwater data were collected from five monitoring wells and were analyzed for gasoline-range hydrocarbons, diesel-range hydrocarbons, BTEX (benzene, toluene, ethylbenzene, and xylene) chemicals, VOCs, total metals, and dissolved arsenic and lead (Kleinfelder 2000). Data Table 11 (Attachment G-1) presents groundwater data from well MW-5, the well closest to the LDW. Well MW-5 is located less than 60 ft from the LDW in the northeast corner of the property. A chemical plume was not identified on the Long Painting property in the SI (Kleinfelder 2000).

Total metals detected in well MW-5 were arsenic (21 µg/L), barium (210 µg/L), chromium (36 µg/L), and lead (45 µg/L). The only two VOCs detected in groundwater from well MW-5 were 1,1,1-trichloroethane and tetrachloroethene, at concentrations of 0.63 µg/L and 0.92 µg/L, respectively. Concentrations of VOCs did not exceed MTCA Method A or B groundwater cleanup levels in any of the site wells. However, it does not appear that well MW-5 was downgradient of the solvent still area in the Recycle Recovery System building, and may not have been deep enough to capture a chlorinated solvent plume should it occur.

Dissolved metals and TPH as gasoline were not detected in groundwater samples from any site wells. The only metals exceeding cleanup levels in any site wells were arsenic and lead, which exceeded the MTCA Method A cleanup levels of 5 µg/L for each, and chromium which exceeded the MTCA Method B cleanup level of 50 µg/L.

G.6.2 Analysis of groundwater COCs in LDW sediment

The chemicals selected for this analysis were arsenic, chromium, and lead, because they exceeded the MTCA Method A or B groundwater cleanup levels[12] in onsite wells and were detected in the monitoring well (MW-5) closest to the LDW. In addition,

[12] Comparison to MTCA cleanup levels was conducted by Kleinfelder (2000); the document did not indicate whether the MTCA cleanup levels were relevant to drinking water or surface water.

1,1,1-trichloroethane and tetrachloroethene were selected for this analysis even though they did not exceed MTCA levels in any wells, because it was not clear if the downgradient monitoring wells would capture a potential chlorinated solvent plume. The potential discharge zone was identified as RM 2.9 to 3.1 on the southwest side of the channel, because this area is downgradient of sources based on groundwater flow direction from the site (Map G-1, Attachment G-2).

Six of approximately 17 sediment samples were analyzed for inorganic COCs but none of the concentrations exceeded SMS standards, indicating that arsenic, chromium, and lead have not migrated from site groundwater to the LDW and significantly accumulated in LDW sediment (Table G-14).

Table G-14. Selected groundwater COCs analyzed and detected in LDW sediments downgradient from the Long Painting site

Analyte	# Sediment Samples	# Detects	# Detects > SQS	# Detects > CSL
Arsenic	6	6	0	0
Chromium	6	6	0	0
Lead	6	6	0	0

One of 17 sediment samples was analyzed for VOCs. Tetrachloroethene was not detected, and its detection limit was below the SL (Table G-15). SMS standards or DMMP guidelines are not available for 1,1,1-trichloroethane. Based on these data, chlorinated solvents have not accumulated in sediment. Due to their low affinity to sediment, this type of analysis does not definitively indicate whether they have migrated to sediment.

Table G-15. Selected groundwater COCs analyzed and not detected in LDW sediment downgradient from the Long Painting site

Analyte	# Sediment Samples	# Detects	Detection Limit	DL > SL	DL > ML
1,1,1-Trichloroethane	1	0	2.3 µg/mg dw	na	na
Tetrachloroethene	1	0	2.3 µg/mg dw	0[a]	0[a]

na – SMS and DMMP criteria not available

[a] SQS and CSL were not available for tetrachloroethene, so DMMP SL and ML were used instead.

G.6.3 Relevance to the LDW

The available data did not identify a groundwater plume of COCs at the Long Painting property, and the soil sampling did not identify a significant soil source to groundwater. In addition, none of the sediment samples in the potential discharge zone had sediment concentrations of metals or chlorinated solvents that exceeded SMS standards or DMMP guidelines. However, there are insufficient groundwater data (i.e.

representation of depth and location) to fully evaluate the potential for groundwater contamination on the Long Painting site.

G.7 MALARKEY ASPHALT

The Malarkey Asphalt site is located approximately 60 ft from the LDW at RM 3.6 on the west side of the LDW. Potential sources of chemicals at this site are associated with the manufacture of roofing asphalt from 1937 to 1993. The Malarkey site was regulated under EPA's RCRA program as a corrective action site.

Investigation activities identified several potential sources (in particular, waste oil tanks) of petroleum, PCBs, and PAHs to the soil and groundwater environment. Waste oil was used as fuel for many of the site operations (SECOR 1998). Residual contamination was found in the former pond/yard area east of the facility and adjacent to the LDW where stormwater runoff collected. Hart Crowser (1992) indicated that non-contact cooling water was possibly discharged to this area, although that was not substantiated (SECOR 1998). Waste transformer oil was reportedly stored in a former UST in the central site area, and the waste oil was reportedly used to fuel a boiler and former hot water and hot oil heaters. A large diameter well (LDW-1) was also described in former reports as a sump, and 2.9 feet of free product was found in the well (SECOR 1998).

The Focused Feasibility Study (FFS) noted that historical sources of COCs were removed from the site by 1998, and recommended a cleanup action alternative that included, among other actions, excavation and offsite disposal of soil containing PCBs and long-term groundwater monitoring (see Figure 6, Attachment G-2, Malarkey section).

In 1999, cleanup activities were conducted at the site as a CERCLA Emergency Removal Action under an AOC between the Port of Seattle and EPA. This Removal Action included removal of soils containing PCBs and implementation of site stabilization measures. The cleanup included the removal and treatment of impounded stormwater, excavation and disposal of over 2,000 tons of contaminated soil, backfilling, installation of storm drain improvements, and site paving (Onsite 2000). The area excavated as part of the remediation is presented in Figure 3.1 (Attachment G-2, Malarkey section).

G.7.1 Summary of available data

The information for this site was obtained primarily from the Focused Feasibility Study (FFS) prepared by SECOR (1998) and the On-Site Enterprises (2000) PCB Removal/Containment Action, South Park Site (Formerly Malarkey Asphalt). A summary of the site characterization data was provided in this report, but the original data were not available for review. This summary is based on a limited verification of

the hydrogeologic data quality. Groundwater data are not available post remediation (i.e., after 1999).

Groundwater flow system

The FFS reported that surface soil at the site is fill (inferred to consist of fine to medium sand) to depths of 3 to 5 ft, below which a silt layer is reported to extend to 5 to 15 ft bgs. The FFS indicated that the uppermost groundwater occurs from 5 to 12 ft bgs, and therefore, by inference, within the silt layer. Boring logs for replacement wells (MW-02, -03, and -04) indicated 7 to 9 ft of a silty sand fill over 5 to 8 ft of silt (sandy silt to slightly plastic silt) with occasional peat layers to a depth of 15 ft. The water level was indicated at a depth of 6 to 8 ft, occurring primarily within the silt.

The groundwater beneath the site is hydraulically connected to the LDW and is tidally influenced. The inferred direction of groundwater flow is to the east-northeast toward the LDW. The groundwater gradient was reported to be 0.03 ft/ft, which is relatively steep for the alluvial aquifer. A site plan showing the relative groundwater elevations from the FFS is presented in Figure 4 (Attachment G-2, Malarkey section).

COCs in groundwater

The FFS (SECOR 1998), completed in June 1998, contains the most recent available groundwater quality data. Groundwater samples were collected during four quarterly sampling rounds from July 1997 to April 1998 from four monitoring wells, and were analyzed for PCBs, PAHs, and petroleum hydrocarbons. Two of the monitoring wells are located within about 25 ft of the LDW (MW-2 and MW-4), and the third is located about 70 ft from the LDW (MW-3). The remaining monitoring well (MW-1) is located immediately west of the property boundary, upgradient of the site. Concentrations of chemicals detected in each of the three wells closest to the LDW are presented in Data Table 12 (Attachment G-1).[13]

Chemicals detected in groundwater during the quarterly sampling in 1997-1998 (pre-cleanup) were PAHs (detected in one of three downgradient monitoring wells during the first quarterly sampling event; concentrations were not available), petroleum TPH-oil (detected once at one well at 5.9 mg/L), and PCBs. Based on the frequency of detection and comparison to ambient water quality criteria, PCBs were the only COCs in groundwater that were identified in the FFS. In the three wells closest to the LDW, Aroclor 1260 was detected in the downgradient monitoring wells at least once during the quarterly sampling at concentrations ranging from 0.56 to 54 µg/L. Aroclor 1260 was detected in MW-3 during all four quarters. No other PCB Aroclors were detected.

[13] The Focused Feasibility Report (SECOR 1998) only presented data for chemicals analyzed in the April 1998 sampling round, with the exception of data for PCBs and TPH (as diesel and heavy fuel), which were from all four sampling rounds.

G.7.2 Analysis of groundwater COCs in LDW sediment

PCBs were the only chemicals selected for this analysis because they were the only groundwater COCs identified in the FFS. The potential discharge zone was identified as the area adjacent to the site (from RM 3.5 to 3.7), based on proximity of the site to the LDW and the flow of groundwater toward the LDW (Map G-1, Attachment G-2).

As shown in Table G-16, PCBs were detected in all sediment samples collected from the potential discharge zone. PCB concentrations in 9 of the 11 samples exceeded the SQS and 5 of the 11 samples exceeded the CSL. Although PCBs are elevated in both groundwater and sediment offsite, it is unlikely that groundwater was a significant pathway for PCBs at the site. It is more likely that surface water pathways, including runoff from unpaved areas to a nearby ditch and storm drain, were responsible, as PCBs are hydrophobic and readily adsorb to soils, and the silty soils will limit the rate of PCB transport via groundwater (i.e., see RI Table 4-14).

Table G-16. Selected groundwater COCs analyzed and detected in LDW sediments downgradient of the Malarkey Asphalt site[a]

Analyte	# Sediment Samples	# Detects	# Detects > SQS	# Detects > CSL
Total PCBs	11	11	9	5

[a] TPH (total petroleum hydrocarbons) was not analyzed for in sediment in potential discharge area

G.7.3 Relevance to the LDW

The Malarkey site used waste transformer oil in industrial processes adjacent to the LDW. PCBs were found in site soils, locally and occasionally in site groundwater, and in sediment adjacent to the site. Between October 1999 and February 2000, ponded stormwater was removed and treated, and 2000 tons of PCB-contaminated soil was excavated and disposed. In addition, areas of the site were paved and a new stormwater drainage system was installed to prevent the entrainment of contaminated soil particles in stormwater discharges. This cleanup action was expected to naturally attenuate groundwater PCB concentrations within 2 to 5 years of accomplishing the cleanup (SECOR 1998).

Although PCBs were detected in groundwater prior to cleanup at the shoreline wells (25 to 70 ft from the LDW) at concentrations ranging from 0.56 to 54 µg/L, PCBs have a very low solubility and mobility except in the presence of a co-solvent such as petroleum fuel. No free product and only a few low level detections of petroleum hydrocarbons (TPH-oil) were identified during quarterly groundwater sampling prior to the site remediation. The well closest to the LDW and on the downgradient site of the site's soil "hot spot" (MW-2, see Figure 6, Attachment G-2, Malarkey section) contained PCBs twice during the quarterly sampling. Because the well was screened in silt, it is likely some turbidity was present in the groundwater sample. Thus, PCB

detections in the groundwater were likely due to suspended soil particles. Collectively, these data indicate that it is not likely that a significant groundwater plume containing PCBs exists to the LDW. Rather, the PCBs detected in sediment are more likely to be from past releases of surface water runoff from the upland area.

G.8 PACCAR (KENWORTH TRUCK)

The PACCAR site, formerly the Kenworth Truck manufacturing facility, is located adjacent to the east bank of the LDW between RM 3.9 and 4.0. As a truck manufacturing plant, site activities included fiberglass fabrication, and the assembly, fueling, lubrication, and painting of trucks. Underground storage tanks once located at the site served as storage for various solvents associated with truck manufacturing, including paint thinners and waste oil (GeoEngineers and Kennedy/Jenks 1990). When removed, these underground tanks were severely corroded and believed to be the source of chlorinated and non-chlorinated solvents in groundwater at the site (GeoEngineers and Kennedy/Jenks 1990). Groundwater in the North Fire Aisle area was remediated using an extraction system consisting of three extraction wells from August 1993 to May 1994, and on a limited basis from September 1994 to April 1995.

G.8.1 Summary of available data

Groundwater data summarized in this section were obtained from three monitoring reports for three separate areas on the property. These reports are as follows:

- Remedial Feasibility Assessment for the Subsurface Solvent Contamination, North Fire Aisle (GeoEngineers and Kennedy/Jenks 1990)
- Groundwater Monitoring Status Report (Kennedy/Jenks 1996) for the North Fire Aisle area
- UST Investigation Report (Kennedy/Jenks 1999) for the South Fire Aisle area
- Supplemental Groundwater Monitoring Data (Kennedy/Jenks 2002) for the northwest portion of the property

Groundwater flow system

Groundwater typically occurs at depths of 5 to 10 ft bgs in sandy soils at this site. These soils consist of 5 to 8 ft of fill material over native, fine to medium sand that extends to an approximate depth of 50 ft. In the North Fire Aisle area, the sand unit includes a discontinuous layer of silt and silty sand at a depth of 35 ft. In the South Fire Aisle area, the presence of a clayey silt layer that locally contained woody debris and roots was noted at depths ranging from 5 to 15 ft (Kennedy/Jenks 1999). Wells in the North Fire Aisle area were completed at depths ranging from 15 to 20 ft, with one well (MW-19) completed at 37.5 ft and at the base of the sandy zone.

The net groundwater flow direction beneath the PACCAR property is to the west toward the LDW. However, during high tide, tidally-induced water level fluctuations cause a gradient reversal in the western portion of the site (Potentiometric Surface Contour Map, Attachment G-2, PACCAR section). Slug testing indicated a hydraulic conductivity of 0.0028 to 0.0097 ft/min in the upper portion of the sand aquifer in the North Fire Aisle area; however, a test recovery well test indicated a hydraulic conductivity of 0.023 ft/min at a depth of between 12 and 28 ft (GeoEngineers and Kennedy/Jenks 1990). Using a mean hydraulic gradient of 0.0017 and a porosity of 20 percent, the average velocity of groundwater moving toward the LDW was estimated to be 12 to 24 ft/year (GeoEngineers and Kennedy/Jenks 1990).

COCs in groundwater

COCs in groundwater vary based on location at the site. In the North Fire Aisle area (about 900 ft from the LDW), chlorinated solvents are of primary concern. In the South Fire Aisle area (about 500 ft from the LDW), chemicals include diesel and oil-range petroleum hydrocarbons. In the northwest portion of the property (about 50 to 100 ft from the LDW), arsenic is the primary chemical of concern in groundwater. These chemicals were analyzed in shallow wells in the North and South Fire Aisle areas; well depths in the northwestern corner were not noted.

In 1987, groundwater samples from the two shoreline downgradient wells, MW-7 and MW-12 (see unnumbered potentiometric figure in PACCAR section of Attachment G-2) were analyzed for VOCs (GeoEngineers and Kennedy/Jenks 1990). These wells were selected because groundwater at these locations was expected to represent maximum chemical concentrations potentially migrating from the site to the LDW. A few VOCs were detected, and at low concentrations, compared to the highest concentrations on the site found at MW-8 in the North Fire Aisle area. These data indicated the plume of solvents was attenuated substantially between the North Fire Aisle area and the LDW prior to groundwater remediation. No groundwater monitoring data since 1987 are known for these downgradient shoreline wells.

Samples collected from wells in 1996 in the North Fire Aisle area were analyzed for a select list of VOCs (Kennedy/Jenks 1996); results are presented in Data Table 13 (Attachment G-1). The two wells sampled during this event are located approximately 100 feet downgradient from the North Fire Aisle UST source (MW-14 and MW-18), and approximately 700 ft from the LDW. The 1996 groundwater monitoring status report identified 1,1,-dichloroethene, trichloroethene, tetrachloroethene, and vinyl chloride as the primary VOCs of concern based on repeated exceedances of MTCA Method B cleanup levels (Kennedy/Jenks 1996). Of these VOCs, 1,1-dichloroethene, trichloroethene, and vinyl chloride were detected in either MW-14 or MW-18 at concentrations exceeding MTCA Method B or C cleanup levels; maximum concentrations were 38, 160, and 190 µg/L, respectively (Data Table 13,

Attachment G-1). Downgradient well MW-7, located adjacent to the LDW, was apparently not sampled during this event.

In the South Fire Aisle area (in the vicinity of MW-6A and MW-9A), groundwater has been analyzed for TPH, ethylene glycol, and propylene glycol. Diesel-range and oil-range petroleum hydrocarbons were detected at maximum concentrations of 2.5 and 0.53 mg/L, respectively. Glycols were not detected. During field observations it was noted that no sheen was observed on the water table surface.

In the supplemental groundwater monitoring report (Kennedy/Jenks 2002), five wells (MW-16A, MW-23A, MW-24A, MW-25A, AND MW-32A) were analyzed for eight metals and oil- and diesel-range hydrocarbons. Petroleum hydrocarbons were not detected in any of the groundwater samples. In two wells located closest to the LDW (approximately 120 and 310 ft from the LDW), low concentrations of barium and arsenic were detected. Arsenic was detected at concentrations of 4 and 16 µg/L in these wells.

G.8.2 Analysis of groundwater COCs in LDW sediment

Chemicals selected for analysis in this appendix are those detected at concentrations exceeding MTCA Method B or C cleanup levels or exceeding the adjacent Boeing Facility cleanup and remediation levels (as reported in Kennedy/Jenks 2002). Of the six chemicals selected for analysis, only arsenic and barium were analyzed in sediment. The remaining four chemicals (1,1-dichloroethene, trichloroethene, tetrachloroethene, and vinyl chloride) were not analyzed in any sediment samples collected from the potential discharge zone, which is the area directly adjacent to the site (from RM 3.9 to 4.0) based on the proximity of the site to the LDW and the westerly groundwater flow direction (Map G-1, Attachment G-2). Results of the analysis are shown in Table G-17. Approximately nine sediment samples have been collected in the potential discharge zone.

Table G-17. Groundwater COCs analyzed and detected in LDW sediment downgradient from the PACCAR site[a]

Analyte	# Sediment Samples Analyzed	# Detects	# Detects > SQS	# Detects > CSL
Arsenic	4	4	0	0
Barium	2	2	na	na

na: SMS and DMMP criteria not available

[a] 1,1- dichloroethene, trichloroethene, tetrachloroethene, and vinyl chloride exceeded MTCA Method B or C levels but were not analyzed for in sediment at the potential discharge area.

Arsenic was analyzed and detected in four of the nine samples, but all concentrations were below the SQS and CSL criteria. Barium was detected in two samples, but there are no SMS standards or DMMP guidelines for barium for comparison. The data do

not indicate migration to and accumulation of arsenic in the LDW sediments at concentrations of concern.

G.8.3 Relevance to the LDW

The primary COCs identified in site groundwater are VOCs associated with past releases from leaking USTs. Tank removal and pump and treat remediation were completed in this area. Groundwater monitoring data show improvement in the groundwater quality (See Figures C-7 and C-8, Attachment G-2, PACCAR site) during remediation. However, only one sampling round (in 1996) was completed post–remediation, and there were no groundwater quality data reported for the downgradient wells closest to the LDW (120 ft), MW-29 and MW-30. In addition, well completion logs were not available and would be needed to assess the potential for attenuation with depth given the nature of VOC transport within the Duwamish alluvial environment.

The VOCs contamination detected in groundwater at the PACCAR site is unlikely to be of concern for the LDW because the source has been removed, and the chemical concentrations detected most recently in the wells 700 feet from the LDW are expected to be reduced by the time the groundwater discharges to the LDW. Review of the fate and transport of chlorinated solvent at other sites (Terra Vac and Floyd Snider 2000, PSC 2001) indicates significant biodegradation of chlorinated solvents along the groundwater pathway. However, no recent sampling has been conducted in the wells closest to the LDW, and it is possible some low levels of solvent occur in this area. These chemicals are not expected to persist or accumulate in sediments.

Diesel and oil-range petroleum hydrocarbons detected in the South Fire Aisle area are unlikely to discharge into the LDW at elevated concentrations. This conclusion is drawn from the distance to the LDW (1,000 ft), the limited migration potential of these heavier petroleum fractions, and the likelihood of natural attenuation in the shallow water table system.

A detected arsenic concentration of 4 µg/L in the well closest to the LDW is within the range of background concentrations for arsenic,[14] and analysis of arsenic in sediment does not indicate accumulation at levels of concern in LDW sediments adjacent to the site.

[14] Site-specific background data are not available. However, arsenic was detected in a background well at the adjacent Boeing Isaacson site at a maximum concentration of 2.7 µg/L in 2000 (ERM and Exponent 2000). In addition, the site-specific arsenic background concentration calculated for the PSC site was 5 µg/L (PSC 2001).

G.9 PHILIP SERVICES CORPORATION (BURLINGTON ENVIRONMENTAL)

The Philip Services Corporation (PSC) site is located northeast of Lucille and Denver Street about 4,300 ft east of the LDW. From 1958 to 1970, the Preservative Paint Company used the site as a distillation plant for reclaiming waste solvents and manufacturing paints as well as alkyd and latex resins. Beginning in 1970, Chempro operated a facility at the site for storage, solvent recycling, and treatment of dangerous wastes by processes including electrolytic destruction of cyanide, distillation, and blending of dangerous waste fuel. Alkyd resins were also manufactured at the facility. In January 1992, Burlington Environmental Inc. (BEI) purchased Chempro and in December 1993, Philip Environmental, Inc., purchased BEI. The facility continues to operate as BEI, a wholly-owned subsidiary of PSC. Over the years, the number of processes occurring at the facility have decreased substantially. The distillation process was shut down in February 1996 and the cyanide treatment was discontinued in March 2000. Currently, the oxidation treatment and fuel blending are the only processes occurring at the site.

PSC began conducting a RCRA Facility Investigation (RFI) in 1988 to implement corrective actions for past releases of hazardous constituents from the site as part of its RCRA hazardous waste treatment, storage and disposal facility operating permit. In June 2001, a draft Comprehensive RFI report was completed (PSC 2001). Currently, groundwater at the site is monitored on a quarterly basis.

G.9.1 Summary of available data

Extensive investigations of the groundwater conditions and quality have been completed by PSC for the RFI. The information for this summary was derived from the following reports:

- Draft Comprehensive RFI Report (PSC 2001)
- *Preliminary Report on Non-PSC Sources in the Georgetown Neighborhood of Seattle, WA* (PSC 2002b)
- June 2002 Quarterly Report (PSC 2002c)
- *Non-PSC Source Area Decision Matrix for Evaluating Groundwater* (PSC 2002a)

Groundwater flow system

The hydrogeology at the PSC site is characterized by a shallow fill and sand unit, which constitutes the shallow aquifer. This unit is underlain by stratified sand and silt lenses, which make up a semi-confined aquifer referred to as the intermediate aquifer. The shallow aquifer and intermediate aquifer are hydraulically connected and may be considered one geologic unit. However, they were distinctly defined and tested separately as part of the RFI. A silt-confining unit, thick and continuous enough to constitute an aquitard, separates the intermediate aquifer from a deep aquifer that lies

below the silt aquitard. The deep aquifer is also contained within a sand deposit. All three aquifers have been extensively characterized beneath and downgradient of the facility.

