9.0 SITE-WIDE SURFACE WATER QUALITY EVALUATION

As part of the Site-wide investigation of the nature and extent of contamination, Boeing conducted an evaluation of surface water in Algona and Auburn, Washington. Various surface water, wetland, and stormwater features are present near the Site. These features include Government Canal, stormwater collection ditches in Algona including the Chicago Avenue ditch, the O Street wetland, The Outlet Collection stormwater ponds and stormwater collection ditch, the Auburn 400 ponds, Mill Creek, and various wetlands associated with Mill Creek including the Auburn Environmental Park. Surface water features are shown on Figure 9-1.

The objective of the Site-wide surface water investigations was to determine if groundwater contaminated with VOCs associated with the Facility was discharging to surface water bodies in Algona and Auburn. This work also sought to characterize the extent and concentration of VOCs associated with the Facility present in Auburn and Algona surface water bodies.

TCE, cDCE, and VC were identified as the VOCs of concern in surface water. TCE and VC are the only plume-related VOCs present in groundwater at concentrations that could result in exceedances of screening levels in surface water; cDCE was included as a VOC of concern because it is an intermediate breakdown compound between TCE and VC. TCE and VC are detected above groundwater screening levels in groundwater near the surface water bodies. CDCE is also present in groundwater near the surface water bodies, but at concentrations below screening levels. PCE is also occasionally detected in surface water; however, the source of the PCE is less clear because it is often not detected in groundwater adjacent to the surface water bodies. PCE is not detected in either groundwater or surface water above screening levels so it is not discussed further. Other detected VOCs in surface water include acetone, carbon disulfide, chloroform, and toluene. These constituents are not associated with the Boeing groundwater plumes and are not detected above applicable surface water screening levels; as a result, they are not discussed further in this section.

Surface water screening levels for detected constituents are defined in Section 5.0 and are presented by area on Figure 9-2. Screening levels for several areas are based on health-risk assessments and may not reflect the final cleanup levels that will be developed during the FS.

9.1 Surface Water Flow

A surface water divide is present in Algona at approximately 4th Avenue North, surface water north of 4th Avenue North flows to Mill Creek; surface water south of 4th Avenue North, including Government Canal, flows south to the White River. Surface water flow for features that drain to Mill Creek is discussed below.

Water in the Chicago Avenue ditch flows north and enters the City of Auburn's piped stormwater system at Boundary Boulevard. Water from the O Street wetland is also channelized and flows into the City of Auburn's piped stormwater system at Boundary Boulevard. The piped water flows west to

the Auburn 400 south pond, which then discharges to the Auburn 400 north pond. The Auburn 400 north pond also captures stormwater from 15th Street SW and the southern portion of The Outlet Collection complex. Water from The Outlet Collection stormwater ponds appears to discharge into a ditch on the northwest side of the stormwater ponds. This ditch combines with flow from the Auburn 400 north pond and discharges through a culvert under SR 167 to a wetland on the west side of the highway. A channelized portion of the wetland carries water north where it joins Mill Creek at the east end of Peasley Canyon Road. Mill Creek then flows northward through various wetland complexes before it joins the Green River several miles downstream. Surface water features and flow directions are presented on Figure 9-1.

9.2 Algona Evaluation

Government Canal, the Chicago Avenue ditch, and yards and ditches in residential Algona were included in the surface water investigation. For all surface water samples collected in Algona, VOC concentrations were below the applicable health-based screening levels; cleanup levels may differ from the screening levels. Sample locations for Government Canal and Chicago Avenue ditch are shown on Figure 9-1. Sample locations for Algona yards and roadside ditches are presented on Figure 9-3.

9.2.1 Government Canal

Government Canal is listed as a Column II SWMU (S-07a) in the Agreed Order, meaning no additional investigation was required as part of the RI. This SWMU was investigated and an independent soil cleanup was completed in the early 1990s. The investigation and cleanup are summarized below.

Soil metals contamination was discovered during a preliminary assessment of Government Canal in 1991 (Tetra Tech 1992). Analysis of soil samples detected elevated levels of chromium and cadmium. A second investigation took place in February and March 1992 (GeoEngineers 1992a). This investigation consisted of collection of approximately 1,400 soil samples along Government Canal and a related feeder channel. Metals, VOCs, and SVOCs were detected in the soil samples. A risk assessment was completed in August 1992 and concentrations were deemed not to pose a risk to human health (ChemRisk 1992). An independent cleanup of soil contamination at two locations along Government Canal occurred in 1994 (GeoEngineers 1995). Ecology issued an NFA determination in 1995 with respect to the release of metals, VOCs, and SVOCs (Ecology 1995).