The general direction of groundwater flow is to the southwest toward the LDW as shown in Figures 2 and 3 (Attachment G-2, PSC section) from PSC's most recent offsite groundwater investigation (PSC 2002a). Extensive testing of the aquifer's hydraulic properties and flow rates has also been completed. The estimated average horizontal groundwater velocity is 190 ft/yr in the shallow aquifer, 25 ft/yr in the intermediate aquifer, and 61 ft/yr in the deep aquifer as shown in Table G-18 (PSC 2001).

Table G-18. Estimated average groundwater flow rates, PSC Georgetown facility

Hydrogeologic Unit	Horizontal Hydraulic Gradient	Assumed Horizontal Hydraulic Conductivity (cm/s)	Specific Discharge (m/s)	Assumed Effective Porosity	Seepage Velocity		
					(m/s)	(ft/day)	(ft/yr)
Shallow aquifer	0.0015	5.3E-02	8.0E-07	0.44	1.8E-06	5.1E-01	190
Intermediate aquifer	0.0017	5.1E-03	8.7E-08	0.36	2.4E-07	6.8E-02	25
Deep aquifer	0.0079	3.0E-03	2.4E-07	0.40	5.9E-07	1.7E-01	61

COCs in groundwater

The primary chemicals identified in the groundwater from past releases at the facility are chlorinated solvents and petroleum products. The primary chemicals identified in PSC (2001) as migrating offsite toward the LDW were trichloroethene and its breakdown products cis-1,2-dichloroethene (DCE) and vinyl chloride.

The most recent groundwater monitoring data that were included in this review were collected in May 2002. Groundwater samples were analyzed for VOCs, SVOCs, PCBs, TPH, and inorganic substances. The data are presented in Data Table 14 (Attachment G-1), for six groundwater monitoring wells located within each of the identified aquifer units as follows:

- Wells CG-122-WT and CG-126-WT screened in the shallow aquifer at the water table
- Wells CG-121-40 and CG-125-40 screened in the lower portion of the shallow aquifer
- Well CG-122-60 screened in the intermediate aquifer
- Well 104-D screened in the deep aquifer, below the confining unit

The groundwater data presented in this summary are from monitoring wells located at the approximate extent of COC migration to the west of the PSC facility (PSC 2002b). These wells are located along Maynard Ave S., with the exception of Well 104-D, which is located approximately 250 ft east of Maynard Ave S. This area is

located approximately 3500 ft from the LDW. Although chlorinated solvents are detected further to the west, PSC (2002) has presented analyses which indicate other sources may be responsible for the solvents in this area (see offsite sources discussion below).

The primary organic chemicals found in these wells are chlorinated ethanes, chlorinated ethenes, and BTEX compounds (Data Table 14, Attachment G-1). The chlorinated ethanes and their maximum concentrations were:

- 1,1,1-trichloroethane (3.8 µg/L)
- 1,1-dichloroethane (13.3 µg/L)
- chloroethane (184 µg/L; diluted sample)

The chlorinated ethenes and their maximum concentrations were:

- 1,1-dichloroethene (1.4 µg/L)
- cis-1,2-dichloroethene (7.3 µg/L)
- tetrachloroethene (2.0 µg/L)
- trichloroethene (27.1 µg/L)
- vinyl chloride (4.6 µg/L)

BTEX compounds were detected at concentrations ranging from 0.5 µg/L (ethylbenzene) to 32 µg/L (benzene).

Offsite sources

PSC has conducted extensive offsite hydrogeologic investigations to determine the nature and extent of groundwater contamination between its facility and the LDW. Over 90 monitoring wells have been sampled and 600 push-probe groundwater grab samples have been collected to evaluate offsite migration of COCs in groundwater between the facility and the LDW. Based on an evaluation of these groundwater quality data, PSC found that there are likely to be additional sources of chlorinated solvents between their facility and the LDW that may be either isolated or co-mingled with other chemical sources and plumes.

Groundwater plume concentration maps were prepared for the primary chemicals identified at the PSC facility. Maps and cross sections showing the downgradient extent of the trichloroethene, dichloroethene, and vinyl chloride plumes identified in their offsite investigation are presented in Figures 5 through 8 (Attachment G-2, PSC section). According to PSC (2002b), examination of the ratio of daughter products dichloroethene and vinyl chloride to the parent trichloroethene, and observation of the shallow depth of trichloroethene occurrence downgradient (Figure 8 in Attachment G-2, PSC section), suggest there may have been newer releases from other sources, rather than the historical release from the PSC facility.

PSC researched the business locations that were large and small hazardous waste generators, UST sites, and sites with ongoing cleanup actions between their facility and the LDW. This research identified the facilities shown in Figure 4 (Attachment G-2, PSC section). In addition, publicly available information was reviewed to identify locations where chemicals, primarily trichloroethene, may have been used in sufficient quantities to affect groundwater if a release occurred. A detailed evaluation process is currently underway to determine if the offsite contamination is solely from PSC, co-mingled with PSC solvent plumes, or from a completely separate source (PSC 2002a).

G.9.2 Analysis of groundwater COCs in LDW sediment

Chemicals selected for this analysis were COCs retained after the first step in the aquatic ERA, as described in Section G.9.3 and were detected in monitoring wells closest to the LDW, as listed in Section G.9.1. The potential discharge zone was assumed to be from RM 1.1 to 1.8 on the east side of the channel, because this area is downgradient of sources based on groundwater flow from the site (Map G-1, Attachment G-2).

Metals and benzoic acid were analyzed in at least 26 samples; in these samples, only benzoic acid exceeded the SMS or DMMP criteria in one sample (Table G-19). These results suggest that metals have not migrated to and accumulated in LDW sediment at concentrations of concern.

Table G-19. Selected groundwater COCs analyzed and detected in LDW sediment downgradient from the PSC site

Analyte	# Sediment Samples	# Detects	# Detects > SQS	# Detects > CSL
Benzoic acid	27[a]	2	1	1
Barium	26	26	na	na
Cadmium[b]	27	27	0	0
Chromium	27	27	0	0
Copper	27	27	0	0
Lead	27	27	0	0
Manganese	26	26	na	na
Nickel	27	27	0 [c]	0 [c]
Silver	27	27	0	0

na - SMS and DMMP values not available

[a] Benzoic acid was not detected in 25 of the 27 samples, and the detection limits did not exceed the SQS or CSL

[b] Cadmium was not analyzed in monitoring wells closest to the LDW

[c] SQS and CSL were not available for nickel, so DMMP SL and ML were used.

Organic chemicals listed in Table G-20 were analyzed in three sediment samples in the potential discharge zone and were not detected in any of those samples. Based on these data, chlorinated solvents have not accumulated in sediment. Due to their low

affinity to sediment, this type of analysis does not definitively indicate whether they have migrated to sediment. Fate and transport considerations, as summarized below, are more valuable in assessing their potential discharge in the LDW.

Table G-20. Selected groundwater COCs analyzed and not detected in LDW sediment downgradient from the PSC site

Analyte	# Sediment Samples	# Detected	Detection Limit	DL>SQS	DL>CSL
1,1,1-Trichloroethane	3	0	2.3–2.8 µg/kg dw	na	na
1,1,-Dichloroethane	3	0	2.3–2.8 µg/kg dw	na	na
Chloroethane	3	0	4.8–55.1 µg/kg dw	na	na
1,1-Dichloroethene	3	0	2.4–5.5 µg/kg dw	na	na
cis-1,2-Dichloroethene	3	0	2.3–2.8 µg/kg dw	na	na
Tetrachloroethene	3	0	2.3–2.8 µg/kg dw	0 [a]	0 [a]
Trichloroethene	3	0	2.3–2.8 µg/kg dw	0 [a]	0 [a]
Vinyl chloride	3	0	2.4–13.8 µg/kg dw	na	na
Benzene	3	0	2.3–2.8 µg/kg dw	na	na
Toluene	3	0	2.3–2.8 µg/kg dw	na	na
Ethyl benzene	3	0	2.3–2.8 µg/kg dw	0	0
Xylene (meta & para)	3	0	4.6–5.5 µg/kg dw	na	na
Xylene (ortho)	3	0	2.3–2.8 µg/kg dw	na	na

na – SQS and CSL values not available

[a] SQS and CSL were not available for tetrachloroethene or trichloroethene, so DMMP SLs and MLs were used instead.

G.9.3 Relevance to the LDW

A screening process was conducted as part of an ecological risk assessment to identify COCs for aquatic organisms (PSC 2001). The aquatic evaluation was conducted in two steps. First, for chemicals that were detected in at least 5% of the groundwater samples, the maximum or 95% UCL (whichever was lower) concentrations were compared to Washington State Ambient Water Quality Criteria or other surface water screening values for the protection of aquatic organisms, and those chemicals were retained if those concentrations exceeded these screening values. For those 22 chemicals that were retained following the first step, fate and transport analyses were conducted, which concluded that none of these chemicals from the PSC site were likely to reach the LDW at concentrations that would affect aquatic organisms. Therefore, no COCs were retained for the aquatic ecological risk assessment. Details of the human health and ecological risk assessment can be found in Part II of the draft comprehensive RFI (PSC 2001).

Although fate and transport analyses indicate no migration of COCs from the PSC site, Figure 8 (Attachment G-2, PSC section) indicates that the 1,2-dichloroethene plume

reaches the LDW and the extent of trichloroethene and vinyl chloride plumes are approximately 200 ft from the LDW, although the number and location of sources is uncertain. PSC is currently undertaking a study to further evaluate the likelihood of their site as the source for the solvents detected to the west of Maynard Ave. S, which they believe to be the extent of the plume from their site (PSC 2002a). PSC is also in the process of designing a remedial action to address their subsurface contamination.

Results of the sediment analysis suggest that metals are not migrating to and accumulating in sediments of the LDW at concentrations of concern. No migration of VOCs from the PSC site is expected (PSC 2001), although less is know about potential migration from additional sources of these chemicals downgradient of the PSC site. VOCs were not detected in sediment samples collected in the LDW downgradient from the PSC site, and are not expected to accumulate due to their low affinity for sediments and high solubility and volatility.

G.10 RHÔNE-POULENC

The Rhône-Poulenc site is located adjacent to Slip 6 and the east side of the LDW between RM 4.0 and 4.2. From the 1930s through 1986, several companies manufactured products such as glues, resins, and hardeners. Beginning in 1952, first Monsanto and then Rhône-Poulenc used the facility to manufacture vanillin from petroleum products until 1991. The site is an EPA Resources Conservation and Recovery Act (RCRA) corrective action site.

G.10.1 Summary of available data

Extensive groundwater monitoring has been conducted at the site, beginning with an initial RCRA Facility Investigation (RFI) sampling in January 1994 (Rhône-Poulenc 1995). Since then, 15 rounds of groundwater sampling have been completed. Information for this site summary was obtained from the following documents:

- RCRA Facility Investigation Report (Rhône-Poulenc 1995)
- Round 3 Data and Sewer Sediment Technical Document (Rhône-Poulenc 1996)
- Round 15 Groundwater Monitoring Report (GeoEngineers 2002)

The action levels to which groundwater data were compared in these documents (as described in the groundwater chemistry section below) were the lowest of the federal or state surface water standards for either fresh or marine water at the time the screening was conducted (Rhône-Poulenc 1995).

Groundwater flow system

The site is underlain by two distinct aquifers separated by a silt and clay aquitard that is laterally continuous across the site and averages about 20 ft in thickness. The upper aquifer consists of alluvial sand and silt, and is first encountered at a depth of

approximately 10 to 15 ft bgs. The upper aquifer averages about 50 ft in thickness, extending to a depth of approximately 60 to 65 ft. The lower aquifer consists of marine sand and gravel and is estimated to be about 20 ft thick. There is an upward hydraulic gradient between the lower aquifer and the upper aquifer that acts in combination with the intervening aquitard to inhibit the downward migration of constituents from the upper aquifer to the lower aquifer. Contamination has been identified in the upper aquifer (Figures 4-1 and 4-3 in Attachment G-2, Rhône-Poulenc section). Groundwater monitoring is being conducted in the upper aquifer within various depth intervals (i.e., the upper portion, an intermediate interval, and a deeper interval).

The net horizontal groundwater flow direction beneath the site is to the west, with discharge to the LDW; however, the groundwater is in constant oscillation from the influence of tidal action in the LDW and Slip 6. The tidally-induced groundwater level fluctuations cause horizontal groundwater flow directions and gradients to change constantly. A 27-day groundwater elevation monitoring program indicated the net flow to be east to west under a hydraulic gradient of 0.002 ft/ft. The hydraulic conductivity of the upper aquifer sediments was calculated to range between 0.5 and 100 ft/day, with a geometric mean of 6.4 ft/day. A potentiometric map from the Round 15 Groundwater Monitoring Report is presented in Figure 3 (Attachment G-2, Rhône-Poulenc section).

COCs in groundwater

Data from comprehensive site investigations indicate that toluene is the primary chemical in groundwater based on elevated concentrations and the presence of a plume. The toluene plume was identified within the upper aquifer, located west of the Tank Farm in the area of well DM-8 (as shown in Figures 4-1, 4-2, and 4-3, Attachment G-2, Rhône-Poulenc section). More recent data indicate there may be a complete pathway to the LDW in the west-central site area around DM-8 (GeoEngineers 2002; see Figures 6 and 7, Attachment G-2, Rhône-Poulenc section). In general, the toluene concentrations were higher near the upper portion of the upper aquifer and decreased with depth. Groundwater sampling over time indicates the size and shape of the toluene plume has remained unchanged (see Figures 12 through 14, Attachment G-2, Rhône-Poulenc section). Other organic compounds were detected in the location of the toluene plume but were less widespread and did not exceed the action levels to the same degree as toluene. The other organic compounds detected in Rounds 1 through 3 at concentrations exceeding their action levels were benzo(a)pyrene, chrysene, bis(2-chloroethyl)ether, pentachlorophenol, 2-methylphenol, 4-methylphenol, bis(2-ethylhexyl)phthalate, benzene, methylene chloride, 1,1-dichloroethane, acetone, and formaldehyde.

Although a small amount of LNAPL was inconsistently indicated in a few wells during the early studies, it was not subsequently identified in any measurable quantity. Results from monitoring in February 2002 indicated that LNAPL was not

present (GeoEngineers 2002). Previous studies determined the composition of LNAPL to be 81.6% Peneteck oil (a white mineral oil not toxic or hazardous), 11.1% toluene, and 7.3% qualitatively identified as Peneteck oil and toluene degradation products (Rhône-Poulenc 1995).

Metals have also been detected in groundwater samples from site monitoring wells. The specific metals that were detected at concentrations above their respective action levels were arsenic, beryllium, cadmium, chromium, copper, lead, nickel, thallium, selenium, silver, vanadium, mercury, and zinc (Rhône-Poulenc 1995, 1996). The elevated metal concentrations occurred in the same general area as the toluene plume. Arsenic and copper were the metals with concentrations most frequently exceeding their action levels. Figures 15 through 19 (Attachment G-2, Rhône-Poulenc section) present arsenic and copper concentrations as a function of time. These data show a general decrease in the total concentrations of arsenic and copper with time. Concentrations of other metals over time were not available.

A black liquid plume was also identified on site in 1994 (Rhône-Poulenc 1995). The plume occupied an area where the groundwater was dark brown to black in color. The RFI suggests that the dark color is due to the water's high tannic acid concentration, TOC, and bicarbonate. The source of the liquid was estimated to be spent sulfite liquor (lignin) that was stored and used on site. Chromium was detected in the plume and is suspected to be chromic acid. The subsequent reports reviewed do not further discuss this plume or identify if any toxic or hazardous substances were co-located within this plume.

During the most recent sampling event in February 2002, groundwater samples were collected and analyzed for VOCs and metals (GeoEngineers 2002). The groundwater data for the six wells adjacent to the LDW and Slip 6 are presented in Data Table 15 (Attachment G-1). For three wells (DM-8, H9, and MW-36) data were available for both high and low tidal stages. All wells were screened within the upper aquifer.

These data show that four VOCs were detected in only one well (DM-8 at both high and low tide) at the following maximum concentrations: benzene at 5 µg/L, ethylbenzene at 2.8 µg/L, xylene at 11 µg/L, and toluene at 3,900 µg/L. Metals were detected in groundwater wells closest to the LDW, and their maximum concentrations were as follows: arsenic at 66 µg/L, chromium at 48 µg/L, copper at 81 µg/L, lead at 12 µg/L, mercury at 0.4 µg/L, vanadium at 337 µg/L, and zinc at 59 µg/L.

Chemicals in seeps and sediment

In addition to groundwater sampling, seven seep samples were collected from intertidal areas in the LDW and Slip 6 adjacent to the site in 1995 (Figure 2-2, Attachment G-2, Rhône-Poulenc section). One dark-colored seep was noted. Arsenic,

cadmium, copper, lead, mercury, nickel, zinc and bis(2-ethylhexyl)phthalate were detected in seeps above their respective action levels (Table G-21).[15] Sediment samples were collected at seven locations in the LDW adjacent to the site during each of two sampling rounds in 1994. None of the site-related groundwater chemicals were detected in sediment at concentrations exceeding SMS standards.

Table G-21. Concentrations of chemicals detected in intertidal seeps adjacent to the Rhône-Poulenc site

ANALYTE	# DETECTS[a]	DETECTION RANGE (µg/L)
Arsenic	1	31
Cadmium	2	2.1 – 12
Copper	1	203
Lead	1	44
Mercury	1	0.65
Nickel	1	70
Zinc	1	223
bis(2-ethylhexyl)phthalate	2	14 – 27

[a] 7 seep samples were analyzed

G.10.2 Analysis of groundwater COCs in LDW sediment

Chemicals considered groundwater COCs for this analysis were those that both exceeded action levels[16] in any onsite wells and were detected in wells closest to the LDW. These COCs are listed in Tables G-22 and G-23, along with sediment data from the potential discharge zone, which is the area directly adjacent to the site (from RM 4.0 to 4.2) based on the proximity of the site to the LDW and the westerly groundwater flow direction (Map G-1, Attachment G-2).

As shown in Table G-22, metals were analyzed in 16 sediment samples (except for vanadium), and none were detected at concentrations exceeding SMS standards. These results suggest that metals have not migrated to and accumulated in LDW sediments at concentrations of concern. Vanadium was analyzed and detected in seven samples, but SMS or DMMP criteria are not available for this substance.

[15] Action levels for seeps were the same as those for groundwater — the lowest of the federal or state surface water standards for either fresh or marine water.

[16] Action levels were the lowest of the federal or state surface water standards for either fresh or marine water.

Table G-22. Groundwater COCs site detected in LDW sediment downgradient from the Rhône-Poulenc site

Analyte[a]	# Sediment Samples	# Detects	# Detects > SQS	# Detects > CSL
Arsenic	16	16	0	0
Chromium	16	16	0	0
Copper	16	16	0	0
Lead	16	16	0	0
Mercury	16	16	0	0
Vanadium	7	7	na	na
Zinc	16	16	0	0

[a] Additional chemicals were detected at other monitoring wells at the site, but were not detected in the wells closest to the LDW; these include beryllium, cadmium, nickel, selenium, silver, thallium, benzo(a)pyrene, chrysene, bis(2-chloroethyl)ether, PCP, 2-methylphenol, 4-methylphenol, BEHP, methylene chloride, 1,1-dichloroethane, acetone, and formaldehyde.

na - SMS standards or DMMP guidelines were not available

Table G-23. Groundwater COCs analyzed and not detected in LDW sediments downgradient from the Rhône-Poulenc site

Analyte	# Sediment Samples	# Detects	Detection Limit	DL>SQS	DL>CSL
Benzene	1	0	3 µg/kg dw	na	na
Ethylbenzene	1	0	3 µg/kg dw	0 [a]	0 [a]
Toluene	1	0	3 µg/kg dw	na	na
Xylene (meta & para)	1	0	3 µg/kg dw	na	na
Xylene (ortho)	1	0	3 µg/kg dw	na	na

na - SMS standards or DMMP guidelines were not available

[a] SQS and CSL were not available for ethylbenzene, so DMMP SL and ML were used instead.

BTEX compounds, the only organic COCs in groundwater, were analyzed in one sediment sample, but were not detected. SMS standards or DMMP guidelines are not available for comparison to the detection limit with the exception of ethylbenzene, which did not exceed DMMP guidelines.

G.10.3 Relevance to the LDW

Rhône-Poulenc (1995) conducted fate and transport analyses for several COCs to evaluate the potential for discharge of those chemicals in groundwater to the LDW at concentrations that exceed applicable surface water quality criteria. The analysis indicated that anaerobic biological decomposition will significantly reduce toluene concentrations. The RFI indicated that as a result of the degradation, toluene would not likely be discharged to the LDW at concentrations exceeding federal surface water quality criteria.

EPA (2000) indicates that existing data suggest COC movement toward the LDW along groundwater flow pathways. They indicate that given the groundwater velocity and the possible dates of release, the COCs (including toluene, metals, and other chemicals) may have already reached the LDW. While they agree that some retardation may occur along the groundwater migration pathway, they state that it is unlikely that a two order of magnitude reduction would occur, which would be needed to reduce the metals to their screening criteria concentrations.

Recent groundwater monitoring and geoprobe sampling indicate an area along the west-central shoreline (Well DM-8 area), where concentrations of toluene, arsenic, and copper have exceeded AWQC. However, none of the site-related groundwater chemicals were detected in sediments at concentrations above the SMS standards or DMMP guidelines.

G.11 SOUTH PARK LANDFILL

The South Park Landfill is located approximately 2,000 ft southwest of the LDW near RM 3. The site consists of the King County South Park Custodial Landfill (KCSPCL), the City of Seattle South Recycling Disposal Station, the Kenyon Business Park, and other adjacent properties. The KCSPCL is currently under regulatory review through the Washington State Department of Ecology's Voluntary Cleanup Program. Ecology has performed an initial review of site characterization documents and indicated that the existing site characterization data provide a good foundation for understanding site conditions and moving forward toward development of a Cleanup Action Plan (CAP), based on commercial/industrial reuse of the property.

G.11.1 Summary of available data

Information for this site summary was only available for the KCSPCL portion of the property, as presented in the South Park Custodial Landfill Monitoring Well and Gas Probe Installation and Technical Memorandum (King County 2000). The most recent groundwater data for the KCSPCL were provided by King County (Holmes 2002).

Groundwater flow system

A perched water-bearing zone and a regional alluvial aquifer have been identified beneath the KCSPCL. The shallow perched zone is located primarily within fill materials above a silt layer and extends throughout most of the site. The deeper alluvial sand aquifer occurs at a depth of roughly 20 to 25 ft and is approximately 30 ft in thickness beneath the site. The alluvial sand aquifer slopes steeply to the east, and appears to thicken to the east.

Groundwater flow moves predominantly in a northeast direction toward the LDW, based on groundwater level measurements obtained seasonally between 1998 and 1999. Figures 3-3 and 3-4 (Attachment G-2, South Park section), provide groundwater

elevation contour maps of a representative wet and dry season period for the alluvial sand aquifer. Calculated groundwater velocities range from 22 to 1,900 ft/yr (Table G-23).

COCs in groundwater

Groundwater monitoring has been conducted in the alluvial aquifer at the KCSPCL site on a quarterly basis at eight monitoring wells since March 1999 (King County 2000). The most recent groundwater samples were collected in June 2002 and analyzed for VOCs, SVOCs, PCBs, conventionals, metals, pesticides/herbicides, and total petroleum hydrocarbons (Holmes 2002). The two wells closest to the LDW are MW-8 and MW-24, located just outside the eastern boundary of the KCSPCL site (Figure 3-6 in Attachment G-2, South Park section). Data for these two wells from the June 2002 sampling event are presented in Data Table 16 in Attachment G-1 (Holmes 2002). All eight wells monitored at the landfill are screened near the base of the alluvial aquifer, which is the main shallow water-bearing zone beneath the site. Wells MW-8 and MW-24 were screened between 36 and 49 ft bgs.

The only organic compounds detected in groundwater from wells MW-8 or MW-24 were vinyl chloride, chlorobenzene, and cis-1,2-dichloroethene at maximum concentrations of 1.5, 0.6, and 1.7 µg/L, respectively.[17] Arsenic was detected at a maximum concentration of 2 µg/L, however, arsenic was detected in the monitoring wells upgradient of the site at higher concentrations (up to 24 µg/L). The low concentration of arsenic in the downgradient monitoring well is consistent with background levels and not considered of concern. Petroleum hydrocarbons as fuel were detected at a concentration of 0.57 mg/L in MW-24.[18] Vinyl chloride did not exceed the MTCA Method B surface water cleanup level in the most recent monitoring, and has rarely exceeded this cleanup level during monitoring conducted from 1999 to 2002 (Figure G-1). Figure G-1 provides a time-series plot that shows the trend of vinyl chloride detected in the downgradient monitoring wells at the KCSPCL site.

[17] AWQC are not available for these compounds.
[18] There is no AWQC for petroleum hydrocarbons.

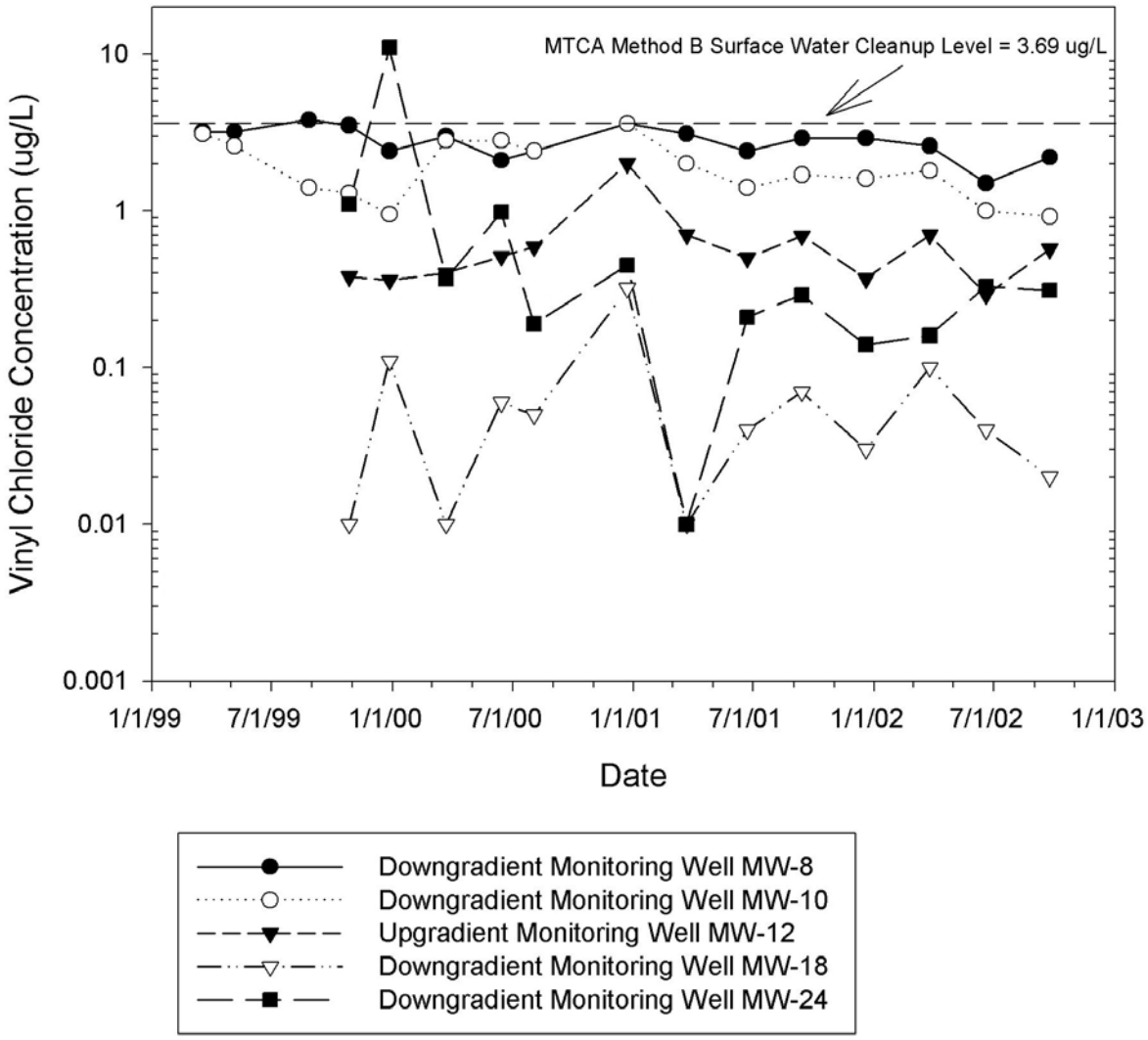

Figure G-1. Time series for vinyl chloride, South Park Custodial Landfill, King County, WA[19]

G.11.2 Analysis of groundwater COCs in LDW sediment

Vinyl chloride is the only COC in groundwater at this site. Because vinyl chloride is not expected to accumulate in sediment, this analysis was not conducted because it would not likely provide additional relevant information.

[19] Non-detect results (<0.02 µg/L) plotted as 0.01 µg/L. Source: Aspect Consulting

G.11.3 Relevance to the LDW

Vinyl chloride is the only COC identified in the downgradient wells at this site. Long-term monitoring for vinyl chloride indicates concentrations rarely exceed the MTCA Method B surface water cleanup level (Figure G-1) at monitoring wells approximately 2000 feet from the LDW. Vinyl chloride is readily degraded under aerobic conditions and with precipitation infiltration and the tidal mixing that occurs prior to any groundwater discharge from the site, it is highly unlikely that vinyl chloride from this site would reach the LDW at concentrations of concern.

G.12 TERMINAL 108/CHIYODA SITE

The T-108/Chiyoda property is located on the east side of the LDW between RM 0.5 and 0.7. The property is located on a filled area that was formerly a tidal marsh. Until 1969, sludge from an onsite municipal sewage treatment plant was placed into ponds and drying beds in the north-central portion of the site. In the mid 1970s, the plant structures were removed and the sludge beds were covered with fill from nearshore LDW sediment removed by berthing area dredging.

The Chiyoda Corporation acquired the site in 1971. In 1975, EPA and the US Army Corps of Engineers negotiated an agreement with Chiyoda to dispose of dredge spoils containing PCBs on the site (located approximately 300 to 500 ft east of the LDW; see Plate 1, Attachment G-2, Chiyoda section). The PCB-containing dredge material came from a PCB spill at the GSA dock in the NW corner of Slip 1. Approximately 1,000 L of Aroclor 1242 leaked into the LDW when a transformer was dropped during loading (AGI 1992). The dredging and disposal operations were conducted under EPA oversight in 1976. Two 25,000-yd^3 pits were excavated in the location of the former sewer sludge drying beds and the dredge materials were pumped from the spill location to the disposal pits. The solids were allowed to settle and the fluid was pumped out and treated using particulate, sand, and charcoal filtering prior to discharge to the LDW. EPA, as onsite coordinator, documented the details of the spill location and analysis of PCBs in sediment, the water column, dredge spoils, and other sampling locations (AGI 1992).

The Port of Seattle purchased the property from Chiyoda in 1982, and subsequently sold the eastern portion to Chevron in 1985, although it later repurchased this portion from Chevron in 1992. In 1989, about 1,400 yd^3 of soil containing petroleum hydrocarbons was stockpiled on the site and treated using solid phase methods to Washington State cleanup levels. During the last soil sampling (AGI 1992), the soil concentrations of PCBs, total PAHs, BTEX, and metals were below the 1991 MTCA Method A Industrial soil cleanup levels, except for isolated exceedances of cadmium and mercury in single samples. A few isolated soil samples exceeded the MTCA TPH cleanup level of 200 mg/kg of that time period; however, these soils were further treated to below the 200-mg/kg cleanup level. In 1992, the Port of Seattle and Ecology

discussed the status of the site under Ecology's MTCA independent remedial action process. The site was deemed a low priority site with no immediate action necessary.

G.12.1 Summary of available data

Groundwater information summarized in this section was obtained from the Site Assessment Summary Report (AGI 1992) prepared for Chevron. These data are limited to the eastern portion of the site (approximately 300 to 500 ft east of the LDW).

Groundwater flow system

The site stratigraphy includes 10 to 20 ft of fill overlying native tideflat marsh deposits. The fill is comprised of fine to medium sand and silty sand with lenses of silt, gravel, and organics. Most of the fill is either hydraulic fill, dredge spoil, or a mixture of both. The tidal marsh is evidenced by organic clay and silt with abundant fibrous organic debris. The silt, clay, and peat was at least several ft thick and generally marked the bottom of the exploration depth for the site investigations. Only two of the borings penetrated the tide marsh deposits and encountered alluvial sand and silty sand at depths below 21 ft bgs. All of the monitoring wells were located within the fill material that makes up the shallowest aquifer on this site. Note that this is one of the few sites reviewed where the wells were located within fill overlying native tideflat sediments.

Groundwater has been measured at the site at depths ranging from 5 to 14 feet below ground surface (AGI 1992). The shallow groundwater beneath the site is tidally influenced, but the water level change is typically less than a foot. During a two-day tidal monitoring study conducted by AGI (1992), variations included rising and falling water levels in the site's monitoring wells. For example, wells C-5 and MW-8 adjacent one another, declined 0.23 feet and 0.03 feet respectively. At the same time the water level in MW—14 rose 0.01 feet and MW-12 rose 1.24 feet.

Groundwater elevation contour maps constructed by AGI (1992) indicate the highest groundwater elevations were located at a well (MW-12) in the north-central part of the site. The groundwater elevation contours developed for the site by AGI (1992) indicated a north-central site mound around MW-12 with radial flow away from this area (see Figure 3 and 4 in Attachment G-2, Chiyoda section). AGI (1992) reported that a former tidal channel extended directly east from the Duwamish along the north property line. This filling, combined with the site filling that has occurred (including the various excavations and filling with sewage sludge and dredge waste) has probably resulted in irregularities in the stratigraphy and soil permeability which affect the groundwater flow patterns and well's response to tidal fluctuations.

Groundwater migrating west of the north central mound is inferred to discharge into the LDW, although flow to the LDW may not be direct (see Figures 3 and 4, Attachment G-2, T-108/Chiyoda section). Otherwise, the groundwater hydraulics data

are insufficient to identify whether groundwater from other portions of the site discharge to the LDW. The tideflat silts, clays, and peats would likely restrict any downward chemical migration because of their low permeability and affinity for adsorption.

COCs in groundwater

Groundwater was sampled from wells within the fill aquifer many times between 1981 and 1992. The most recent groundwater sampling at the site was conducted in October 1991 and January 1992, and data were reported in a site assessment summary (AGI 1992). During both sampling events, samples were collected from 14 monitoring wells and analyzed for PCBs, PAHs, BTEX, TPH, and metals. The analytical results for the five wells located on the western side of the property from the January 1992 sampling are presented in Data Table 17 (Attachment G-1). These data likely present a conservative assessment of the groundwater quality because it does not appear that any of the samples were filtered. It is likely the groundwater samples were turbid given the types of fill material and groundwater sampling methods used at that time period. These data are summarized below.

- **PCBs** were detected 3 of 30 times analyzed from 1981 to 1992, and the detections were all during the earlier groundwater quality sampling events. PCBs were not detected in 1991 or 1992, except in a duplicate sample sent to a different laboratory than the other samples. That detection was at a concentration of 0.3 µg/L of Aroclor 1248. All other samples were below the detection limit of 0.1 µg/L.
- **PAHs** were analyzed during the more recent 1991 and 1992 sampling period by AGI (1992). All 14 wells were sampled and analyzed for PAHs during both sampling events. Groundwater results during the 1991 sampling indicated groundwater from 6 of the 14 wells had cPAH compounds just slightly in excess of the MTCA Method A Cleanup Level of 0.1 µg/L. However, the results from the 1992 sampling did not find groundwater with any cPAH compound at concentrations above this level.
- **Petroleum hydrocarbons—** All groundwater samples tested during the 1991 and 1992 sampling were below the MTCA Method A cleanup level for TPH and BTEX.
- **Metals—** Lead, cadmium, arsenic, and chromium exceeded the MTCA Method C groundwater cleanup levels in some of the wells during the 1991 and 1992 sampling. Although concentrations of copper, nickel, and zinc did not exceed MTCA Method C levels (which are relatively high for these metals), they exceeded the lower federal AWQC in wells closest to the LDW. However, it does not appear that the groundwater samples were field-filtered and the

results appear to be total metals rather than dissolved metals. The maximum concentrations of these metals detected in the groundwater samples were:

- Arsenic at 7 µg/L
- Cadmium at 38 µg/L
- Lead at 130 µg/L
- Chromium at 65 µg/L
- Copper at 200 µg/L
- Nickel at 380 µg/L
- Zinc at 6200 µg/L

G.12.2 Analysis of groundwater COCs in LDW sediment

Chemicals considered groundwater COCs for this analysis were those that exceeded MTCA Method A or C levels in any on-site wells, if they were also detected at any concentration in wells closest to the LDW in 1992 (the most recent data). In addition, copper, nickel, and zinc were selected based on their exceedances of federal AWQC. PCBs were not compared to screening levels in the documents reviewed. However, as a conservative measure, they were included in this sediment analysis because they were detected in one duplicate sample. These COCs are listed in Table G-24, along with sediment data from the potential discharge zone which is the area directly adjacent to the site (from RM 0.4 to 0.7) based on the proximity of the site to the LDW and the westerly groundwater flow direction (Map G-1, Attachment G-2).

Over 50 sediment samples were analyzed for each of the groundwater COCs in the potential discharge zone. Of these samples, with the exception of zinc and PCBs, at most one sample exceeded concentrations of concern (either SQS or CSL) for each of the groundwater COCs. Four of the 61 samples analyzed for zinc exceeded its SQS in the discharge area. These results suggest that these chemicals have not generally migrated to and accumulated in LDW sediments at concentrations of concern. Of the 65 samples with PCBs detections, 33 samples had sediment concentrations of PCBs exceeding the SQS and 5 samples exceeded the CSL. However, as discussed below, the groundwater pathway is unlikely to be responsible for elevated PCBs in this area.

Table G-24. Groundwater COCs analyzed and detected in sediment downgradient from the T108/Chiyoda site

ANALYTE	# SEDIMENT SAMPLES	# DETECTS	# DETECTS > SQS	# DETECTS > CSL
Total LPAHs	61	59	0	0
Total HPAHs	61	59	1	0
Total PCBs	70	65	33	5
Arsenic	61	61	1	0
Cadmium	59	51	1	1
Chromium	61	61	1	1
Copper	61	61	0	0
Lead	61	61	1	0
Nickel	61	61	0	0
Zinc	61	61	4	0

G.12.3 Relevance to the LDW

The shallow groundwater sampled from the T-108/Chiyoda site was collected primarily within dredge-fill material, above the native tideflat surface. Given the relatively shallow nature of this aquifer and groundwater level measurements, it is not clear whether groundwater from the site discharges directly to the LDW. In any case, the most recent sampling (1991 and 1992) data do not indicate either a PCB or PAH groundwater plume migrating from the site. PCBs were detected at low concentrations in samples collected before 1991, but not in any consistent pattern. The most recent data did not detect PAHs above MTCA levels.

Arsenic, cadmium, chromium, lead, and zinc were detected in a few monitoring wells at concentrations above the MTCA cleanup criteria. Given the fine-grained nature of the on-site soils it is suspected that some of the metals detected in the groundwater samples may be associated with fine soil particles suspended in the water samples and subsequently dissolved in the acid extraction conducted for laboratory analysis. Because the on-site soils analyses did not indicate any significant exceedance of MTCA industrial cleanup levels for these metals, it is not expected that groundwater concentrations are at high enough levels to migrate to and adversely affect LDW sediments.

Data for PAHs and the metals listed above show that at most one sample, or four for zinc, exceeded SQS criteria for any of these chemicals in over 50 LDW samples. These results indicate that groundwater migration of these site-related chemicals has not resulted in accumulation in LDW sediments at concentrations of concern. Elevated concentrations of PCBs have been measured in sediments adjacent to the site, however, based on the groundwater data for the site and the known high attenuation of PCBs in groundwater, it is likely that a source other than groundwater migration was responsible for elevated PCBs in LDW sediment adjacent to this site.

Summary

For the purposes of this Phase 1 RI, EPA and Ecology compiled a list of twelve sites of interest in the LDW with groundwater data available for analysis. In this appendix, the following data were summarized for each site:

- Site operations and regulatory status
- Information on the affected aquifer, its characteristics, and the groundwater flow direction and rates
- Concentrations of COCs in samples from groundwater monitoring wells located closest to the LDW during the most recent sampling events, summary of COCs in groundwater, and chemical contour or plume maps, as available
- Concentrations of COCs in groundwater seeps or sediment in the LDW in relation to potential groundwater discharge, as available
- Summary of fate and transport analyses, if conducted

Two main questions formed the focus of this assessment. First, are chemicals in groundwater likely to reach the LDW, or are they likely to be naturally attenuated during their migration in groundwater flow. Second, if chemicals reach the LDW, are they likely to be present at concentrations exceeding SMS standards or DMMP guidelines, or accumulate in sediment to concentrations relevant to recontamination potential.[20] This appendix has focused on these two questions to aid in the pathways analysis for the site (see RI Section 4.3), to aid the source control process currently being conducted by the LDW Source Control Work Group, and to aid in the identification of data gaps that may need to be filled prior to the completion of Phase 2 of the RI.

It should be noted that this preliminary analysis of potential COC migration to LDW sediment has its limitations based on the type of data used for analysis and uncertainties associated with the data. For example, data were not available to determine potential effects on benthic organisms from exposure to VOCs and SVOCs in porewater, which would not be accounted for in sediment toxicity testing due to volatilization. This issue will be addressed in Phase 2 by analyzing sediment porewater samples from the biologically active zone in areas where groundwater is suspected to be a source of these chemicals. Additional uncertainties include: 1) all potential groundwater sources may not have been addressed, such as fill sites that have not yet been characterized, 2) few groundwater samples have been collected on the west side of the LDW (although few potential sources have been identified in that

[20] Potential recontamination could be relevant if sediments in the site-specific groundwater discharge zone were slated for remediation.

area), 3) sediment and groundwater samples may not have been collected synoptically, 4) lack of SMS standards or DMMP guidelines for some chemicals, and 5) lack of data on water chemistry from the biologically active groundwater/surface water transition zone (it is not known if existing seep data were collected from these zones).

Table G-25 provides an overview of the conclusions reached at each of the 12 sites assessed.[21] Based on varying screening criteria, COCs identified in groundwater include chlorinated solvents and their breakdown products, metals, BTEX compounds, TPH, PCBs, PAHs, and a few other organic compounds at a few sites. The most common COCs were metals and chlorinated solvents, both of which were COCs at over half of the sites (Table G-25).

At 11 of the 12 sites, no evidence was found for metals accumulation in sediment to concentrations greater than SMS standards or DMMP guidelines in potential discharge zones.[22] Elevated concentrations of metals in sediment adjacent to Boeing Plant 2 are likely associated with contaminated fill rather than groundwater. Remediation is proposed for this area and the fill material, and detailed mass loading analyses concluded that following remediation planned for the site, metals will not accumulate in nearshore sediments through the groundwater pathway.

PCB concentrations in sediment near Boeing Plant 2,[23] Malarkey Asphalt, and Terminal 108/Chiyoda were also elevated. PCBs near Plant 2 are known to have originated from releases via outfalls from underground transformer vaults, and PCBs have not been identified as a COC in groundwater. Pathways other than groundwater are also highly probable at Malarkey Asphalt and the T108/Chiyoda sites based on groundwater data and the known high retardation factors for PCBs in groundwater.

Seep data were available at 4 of the 12 sites. Chemical concentrations in seep samples may be influenced by inputs from LDW water, groundwater, and sediment. Available seep data indicate a few sites where chlorinated solvents have been detected in seeps (i.e., Great Western and Boeing Plant 2). The significance of these low concentrations of chlorinated solvents in the LDW is unknown. As expected due to their low affinity to sediments and high solubility and volatility, chlorinated solvents have not been detected in sediment at any of the potential discharge zones based on the data available. Select metals have been measured in seeps at Boeing Isaacson, Boeing Plant

[21] The agencies have not accepted or rejected the conclusions of this preliminary analysis of whether or not chemicals in groundwater are migrating to and adversely affecting the LDW sediments for sites discussed in this appendix. The agencies will be conducting independent analyses of groundwater contamination impacts on the LDW for these sites and for other contaminated sites as appropriate.

[22] At 3 of these 11 sites, metals exceeded their SMS criteria in a small percentage of sediment samples (Table G-25).

[23] PCBs were also detected in seep samples.

2, and Rhone-Poulenc; metals in seep samples exceeded AWQC at the latter two sites. Metals did not exceed SQS criteria in sediment adjacent to Rhone-Poulenc, whereas metals SQS criteria were exceeded in sediment adjacent to Boeing Plant 2 likely due to fill material, as discussed above. Seep data, at Boeing Plant 2 in particular, are difficult to interpret with respect to the source of the chemicals because of additional influences (i.e., chemicals in seeps may be due to a mix of inputs from LDW water, groundwater, and sediment).

In summary, the above preliminary review of available data indicates that at most of the contaminated groundwater sites in the LDW basin, COCs are likely to be attenuated or diluted prior to groundwater discharge to the LDW due to source control and natural processes, resulting in concentrations below those of concern. At the few sites where COCs have been found in both groundwater and seeps, these chemicals have not accumulated in sediment via the groundwater pathway. At the few sites with elevated PCBs in nearby sediments, a source other than groundwater has either been demonstrated or is suspected.