A surface water sample (SW-6) was collected from Government Canal in June 2012 to assess water quality (LAI 2012f). VOC compounds were not detected in the surface water sample. There is no evidence of VOC contamination in the surface water of Government Canal.

9.2.2 Chicago Avenue Ditch

Surface water samples were collected from the Chicago Avenue ditch beginning in June 2012 (LAI 2012f). For all samples collected at the Chicago Avenue ditch, detected VOCs concentrations were

below applicable health-based screening levels. The maximum and most recent detected VOC concentrations for Chicago Ave ditch sample locations (SW-CD1 through SW-CD4, and SW-CD13) are presented on Table 9-1.

Concentrations of VOCs in surface water at the Chicago Avenue ditch were characterized by conducting both spatially distributed and seasonal sampling. Samples have been collected at five separate locations along the Chicago Avenue ditch. For the spatial evaluation, surface water samples were collected at four locations in September 2012 (SW-CD1 through SW-CD4[111]) (LAI 2012e) and at three locations (SW-CD2, SW-CD13, and SW-CD4) quarterly from December 2013 through September 2014 (LAI 2015b) and semiannually in 2015 at one location (SW-CD4) (LAI 2015e) (Figure 9-1). Spatially distributed sampling indicated that concentrations of VOCs were lowest at the upstream sample location SW-CD3. TCE concentrations were the highest at the second furthest downstream quarterly sampling location SW-CD4. VC concentrations were highest at the middle sampling location SW-CD13.

Seasonal VOC concentration variability was evaluated by collecting quarterly samples from December 2013 through September 2014 at three locations (SW-CD2, SW-CD13, and SW-CD4). Seasonal sampling results indicate that at all three locations, TCE concentrations are highest in the dry season while VC concentrations appear to be highest in the wet season. This pattern may be due to a number of factors including: an increased groundwater capture zone for the Chicago Avenue ditch during the wet season, changes in groundwater elevation due to increased precipitation during winter, variability in biodegradation due to variations in temperature and groundwater elevation, and volatilization of VC in dry, warmer months. A time series plot of surface water concentrations demonstrating these trends at the location with the most sampling events (SW-CD4) is presented on Figure 9-4.

Groundwater discharge is likely the source of TCE, cDCE, and VC detected in the Chicago Avenue ditch. Groundwater discharge appears to be occurring to the ditch throughout the year because groundwater elevations measured in wells adjacent to the ditch are higher than the surface water elevation in the ditch.

Surface water VOC concentrations in the Chicago Avenue ditch are expected to be less than groundwater VOC concentrations due to dispersion (i.e., mixing or dilution with stormwater in the ditch) and degradation (i.e., reductive dechlorination where anaerobic conditions occur near the groundwater-surface water interface). TCE and cDCE concentrations are significantly lower in surface water than in groundwater. VC concentrations are more similar in groundwater and surface water although surface water concentrations are still consistently less than groundwater concentrations. The concentration trends between groundwater and surface water are an indication that reductive dechlorination may be a significant process in the subsurface as groundwater discharges to surface water. Reductive dechlorination would be expected to cause TCE and cDCE concentrations to decrease and VC concentrations to increase. If this process is significant, it could result in increased VC

[111] SW-CD4 and SW-4 represent the same location. In this report, this location will be referred to as SW-CD4.

concentrations in surface water that offsets the concentration decrease due to dispersion. A plot of surface water versus groundwater VOC concentrations is presented on Figure 9-5. This figure includes a 10 to 1 (10:1) concentration line (concentrations in groundwater are 10 times than in surface water) and a 1:1 concentration line. The figure shows that TCE and cDCE concentrations are typically close to 10 times greater in groundwater than in surface water; whereas, VC concentrations are typically only slightly lower in surface water than in groundwater.

9.2.3 Residential Yards and Ditches

Surface water samples were collected from standing water in roadside ditches in November 2013 (LAI 2014b) and ponded yard water in January and March 2014 (LAI 2014c). The investigation was conducted to address whether VOCs of concern from the groundwater plumes were discharging to shallow surface water features within Algona and if so, to evaluate potential risks to human health. VOC concentrations were below the applicable health-based screening levels in all samples collected from ditch and yard water.