Table G-25. Summary of groundwater sites evaluated in this appendix

SITE	COCs IN GROUNDWATER[a]	FATE AND TRANSPORT ISSUES	SEEP DATA	COCs EVALUATED IN SEDIMENT[b]
Advance Electroplating	Trichloroethene, tetrachloroethene, cadmium, chromium, and nickel	Site is significant distance from LDW, but may discharge to Hamm Creek first. Biodegradation and volatilization of VOCs expected between the site and LDW	No known data	Trichloroethene, tetrachloroethene, and metals Metals: No detects > SMS Organic chemicals: No detects. TCE and PCE analyzed in one sample.
Boeing Developmental Center	Arsenic, copper, lead, nickel, tetrachloroethene, benzene, and TPH	Plumes of chlorinated solvents are locally contained and do not extend to LDW. Natural attenuation expected for hydrocarbons and benzene (500 ft from LDW).	No known data	Arsenic, copper, lead, nickel, trichloroethene, benzene, and TPH Metals: Only lead > SQS and CSL in 1/24 samples; others < SQS Organic chemicals: No detects. TCE analyzed in 1 sample.
Boeing Isaacson	Arsenic	Natural attenuation apparent from well pairs, and seep concentrations low. Sediment data do not show accumulation.	Arsenic detected at 7 µg/L in the only seep sample collected	Arsenic, chromium, lead, and zinc Metals: Arsenic > SQS in 1/9 samples. Other metals < SQS.
Boeing Plant 2	Vinyl chloride, cis-1,2-dichloroethene, 1,1-dichloroethene, arsenic, cadmium, copper, lead, silver, thallium, selenium, nickel, and zinc	Weston's mass loading analysis indicated no accumulation for metals following bank removal. VOCs were not included because they are non-persistent and highly volatile. PCBs were detected in seeps but not groundwater. The likely source of PCBs in seeps is sediment.	All COCs analyzed in 18 seep samples; metals and PCBs exceeded AWQC in some samples: VOCs detected at concentrations below AWQC	Trichloroethene, vinyl chloride,1,1-dichloroethene, PCBs, and metals. Metals: Except for As, metals > SQS in up to 20% of samples. Organic chemicals: PCBs > SQS in 89% of samples. VOCs analyzed in 6 samples, no detections.

SITE	COCS IN GROUNDWATER[a]	FATE AND TRANSPORT ISSUES	SEEP DATA	COCS EVALUATED IN SEDIMENT[b]
GWI	Chlorinated ethenes and ethanes, benzene, toluene, ethyl benzene, 1,4-dichlorobenzene, pentachlorophenol, and TPH	Of the groundwater COCs, only chlorinated ethenes and ethanes were detected at the point of discharge (seeps). These chemicals were not detected in sediment or mussels. Fate and transport analyses for VOCs indicated extensive degradation prior to discharge	Chlorinated ethenes and ethanes detected in 5 of 12 seeps sampled in 1998 and 1999	Tetrachloroethene, trichloroethene, 1,2-dichloroethene, vinyl chloride, 1,1-dichlororethane, and methylene chloride Organic chemicals: VOCs were not detected in all three samples.
Long Painting	Arsenic, chromium, lead, and possibly VOCs	No plume identified on site, but groundwater data were insufficient.	No known data	Arsenic, chromium, lead, 1,1,1-trichloroethane, tetrachloroethene. Metals: Six metals samples analyzed, no detects > SQS. Organic chemicals: VOCs not detected in one sample analyzed.
Malarkey	PCBs	PCBs not expected to migrate in groundwater because of low solubility, high affinity for organic matter (natural attenuation expected).	No known data	PCBs Organic chemicals: PCBs > SQS in 9/11 samples, > CSL in 5/11 samples.
PACCAR	Chlorinated solvents, TPH, and arsenic	Solvents likely attenuated; arsenic in range of background; likely attenuation of TPH	No known data	1,1-dichloroethene, trichloroethene, tetrachloroethene, vinyl chloride, arsenic, and barium Metals: No detects > SQS. Organic chemicals: Not analyzed in sediment.
Philip Services	Chlorinated ethanes, chlorinated ethenes, and BTEX compounds	PSC 2001 concluded no COCs would reach LDW at concentrations greater than AWQC from their site. Trichloroethene, tetrachloroethene, and vinyl chloride, attributed to other sources, may reach LDW based on plume data.	No known data	Chlorinated ethanes and ethenes, BTEX, benzoic acid, barium, cadmium, chromium, copper, lead, manganese, nickel, and silver. Metals: No detects > SQS. Organic chemicals: VOCs not detected in three samples analyzed. Benzoic acid > CSL in 1/27 samples.

SITE	COCS IN GROUNDWATER[a]	FATE AND TRANSPORT ISSUES	SEEP DATA	COCS EVALUATED IN SEDIMENT[b]
Rhône-Poulenc	Toluene and metals; also PAHs, BEHP, and nine organic compounds.	Toluene modeled to be degraded to less than AWQC by earlier analysis, but this conclusion has been contested by EPA (2000).	Seven seep samples were collected; seven metals and BEHP exceeded action levels	Toluene, arsenic, chromium, copper, lead, mercury, vanadium, zinc, benzene, ethylbenzene, and xylene. Metals: No detects > SQS Organic chemicals: BTEX not detected in single sample available
South Park Landfill	Vinyl chloride	Vinyl chloride not expected to discharge at concentrations of concern due to relatively low concentrations and distance to LDW	No known data	Sediment evaluation was not conducted because of distance to LDW and because vinyl chloride not expected to accumulate in sediment.
T-108/Chiyoda	cPAHs, arsenic, cadmium, lead, chromium, copper, nickel, and zinc (PCBs detected in duplicate sample)	No PCBs and cPAHs plumes	No known data	PAHs, PCBs, arsenic, cadmium, lead, chromium, copper, nickel, and zinc. Metals: Of 59-61 detects, Cu, Ni 0>SQS; As, Cd, Cr, Pb 1 > SQS or CSL; Zn 4 > SQS; Organic chemicals: PCBs > SQS in 33 of 70 samples, > CSL in 5 samples

[a] COCs in groundwater identified using best professional judgment after evaluation of data presented in referenced reports on the presence of groundwater plumes, comparisons to screening criteria, and frequency of detection. These chemicals are not necessarily considered COCs with respect to migration to the LDW or accumulation in LDW sediment, but were evaluated further for those considerations.

[b] The process for selecting groundwater COCs for evaluation in sediment is described in the introduction to this appendix as well as in each site-specific section. Some groundwater COCs listed in the first column for a site may not have been evaluated in sediment if not detected in downgradient wells closest to the LDW. Additional COCs may have been evaluated even if not listed as primary groundwater COCs, based on rationale presented in site-specific sections.

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Attachment G-1. Data Tables

Data Table 1. Advance Electroplating groundwater data

ANALYTE	MW-1		ANALYTE	MW-1	
Organic Compounds (µg/L)			**Inorganic substances (µg/L)**		
1,1,1-Trichloroethane	**470**		Aluminum	**128,000**	J
1,1,2-Trichloroethane	**1.5**	J	Antimony	**3.6**	
1,1-Dichloroethane	**21**		Arsenic	**13.7**	
1,1-Dichloroethene	**77**		Barium	**714**	
2-Butanone	8	R	Beryllium	**13.2**	
2-Hexanone	8	R	Cadmium	**103**	
Acetone	**0.82**	J	Chromium	**1,930**	J
Chloroethane	18	U	Cobalt	**267**	J
Chloroform	**97**		Copper	**2,240**	J
Chloromethane	**15**		Cyanide	**100**	
cis-1,2-Dichloroethene	**180**	[a]	Iron	**48,100**	
Methylene chloride	**14**	J	Lead	**303**	
Tetrachloroethene	**84**		Manganese	**12,200**	
trans-1,2-Dichloroethene	**180**	[a]	Mercury	**1.5**	
Trichloroethene	**2600**	J	Nickel	**4,410**	J
			Selenium	**10.2**	J
			Silver	**0.33**	
			Thallium	**2**	
			Vanadium	**109**	
			Zinc	**34,600**	J
			Cations (mg/L)		
			Calcium	**212**	
			Magnesium	**109**	
			Potassium	**62.5**	
			Sodium	**228**	

Note: Detected values are shown in **bold type**.

U - Undetected. The associated numerical value is the sample quantitation limit.

J - Estimated because the reported concentrations were less than the contract required detection limits, or because quality control criteria were not met.

R- Rejected because quality control assurance criteria were not met. The analyte may or may not be present at the reported concentration.

[a] The laboratory was unable to resolve the cis- and trans- isomers of dichloroethene. The result reported is the total of the two isomers.

Data Table 2. Boeing Developmental Center groundwater monitoring, SWMU-17 (former DC-05 waste oil tank), June 2002

ANALYTE:	BDC-05-2		BDC-05-3		BDC-05-4		BDC-05-5		BDC-05-7	
VOAs										
Chloromethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Bromomethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Vinyl chloride	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Chloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Methylene Chloride	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
Acetone	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Carbon Disulfide	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1-Dichloroethene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1-Dichloroethane	1.0	U	**1.6**		**2.1**		1.0	U	**1.6**	
trans-1,2-Dichloroethene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
cis-1,2-Dichloroethene	**1.7**		**7.5**		**4.9**		1.0	U	**4.5**	
Chloroform	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2-Dichloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
2-Butanone	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
1,1,1-Trichloroethane	**6.5**		1.0	U	1.0	U	1.0	U	**7.8**	
Carbon Tetrachloride	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Vinyl Acetate	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Bromodichloromethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2-Dichloropropane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
cis-1,3-Dichloropropene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Trichloroethene	**38**		**11**		**1.2**		**1.6**		**28**	
Dibromochloromethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1,2-Trichloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Benzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
trans-1,3-Dichloropropene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
2-Chloroethylvinylether	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Bromoform	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
4-Methyl-2-Pentanone (MIBK)	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
2-Hexanone	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Tetrachloroethene	**23**		**4.1**		1.0	U	1.0	U	**13**	
1,1,2,2-Tetrachloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Toluene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Chlorobenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Ethylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Styrene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Trichlorofluoromethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1,2-Trichloro-1,2,2-trifluoroethane	**2.0**	**U**	**2.0**	**U**	**2.0**	**U**	**2.0**	**U**	**2.1**	
m,p-Xylene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
o-Xylene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2-Dichlorobenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,3-Dichlorobenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,4-Dichlorobenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Acrolein	50	U	50	U	50	U	50	U	50	U

Data Table 2, cont.

ANALYTE:	BDC-05-2		BDC-05-3		BDC-05-4		BDC-05-5		BDC-05-7	
Methyl Iodide	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Bromoethane	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
Acrylonitrile	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1-Dichloropropene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Dibromomethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1,1,2-Tetrachloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2-Dibromo-3-chloropropane	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
1,2,3-Trichloropropane	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U
trans-1,4-Dichloro-2-butene	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
1,3,5-Trimethylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2,4-Trimethylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Hexachlorobutadiene	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Ethylene dibromide	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Bromochloromethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
2,2-Dichloropropane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,3-Dichloropropane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Isopropylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
n-Propylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Bromobenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
2-Chlorotoluene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
4-Chlorotoluene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
tert-Butylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
sec-Butylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
4-Isopropyltoluene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
n-Butylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2,4-Trichlorobenzene	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Naphthalene	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
1,2,3-Trichlorobenzene	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Total Metals (mg/L)										
Aluminum	**0.09**		**0.24**		0.05	U	**0.36**		**0.12**	
Arsenic	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
Barium	**0.011**		**0.009**		**0.013**		**0.017**		**0.019**	
Cadmium	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U
Calcium	**25.9**		**19.6**		**23.9**		**43.0**		**33.2**	
Chromium	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
Cobalt	**0.007**		0.003	U	0.003	U	**0.020**		**0.006**	
Copper	0.002	U	0.002	U	0.002	U	**0.003**		**0.004**	
Iron	**9.62**		**8.69**		**22.5**		**5.23**		**3.60**	
Lead	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U
Magnesium	**16.3**		**8.11**		**10.4**		**11.9**		**16.4**	
Molybdenum	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
Nickel	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Silver	0.003	U	0.003	U	0.003	U	0.003	U	0.003	U
Zinc	0.006	U	0.006	U	0.006	U	**0.019**		0.006	U

Data Table 2, cont.

ANALYTE:	BDC-05-2		BDC-05-3		BDC-05-4		BDC-05-5		BDC-05-7	
Dissolved Metals (mg/L)										
Aluminum	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
Arsenic	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
Barium	**0.007**		**0.007**		**0.005**		**0.011**		**0.014**	
Cadmium	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U
Calcium	**25.8**		**20.9**		**23.8**		**44.9**		**33.8**	
Chromium	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
Cobalt	**0.004**		0.003	U	0.003	U	0.003	U	0.003	U
Copper	0.002	U	0.002	U	0.002	U	0.002	U	0.003	
Iron	**8.09**		**6.44**		**3.92**		0.05	U	**0.16**	
Lead	0.02	U	0.02	U	0.02	U	0.02	U	0.02	U
Magnesium	**16.6**		**8.71**		**10.7**		**12.9**		**17.1**	
Molybdenum	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
Nickel	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Silver	0.003	U	0.003	U	0.003	U	0.003	U	0.003	U
Zinc	0.006	U	0.006	U	0.006	U	**0.008**		0.006	U

Note: Detected values are shown in **bold type**.

U - Indicates compound was analyzed for, but was not detected at the given detection limit.

Data Table 3. Boeing Developmental Center groundwater monitoring, SWMU-20 (Building 9-101), June 2002

Horizon A

Analyte	Horizon A (6.5-21.5 ft)									
	DC-MW9A		DC-MW10A		DC-MW11A		DC-MW12A		DC-MW13A	
VOAs (µg/L)										
Chloromethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Bromomethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Vinyl chloride	**46**		**28**		1.0	U	1.0	U	1.0	U
Chloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Methylene chloride	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
Acetone	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Carbon Disulfide	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1-Dichloroethene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1-Dichloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
trans-1,2-Dichloroethene	2.9		2.7		1.0	U	1.0	U	1.0	U
cis-1,2-Dichloroethene	**280**		**80**		**6.0**		**1.8**		1.0	U
Chloroform	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2-Dichloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
2-Butanone	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
1,1,1-Trichloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Carbon Tetrachloride	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Vinyl Acetate	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Bromodichloromethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2-Dichloropropane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
cis-1,3-Dichloropropene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Trichloroethene	**24**		**24**		**1.9**		1.0	U	**3.4**	
Dibromochloromethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1,2-Trichloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Benzene	**1.0**	**U**	1.0	U	1.0	U	1.0	U	1.0	U
trans-1,3-Dichloropropene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
2-Chloroethylvinylether	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Bromoform	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
4-Methyl-2-Pentanone (MIBK)	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
2-Hexanone	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Tetrachloroethene	**14**		**24**		1.0	U	1.0	U	**2.7**	
1,1,2,2-Tetrachloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Toluene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Chlorobenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Ethylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Styrene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Trichlorofluoromethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1,2-Trichloro-1,2,2-trifluoroethane	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
m,p-Xylene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
o-Xylene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2-Dichlorobenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,3-Dichlorobenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,4-Dichlorobenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Acrolein	50	U	50	U	50	U	50	U	50	U
Methyl Iodide	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U

Data Table 3, cont.

Analyte	Horizon A (6.5-21.5 ft)									
	DC-MW9A		DC-MW10A		DC-MW11A		DC-MW12A		DC-MW13A	
Bromoethane	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
Acrylonitrile	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1-Dichloropropene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Dibromomethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1,1,2-Tetrachloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2-Dibromo-3-chloropropane	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
1,2,3-Trichloropropane	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U
trans-1,4-Dichloro-2-butene	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
1,3,5-Trimethylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2,4-Trimethylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Hexachlorobutadiene	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Ethylene Dibromide	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Bromochloromethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
2,2-Dichloropropane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,3-Dichloropropane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Isopropylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
n-Propylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Bromobenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
2-Chlorotoluene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
4-Chlorotoluene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
tert-Butylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
sec-Butylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
4-Isopropyltoluene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
n-Butylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2,4-Trichlorobenzene	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Naphthalene	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
1,2,3-Trichlorobenzene	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U

Note: Detected values are shown in **bold type**.

U = Indicates compound was analyzed for, but was not detected at the given detection limit.

J = Indicates an estimated value.

Y = Indicates compound was analyzed for, but was not detected at the given elevated detection limit.

M = Indicates an estimated value of analyte detected and confirmed by analyst with low spectral match parameters.

Data Table 3, cont.

Horizon A

	Horizon A, cont. (6.5-21.5 ft)									
Analyte	**DC-MW14A**		**DC-MW15A**		**Dc-MW16A**		**DC-MW17A**		**DC-MW21A**	
VOAs (µg/L)										
Chloromethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Bromomethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Vinyl chloride	1.0	U	**2.0**		1.0	U	1.0	U	1.0	U
Chloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Methylene chloride	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
Acetone	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Carbon Disulfide	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1-Dichloroethene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1-Dichloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
trans-1,2-Dichloroethene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
cis-1,2-Dichloroethene	1.0	U	**2.8**		1.0	U	1.0	U	1.0	U
Chloroform	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2-Dichloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
2-Butanone	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
1,1,1-Trichloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Carbon Tetrachloride	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Vinyl Acetate	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Bromodichloromethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2-Dichloropropane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
cis-1,3-Dichloropropene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Trichloroethene	1.0	U	1.0	U	1.0	U	**7.4**		1.0	U
Dibromochloromethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1,2-Trichloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Benzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
trans-1,3-Dichloropropene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
2-Chloroethylvinylether	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Bromoform	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
4-Methyl-2-Pentanone (MIBK)	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
2-Hexanone	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Tetrachloroethene	1.0	U	1.0	U	1.0	U	**3.8**		1.0	U
1,1,2,2-Tetrachloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Toluene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Chlorobenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Ethylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Styrene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Trichlorofluoromethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1,2-Trichloro-1,2,2-trifluoroethane	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
m,p-Xylene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
o-Xylene	1.0	U	1.4		1.0	U	1.0	U	1.0	U
1,2-Dichlorobenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,3-Dichlorobenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,4-Dichlorobenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Acrolein	50	U	50	U	50	U	50	U	50	U
Methyl Iodide	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Bromoethane	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U

Data Table 3, cont.

	Horizon A, cont. (6.5-21.5 ft)									
Analyte	**DC-MW14A**		**DC-MW15A**		**Dc-MW16A**		**DC-MW17A**		**DC-MW21A**	
Acrylonitrile	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1-Dichloropropene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Dibromomethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1,1,2-Tetrachloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2-Dibromo-3-chloropropane	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
1,2,3-Trichloropropane	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U
trans-1,4-Dichloro-2-butene	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
1,3,5-Trimethylbenzene	1.0	U	**1.5**		1.0	U	1.0	U	1.0	U
1,2,4-Trimethylbenzene	1.0	U	**4.2**		1.0	U	1.0	U	1.0	U
Hexachlorobutadiene	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Ethylene Dibromide	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Bromochloromethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
2,2-Dichloropropane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,3-Dichloropropane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Isopropylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
n-Propylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Bromobenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
2-Chlorotoluene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
4-Chlorotoluene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
tert-Butylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
sec-Butylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
4-Isopropyltoluene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
n-Butylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2,4-Trichlorobenzene	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Naphthalene	**5.7**		**840**	**J**	5.0	U	5.0	U	5.0	U
1,2,3-Trichlorobenzene	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U

Note: Detected values are shown in **bold type**.

U = Indicates compound was analyzed for, but was not detected at the given detection limit.

J = Indicates an estimated value.

Y = Indicates compound was analyzed for, but was not detected at the given elevated detection limit.

M = Indicates an estimated value of analyte detected and confirmed by analyst with low spectral match parameters.

Data Table 3, cont.

Horizon B and C

	Horizon B Wells (22–27.5 ft)				Horizon C Wells (23.5–40.5 ft)							
Analyte	DC-MW6B		DC-MW9B		DC-MW6C		DC-MW8C		DC-MW9C		DC-MW10C	
VOAs (µg/L)	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Chloromethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Bromomethane	**12**		**7.6**		1.0	U	1.0	U	**18**		**1.6**	
Vinyl chloride	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Chloroethane	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
Methylene chloride	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Acetone	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Carbon Disulfide	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1-Dichloroethene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1-Dichloroethane	1.0	U	**2.4**		1.0	U	1.0	U	1.0	U	1.0	U
trans-1,2-Dichloroethene	**40**		**180**	**Y**	1.0	U	1.0	U	**6.7**		1.0	U
cis-1,2-Dichloroethene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Chloroform	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2-Dichloroethane	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
2-Butanone	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1,1-Trichloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Carbon Tetrachloride	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Vinyl Acetate	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Bromodichloromethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2-Dichloropropane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
cis-1,3-Dichloropropene	**5.9**		**2.5**		1.0	U	1.0	U	1.0	U	1.0	U
Trichloroethene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Dibromochloromethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1,2-Trichloroethane	1.0	U	1.0	U	1.0	U	**5.4**		1.0	U	1.0	U
Benzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
trans-1,3-Dichloropropene	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
2-Chloroethylvinylether	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Bromoform	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
4-Methyl-2-Pentanone (MIBK)	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
2-Hexanone	**10**		1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Tetrachloroethene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1,2,2-Tetrachloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Toluene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Chlorobenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Ethylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Styrene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Trichlorofluoromethane	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
1,1,2-Trichloro-1,2,2-trifluoroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
m,p-Xylene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
o-Xylene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2-Dichlorobenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,3-Dichlorobenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,4-Dichlorobenzene	50	U	50	U	50	U	50	U	50	U	50	U
Acrolein	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Methyl Iodide	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
Bromoethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Acrylonitrile	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U

Data Table 3, cont.

	Horizon B Wells (22–27.5 ft)				Horizon C Wells (23.5–40.5 ft)							
Analyte	DC-MW6B		DC-MW9B		DC-MW6C		DC-MW8C		DC-MW9C		DC-MW10C	
1,1-Dichloropropene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Dibromomethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1,1,2-Tetrachloroethane	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
1,2-Dibromo-3-chloropropane	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U
1,2,3-Trichloropropane	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
trans-1,4-Dichloro-2-butene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,3,5-Trimethylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2,4-Trimethylbenzene	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Hexachlorobutadiene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Ethylene Dibromide	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Bromochloromethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
2,2-Dichloropropane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,3-Dichloropropane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Isopropylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
n-Propylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Bromobenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
2-Chlorotoluene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
4-Chlorotoluene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
tert-Butylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
sec-Butylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
4-Isopropyltoluene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
n-Butylbenzene	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
1,2,4-Trichlorobenzene	5.0	U	5.0	U	5.0	U	180	J	5.0	U	5.0	U
Naphthalene	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
1,2,3-Trichlorobenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U		

Note: Detected values are shown in **bold type**.

U = Indicates compound was analyzed for, but was not detected at the given detection limit.

J = Indicates an estimated value.

Y = Indicates compound was analyzed for, but was not detected at the given elevated detection limit.

M = Indicates an estimated value of analyte detected and confirmed by analyst with low spectral match parameters.

Data Table 3, cont.

Horizon C

	Horizon C, cont. (23.5–40.5 ft)											
Analyte	DC-MW14C		DC-MW15C		DC-MW16C		DC-MW18C		DC-MW19C		DC-MW20C	
VOAs (µg/L)												
Chloromethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Bromomethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Vinyl chloride	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	**1.4**	**M**
Chloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Methylene chloride	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
Acetone	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Carbon Disulfide	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1-Dichloroethene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1-Dichloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
trans-1,2-Dichloroethene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
cis-1,2-Dichloroethene	**1.5**		1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Chloroform	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2-Dichloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
2-Butanone	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
1,1,1-Trichloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Carbon Tetrachloride	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Vinyl Acetate	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Bromodichloromethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2-Dichloropropane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
cis-1,3-Dichloropropene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Trichloroethene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Dibromochloromethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1,2-Trichloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Benzene	1.0	U	1.0	U	**1.7**		1.0	U	1.0	U	1.0	U
trans-1,3-Dichloropropene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
2-Chloroethylvinylether	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Bromoform	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
4-Methyl-2-Pentanone (MIBK)	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
2-Hexanone	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Tetrachloroethene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1,2,2-Tetrachloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Toluene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Chlorobenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Ethylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Styrene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Trichlorofluoromethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1,2-Trichloro-1,2,2-trifluoroethane	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
m,p-Xylene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
o-Xylene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2-Dichlorobenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,3-Dichlorobenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,4-Dichlorobenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Acrolein	50	U	50	U	50	U	50	U	50	U	50	U
Methyl Iodide	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Bromoethane	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
Acrylonitrile	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U

Data Table 3, cont.

	HORIZON C, cont. (23.5–40.5 ft)											
ANALYTE	DC-MW14C		DC-MW15C		DC-MW16C		DC-MW18C		DC-MW19C		DC-MW20C	
1,1-Dichloropropene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Dibromomethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1,1,2-Tetrachloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2-Dibromo-3-chloropropane	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
1,2,3-Trichloropropane	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U
trans-1,4-Dichloro-2-butene	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
1,3,5-Trimethylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2,4-Trimethylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Hexachlorobutadiene	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Ethylene Dibromide	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Bromochloromethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
2,2-Dichloropropane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,3-Dichloropropane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Isopropylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
n-Propylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Bromobenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
2-Chlorotoluene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
4-Chlorotoluene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
tert-Butylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
sec-Butylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
4-Isopropyltoluene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
n-Butylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2,4-Trichlorobenzene	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Naphthalene	5.0	U	5.0	UJ	5.0	U	5.0	U	5.0	U	5.0	U
1,2,3-Trichlorobenzene	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U

Note: Detected values are shown in **bold type**.

U = Indicates compound was analyzed for, but was not detected at the given detection limit.

J = Indicates an estimated value.

Y = Indicates compound was analyzed for, but was not detected at the given elevated detection limit.

M = Indicates an estimated value of analyte detected and confirmed by analyst with low spectral match parameters.

Data Table 3, cont.

Horizon C, D, and E

	Horizon C, cont.		Horizon D (40-50 ft)				Horizon E (77-82 ft)	
Analyte	DC-MW21C		DC-MW9D		DC-MW15D		DC-MW14E	
VOAs (µg/L)								
Chloromethane	1.0	U	1.0	U	1.0	U	1.0	U
Bromomethane	1.0	U	1.0	U	1.0	U	1.0	U
Vinyl chloride	1.0	U	1.0	U	1.0	U	1.0	U
Chloroethane	1.0	U	1.0	U	1.0	U	1.0	U
Methylene chloride	2.0	U	2.0	U	2.0	U	2.0	U
Acetone	5.0	U	5.0	U	5.0	U	5.0	U
Carbon Disulfide	1.0	U	1.0	U	1.0	U	1.0	U
1,1-Dichloroethene	1.0	U	1.0	U	1.0	U	1.0	U
1,1-Dichloroethane	1.0	U	1.0	U	1.0	U	1.0	U
trans-1,2-Dichloroethene	1.0	U	1.0	U	1.0	U	1.0	U
cis-1,2-Dichloroethene	1.0	U	1.0	U	1.0	U	1.0	U
Chloroform	1.0	U	1.0	U	1.0	U	1.0	U
1,2-Dichloroethane	1.0	U	1.0	U	1.0	U	1.0	U
2-Butanone	5.0	U	5.0	U	5.0	U	5.0	U
1,1,1-Trichloroethane	1.0	U	1.0	U	1.0	U	1.0	U
Carbon Tetrachloride	1.0	U	1.0	U	1.0	U	1.0	U
Vinyl Acetate	5.0	U	5.0	U	5.0	U	5.0	U
Bromodichloromethane	1.0	U	1.0	U	1.0	U	1.0	U
1,2-Dichloropropane	1.0	U	1.0	U	1.0	U	1.0	U
cis-1,3-Dichloropropene	1.0	U	1.0	U	1.0	U	1.0	U
Trichloroethene	1.0	U	1.0	U	1.0	U	1.0	U
Dibromochloromethane	1.0	U	1.0	U	1.0	U	1.0	U
1,1,2-Trichloroethane	1.0	U	1.0	U	1.0	U	1.0	U
Benzene	1.0	U	1.0	U	1.0	U	1.0	U
trans-1,3-Dichloropropene	1.0	U	1.0	U	1.0	U	1.0	U
2-Chloroethylvinylether	5.0	U	5.0	U	5.0	U	5.0	U
Bromoform	1.0	U	1.0	U	1.0	U	1.0	U
4-Methyl-2-Pentanone (MIBK)	5.0	U	5.0	U	5.0	U	5.0	U
2-Hexanone	5.0	U	5.0	U	5.0	U	5.0	U
Tetrachloroethene	1.0	U	1.0	U	1.0	U	1.0	U
1,1,2,2-Tetrachloroethane	1.0	U	1.0	U	1.0	U	1.0	U
Toluene	1.0	U	1.0	U	1.0	U	1.0	U
Chlorobenzene	1.0	U	1.0	U	1.0	U	1.0	U
Ethylbenzene	1.0	U	1.0	U	1.0	U	1.0	U
Styrene	1.0	U	1.0	U	1.0	U	1.0	U
Trichlorofluoromethane	1.0	U	1.0	U	1.0	U	1.0	U
1,1,2-Trichloro-1,2,2-trifluoroethane	2.0	U	2.0	U	2.0	U	2.0	U
m,p-Xylene	1.0	U	1.0	U	1.0	U	1.0	U
o-Xylene	1.0	U	1.0	U	1.0	U	1.0	U
1,2-Dichlorobenzene	1.0	U	1.0	U	1.0	U	1.0	U
1,3-Dichlorobenzene	1.0	U	1.0	U	1.0	U	1.0	U
1,4-Dichlorobenzene	1.0	U	1.0	U	1.0	U	1.0	U
Acrolein	50	U	50	U	50	U	50	U
Methyl Iodide	1.0	U	1.0	U	1.0	U	1.0	U
Bromoethane	2.0	U	2.0	U	2.0	U	2.0	U
Acrylonitrile	1.0	U	1.0	U	1.0	U	1.0	U

Data Table 3, cont.

	Horizon C, cont.		Horizon D (40-50 ft)				Horizon E (77-82 ft)	
Analyte	DC-MW21C		DC-MW9D		DC-MW15D		DC-MW14E	
1,1-Dichloropropene	1.0	U	1.0	U	1.0	U	1.0	U
Dibromomethane	1.0	U	1.0	U	1.0	U	1.0	U
1,1,1,2-Tetrachloroethane	1.0	U	1.0	U	1.0	U	1.0	U
1,2-Dibromo-3-chloropropane	5.0	U	5.0	U	5.0	U	5.0	U
1,2,3-Trichloropropane	3.0	U	3.0	U	3.0	U	3.0	U
trans-1,4-Dichloro-2-butene	5.0	U	5.0	U	5.0	U	5.0	U
1,3,5-Trimethylbenzene	1.0	U	1.0	U	1.0	U	1.0	U
1,2,4-Trimethylbenzene	1.0	U	1.0	U	1.0	U	1.0	U
Hexachlorobutadiene	5.0	U	5.0	U	5.0	U	5.0	U
Ethylene Dibromide	1.0	U	1.0	U	1.0	U	1.0	U
Bromochloromethane	1.0	U	1.0	U	1.0	U	1.0	U
2,2-Dichloropropane	1.0	U	1.0	U	1.0	U	1.0	U
1,3-Dichloropropane	1.0	U	1.0	U	1.0	U	1.0	U
Isopropylbenzene	1.0	U	1.0	U	1.0	U	1.0	U
n-Propylbenzene	1.0	U	1.0	U	1.0	U	1.0	U
Bromobenzene	1.0	U	1.0	U	1.0	U	1.0	U
2-Chlorotoluene	1.0	U	1.0	U	1.0	U	1.0	U
4-Chlorotoluene	1.0	U	1.0	U	1.0	U	1.0	U
tert-Butylbenzene	1.0	U	1.0	U	1.0	U	1.0	U
sec-Butylbenzene	1.0	U	1.0	U	1.0	U	1.0	U
4-Isopropyltoluene	1.0	U	1.0	U	1.0	U	1.0	U
n-Butylbenzene	1.0	U	1.0	U	1.0	U	1.0	U
1,2,4-Trichlorobenzene	5.0	U	5.0	U	5.0	U	5.0	U
Naphthalene	5.0	U	5.0	U	5.0	U	5.0	U
1,2,3-Trichlorobenzene	5.0	U	5.0	U	5.0	U	5.0	U

Note: Detected values are shown in **bold type**.

U = Indicates compound was analyzed for, but was not detected at the given detection limit.

J = Indicates an estimated value.

Y = Indicates compound was analyzed for, but was not detected at the given elevated detection limit.

M = Indicates an estimated value of analyte detected and confirmed by analyst with low spectral match parameters.

Data Table 4. Boeing Developmental Center groundwater monitoring, AOC-03/04, June 2002

Analyte	DC-MW21A (mg/L)		DC-Mw21C (mg/L)	
Diesel range hydrocarbons	0.25	U	0.25	U
Motor oil	0.50	U	0.50	U

U – Compound was analyzed for, but was not detected at the given detection limit

Data Table 5. Boeing Developmental Center groundwater monitoring, AOC-05 (formerly DC-01 gasoline tank), June 2002

Analyte	BDC-101		BDC-102		BDC-103	
BTEX (µg/L)						
Benzene	**1.0**		**4.4**		**960**	
Toluene	1.0	U	1.0	U	**17,000**	
Ethylbenzene	1.0	U	1.0	U	**5,100**	
m,p-Xylene	1.0	U	1.0	U	**20,000**	
o-Xylene	1.0	U	1.0	U	**7,100**	
NWTPH-G (mg/L)						
Gasoline range hydrocarbons	0.25	U	0.25	U	**200**	

Note: Detected values are shown in **bold type**.

U – Compound was analyzed for, but was not detected at the given detection limit

Data Table 6. Boeing Isaacson groundwater data

Analyte (mg/L)	Monitoring Well (screened depth ft bgs)					
	MW I-104 (15-25)	MW I-203 (16-265)	MW I-205 (14-24.5)	MW I-206 (14-24.5)	P2-7 (14-24)	P2-8 (14-24)
Dissolved arsenic[a] (µg/L)						
8/24/00	**1,600**	**1,200**	**27**	**1,100**	**9**	**2**
10/25/00	**810**	**98**	**112**	**1.4**	**3.7**	**2.8**
Total iron (mg/L)						
8/24/00	**11.3**	**7.73**	**22.2**	**24.1**	0.02 U	**12.1**

Note: Detected values are shown in **bold type**.

[a] The highest concentration from two sampling events, 8/24/00 and 10/25/00, is reported.

Data Table 7. Boeing Plant 2 groundwater data from the last four quarters of shoreline monitoring in 2001/2002

Compound	PMCLs	Unit	Number Detected Results	Number Observed Results	Detection Frequency	Minimum Non-Detected Result	Maximum Non-Detected Result	Minimum Detected Result	Maximum Detected Result	Sample ID Associated with Maximum Detected Result	Median	Arithmetic Mean	Upper 95% Confidence Limit
VOC													
1,1,1-Trichloroethane	31200	µg/L	0	114	0	1	15	n/a	n/a		0.5	0.7544	0.9290
1,1,2,2-Tetrachloroethane	6.5	µg/L	0	114	0	1	15	n/a	n/a		0.5	0.7544	0.9290
1,1,2-Trichloroethane	25	µg/L	0	114	0	1	15	n/a	n/a		0.5	0.7544	0.9290
1,1,2-Trichlorotrifluoroethane	12962963	µg/L	0	114	0	2	30	n/a	n/a		1	1.5088	1.8579
1,1-Dichloroethane	63234	µg/L	7	114	6.1	1	15	1.1	2.5	GW020204-PL2-044B-0	0.5	0.8377	1.0181
1,1-Dichloroethene	1.9	µg/L	5	114	4.4	1	15	1.1	10	GW020121-PL2-JF01AR-	0.5	0.8561	1.0766
1,2-Dichloroethane	59	µg/L	0	114	0	1	15	n/a	n/a		0.5	0.7544	0.9290
1,2-Dichloropropane	n/a	µg/L	0	114	0	1	15	n/a	n/a		0.5	0.7544	0.9290
2-Butanone	n/a	µg/L	0	114	0	5	75	n/a	n/a		2.5	3.7719	4.6449
2-Chloroethylvinylether	n/a	µg/L	0	102	0	5	75	n/a	n/a		2.5	3.9216	4.8947
2-Hexanone	n/a	µg/L	0	114	0	5	75	n/a	n/a		2.5	3.7719	4.6449
4-Methyl-2-Pentanone	n/a	µg/L	0	114	0	5	75	n/a	n/a		2.5	3.7719	4.6449
Acetone	2552858	µg/L	7	114	6.1	5	75	5.9	22	GW010517-PL2-JF01C-0	2.5	4.2781	5.2105
Benzene	43	µg/L	6	114	5.3	1	15	1	29	GW020121-PL2-JF01AR-	0.5	1.1184	1.5874
Bromodichloromethane	28	µg/L	0	114	0	1	15	n/a	n/a		0.5	0.7544	0.9290
Bromoform	219	µg/L	0	114	0	1	15	n/a	n/a		0.5	0.7544	0.9290
Bromomethane	n/a	µg/L	0	114	0	1	15	n/a	n/a		0.5	0.7544	0.9290
Carbon disulfide	n/a	µg/L	3	114	2.6	1	15	1.2	1.6	GW010423-PL2-015B-0	0.5	0.7763	0.9514
Carbon tetrachloride	2.7	µg/L	2	114	1.8	1	15	1.5	2.2	GW020122-PL2-015A-0	0.5	0.7781	0.9542
Chlorobenzene	129	µg/L	3	114	2.6	1	15	1.4	41	GW020121-PL2-JF01AR-	0.5	1.1342	1.7509
Chloroethane	230000	µg/L	3	114	2.6	1	15	1.5	1.8	GW010725-PL2-JF03A-0	0.5	0.7842	0.9601
Chloroform	283	µg/L	6	114	5.3	1	15	1.4	5.1	GW010723-PL2-015A-0	0.5	0.8965	1.0967
Chloromethane	n/a	µg/L	4	114	3.5	1	15	1.6	48	GW020121-PL2-JF01AR-	0.5	1.1895	1.9035
cis-1,2-Dichloroethene	16204	µg/L	47	114	41.2	1	2	1.2	26000	GW020121-PL2-JF01AR-	0.5	368.6965	753.5588
cis-1,3-Dichloropropene	n/a	µg/L	0	114	0	1	15	n/a	n/a		0.5	0.7544	0.9290
Dibromochloromethane	n/a	µg/L	0	114	0	1	15	n/a	n/a		0.5	0.7544	0.9290
Ethylbenzene	430	µg/L	1	114	0.9	1	15	92	92	GW020121-PL2-JF01AR-	0.5	1.5395	2.8883

Data Table 7, cont.

Compound	PMCLs	Unit	Number Detected Results	Number Observed Results	Detection Frequency	Minimum Non-Detected Result	Maximum Non-Detected Result	Minimum Detected Result	Maximum Detected Result	Sample ID Associated with Maximum Detected Result	Median	Arithmetic Mean	Upper 95% Confidence Limit
m,p-Xylene	n/a	µg/L	3	114	2.6	1	15	1.2	80	GW020121-PL2-JF01AR-	0.5	1.4474	2.6218
Methylene chloride	960	µg/L	0	114	0	2	30	n/a	n/a		1	1.5088	1.8579
o-Xylene	154155	µg/L	5	114	4.4	1	15	1	76	GW020121-PL2-JF01AR-	0.5	1.4342	2.5507
Styrene	n/a	µg/L	0	114	0	1	15	n/a	n/a		0.5	0.7544	0.9290
Tetrachloroethene	8.9	µg/L	0	114	0	1	15	n/a	n/a		0.5	0.7544	0.9290
Toluene	5000	µg/L	1	114	0.9	1	15	680	680	GW020121-PL2-JF01AR-	0.5	6.6974	16.6554
trans-1,2-Dichloroethene	32800	µg/L	16	114	14	1	15	1	380	GW020124-PL2-258A-0	0.5	8.5404	15.7648
trans-1,3-Dichloropropene	n/a	µg/L	0	114	0	1	15	n/a	n/a		0.5	0.7544	0.9290
Trichloroethene	55	µg/L	16	114	14	1	15	1.2	31	GW010423-PL2-013AR-0	0.5	2.7500	3.7092
Trichlorofluoromethane	6400	µg/L	0	114	0	1	15	n/a	n/a		0.5	0.7544	0.9290
Vinyl acetate	n/a	µg/L	0	113	0	5	75	n/a	n/a		2.5	3.7832	4.6637
Vinyl chloride	2.9	µg/L	43	114	37.7	1	15	1	16000	GW020121-PL2-JF01AR-	0.5	229.9456	468.5474
Pesticides / PCB's													
Aroclor 1016	1	µg/L	0	8	0	0.017	0.017	n/a	n/a		0.0085	0.0085	0.0085
Aroclor 1242	1	µg/L	0	8	0	0.017	0.017	n/a	n/a		0.0085	0.0085	0.0085
Aroclor 1248	1	µg/L	0	8	0	0.017	0.017	n/a	n/a		0.0085	0.0085	0.0085
Aroclor 1254	1	µg/L	0	8	0	0.017	0.017	n/a	n/a		0.0085	0.0085	0.0085
Aroclor 1260	1	µg/L	4	8	50	0.017	0.017	0.02	0.045	GW010424-PL2-036A-0	0.01425	0.0180	0.0265
Total PCB	1	µg/L	4	8	50	0.017	0.017	0.02	0.045	GW010424-PL2-036A-0	0.01425	0.0180	0.0265
Total Inorganics													
Antimony	500	µg/L	5	112	4.5	2	20	2	4	GW010423-PL2-013A-0	1	2.1696	2.4655
Arsenic	3	µg/L	88	112	78.6	0.5	5	0.4	23.3	GW011108-PL2-425A-0	2.05	4.3058	5.1469
Beryllium	3	µg/L	3	112	2.7	0.2	5	0.2	0.6	GW010423-PL2-030C-0	0.1	0.3165	0.3806
Cadmium	9.3	µg/L	5	112	4.5	2	10	3	91	GW010724-PL2-013A-0	1	2.4554	3.9040
Chromium	50	µg/L	12	112	10.7	5	20	6	70	GW010424-PL2-043B-0	2.5	4.6071	5.8381
Copper	2.9	µg/L	76	112	67.9	0.5	11	0.5	108	GW010423-PL2-013A-0	2	9.1580	12.4811
Lead	5.6	µg/L	16	112	14.3	1	20	1	16	GW010424-PL2-043B-0	0.5	2.0313	2.4529
Mercury	0.025	µg/L	100	112	89.3	0.0002	0.1	0.000227	0.0744	GW010424-PL2-043B-0	0.00117	0.0061	0.0081

Data Table 7, cont.

Compound	PMCLs	Unit	Number Detected Results	Number Observed Results	Detection Frequency	Minimum Non-Detected Result	Maximum Non-Detected Result	Minimum Detected Result	Maximum Detected Result	Sample ID Associated with Maximum Detected Result	Median	Arithmetic Mean	Upper 95% Confidence Limit
Nickel	8.3	µg/L	109	112	97.3	2	5	0.6	46	GW010724-PL2-013A-0	2.5	5.5491	6.7345
Selenium	71	µg/L	21	112	18.8	50	250	50	260	GW010425-PL2-258C-0	25	39.7768	45.0032
Silver	2.3	µg/L	7	112	6.3	0.5	10	0.6	31	GW010724-PL2-013A-0	0.25	1.1482	1.6721
Thallium	6.3	µg/L	0	112	0	0.2	5	n/a	n/a		0.1	0.2906	0.3466
Vanadium	648	µg/L	86	112	76.8	3	20	3	150	GW010424-PL2-043B-0	7	11.1429	13.9269
Zinc	86	µg/L	35	112	31.3	6	30	8	1760	GW010724-PL2-013A-0	3	41.6786	70.4137
Dissolved Inorganics													
Antimony	500	µg/L	7	112	6.3	2	20	2	7	GW010724-PL2-013A-0	1	2.2232	2.5374
Arsenic	3	µg/L	83	112	74.1	0.5	10	0.4	27.3	GW011108-PL2-425A-0	2.1	4.3129	5.2209
Beryllium	3	µg/L	2	112	1.8	0.2	4	0.2	0.5	GW011108-PL2-443A-0	0.1	0.3018	0.3633
Cadmium	9.3	µg/L	5	112	4.5	2	10	3	102	GW010724-PL2-013A-0	1	2.6071	4.2296
Chromium	50	µg/L	3	112	2.7	5	20	7	12	GW011108-PL2-443A-0	2.5	3.1830	3.4835
Copper	2.9	µg/L	67	112	59.8	0.5	10	0.5	110	GW010423-PL2-013A-0	1.1	5.4335	8.1819
Lead	5.6	µg/L	2	112	1.8	1	20	3	4	GW010423-PL2-013A-0	0.5	1.4955	1.7831
Mercury	n/a	µg/L	79	112	70.5	0.0002	0.1	0.000207	0.1	GW020122-PL2-015B-0	0.00045	0.0029	0.0048
Nickel	8.3	µg/L	107	112	95.5	0.5	2	0.5	46	GW010724-PL2-013A-0	1.95	4.0652	4.9867
Selenium	71	µg/L	25	112	22.3	50	250	50	300	GW010425-PL2-214C-0	25	44.4643	50.6891
Silver	2.3	µg/L	4	112	3.6	0.5	10	1	30	GW010724-PL2-013A-0	0.25	1.0879	1.5867
Thallium	6.3	µg/L	0	112	0	0.2	4	n/a	n/a		0.1	0.2884	0.3454
Vanadium	648	µg/L	75	112	67	3	20	3	23	GW020122-PL2-233A-0	6	6.9196	7.7714
Zinc	86	µg/L	17	112	15.2	6	30	6	1950	GW010724-PL2-013A-0	3	36.2321	67.7713
Conventional Parameters													
Conductivity	n/a	uS/cm	116	116	100	0	0	367	34382	GW011023-PL2-258C-0	2362.5	7407.6293	8838.7513
Dissolved oxygen	n/a	mg/L	116	116	100	0	0	0.09	9.08	GW020122-PL2-036A-0	0.62	1.2266	1.5137
pH (Field)	n/a	pH	116	116	100	0	0	6.2	7.98	GW020122-PL2-036A-0	6.91	6.9405	6.9940
Redox potential	n/a	mV	116	116	100	0	0	-178.6	225	GW010423-PL2-015A-0	57.3	52.8388	68.7023
Salinity	n/a	PPT	111	111	100	0	0	0.21	27.43	GW011023-PL2-258C-0	1.24	5.3024	6.4363
Temperature	n/a	degC	116	116	100	0	0	6.27	19.62	GW011105-PL2-232A-0	15.31	15.1451	15.4945

Data Table 7, cont.