In November of 2013, surface water samples were collected from 19 Algona ditch locations (LAI 2014b)(Figure 9-3). TCE and cDCE were each detected in five samples, and VC was detected in eight samples. At 11 sample locations, no VOCs of concern were detected. Detections of TCE, cDCE, and VC in ditch surface water generally coincide with the location of the groundwater plume in the northeast corner of residential Algona. This suggests that groundwater containing TCE, cDCE, or VC is likely entering ditches in this area. Two samples with detections of VC (SWRD-12 and SWRD-13) were outside of the groundwater plume area and do not appear to be related to the groundwater plume. These two samples also had detections of PCE, a constituent that is not detected in groundwater in this area. The VC detections in these locations could be related to the breakdown of PCE from a different source. Concentrations of all VOCs detected in the ditches are all at least an order of magnitude below applicable screening levels. Detected VOC concentrations data from roadside ditch surface water sampling (SWRD-01 through SWRD-22) are presented in Table 9-1. Locations of ditch samples are shown on Figure 9-3.

A total of 12 yard water samples were collected from standing water in the yards of five Algona properties (LAI 2014c). Four of the properties were sampled in January 2014, and the remaining property was sampled in March 2014. No VOCs of concern were detected in samples SWYP-01 through SWYP-11. TCE, cDCE, and VC were detected in sample SWYP-12. The TCE, cDCE, and VC concentrations detected did not exceed screening levels for this area. Shallow groundwater may be discharging to the ground surface and ponding in this location[112]. Detected VOC concentration data for yard water samples are presented in Table 9-2. Yard sample locations are shown in Figure 9-3.

Because VOCs associated with the Boeing groundwater plumes were not detected in the majority of yard water samples when groundwater levels were high (i.e., winter and early spring), it is unlikely

[112] Based on visual observations, the ground surface elevation appeared to be lower at this location than the surrounding area.

that ponded yard water quality is caused by groundwater discharge in most locations. Ponded water sampled from the yards in Algona is most likely rainwater that remains above the ground surface for more than 48 hours. Locally fine-grained soil can limit rainwater infiltration and contribute to ponded yard water in residential northern Algona.

9.3 Auburn Evaluation

Surface water quality was investigated at the O Street wetland, the Auburn Environmental Park wetlands, The Outlet Collection stormwater ponds, the Auburn 400 ponds, the channelized portion of the wetlands west of SR 167, the Auburn Environmental Park Wetlands, and Mill Creek (LAI 2012f, 2014g, 2015b, 2016b). The investigation was conducted to evaluate the hydrologic relationship between groundwater and surface water, the extent of VOCs in surface water, and whether VOCs are discharging to Mill Creek or other water bodies. For all surface water samples collected in Auburn, detected VOC concentrations were below the applicable screening levels. Surface water features, sample locations, and screening levels are presented in Figure 9-2.

9.3.1 Stormwater Features

Manmade stormwater features included in the surface water investigations in Auburn are The Outlet Collection stormwater ponds, the Auburn 400 ponds, and various storm ditches. Health-based screening levels for these areas are protective of workers as they are the only population expected to routinely come in contact with surface water in these areas, as discussed in Section 5.0. For all stormwater features, detected VOC concentrations were below the applicable health-based screening levels. Samples collected from stormwater features are presented on Figure 9-2. Maximum and most recent detected VOC concentrations from stormwater features in Auburn and applicable health-based screening levels are presented in Table 9-3.

9.3.1.1 The Outlet Collection Stormwater Ponds and Associated Ditch

In June 2012, two dry season samples (SW-3 and SW-10) were collected at The Outlet Collection stormwater pond and collection ditch. Wet season samples were collected from the same locations in 2014 (Ecology 2014, LAI 2014g). TCE, cDCE, and VC were not detected at either location. Surface water sample results show no indication that VOC-impacted groundwater is discharging to The Outlet Collection stormwater ponds or the associated ditch during the wet or dry seasons (LAI 2015b).

9.3.1.2 Auburn 400 Ponds

Surface water samples were collected from the Auburn 400 north and south ponds during both the dry and wet seasons beginning in June 2012, and most recently, in September 2015. These ponds are a part of the Auburn stormwater system. Water from the Chicago Avenue ditch and the O Street wetland, along with road runoff from commercial areas of Auburn and Algona, flows into the Auburn 400 south pond. The Auburn 400 south pond discharges to the Auburn 400 north pond (LAI 2014g), which also receives stormwater runoff from commercial areas of Auburn along 15th Street SW. TCE,

cDCE, and VC were detected in several samples from the ponds. However, all VOC concentrations were below the applicable health-based screening levels. Three locations were sampled at the Auburn 400 south pond (SW-5, SW-14, and SW-15), and three locations were sampled at the Auburn 400 north pond (SW-11, SW-16, and SW-19[113]).