Source: Weston (2002)

Note: Detected values are shown in **bold type**.

Data Table 8. Comparison of facility boundary monitoring well data to proposed media cleanup levels (µg/L) at the Boeing Plant 2 site (Weston 1998)

Station	CAS No.	Constituent	Quarter 1 11/95	Quarter 2 2-3/96	Quarter 3 5/96	Quarter 4 8/96	Mean	PMCLs
PL2-008C	75-01-4	Vinyl Chloride	14	2.8	1 U	1 U	4.7	2.9
	7440-38-2	Arsenic	5 U	2	2	2	2.75	0.098
PL2-013A	75-01-4	Vinyl Chloride	3.6	56	6.4	1 U	16.75	2.9
	7440-38-2	Arsenic	32	0.5 U	2	22	14.125	0.098
	7440-43-9	Cadmium	1 U	3	9	29	10.5	9.3
	7440-50-8	Copper	200	48	24	98	92.5	2.9
	7439-92-1	Lead	10	2.5 UB	2	2	4.125	5.6
	7440-02-0	Nickel	10	5 U	5 U	5 U	6.25	8.3
	7440-22-4	Silver	1.5 U	1.5 U	1.5 U	5	2.375	2.3
	7440-66-6	Zinc	148	300	329	404	295.25	86
PL2-015A	7440-38-2	Arsenic	7	6	2	3	4.5	0.098
	7440-50-8	Copper	6	13	5	3	6.75	2.9
	7439-92-1	Lead	0.5 U	6	0.5 U	0.5 U	1.875	5.6
PL2-015B	7440-50-8	Copper	23	1 U	1 U	4	7.25	2.9
	7439-92-1	Lead	11	1 UB	0.5 U	0.5 U	3.25	5.6
PL2-036A	11096-82-5	Aroclor 1260	0.5 U	1.9	0.5 U	0.5 U	0.85	0.000045
	TOTAL-PCB	Total PCB	0.5 UT	1.9 T	0.5 UT	0.5 UT	0.85	0.000104
	7440-38-2	Arsenic	1.5 UB	5	5	2.5 U	3.5	0.098
	7440-50-8	Copper	1 U	11	7	3	5.5	2.9
	7439-92-1	Lead	1 UB	25	13	0.5 U	9.875	5.6
	7782-49-2	Selenium	25 U	25 U	25 U	80	38.75	71
	7440-28-0	Thallium	25 U	25 U	25 U	60	33.75	6.3
PL2-214A	75-01-4	Vinyl Chloride	2.4	47	2.9	10	15.575	2.9
	7440-38-2	Arsenic	20	0.5 U	1	2	5.875	0.098
	7440-50-8	Copper	3	1 U	1 U	1 U	1.5	2.9
PL2-214B	7782-49-2	Selenium	70	80	25 U	50	56.25	71
	7440-28-0	Thallium	60	25 U	50	25 U	40	6.3
PL2-232A	75-01-4	Vinyl Chloride	2.3	3.5	2.3	4.7	3.2	2.9
	7440-38-2	Arsenic	5	6	2	3	4	0.098
PL2-233A	7440-38-2	Arsenic	1.5 UB	15	2	8	6.625	0.098
	7440-50-8	Copper	2	14	2	3	5.25	2.9
	7439-92-1	Lead	0.5 U	12	0.5 U	0.5 U	3.375	5.6
	7440-02-0	Nickel	5 U	5 U	5 U	20	8.75	8.3
	7782-49-2	Selenium	25 U	25 U	25 U	90	41.25	71

Data Table 8, cont.

Station	CAS No.	Constituent	Quarter 1 11/95	Quarter 2 2-3/96	Quarter 3 5/96	Quarter 4 8/96	Mean	PMCLs
PL2-240A	7440-38-2	Arsenic	9	14	19	15	14.25	0.098
	7440-50-8	Copper	3	1 U	1 U	1 U	1.5	2.9
PL2-258A	75-35-4	1,1-Dichloroethene	47	47	31 J	25 U	37.5	1.9
	79-01-6	Trichloroethene	3.3	7.3	240 D	25 U	68.9	55
	75-01-4	Vinyl Chloride	890 DJH	1800 D	1200 D	1800	1422.5	2.9
	7440-38-2	Arsenic	5 U	6	8	6	6.25	0.098
	7440-02-0	Nickel	5 U	5 U	5 U	10	6.25	8.3
PL2-258B	75-01-4	Vinyl Chloride	7.6	1 U	1 U	5.5	3.775	2.9
	7440-28-0	Thallium	60	25 U	25 U	80	47.5	6.3
PL2-258C	7440-50-8	Copper	2 U	2 U	2 U	6	3	2.9
	7782-49-2	Selenium	50 U	50 U	50 U	100	62.5	71
	7440-28-0	Thallium	100	50 U	50 U	50 U	62.5	6.3
PL2-425A	7440-38-2	Arsenic	20	19	24	20	20.75	0.098
	7440-50-8	Copper	1 U	1 U	5	8	3.75	2.9
PL2-443A	7440-38-2	Arsenic	1	0.5 U	1	1	0.875	0.098
	7440-50-8	Copper	5	4	5	7	5.25	2.9
PL2-444A	7440-38-2	Arsenic	5 U	0.5 U	4	2	2.875	0.098
	7440-50-8	Copper	1 U	33 J	1 U	3	9.5	2.9
PL2-JF01A	7440-38-2	Arsenic	0.5 U	1	2	0.5 U	1	0.098
PL2-JF01B	7440-38-2	Arsenic	0.5 U	0.5 U	1	0.5 U	0.625	0.098
PL2-JF02A	7440-38-2	Arsenic	2	4	4	4	3.5	0.098
PL2-JF03A	7440-38-2	Arsenic	2	0.5 U	1	1	1.125	0.098
	7440-50-8	Copper	1 U	1 U	8	7	4.25	2.9
	7440-02-0	Nickel	10	5 U	5 U	5 U	6.25	8.3

Source: Weston (1998)

Note: Detected values are shown in **bold type**.

Data Table 9. Comparison of seep data (March-June 1995) to proposed media cleanup levels at Boeing Plant 2 (Weston 1998)

Station	CAS No.	Constituent	Concentration (µg/L)	PMCLs
SE-01001	75-01-4	Vinyl Chloride	36	2.9
	7440-38-2	Arsenic (Total)	12	0.098
	7782-49-2	Selenium (Total)	300	71
	7440-28-0	Thallium (Total)	300	6.3
	7440-38-2	Arsenic (Dissolved)	10	0.098
	7782-49-2	Selenium (Dissolved)	120	71
SE-01002	7440-38-2	Arsenic (Total)	12	0.098
	7440-38-2	Arsenic (Dissolved)	6	0.098
SE-01003	7440-38-2	Arsenic (Total)	20	0.098
	7440-50-8	Copper (Total)	30	2.9
	7439-97-6	Mercury (Total)	0.2	0.025
	7782-49-2	Selenium (Total)	300	71
	7440-38-2	Arsenic (Dissolved)	10	0.098
SE-01004	7440-38-2	Arsenic (Total)	9	0.098
	7440-38-2	Arsenic (Dissolved)	8	0.098
SE-01005	7440-38-2	Arsenic (Total)	10	0.098
	7440-38-2	Arsenic (Dissolved)	8	0.098
SE-01006	7440-38-2	Arsenic (Total)	10	0.098
	7439-92-1	Lead (Total)	6	5.6
	7440-38-2	Arsenic (Dissolved)	10	0.098
	7440-28-0	Thallium (Dissolved)	50	6.3
SE-04101	7440-38-2	Arsenic (Total)	5	0.098
	7440-50-8	Copper (Total)	14	2.9
	7439-92-1	Lead (Total)	16	5.6
SE-04102	11096-82-5	Aroclor 1260	1.8	0.000045
	TOTAL-PCB	Total PCB	1.8 T	0.000104
	7440-38-2	Arsenic (Total)	4	0.098
	7440-50-8	Copper (Total)	13	2.9
	7439-92-1	Lead (Total)	22	5.6
	7440-02-0	Nickel (Total)	10	8.3
SE-04105	7440-38-2	Arsenic (Total)	8	0.098
	7440-50-8	Copper (Total)	30	2.9
	7440-38-2	Arsenic (Dissolved)	8	0.098
	7440-50-8	Copper (Dissolved)	8	2.9
	7782-49-2	Selenium (Dissolved)	100	71
	7440-28-0	Thallium (Dissolved)	70	6.3

Data Table 9, cont.

Station	CAS No.	Constituent	Concentration (µg/L)	PMCLs
SE-SWY01	75-01-4	Vinyl Chloride	3.4	2.9
	11096-82-5	Aroclor 1260	0.96 J	0.000045
	TOTAL-PCB	Total PCB	0.96 T	0.000104
	7440-38-2	Arsenic (Total)	16	0.098
	7440-50-8	Copper (Total)	19 J	2.9
	7439-92-1	Lead (Total)	25 J	5.6
SE-SWY02	7440-50-8	Copper (Total)	7	2.9
	7439-92-1	Lead (Total)	104	5.6
SE-SWY03	11096-82-5	Aroclor 1260	4.6	0.000045
	TOTAL-PCB	Total PCB	4.6 T	0.000104
	7440-38-2	Arsenic (Total)	18	0.098
	7440-50-8	Copper (Total)	116	2.9
	7439-92-1	Lead (Total)	200	5.6
	7439-97-6	Mercury (Total)	0.2	0.025
	7440-02-0	Nickel (Total)	30	8.3
	7440-66-6	Zinc (Total)	212	86
SE-SWY04	7440-38-2	Arsenic (Total)	12	0.098
	7440-50-8	Copper (Total)	52	2.9
	7439-92-1	Lead (Total)	81	5.6
	7782-49-2	Selenium (Total)	80	71
	7440-28-0	Thallium (Total)	50	6.3
	7440-66-6	Zinc (Total)	223	86
SE-SWY05	75-01-4	Vinyl Chloride	3.5	2.9
	7440-38-2	Arsenic (Total)	8	0.098
	7440-50-8	Copper (Total)	6	2.9
	7440-28-0	Thallium (Total)	50	6.3
SE-SWY06	75-01-4	Vinyl Chloride	32	2.9
	7440-38-2	Arsenic (Total)	6	0.098
	7440-28-0	Thallium (Total)	60	6.3
SE-SWY07	7440-38-2	Arsenic (Total)	6	0.098
	7440-28-0	Thallium (Total)	60	6.3
SW-SWY01	11097-69-1	Aroclor 1254	0.93 J	0.000045
	TOTAL-PCB	Total PCB	0.93 T	0.000104
	7440-38-2	Arsenic (Total)	2	0.098
	7440-50-8	Copper (Total)	15	2.9

Source: Weston (1998)

Note: Detected values are shown in **bold type**.

Data Table 10. Great Western groundwater data for wells located closest to the LDW

Analyte	Monitoring Well (screened depth ft bgs)			
	B-33A (11.5 ft; first water-bearing zone)		B-34 (34 ft; second water-bearing zone)	
Organic Compound (µg/L)				
1,1,1,2-Tetrachloroethane	100	U	1	U
1,1,1-Trichloroethane	500	U	5	U
1,1,2,2-Tetrachloroethane	500	U	5	U
1,1,2-Trichloroethane	100	U	1	U
1,1-Dichloroethane	**170**		1	U
1,1-Dichloroethene	100	U	1	U
1,1-Dichloropropene	100	U	1	U
1,2,3-Trichlorobenzene	100	U	1	U
1,2,3-Trichloropropane	500	U	5	U
1,2,4-Trichlorobenzene	0.5	U	0.5	U
1,2,4-Trichlorobenzene	100	U	1	U
1,2,4-Trimethylbenzene	100	U	1	U
1,2-Dibromo-3-chloropropane	2,000	U	20	U
1,2-Dibromoethane (EDB)	100	U	1	U
1,2-Dichlorobenzene	0.5	U	0.5	U
1,2-Dichlorobenzene	100	U	1	U
1,2-Dichloroethane	100	U	1	U
1,2-Dichloropropane	100	U	1	U
1,3,5-Trimethylbenzene	100	U	1	U
1,3-Dichlorobenzene	0.5	U	0.5	U
1,3-Dichlorobenzene	100	U	1	U
1,3-Dichloropropane	100	U	1	U
1,4-Dichlorobenzene	0.5	U	0.5	U
1,4-Dichlorobenzene	100	U	1	U
2,2-Dichloropropane	100	U	1	U
2,4,5-Trichlorophenol	5	U	5	U
2,4,6-Trichlorophenol	5	U	5	U
2,4-Dichlorophenol	5	U	5	U
2,4-Dimethylphenol	0.5	U	0.5	U
2,4-Dinitrophenol	5	U	5	U
2,4-Dinitrotoluene	5	U	5	U
2,6-Dinitrotoluene	5	U	5	U
2-Chloroethyl vinyl ether	2,000	U	20	U
2-Chloronaphthalene	0.5	U	0.5	U
2-Chlorophenol	0.5	U	0.5	U
2-Chlorotoluene	2,000	U	20	U
2-Methylnaphthalene	0.5	U	0.5	U
2-Methylphenol	0.5	U	0.5	U
2-Nitroaniline	0.5	U	0.5	U

Data Table 10, cont.

Analyte	Monitoring Well (screened depth ft bgs)			
	B-33A (11.5 ft; first water-bearing zone)		B-34 (34 ft; second water-bearing zone)	
2-Nitrophenol	5	U	5	U
3,3'-Dichlorobenzidine	0.5	U	0.5	U
3-Nitroaniline	0.5	U	0.5	U
4,6-Dinitro-o-cresol	5	U	5	U
4-Bromophenyl phenyl ether	0.5	U	0.5	U
4-Chloro-3-methylphenol	0.5	U	0.5	U
4-Chloroaniline	0.5	U	0.5	U
4-Chlorophenyl phenyl ether	0.5	U	0.5	U
4-Chlorotoluene	100	U	1	U
4-Methylphenol	0.5	U	0.5	U
4-Nitroaniline	0.5	U	0.5	U
4-Nitrophenol	5	UJ	5	UJ
Acenaphthene	0.5	U	0.5	U
Acenaphthylene	0.5	U	0.5	U
Acetone	5,000	UB	50	UB
Aniline	0.5	U	0.5	U
Anthracene	0.5	U	0.5	U
Benzene	100	U	1	U
Benzidine	13	U	13	U
Benzo(a)anthracene	0.5	U	0.5	U
Benzo(a)pyrene	0.5	U	0.5	U
Benzo(b)fluoranthene	0.5	U	0.5	U
Benzo(g,h,i)perylene	0.5	U	0.5	U
Benzo(k)fluoranthene	0.5	U	0.5	U
Benzoic acid	13	U	13	U
Benzyl alcohol	0.5	U	0.5	U
bis(2-chloroethoxy)methane	0.5	U	0.5	U
bis(2-chloroethyl)ether	0.5	U	0.5	U
bis(2-chloroisopropyl)ether	0.5	U	0.5	U
bis(2-ethylhexyl)phthalate	1.6	UB	0.74	UB
Bromobenzene	100	U	1	U
Bromodichloromethane	500	U	5	U
Bromoform	100	U	1	U
Bromomethane	100	U	1	U
Butyl benzyl phthalate	0.5	U	0.5	U
Carbazole	0.5	U	0.5	U
Carbon disulfide	100	U	1	U
Carbon tetrachloride	100	U	1	U
Chlorobenzene	100	U	1	U
Chloroethane	100	U	1	U
Chloroform	100	U	1	U

Data Table 10, cont.

Analyte	Monitoring Well (screened depth ft bgs)			
	B-33A (11.5 ft; first water-bearing zone)		B-34 (34 ft; second water-bearing zone)	
Chloromethane	100	U	1	U
Chrysene	0.5	U	0.5	U
cis-1,2-Dichloroethene	**21,000**		**7.6**	
cis-1,3-Dichloropropene	100	U	1	U
Dibenzo(a,h)anthracene	0.5	U	0.5	U
Dibenzofuran	0.5	U	0.5	U
Dibromochloromethane	100	U	1	U
Dibromomethane	1,000	U	10	U
Dichlorodifluoromethane	100	U	1	U
Dichloromethane	500	U	5	U
Diethylphthalate	0.5	U	0.5	U
Dimethyl phthalate	0.5	U	0.5	U
Di-n-butyl phthalate	0.5	UB	0.5	UB
Di-n-octyl phthalate	5	U	5	U
Ethane	0.5	U	0.5	U
Ethene	**83**		0.5	U
Ethylbenzene	100	U	1	U
Fluoranthene	0.5	U	0.5	U
Fluorene	0.5	U	0.5	U
Hexachlorobenzene	0.5	U	0.5	U
Hexachlorobutadiene	0.5	U	0.5	U
Hexachlorobutadiene	1,000	U	10	U
Hexachlorocyclopentadiene	5	U	5	U
Hexachloroethane	0.5	U	0.5	U
Indeno(1,2,3-cd)pyrene	0.5	U	0.5	U
Isophorone	0.5	U	0.5	U
iso-Propylbenzene	100	U	1	U
iso-Propyltoluene	100	U	1	U
Methane	**58**		0.5	U
Methyl ethyl ketone	5,000	U	50	U
Methyl iso-butyl ketone	2,000	U	20	U
Naphthalene	0.5	UB	0.5	UB
Naphthalene	2,000	U	20	U
n-Butylbenzene	100	U	1	U
Nitrobenzene	0.5	U	0.5	U
N-Nitroso-di-n-propylamine	0.5	U	0.5	U
N-Nitrosodiphenylamine	0.5	U	0.5	U
n-Propylbenzene	100	U	1	U
Pentachlorophenol	0.5	U	0.5	U
Pentachlorophenol	5	U	5	U
Phenanthrene	0.5	U	0.5	U

Data Table 10, cont.

Analyte	Monitoring Well (screened depth ft bgs)			
	B-33A (11.5 ft; first water-bearing zone)		B-34 (34 ft; second water-bearing zone)	
Phenol	0.5	U	0.5	U
Pyrene	0.5	U	0.5	U
sec-Butylbenzene	100	U	1	U
Styrene	100	U	1	U
tert-Butylbenzene	100	U	1	U
Tetrachloroethene	**130**		**11**	
Toluene	100	U	1	U
trans-1,2-Dichloroethene	**100**		1	U
trans-1,3-Dichloropropene	100	U	1	U
Trichloroethene	100	U	**5.7**	
Trichlorofluoromethane	100	U	1	U
Vinyl acetate	2,000	U	20	U
Vinyl chloride	**23,000**		**2.2**	
Xylene (meta & para)	200	U	2	U
Xylene (ortho)	100	U	1	U
Other (mg/L)				
Ammonia (total as nitrogen)	**0.6**		**0.09**	
Nitrate	0.3	U	**0.55**	J
Nitrite	0.3	U	**11**	J
Sulfate	**86**		**1,600**	
Phosphorus (total)	**0.4**		**0.1**	
Chloride	**730**		**11,000**	
Iron (µg/L)	**42,000**		**590**	

Note: Detected values are shown in **bold type**.

U - Undetected

UJ - The material was analyzed for, but was not detected. The associated value is an estimate and may be inaccurate or imprecise.

J - The reported concentration is to be considered an estimated value.

B - Suspected laboratory contamination

Data Table 11. Long Painting groundwater data for MW-5

ANALYTE	MW-5 (screened at 14.4 ft bgs)	
Organic Compounds (µg/L)		
1,1,1,2-Tetrachloroethane	0.20	U
1,1,1-Trichloroethane	**0.63**	
1,1,2,2-Tetrachloroethane	0.20	U
1,1,2-Trichloroethane	0.20	U
1,1-Dichloroethane	0.20	U
1,1-Dichloroethene	0.20	U
1,1-Dichloropropene	0.20	U
1,2,3-Trichlorobenzene	0.20	U
1,2,3-Trichloropropane	0.20	U
1,2,4-Trichlorobenzene	0.20	U
1,2,4-Trimethylbenzene	0.20	U
1,2-Dibromo-3-chloropropane	5.0	U
1,2-Dibromoethane	0.20	U
1,2-Dichlorobenzene	0.20	U
1,2-Dichloroethane	0.20	U
1,2-Dichloropropane	0.20	U
1,3,5-Trimethylbenzene	0.20	U
1,3-Dichlorobenzene	0.20	U
1,3-Dichloropropane	0.20	U
1,4-Dichlorobenzene	0.20	U
2,2-Dicholorethene	0.20	U
2-Butanone	5.0	U
2-Chloroethyl vinyl ether	5.0	U
2-Chlorotoluene	0.20	U
4-Chlorotoluene	0.20	U
Acetone	5.0	U
Benzene	0.20	U
Bromobenzene	0.20	U
Bromodichloromethane	0.20	U
Bromoform	1.0	U
Bromomethane	0.20	U
Carbon disulfide	0.20	U
Carbon tetrachloride	0.20	U
Chlorobenzene	0.20	U
Chloroethane	0.20	U
Chloroform	0.20	U
Chloromethane	0.20	U
cis-1,2-Dichloroethene	0.20	U
cis-1,3-Dichloropropene	0.20	U
Dibromochloromethane	0.20	U
Dibromomethane	0.20	U
Dichlorodifluoromethane	0.20	U
Ethylbenzene	0.20	U
Hexachlorobutadiene	0.20	U

Data Table 11, cont.

ANALYTE	MW-5 (screened at 14.4 ft bgs)	
Isopropylbenzene	0.20	U
m,p-Xylene	0.40	U
Methyl isobutyl ketone	1.0	U
Methylene chloride	1.0	U
Naphthalene	1.0	U
n-Butylbenzene	0.20	U
n-Propylbenzene	0.20	U
o-Xylene	0.20	U
p-Isopropyltoluene	0.20	U
sec-Butylbenzene	0.20	U
Styrene	0.20	U
tert-Butylbenzene	0.20	U
Tetrachloroethene	**0.92**	
Toluene	0.20	U
TPH as gasoline	100	U
trans-1,2-Dichloroethene	0.20	U
trans-1,3-Dichloropropene	0.20	U
Trichloroethene	0.20	U
Trichlorofluoromethane	0.20	U
Vinyl acetate	1.0	U
Vinyl chloride	0.20	U
Metals (µg/L)		
Arsenic (dissolved)	3.0	U
Arsenic (total)	**21**	
Barium (total)	**210**	
Cadmium (total)	4.4	U
Chromium (total)	**36**	
Lead (dissolved)	1.0	U
Lead (total)	**45**	
Mercury (total)	0.50	U
Selenium (total)	5.6	U
Silver (total)	11.0	U
pH	6.06	
temp (C)	15.00	
DO	3.60	
Conductivity (mS)	603.00	

Note: Detected values are shown in **bold type**.