In the Auburn 400 south pond, TCE, cDCE, and VC were detected in the east sample (SW-14) adjacent to the influent stormwater outfall that drains the Chicago Avenue ditch. Additional samples (SW-5 and SW-15) were collected on the west side of the pond to determine if VOCs were present at the outflow from the south pond to the north pond. TCE, cDCE, and VC were not detected in SW-5 or SW-15. The pond may be capturing VOC-impacted groundwater along the east side. However, it is also likely that water from the Chicago Avenue ditch[114] may contribute to the detections observed at SW-14, since the sample was located at the influent outfall.

In the Auburn 400 north pond, the only VOC of concern detected at SW-19 was VC during the 2014 dry season sampling event. Sample location SW-11 was sampled once in June of 2012, and had detections of cDCE (0.5 µg/L) and VC (0.087 µg/L). Sample location SW-16 was sampled during both wet and dry season sampling events between July 2013 and September 2015 and had detections of TCE, cDCE, and VC. At the locations where VOCs of concern were detected, concentrations were generally lower during the wet season sampling than during the dry season sampling. This effect is likely due to the dilution of impacted surface water by stormwater runoff. Additionally, the concentrations of TCE, cDCE, and VC are lower in the northwest portion of the pond (SW-19) and higher in the southeast portion of the pond (SW-11 and SW-16). Based on the concentrations of VOCs in the pond, it appears that impacted groundwater is discharging to the pond along the eastern edge. All VOC concentrations measured in the ponds were below applicable health-based screening levels.

9.3.2 Wetlands

Wetlands included in the surface water investigations in Auburn are the O Street wetland, the Auburn Environmental Park and associated wetlands, and the wetland west of SR 167. These locations have screening levels protective of non-potable surface water where human exposure is related to consumption of fish that utilize the surface water as discussed in Section 5.0. For all wetland samples, detected VOC concentrations were below the applicable screening levels. Samples collected from these wetlands are presented on Figure 9-2. Maximum and most recent detected VOC concentrations from wetlands in Auburn along with applicable screening levels are presented on Table 9-4.

With the exception of SW-17, which is adjacent to the Auburn 400 north pond outfall, no constituents of concern were detected in surface water samples collected from wetlands. There may be a number

[113] Sampling at SW-19 was implemented to help determine if the VOC detections at SW-17 in the channelized portion of the wetland west of SR 167 were due to the movement of surface water through the system or if VOC-impacted groundwater was discharging farther downstream.

[114] Water in the Chicago Avenue ditch is piped into the City of Auburn stormwater system and discharges into the Auburn 400 south pond at a southeastern stormwater outfall.

of reasons that constituents of concern are not detected in wetlands. Aquifer heterogeneity results in variations in dissolved constituent concentrations and groundwater flow rates. Consequently, the mass flux rate of dissolved constituents likely varies for different surface water discharge points. Another contributing factor is a high rate of attenuation at the groundwater to surface water interface (hyporheic zone) in wetlands. Anaerobic conditions caused by high organic carbon content in wetland soil and associated biological activity may be contributing to high rates of reductive dechlorination that biodegrade constituents of concern.

9.3.2.1 O Street Wetland

To determine if VOC-impacted groundwater was discharging to the wetland, a dry season, base flow sample was collected from the O Street wetland in July 2013 (LAI 2014g). An additional wet season sample was collected in April 2014 (LAI 2015b). Both samples were collected from sample location SW-12. There were no detections of TCE, cDCE, or VC in either of these samples. There is no evidence of VOC-impacted groundwater discharging to the O Street wetland during the wet or dry seasons.

9.3.2.2 Auburn Environmental Park and Associated Wetlands

In June 2012, three surface water samples (SW-1, SW-7, and SW-8) were collected from the Auburn Environmental Park wetlands (LAI 2012f). No VOCs of concern were detected at these locations. In 2014, one additional sample was collected from the Auburn Environmental Park at location SW-22 during the wet season, when groundwater elevations were highest, to determine whether VOC-contaminated groundwater from the intermediate groundwater zone was discharging to the surface in this area (LAI 2015b). There is no evidence of VOC-impacted groundwater discharging to the Auburn Environmental Park wetlands.