U - Undetected

Data Table 12. Malarkey Asphalt groundwater data for wells located closest to the LDW[a]

Analyte	Monitoring Well					
	MW-2		MW-3		MW-4	
Organic Compounds (µg/L)						
Acenaphthene	1	U	1	U	1	U
Acenaphthylene	1	U	1	U	1	U
Anthracene	0.1	U	0.1	U	0.1	U
Benzo(a)anthracene	0.1	U	0.1	U	0.1	U
Benzo(a)pyrene	0.1	U	0.1	U	0.1	U
Benzo(b)fluoranthene	0.2	U	0.2	U	0.2	U
Benzo(g,h,i)perylene	0.2	U	0.2	U	0.2	U
Benzo(k)fluoranthene	0.1	U	0.1	U	0.1	U
Chrysene	0.1	U	0.1	U	0.1	U
Dibenzo(a,h)anthracene	0.1	U	0.1	U	0.1	U
Fluoranthene	0.2	U	0.2	U	0.2	U
Fluorene	0.2	U	0.2	U	0.2	U
Indeno(1,2,3-cd)pyrene	0.1	U	0.1	U	0.1	U
Naphthalene	1	U	1	U	1	U
Phenanthrene	0.1	U	0.1	U	0.1	U
Pyrene	0.2	U	0.2	U	0.2	U
PCBs (µg/L)						
Aroclor 1016	0.2	U	0.2	U	0.2	U
Aroclor 1221	0.2	U	0.2	U	0.2	U
Aroclor 1232	0.2	U	0.2	U	0.2	U
Aroclor 1242	0.2	U	0.2	U	0.2	U
Aroclor 1248	0.2	U	0.2	U	0.2	U
Aroclor 1254	0.2	U	0.2	U	0.2	U
Aroclor 1260	**12**		**54**		0.73	U
Other (µg/L)						
Diesel	250	U	250	U	250	U
Jet Fuel as Jet A	250	U	250	U	250	U
Kerosene	250	U	250	U	250	U
Lube Oil	250	U	**5,900**		250	U
Mineral spirits	250	U	250	U	250	U
Non-PHC as diesel	250	U	250	U	250	U
PHC as diesel	250	U	250	U	250	U

Note: Detected values are shown in **bold type**.

U - Undetected

[a] Concentrations for PCBs and TPH as diesel and heavy fuel (lube) oil are maximum values measured during the four sampling rounds from July 1997 to April 1998.

Data Table 13. PACCAR groundwater data for wells located closest to the LDW

Analyte	Monitoring Well			
	MW-14		MW-18	
Organic Compounds (µg/L)				
1,1,1,-Trichloroethane	**260**		**2.9**	
1,1,2-Trichloroethane	**1.0**		1.0	U
1,1-Dichloroethane	**100**		**64**	
1,1-Dichloroethene	**38**		**1.2**	
1,2-Dichloroethane	**4.7**		**1.3**	
1,2-Dichloroethylene				
2-Butanone	5.0	U	5.0	U
4-Methyl-2-pentanone	5.0	U	5.0	U
Acetone	5.0	U	5.0	U
Benzene	1.0	U	**2.1**	
Carbon disulfide	1.0	U	1.0	U
Carbon tetrachloride	1.0	U	1.0	U
Chloroethane	2.0	U	**54**	
Chloroform	**1.6**		1.0	U
Chloromethane	2.0	U	2.0	U
cis-1,2-Dichloroethene	**43**		**110**	
Ethylbenzene	1.0	U	1.0	U
Methylene chloride	2.0	U	2.0	U
Tetrachloroethene	**1.8**		1.0	U
Toluene	1.0	U	1.0	U
Total xylenes	1.0	U	1.0	U
trans-1,2-Dichloroethene	**1.3**		**1.7**	
Trichloroethene	**160**		**1.3**	
Vinyl chloride	**30**		**190**	

Note: Detected values are shown in **bold type**.

na - Not analyzed

U - Undetected

Data Table 14. Philip Services groundwater data for wells located closest to the LDW

Analyte	Monitoring Well (screened depth ft bgs)											
	Water-Table Aquifer				Shallow Aquifer				Intermediate Aquifer		Deep Aquifer	
	CG-122-WT		CG-126-WT		CG-121-40		CG-125-40		CG-122-60		104-D	
	11 ft		11 ft		35 ft		35 ft		55 ft		118.5 ft	
Organic Compounds (µg/L)												
1,1,1-Trichloroethane	1.00	U	**3.82**		1.00	U	1.00	U	1.00	U	na	
1,1,2,2, Tetrachloroethane	1.00	U	1.00	U	1.00	U	1.00	U	1.00	U	na	
1,1,2-Tri-chloroethane	1.00	U	1.00	U	1.00	U	1.00	U	1.00	U	na	
1,1,2-Trichlorortrifluoroethane	2.00	U	2.00	U	2.00	U	2.00	U	2.00	U	na	
1,1-Dichloroethane	**10.1**		**13.3**		1.00	U	2.38		**0.695**	J	na	
1,1-Dichloroethene	1.00	U	**1.44**		1.00	U	1.00	U	1.00	U	na	
1,2,4-Trichlorobenzene	4.76	U	4.78	U	4.76	U	4.85	U	4.76	U	na	
1,2,4-Trimethyl benzene	**2.08**		1.00	U	1.00	U	1.00	U	1.00	U	na	
1,2,-Dichloroethane	1.00	U	1.00	U	1.00	U	1.00	U	1.00	U	na	
1,2-Dichlorobenzene	1.00	U	1.00	U	1.00	U	1.00	U	1.00	U	na	
1,2-Dichloropropane	1.00	U	1.00	U	1.00	U	1.00	U	1.00	U	na	
1,3,5-Trimethylbenzene	1.00	U	1.00	U	1.00	U	1.00	U	1.00	U	na	
1,3-Dichlorobenzene	1.00	U	1.00	U	1.00	U	1.00	U	1.00	U	na	
1,4-Dichlorobenzene	1.00	U	1.00	U	1.00	U	1.00	U	1.00	U	na	
1-Methyl naphthalene	NT		NT		NT		NT		NT		NT	
2,4,5-Trichlorophenol	4.76	U	4.78	U	4.76	UJ	4.85	U	4.76	U	na	
2,4,6-Trichlorophenol	4.76	U	4.78	U	4.76	UJ	4.85	U	4.76	U	na	
2,4-Dichlorophenol	4.76	U	4.78	U	4.76	UJ	4.85	U	4.76	U	na	
2,4-Dimethylphenol	4.76	U	4.78	U	4.76	UJ	4.85	U	4.76	U	na	
2,4-Dinitrophenol	9.52	U	9.57	U	9.52	UJ	9.71	U	9.52	U	na	
2,4-Dinitrotoluene	4.76	U	4.78	U	4.76	U	4.85	U	4.76	U	na	
2,6-Dinitrotoluene	4.76	U	4.78	U	4.76	U	4.85	U	4.76	U	na	
2-Butanone	10.0	U	10.0	U	10.0	U	**8.18**	**J**	10.0	U	na	
2-Chloroethyl vinyl ether	5.00	U	5.00	U	5.00	U	5.00	U	5.00	U	na	
2-Chloronaphthalene	4.76	U	4.78	U	4.76	U	4.85	U	4.76	U	na	
2-Chlorophenol	4.76	U	4.78	U	4.76	UJ	4.85	U	4.76	U	na	
2-Hexane	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	na	
2-Methylnaphthalene	4.76	U	4.78	U	4.76	U	4.85	U	4.76	U	na	
2-Methylphenol	4.76	U	4.78	U	4.76	UJ	4.85	U	4.76	U	na	
2-Nitroaniline	4.76	U	4.78	U	4.76	U	4.85	U	4.76	U	na	
2-Nitrophenol	4.76	U	4.78	U	4.76	UJ	4.85	U	4.76	U	na	
3,3-Dichlorobenzidine	0.0238	U	0.0239	U	0.0238	U	0.0243	U	0.0238	U	na	
3-Nitroanaline	4.76	U	4.78	U	4.76	U	4.85	U	4.76	U	na	
4,6-Dinitro 2-methylphenol	4.76	U	4.78	U	4.76	UJ	4.85	U	4.76	U	na	
4-Bromophenyl phenyl ether	4.76	U	4.78	U	4.76	U	4.85	U	4.76	U	na	
4-Chloro 3-methylphenol	4.76	U	4.78	U	4.76	UJ	4.85	U	4.76	U	na	
4-Chloroanaline	4.76	U	4.78	U	4.76	U	4.85	U	4.76	U	na	
4-Chlorophenyl ether	4.76	U	4.78	U	4.76	U	4.85	U	4.76	U	na	
4-Methyl 2-Pentanone	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	na	
4-Nitroaniline	4.76	U	4.78	U	4.76	U	4.85	U	4.76	U	na	

Data Table 14, cont.

Analyte	Monitoring Well (screened depth ft bgs)					
	Water-Table Aquifer		Shallow Aquifer		Intermediate Aquifer	Deep Aquifer
	CG-122-WT	CG-126-WT	CG-121-40	CG-125-40	CG-122-60	104-D
	11 ft	11 ft	35 ft	35 ft	55 ft	118.5 ft
4-Nitrophenol	4.76 U	4.78 U	4.76 UJ	4.85 U	4.76 U	na
Acenaphthene	4.76 U	4.78 U	4.76 U	4.85 U	4.76 U	na
Acenaphthylene	4.76 U	4.78 U	4.76 U	4.85 U	4.76 U	na
Acenophenone	4.76 U	4.78 U	4.76 U	4.85 U	4.76 U	na
Acetone	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	na
Aniline	4.76 U	4.78 U	4.76 U	4.85 U	4.76 U	na
Anthracene	4.76 U	4.78 U	4.76 U	4.85 U	4.76 U	na
Benzene	**14.1**	0.50 U	**32**	**0.619**	0.50 U	na
Benzo(a)anthracene	0.0100 U	0.0100 U	**0.0136**	0.0100 U	0.0115 U	na
Benzo(a)pyrene	0.0100 U	0.0100 U	**0.0108**	0.0100 U	0.0100 U	na
Benzo(b)fluoranthene	0.0100 U	0.0100 U	**0.0116**	0.0100 U	0.0100 U	na
Benzo(g,h,i)perylene	0.0476 U	0.0478 U	**0.0667**	0.0485 U	0.0476 U	na
Benzo(k)fluoranthene	0.0100 U	0.01 U	**0.0135**	0.01 U	**0.0103**	na
Benzoic acid	9.52 U	9.57 U	9.52 UJ	9.71 U	**10.6**	na
Benzyl alcohol	4.76 U	4.78 U	4.76 U	4.85 U	4.76 U	na
bis(2 ethyl-hexyl)phthalate (BEHP)	23.8 U	23.9 U	23.8 U	24.3 U	23.8 U	na
bis(2-chlorisopropyl)ether	4.76 U	4.78 U	4.76 U	4.85 U	4.76 U	na
bis(2-chloro-ethoxylmethane)	4.76 U	4.78 U	4.76 U	4.85 U	4.76 U	na
bis(2-chloro-ethyl)ether	0.00952 U	0.00957 U	0.00952 U	0.00971 U	0.00952 U	na
Bromodichloromethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	na
Bromoform	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	na
Bromomethane	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	na
butyl benzyl phthalate	4.76 U	4.78 U	4.76 U	4.85 U	4.76 U	na
Carbon Disulfide	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	na
Carbon tetrachloride	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	na
carbozole	4.76 U	4.78 U	4.76 U	4.85 U	4.76 U	na
Chlorobenzene	**0.603 J**	1.00 U	1.00 U	1.00 U	1.00 U	na
Chloroethane	**90.4 D**	1.00 U	**184 D**	**3.56**	**14.8**	na
Chloroform	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	na
Chloromethane	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	na
Chrysene	0.0100 U	0.0100 U	**0.0129**	0.0100 U	**0.0151**	na
cis-1,2-Dichloroethylene	**2.23**	**7.28**	**0.601 J**	1.00 U	1.00 U	na
cis-1,3-Dichloropropene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	na
Dibenzo(a,h)anthracene	0.0100 U	0.0100 U	**0.0122**	0.0100 U	**0.0111**	na
Dibenzofuran	4.76 U	4.78 U	4.76 U	4.85 U	4.76 U	na
Dibromochloromethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	na
Diethylphthalate	4.76 U	4.78 U	4.76 U	4.85 U	4.76 U	na
Dimethyl phthalate	4.76 U	4.78 U	4.76 U	4.85 U	4.76 U	na
Di-n-butyl phthalate	4.76 U	4.78 U	4.76 U	4.85 U	4.76 U	na
Di-n-octyl phthalate	4.76 U	4.78 U	4.76 U	4.85 U	4.76 U	na
Ethylbenzene	1.00 U	1.00 U	**0.554 J**	1.00 U	1.00 U	na
Fluoranthene	4.76 U	4.78 U	4.76 U	4.85 U	4.76 U	na

Data Table 14, cont.

Analyte	Monitoring Well (screened depth ft bgs)					
	Water-Table Aquifer		Shallow Aquifer		Intermediate Aquifer	Deep Aquifer
	CG-122-WT	CG-126-WT	CG-121-40	CG-125-40	CG-122-60	104-D
	11 ft	11 ft	35 ft	35 ft	55 ft	118.5 ft
Fluorene	4.76 U	4.78 U	4.76 U	4.85 U	4.76 U	na
Hexachlorobenzene	0.0238 U	0.0239 U	0.0238 U	0.0243 U	0.0238 U	na
Hexachlorobutadiene	0.00476 U	0.00478 U	0.00476 U	0.00485 U	0.00476 U	na
Hexachlorocyclopentadiene	4.76 U	4.78 U	4.76 U	4.85 U	4.76 U	na
Hexachloroethane	4.76 U	4.78 U	4.76 U	4.85 U	4.76 U	na
Indeno(1,2,3-cd)pyrene	0.0100 U	0.0100 U	**0.0129**	0.0100 U	0.0100 U	na
Isophorone	4.76 U	4.78 U	4.76 U	4.85 U	4.76 U	na
m,p-Xylenes	**1.28 J**	2.00 U	**3.68**	2.00 U	2.00 U	na
Methylene chloride	5.00 U	5.00 U	**9.84**	5.00 U	5.00 U	na
Methylphenol	4.76 U	4.78 U	4.76 UJ	4.85 U	4.76 U	na
Naphthalene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	na
Naphthalene	1.00 U	1.00 U	1.00 U	1.00 U	na	na
n-Butylbenzene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	na
n-Butylbenzene	1.00 U	1.00 U	1.00 U	1.00 U	na	na
n-Hexane	NT	NT	NT	NT	NT	na
Nitrobenzene	4.76 U	4.78 U	4.76 U	4.85 U	4.76 U	na
N-Nitro-diphenylamine	4.76 U	4.78 U	4.76 U	4.85 U	4.76 U	na
N-Nitro-dipropylamine	0.00476 U	0.00478 U	0.00476 U	0.00485 U	0.00476 U	na
o-Xylene	**0.965 J**	1.00 U	**1.39**	1.00 U	1.00 U	na
Pentachlorophenol	4.76 U	4.78 U	4.76 U	4.85 U	4.76 U	na
Phenanthrene	4.76 U	4.78 U	4.76 U	4.85 U	4.76 U	na
Phenol	4.76 U	4.78 U	4.76 UJ	4.85 U	4.76 U	na
Pyrene	4.76 U	4.78 U	4.76 U	4.85 U	4.76 U	na
Styrene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	na
Tetrachloroethene	1.00 U	**2.01**	1.00 U	0.0500 U	1.00 U	na
Toluene	**1.01**	1.00 U	**1.84**	1.00 U	1.00 U	na
trans-1,2,-Dichloroethene	**1.23**	1.00 U	**0.502** J	1.00 U	1.00 U	na
trans-1,2-Dichloropropene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	na
Trichloroethene	1.00 U	**27.1**	1.00 U	1.00 U	1.00 U	na
Trichlorofluoromethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	na
Vinyl acetate	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	na
Vinyl chloride	**1.84**	**4.11**	**1.29**	**4.6**	**1.66**	na
Diesel	0.250 U	0.250 U	0.250 U	0.250 U	0.250 U	0.250 U
Lube oil	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U
Gasoline	**144**	0.0500 U	**118**	0.0500 U	0.0500 U	0.0500 U
PCBs (µg/L)						
Aroclor 1016	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U
Aroclor 1221	0.219 U	0.219 U	0.219 U	0.219 U	0.219 U	0.219 U
Aroclor 1232	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U
Aroclor 1242	0.131 U	0.131 U	0.131 U	0.131 U	0.131 U	0.131 U
Aroclor 1248	0.123 U	0.123 U	0.123 U	0.123 U	0.123 U	0.123 U
Aroclor 1254	0.180 U	0.180 U	0.180 U	0.180 U	0.180 U	0.180 U

Data Table 14, cont.

Analyte	Monitoring Well (screened depth ft bgs)											
	Water-Table Aquifer				Shallow Aquifer				Intermediate Aquifer		Deep Aquifer	
	CG-122-WT		CG-126-WT		CG-121-40		CG-125-40		CG-122-60		104-D	
	11 ft		11 ft		35 ft		35 ft		55 ft		118.5 ft	
Aroclor 1260	0.100	U	0.100	U	0.100	U	0.100	U	0.100	U	0.100	U
Aroclor 1262	0.100	U	0.100	U	0.100	U	0.100	U	0.100	U	0.100	U
Aroclor 1268	0.100	U	0.100	U	0.100	U	0.100	U	0.100	U	0.100	U
Metals (mg/L)												
Arsenic	**0.0151**		**0.00169**		NT		0.00100	U	**0.00199**		**0.0057**	
Barium	0.00100	U	0.00100	U	0.00100	U	0.00100	U	**0.483**		**0.0658**	
Chromium	0.00100	U	0.00100	U	0.00100	U	**0.00281**		**0.0103**		**0.00275**	
Chromium (hexavalent)	0.00500	UR	0.00500	UR	0.00500	UR	0.00829	R	na		0.00500	UR
Copper	**0.00619**		**0.00329**		**0.00117**		**0.00124**		**0.0217**		**0.00337**	
Lead	0.00100	U	0.00100	U	0.00100	U	0.00100	U	**0.00316**		0.00100	U
Manganese	**0.466**	D	**0.163**		**3.76**	D	**0.145**		**0.586**	**D**	**0.519**	D
Nickel	**0.00471**		**0.00343**		**0.00228**		**0.00118**		**0.00869**		**0.00293**	
Selenium	0.00100	U	0.00100	U	0.00100	U	**0.00135**		na		**0.024**	
Silver	0.00100	U	0.00100	U	0.00100	U	0.00100	U	na		**0.00431**	
Vanadium	**0.00536**		**0.00204**		**0.00263**		**0.0114**		**0.0258**		**0.00393**	
Other (mg/L)												
Ammonia	**0.233**		na		**1.2**		na		**4.77**		**9.29**	
Bicarbonate alkalinity ($CaCO_3$)	**165**		na		**531**		na		**609**		**3,020**	
Calcium	**28.7**		na		**88.8**		na		**24.2**		**95.9**	
Carbonate alkalinity ($CaCO_3$)	5.00	U	na		5.00	U	na		5.00	U	5.00	U
Chloride	**14.6**		na		**27**	D	na		93	D	**6,930**	D
CO2	**32.9**		na		**169**		na		**29.4**		**189**	
Cyanide	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	NT	
Ferric Iron	**10.5**		na		**1.88**		na		**15.5**		**6.79**	
Ferrous Iron	**10.8**		na		**14.1**	**DJ**	na		0.500	UJ	0.500	U
Hydroxide alkalinity ($CaCO_3$)	5.00	U	na		5.00	U	na		5.00	U	5.00	U
Magnesium	**7.99**		na		**39.9**		na		**49.2**		**301**	
Nitrate	**0.578**		na		0.200	U	na		0.200	U	0.400	UD
Nitrite	0.200	U	na		0.200	U	na		0.200	U	200	UD
Potassium	**8.19**		na		**18.6**		na		**29.4**		**170**	
Sodium	**38.8**		na		**67.2**		na		**172**	**D**	**4,300**	**D**
Sulfate	12	D	na		**0.543**		na		0.400	U	0.800	UD
Sulfide	20.0	U	20.0	U	20.0	U	20.0	U	20.0	U	20.0	U
Sulfide	20.0	U	na		20.0	U	na		20.0	U	20.0	U
TOC	**14.4**	**D**	na		**64.5**	**D**	na		**32.6**	**D**	**115**	**D**
total alkalinity ($CaCO_3$)	**165**		na		**531**		na		**609**		**3,020**	
TSS	**290**		na		**630**		na		**760**		**14,000**	
Other (µg/L)												
Methane	**9,640**		na		**31,800**		na		**43,700**		**50,100**	
Ethane	**498**		na		**290**		na		**2,140**		10.0	U
Ethylene	10.0	U	na		10.0	U	Na		10.0	U	10.0	U

Data Table 14, cont.

Note: Detected values are shown in **bold type**.

U - Undetected

J - The reported concentration is to be considered an estimated value.

B - The analyte was detected in the laboratory method blank.

D - The sample required dilution.

R- The reported result is to be considered invalid (rejected).

NT - Tentatively identified compound (TIC).

na - Not analyzed

Data Table 15. Rhône-Poulenc groundwater data for wells located closest to the LDW

Analyte	Monitoring Well (screened depth ft bgs)																			
	Intermediate Interval						Upper Interval													
	DM-2A		DM-8 HT		DM-8 LT		A9		H6		H9 HT		H9 LT		MW-36 HT		MW-36 LT	
	9-29 ft		16-36 ft		16-36 ft		11-21 ft		10-20 ft		10-19 ft		10-19 ft		20-25 ft		20-25 ft	
Organic Compounds (µg/L)																		
1,1,1,2-Tetrachloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1,1-Trichloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1,2,2-Tetrachloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1,2-Trichloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1-Dichloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1-Dichloroethene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1-Dichloropropene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2,3-Trichlorobenzene	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
1,2,3-Trichloropropane	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U
1,2,4-Trichlorobenzene	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
1,2,4-Trimethylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2-Dibromo-3-chloropropane	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
1,2-Dichlorobenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2-Dichloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,2-Dichloropropane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,3,5-Trimethylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,3-Dichlorobenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,3-Dichloropropane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,4-Dichlorobenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
2,2-Dichloropropane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
2-Butanone	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
2-Chlorotoluene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
2-Hexanone	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
4-Chlorotoluene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
4-Isopropyltoluene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
4-Methyl 2-Pentanone	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Acetone	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Benzene	1.0	U	**3.0**		**5.0**		1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Bromobenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Bromodichloromethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Bromochloromethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Bromoform	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Bromomethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Carbon disulfide	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Carbon tetrachloride	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Chlorobenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Chloroethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Chloroform	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Chloromethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
cis-1,2-Dichloroethene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
cis-1,2-Dichloropropene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Dibromochloromethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Dibromomethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U

Data Table 15, cont.