9.3.2.3 Wetland West of State Route 167

Wet and dry season surface water samples were collected from the channelized portion of the wetland (SW-17 and SW-20) west of SR 167 beginning in June of 2012. A dry season sample was collected at SW-9 in the western portion of the wetland in June 2012. Dry season samples were also collected in September 2015 from the channelized portions of the wetland (SW-25 and SW-26) co-located with pore water sample locations (Section 9.3.4). TCE was not detected at any of the five sample locations. VC and cDCE were detected at only one of the four sample locations, SW-17, which is at the outfall from the Auburn 400 North pond. Detected concentrations of cDCE and VC were below applicable screening levels.

9.3.3 Mill Creek (State Route 18 to West Main Street)

Surface water samples were collected from Mill Creek beginning in June of 2012. An initial surface water sample was collected in June 2012 from the western portion of Mill Creek at sample location SW-2. Additional samples were collected at SW-18 and SW-21 (Figure 9-1) four times and two times, respectively, at dates ranging from July 2013 to September 2015 (LAI 2012f, 2016b). Dry season

samples were also collected in September 2015 from Mill Creek (SW-23 and SW-24) co-located with pore water sample locations (9.3.4). VOCs of concern were not detected in any samples from Mill Creek. Detected VOC concentrations for Mill Creek surface water samples are presented in Table 9-5.

The absence of TCE, cDCE, and VC in Mill Creek indicates that VOC-impacted surface water within the Auburn stormwater system, including the Chicago Avenue ditch and the Auburn 400 ponds, is not affecting water quality in Mill Creek. In addition, VOC-impacted groundwater does not appear to be affecting water quality in Mill Creek. In order to verify that impacted groundwater was not discharging to surface water near Mill Creek, Boeing conducted sediment pore water sampling at four locations near the groundwater plumes.

9.3.4 Sediment Pore Water Sampling

Co-located surface water and sediment pore water samples were collected during a one-time event in September 2015 (LAI 2016b). Samples were collected from two locations in the wetland south of Mill Creek (west of SR 167 [SW/PW-25 and SW/PW-26]) and from two locations along Mill Creek north of where the creek enters the valley near the SR 167 and SR 18 interchange (SW-23/PW-23 and SW-24/PW-24). The co-located surface water and pore water sample locations are shown on Figure 9-2.

TCE, cDCE, and VC were not detected in either the surface water samples or the co-located pore water samples. The pore water samples were compared to groundwater screening levels. Detected VOC concentrations from the pore water samples along with applicable screening levels are presented on Table 9-6. VOC-impacted groundwater does not appear to be discharging to or affecting water quality in Mill Creek or the wetland south of SR 18.

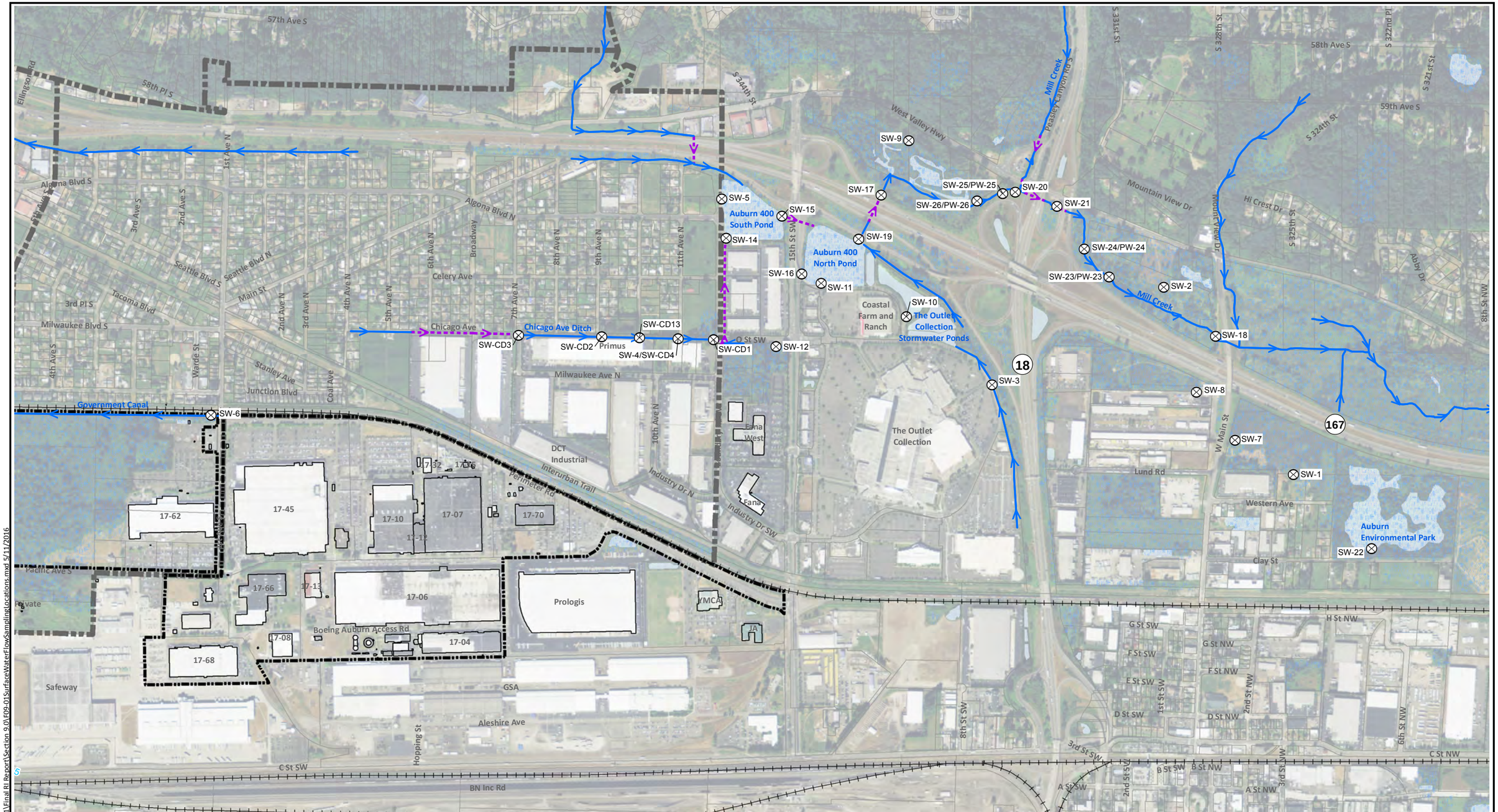
9.4 Summary

Surface water quality at the Site was evaluated as part of the investigation of the nature and extent of contaminant impacts related to releases at the Facility. The investigation sought to evaluate groundwater and surface water interactions as well as contaminant impacts. All types of surface water features (stormwater collection and control, wetlands, and streams) present in and near the Site were evaluated. The investigation included both seasonal and longer-term temporal evaluation.

Although TCE and VC were detected in some of the stormwater collection and control features in Algona and southwest Auburn, their extent is limited and all concentrations are less than screening levels. No contaminants of concern were detected in Mill Creek or the Auburn Environmental Park wetlands. Additionally, pore water collected from below Mill Creek indicates that contaminants do not appear to be present in the groundwater directly discharging to the creek, indicating that the lack of detections in Mill Creek is not merely the result of dilution.

Surface water screening levels were not exceeded anywhere at the Site. However, final cleanup levels for surface water may be different from the health-based screening criteria. For the purpose of

cleanup, Site-wide surface water quality is designated as a separate AOC (AOC A-15). AOC A-15 is defined by areas where constituents of concern are detected in surface water and the area of Mill Creek directly downgradient of the groundwater plumes. AOC A-15 is shown on Figure 9-6. Surface water will be carried forward for consideration in the FS.



Legend

- Surface Water Sample
- Wetland Areas
- Open Waterways
- Piped Waterways
- Boeing Property
- City Limits

Notes

1. Surface water sampling locations are designated by SW. Pore water sampling locations are designated by PW.
2. The locations of surface water features are approximate.
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

N

0 1,000 2,000

Scale in Feet

Base Map Source: Geometrix 2003; Parcel Data Source: King County 2015; Aerial Photo Source: Esri World Imagery.

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Boeing Auburn Remedial Investigation Auburn, Washington	**Surface Water Flow and Sampling Locations**	Figure 9-1