Analyte	Monitoring Well (screened depth ft bgs)																			
	Intermediate Interval						Upper Interval													
	DM-2A		DM-8 HT		DM-8 LT		A9		H6		H9 HT		H9 LT		MW-36 HT		MW-36 LT	
	9-29 ft		16-36 ft		16-36 ft		11-21 ft		10-20 ft		10-19 ft		10-19 ft		20-25 ft		20-25 ft	
Dichlorodifluoromethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Ethylbenzene	1.0	U	**1.4**		**2.8**		1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Ethylene dibromide	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Hexachlorobutadiene	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Isopropylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
m,p-Xylene	1.0	U	**5.6**		**11**		1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Methylene chloride	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
Naphthalene	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
n-Butylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
n-Propylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
o-Xylene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
sec-Butylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Styrene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
tert-Butylbenzene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Tetrachloroethene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Toluene	1.0	U	**1,300**		**3,900**		1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
trans-1,2-Dichloroethene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
trans-1,2-Dichloropropene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Trichloroethene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Trichlorofluoromethane	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Vinyl acetate	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Vinyl chloride	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Metals (mg/L)																		
Arsenic	**0.002**		**0.018**		**0.018**		**0.002**		**0.008**		**0.002**		**0.002**		**0.059**		**0.066**	
Cadmium	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U
Chromium	0.005	U	**0.009**		**0.018**		0.005	U	**0.023**		0.005	U	0.005	U	**0.048**		**0.044**	
Copper	**0.008**		**0.003**		**0.024**		0.002	U	**0.069**		**0.021**		**0.016**		**0.081**		**0.078**	
Lead	0.001	U	0.001	U	**0.001**		0.001	U	**0.004**		**0.002**		**0.002**		**0.012**		**0.010**	
Mercury	0.0001	U	0.0001	U	0.0001	U	0.0001	U	0.0004		0.0001	U	0.0001	U	**0.0001**		**0.0001**	
Nickel	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Selenium	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U
Thallium	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U
Vanadium	**0.017**		**0.035**		**0.147**		**0.016**		**0.027**		**0.004**		0.003	U	**0.337**		**0.332**	
Zinc	**0.008**		0.006	U	**0.007**		0.006	U	**0.012**		**0.052**		**0.059**		**0.009**		**0.010**	
Temperature (C)	13.19		14.35		14.55		14.13		12.95		11.30		9.35		14.50		14.77	
Specific conductance (us/cm)	0.34		2.02		1.79		0.55		0.39		0.04		0.03		1.37		1.4	
PH	6.37		6.64		6.64		6.20		6.95		6.38		6.41		6.95		6.94	
Dissolved oxygen (mg/L)	1.89		0.02		0.05		2.30		2.86		4.21		6.63		3.36		3.3	
ORP (millivolts)	253		70		63		144		262		389		-110		21		19	
turbidity (NTU)	20		14		12.0		24		79.9		14.7		26.3		11.6		10.6	

Note: Detected values are shown in **bold type**.

Data Table 15, cont.

U – Undetected

Data Table 16. King County South Park Custodial Landfill groundwater data for wells located closest to the LDW

Analyte	Monitoring Well (depth screened in ft bgs)			
	MW-24 (45-49 ft)		MW-8 (36-46 ft)	
Organic Compounds (µg/L)				
1,1,1,2-Tetrachloroethane	0.20	U	0.20	U
1,1,1-Tri-chloroethane	0.20	U	0.20	U
1,1,2,2-Tetrachloroethane	0.20	U	0.20	U
1,1,2-Trichloroethane	0.20	U	0.20	U
1,1-Dichloroethane	0.20	U	0.20	U
1,1-Dichloroethene	0.20	U	0.20	U
1,1-Dichloropropene	0.20	U	0.20	U
1,2,3-Trichloropropane	0.20	U	0.20	U
1,2,4-Trichlorobenzene	3.4	U	3.4	U
1,2-Dibromo-3-chloropropane	0.20	U	0.20	U
1,2-Dibromoethane	0.20	U	0.20	U
1,2-Dichlorobenzene	0.20	U	0.20	U
1,2-Dichlorobenzene	0.20	U	0.20	U
1,2-Dichloroethane	0.20	U	0.20	U
1,2-Dichloropropane	0.20	U	0.20	U
1,2-Diphenylhydrazine	1.8	U	1.8	U
1,3-Dichlorobenzene	0.20	U	0.20	U
1,3-Dichlorobenzene	0.20	U	0.20	U
1,3-Dichloropropane	0.20	U	0.20	U
1,4-Dichlorobenzene	0.20	U	0.20	U
1,4-Dichlorobenzene	0.20	U	0.20	U
2,2-Dichloropropane	0.20	U	0.20	U
2,2-Oxybis (1-Chloropropane)	3.7	U	3.7	U
2,4,5-T	2.0	U	2.0	U
2,4,5-TP	1.0	U	1.0	U
2,4,5-Trichlorophenol	2.6	U	2.6	U
2,4,6-Trichlorophenol	2.1	U	2.1	U
2,4-D	5.0	U	5.0	U
2,4-Dichlorophenol	3.6	U	3.6	U
2,4-Dimethylphenol	11	U	11	U
2,4-Dinitrophenol	7.3	U	7.2	U
2,4-Dinitrotoluene	0.9	U	0.9	U
2-Butanone	4.0	U	4.0	U
2-Chloronaphthalene	2.2	U	2.2	U
2-Chlorophenol	4.0	U	3.9	U
2-Chlorotethylvinylether	0.20	U	0.20	U
2-Hexanone	4.0	U	4.0	U
2-Methyl-1-propanol	100	U	100	U
2-Methylphenol	6.3	U	6.2	U
2-Nitroaniline	3.5	U	3.5	U
2-Nitrophenol	3.9	U	3.8	U

Data Table 16, cont.

Analyte	Monitoring Well (depth screened in ft bgs)			
	MW-24		MW-8	
	(45-49 ft)		(36-46 ft)	
3,3-Dichlorobenzidine	6.8	U	6.7	U
3-Chloropropene	10	U	10	U
3-Nitroaniline	1.7	U	1.7	U
4,6-Dinitro-2-methylphenol	1.7	U	1.6	U
4,6-Dinitrotoluene	1.8	U	1.8	U
4-Bromophenyl phenyl ether	2.1	U	2.1	U
4-Chloro-3-Methylphenol	2.7	U	2.7	U
4-Chloroaniline	2.5	U	2.5	U
4-Chlorophenyl phenyl ether	2.3	U	2.3	U
4-Methyl-2-pentanone	4.0	U	4.0	U
4-Methylphenol	5.8	U	5.8	U
4-Nitroaniline	4.9	U	4.8	U
4-Nitrophenol	3.9	U	3.8	U
5-2-Methylnaphthalene	3.0	U	3.0	U
Acenaphthalene	2.6	U	2.6	U
Acenaphthylene	2.7	U	2.7	U
Acetone	4.0	BU	4.0	BU
Acetonitrile	100	U	100	U
Acrolein	10	U	10	U
Acrylonitrile	10	U	10	U
Aldrin	0.024	U	0.024	U
Alpha BHC	0.024	U	0.024	U
alpha-Chlordane	0.024	U	0.024	U
Anthracene	2.1	U	2.1	U
Benzene	0.20	U	0.20	U
Benzo(a)anthracene	2.1	U	2.1	U
Benzo(a)pyrene	2.7	U	2.7	U
Benzo(b)fluoranthene	2.2	U	2.2	U
Benzo(g,h,i)perylene	3.5	U	3.5	U
Benzo(k)fluoranthene	4.5	U	4.4	U
Benzoic acid	17	U	16	U
Benzyl alcohol	3.7	U	3.7	U
Beta-BHC	0.024	U	0.024	U
Bis(2-chloroethoxy)methane	3.9	U	3.8	U
Bis(2-chloroethyl)ether	3.7	U	3.7	U
Bis(2-ethylhexyl) phthalate	5.3	U	5.3	U
Bromochloromethane	0.20	U	0.20	U
Bromodichloromethane	0.20	U	0.20	U
Bromoethane	0.20	U	0.20	U
Bromoform	0.20	U	0.20	U
Bromomethane	0.20	U	0.20	U
Butyl benzyl phthalate	3.0	U	3.0	U
Carbon disulfide	0.20	U	0.20	U

Data Table 16, cont.

Analyte	Monitoring Well (depth screened in ft bgs)			
	MW-24		MW-8	
	(45-49 ft)		(36-46 ft)	
Carbon tetrachloride	0.20	U	0.20	U
Carbozole	1.0	U	1.0	U
Chlorobenzene	**0.6**		0.20	U
Chlorodibromomethane	0.20	U	0.20	U
Chloroethane	0.20	U	0.20	U
Chloroform	0.20	U	0.20	U
Chloromethane	0.20	U	0.20	U
Chloroprene	20	U	20	U
Chrysene	1.7	U	1.6	U
cis-1,2-Dichloroethene	0.20	U	**1.7**	
cis-1,3-Dichloropropene	0.20	U	0.20	U
DDD	0.096	U	0.097	U
DDE	0.096	U	0.097	U
DDT	0.096	U	0.097	U
Delta NHC	0.096	U	0.097	U
Dibenzo(a,h)anthracene	3.7	U	3.7	U
Dibenzofuran	1.7	U	1.6	U
Dibromomethane	0.20	U	0.20	U
Dichlorodifluoromethane	0.20	U	0.20	U
Dieldrin	0.096	U	0.097	U
Diethylphthalate	2.2	U	2.2	U
Dimethyl phthalate	1.8	U	1.8	U
Di-n-butyl phthalate	1.7	U	1.6	U
Di-n-octyl phthalate	5.3	U	5.3	U
Dinoseb	1.0	U	1.0	U
Endosulfan I	0.096	U	0.097	U
Endosulfan II	0.096	U	0.097	U
Endosulfan sulfate	0.48	U	0.49	U
Endrin	0.096	U	0.097	U
Endrin aldehyde	0.19	U	0.19	U
Ethylbenzene	0.20	U	0.20	U
Fluoranthene	1.4	U	1.3	U
Fluorene	1.8	U	1.8	U
Heptachlor	0.024	U	0.024	U
Heptachlor epoxide	0.024	U	0.024	U
Hexachlorobenzene	2.7	U	2.7	U
Hexachlorobutadiene	3.7	U	3.7	U
Hexachlorocyclopentadiene	7.3	U	7.2	U
Hexachloroethane	4.0	U	3.9	U
Indeno(1,2,3-cd)pyrene	3.1	U	3.1	U
Isodrin	9.6	U	9.7	U
Isophorone	3.6	U	3.6	U
Lindane	0.024	U	0.024	U

Data Table 16, cont.

Analyte	Monitoring Well (depth screened in ft bgs)			
	MW-24		MW-8	
	(45-49 ft)		(36-46 ft)	
Methacrylonitrile	5.0	U	5.0	U
Methoxychlor	1.9	U	1.9	U
Methyl Iodide	0.20	U	0.20	U
Methyl methacrylate	2.0	U	2.0	U
Methylene chloride	0.20	U	0.20	U
Naphthalene	2.8	U	2.8	U
Nitrobenzene	3.3	U	3.3	U
N-Nitrodipropylamine	4.2	U	4.1	U
N-Nitrosodimethylamine	4.9	U	4.8	U
N-Nitrosodiphenylamine	4.6	U	4.5	U
o-Xylene	0.20	U	0.20	U
Pentachlorophenol	1.7	U	1.7	U
Phenanthrene	1.7	U	1.6	U
Phenol	3.3	U	3.3	U
Propionitrile	60	U	60	U
Pyrene	3.1	U	3.1	U
Styrene	0.20	U	0.20	U
Tetrachloroethene	0.20	U	0.20	U
Toluene	0.20	U	0.20	U
Total 1,3-dichloropropene	0.20	U	0.20	U
Total xylenes	0.40	U	0.40	U
Toxaphene	2.4	U	2.4	U
trans-1,2-Dichlorothene	0.20	U	**0.35**	J
trans-1,3-Dichloropropene	0.20	U	0.20	U
trans-1,4-Dichloro-2-butene	100	U	100	U
Trichloroethene	0.20	U	0.20	U
Trichlorofluoromethane	0.20	U	0.20	U
Vinyl acetate	0.20	U	0.20	U
Vinyl chloride	**0.33**		**1.5**	
PCBs (µg/L)				
Aroclor 1016	0.010	U	0.010	U
Aroclor 1232	0.010	U	0.010	U
Aroclor 1242	0.010	U	0.010	U
Aroclor 1248	0.010	U	0.010	U
Aroclor 1254	0.010	U	0.010	U
Aroclor 1260	0.010	U	0.010	U
Aroclor 1221	0.010	U	0.010	U
Inorganics, dissolved (mg/L)				
Aluminum	**0.027**		**0.042**	
Antimony	0.001	U	0.001	U
Arsenic	0.001	U	**0.002**	J

Data Table 16, cont.

Analyte	Monitoring Well (depth screened in ft bgs)			
	MW-24		MW-8	
	(45-49 ft)		(36-46 ft)	
Barium	**0.019**		**0.027**	
Beryllium	0.001	U	0.001	U
Cadmium	0.002	U	0.002	U
Calcium	**60**		**67**	
Chromium	0.005	U	0.005	U
Cobalt	0.003	U	0.003	U
Copper	0.002	U	**0.004**	
Iron	**24**		**30**	
Lead	0.001	U	0.001	U
Magnesium	**23**		**45**	
Manganese	**1.6**		**1.7**	
Mercury	0.0001	U	0.0001	U
Nickel	0.010	U	0.010	U
Potassium	**10**		**15**	
Selenium	**0.003**	J	**0.044**	
Silver	0.003	U	0.003	U
Sodium	66	M	210	M
Inorganics, total (mg/L)				
Aluminum	**0.03**		0.020	U
Antimony	0.001	U	0.001	U
Arsenic	0.001	U	**0.002**	J
Barium	**0.02**		**0.028**	
Beryllium	0.001	U	0.001	U
Cadmium	0.002	U	0.002	U
Calcium	**60**		**61**	
Chromium	0.005	U	0.005	U
Cobalt	0.003	U	0.003	U
Copper	0.002	U	0.003	
Iron	**25**		**29**	
Lead	0.001	U	0.001	U
Magnesium	**23**		**44**	
Manganese	**1.6**		**1.7**	
Mercury	0.0001	U	0.0001	U
Nickel	0.010	U	0.010	U
Potassium	**10**		**14**	
Selenium	**0.004**	J	**0.041**	
Silver	0.003	U	0.003	U
Sodium	67	M	210	M
Other (mg/L)				
Alkalinity, total ($CaCO_3$)	440	M	370	M
Ammonia, (NH_3)	**1.8**		3.3	M

Data Table 16, cont.

Analyte	Monitoring Well (depth screened in ft bgs)			
	MW-24 (45-49 ft)		MW-8 (36-46 ft)	
Chloride	32	M	440	M
Cyanide	0.02	U	0.02	U
Fluoride	1.0	U	1.0	U
Nitrate (NO_3)	0.01	U	0.01	U
Nitrite (NO_2)	0.01	U	0.01	U
Non-polar fats, oils & grease	1.0	U	1.0	U
Petroleum hydrocarbons as fuel	**0.57**		0.20	U
Petroleum hydrocarbons as gasoline	25	U	25	U
Petroleum hydrocarbons as oil	0.82	U	0.80	U
Phosphate (total)	0.85	OM	1.2	OM
Sulfate (SO_4)	**12**		**15**	
Sulfide (total)	**0.5**	J	**0.6**	J
Suspended solids	48		70	
Total dissolved solids	550		1100	
Total organic carbon	10		5	
Total organic halogens	0.06	MJ	0.08	MJ
Total solids	600		1,200	
Lab pH	6.7		6.7	
Lab conductance (us/cm)	650		1,700	
Turbidity (NTU)	16		22	

Note: Detected values are shown in **bold type**.

na – not analyzed

U – Undetected

J – The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample.

M –?

O –?

B – Suspected laboratory contamination

Data Table 17. Terminal 108 /Chiyoda groundwater data for wells located closest to the LDW

Analyte	Monitoring Well (depth screened in ft bgs)									
	C-5 (5–17)		C-6 (5–15)		MW-7 (5–15)		MW-8 (5–15)		MW-11 (5–15)	
PAHs (µg/L)										
Naphthalene	**1.3**		0.14	U	0.14	U	0.14	U	0.14	U
Acenaphthylene	0.069	U	0.069	U	0.069	U	0.069	U	0.069	U
Acenaphthene	0.02	U	0.02	U	**0.041**		**0.09**		0.02	U
Fluorene	**0.22**		0.013	U	**0.028**		**0.049**		0.013	U
Phenanthrene	0.019	U	0.019	U	**0.022**		**0.065**		0.019	U
Anthracene	**0.03**		0.014	U	0.014	U	**0.015**		0.014	U
Fluoranthene	**0.055**		0.025	U	0.025	U	**0.035**		0.025	U
Pyrene	**0.041**		0.014	U	0.014	U	**0.036**		0.014	U
Benzo(a)anthracene	0.011	U	0.011	U	0.011	U	**0.016**		0.011	U
Chrysene	0.013	U	0.013	U	0.013	U	**0.016**		0.013	U
Benzo(b)fluoranthene	0.013	U	0.013	U	**0.017**		**0.015**		0.013	U
Benzo(k)fluoranthene	0.011	U	0.011	U	0.011	U	**0.013**		0.011	U
Benzo(a)pyrene	0.012	U	0.012	U	0.012	U	**0.012**		0.012	U
Dibenzo(a,h)anthracene	0.011	U	0.011	U	0.011	U	0.011	U	0.011	U
Benzo(g,h,i)perylene	0.03	U	0.03	U	0.03	U	0.03	U	0.03	U
Indeno(1,2,3-cd)pyrene	0.012	U	0.012	U	0.012	U	0.012	U	0.012	U
SVOCs (µg/L)										
Benzoic Acid	50	U	na		na		na		na	
2-Chlorophenol	10	U	na		na		na		na	
4-Chloro-3-methylphenol	10	U	na		na		na		na	
2,4-Dichlorophenol	10	U	na		na		na		na	
2,4-Dimethylphenol	10	U	na		na		na		na	
2,4-Dinitrophenol	50	U	na		na		na		na	
4,6-Dinitro-2-methylphenol	50	U	na		na		na		na	
2-Methylphenol	10	U	na		na		na		na	
4-Methylphenol	10	U	na		na		na		na	
2-Nitrophenol	10	U	na		na		na		na	
4-Nitrophenol	50	U	na		na		na		na	
Pentachlorophenol	50	U	na		na		na		na	
Phenol	10	U	na		na		na		na	
2,4,6-Trichlorophenol	10	U	na		na		na		na	
2,4,5-Tricholorphenol	50	U	na		na		na		na	
Acenaphthene	10	U	na		na		na		na	
Benzidine	20	U	na		na		na		na	
Benzyl Alcohol	10	U	na		na		na		na	
Bis(2-chloroethoxy)methane	10	U	na		na		na		na	
Bis(2-chloroethyl)ether	10	U	na		na		na		na	
Bis(2-chloroisopropyl)ether	10	U	na		na		na		na	
Bis(2-ethylhexyl)phthalate	10	U	na		na		na		na	
4-Bromophenyl-phenylether	10	U	na		na		na		na	

Data Table 17, cont.

Analyte	Monitoring Well (depth screened in ft bgs)									
	C-5 (5–17)		C-6 (5–15)		MW-7 (5–15)		MW-8 (5–15)		MW-11 (5–15)	
Butylbenzylphthalate	10	U	na		na		na		na	
4-Chloroaniline	10	U	na		na		na		na	
2-Chloronapthalene	10	U	na		na		na		na	
4-Chlorophenyl-phenylether	10	U	na		na		na		na	
Chrysene	10	U	na		na		na		na	
Dibenzofuran	10	U	na		na		na		na	
Di-n-butylphthalate	10	U	na		na		na		na	
3,3-Dichlorobenzidine	20	U	na		na		na		na	
1,2-Dichlorobenzene	10	U	na		na		na		na	
1,3-Dichlorobenzene	10	U	na		na		na		na	
1,4-Dichlorobenzene	10	U	na		na		na		na	
Diethylphthalate	10	U	na		na		na		na	
Dimethylphthalate	10	U	na		na		na		na	
2,4-Dinitrotoluene	10	U	na		na		na		na	
4,6-Dinitrotoluene	10	U	na		na		na		na	
Hexachlorobutadiene	10	U	na		na		na		na	
Hexachlorobenzene	10	U	na		na		na		na	
Hexachlorocyclopentadiene	10	U	na		na		na		na	
Hexachloroethane	10	U	na		na		na		na	
Isophorone	10	U	na		na		na		na	
2-Methylnaphthalene	10	U	na		na		na		na	
Naphthalene	10	U	na		na		na		na	
2-Nitroaniline	50	U	na		na		na		na	
3-Nitroaniline	50	U	na		na		na		na	
4-Nitroaniline	50	U	na		na		na		na	
Nitrobenzene	10	U	na		na		na		na	
N-Nitrosodiphenylamine	10	U	na		na		na		na	
N-Nitroso-di-n-propylamine	10	U	na		na		na		na	
Di-n-octylphthalate	10	U	na		na		na		na	
1,2,4-Trichlorobenzene	10	U	na		na		na		na	
BTEX (µg/L)										
Benzene	**0.6**		0.3	U	0.3	U	0.3	U	0.3	U
Ethylbenzene	**0.4**		0.3	U	0.3	U	0.3	U	0.3	U
Toluene	**0.9**		0.3	U	0.3	U	0.3	U	0.3	U
Total Xylenes	**1.0**		0.5	U	0.5	U	0.5	U	0.5	U
PCBs (µg/L)										
Aroclor 1016	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Aroclor 1221	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Aroclor 1232	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Aroclor 1242	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Aroclor 1248	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Aroclor 1254	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U

Data Table 17, cont.

Analyte	Monitoring Well (depth screened in ft bgs)									
	C-5 (5–17)		C-6 (5–15)		MW-7 (5–15)		MW-8 (5–15)		MW-11 (5–15)	
Aroclor 1260	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Metals (µg/L)										
Antimony	100	U	100	U	100	U	100	U	100	U
Arsenic	5	U	5	U	5	U	5	U	5	U
Beryllium	20	U	20	U	20	U	20	U	20	U
Cadmium	**0.43**		0.25	U	**38**		**3.5**		**0.27**	
Chromium	20	U	20	U	20	U	**42**		20	U
Copper	20	U	20	U	**200**		20	U	20	U
Lead	5	U	**5**		**7**		5	U	5	U
Mercury	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Nickel	50	U	50	U	**380**		**98**		50	U
Selenium	100	U	100	U	100	U	100	U	100	U
Silver	50	U	50	U	50	U	50	U	50	U
Thallium	100	U	100	U	100	U	100	U	100	U
Zinc	50	U	50	U	**6,200**		**490**		50	U
Temperature (C)	12.3		11.3		11.9		13.1		11.3	
Conductivity (microhos/cm)	9,660		950		2,640		4,190		620	
pH	6.82		6.69		4.68		5.92		6.25	

Note: Detected values are shown in **bold type**.

na – Not analyzed

U – Undetected