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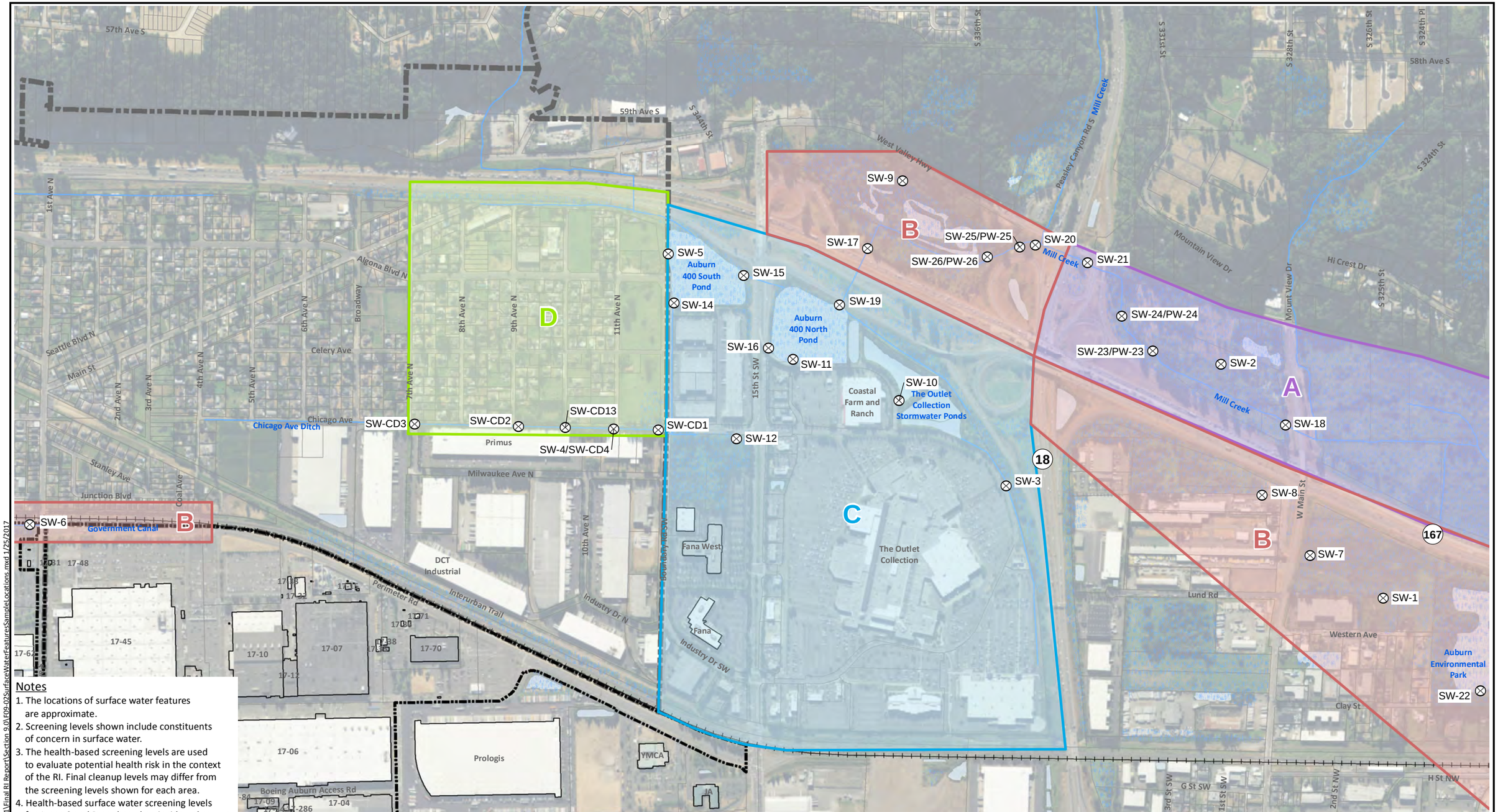

Notes

1. The locations of surface water features are approximate.
2. Screening levels shown include constituents of concern in surface water.
3. The health-based screening levels are used to evaluate potential health risk in the context of the RI. Final cleanup levels may differ from the screening levels shown for each area.
4. Health-based surface water screening levels for Areas C and D are based on incidental contact, inhalation, and ingestion. Surface water screening levels for Areas A and B are based on use as drinking water and/or the consumption of fish.
5. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Legend

- Surface Water Sample
- Wetland Areas
- Waterways
- City Limits
- Area A
- Area B
- Area C
- Area D

Screening Levels (µg/L)

	TCE	VC
Area A	0.3	0.02
Area B	0.7	0.18
Area C	58	98
Area D	58	15

N

0 800 1,600

Scale in Feet

Base Map Source: Geometrix 2003; Parcel Data Source: King County 2015; Aerial Photo Source: Esri World Imagery.

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Boeing Auburn Remedial Investigation Auburn, Washington	**Surface Water Features and Sample Locations**	Figure 9-2

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G:\Projects\025\164\130\111\Final RI Report\Section 9.0\F09-03YardWaterRoadDitchSampling.mxd 5/11/2016

Legend

- Ditch Samples
- Surface Water Sample Location
- Wet Ditch Segment and Designation
- Dry Ditch Segment and Designation (No Sample Collected)
- Yard Water Sampling Completed
- Wetland Areas
- Water Bodies

Notes

1. Yard water sampling locations are designated by SWYP. Roadside ditch sampling locations are designated by SWRD.
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

N

0 250 500

Scale in Feet

Data Source: King County GIS 2013.

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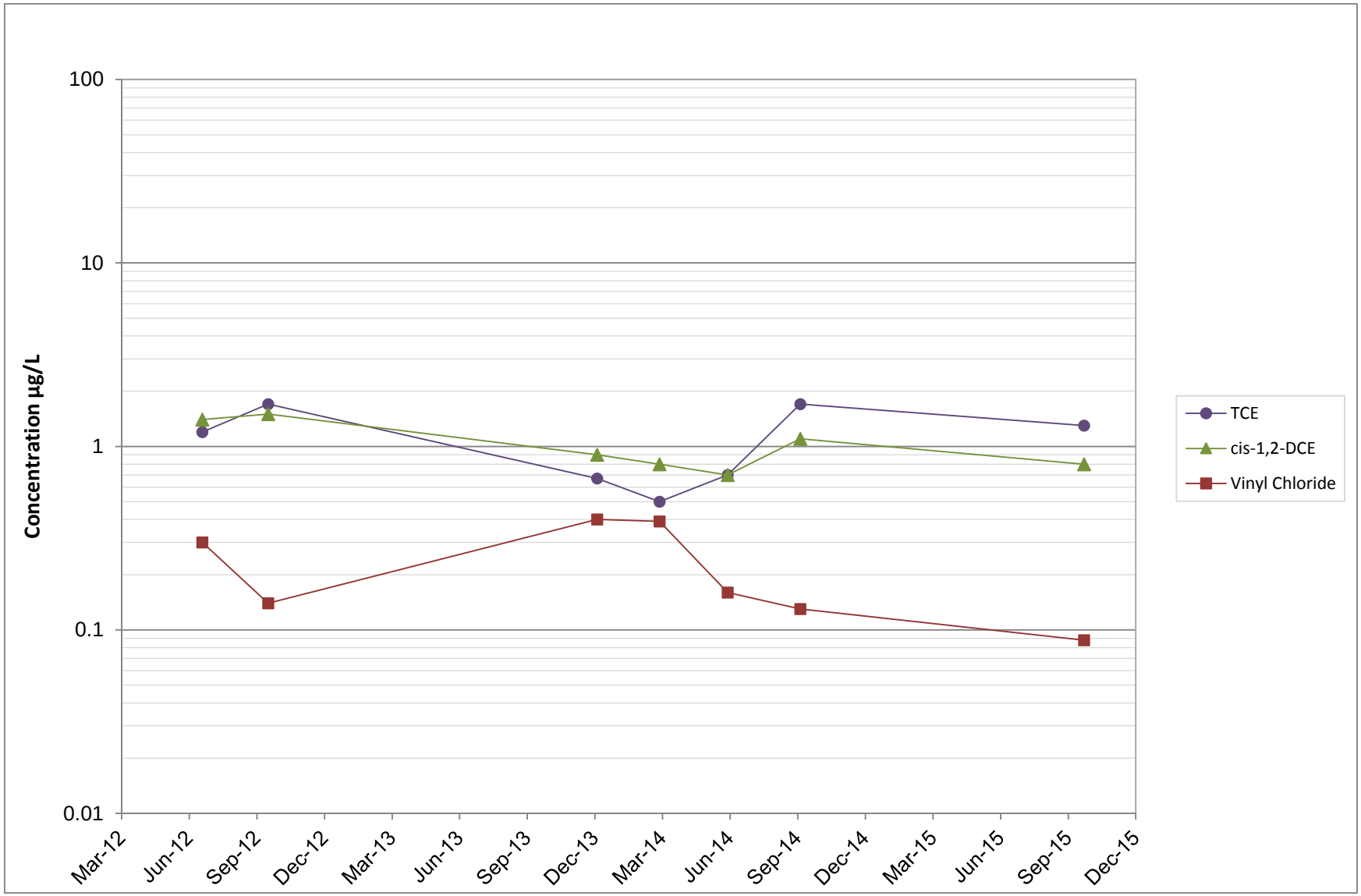
Boeing Auburn
Remedial Investigation
Auburn, Washington

Yard Water and Roadside Ditch Sampling

Figure 9-3



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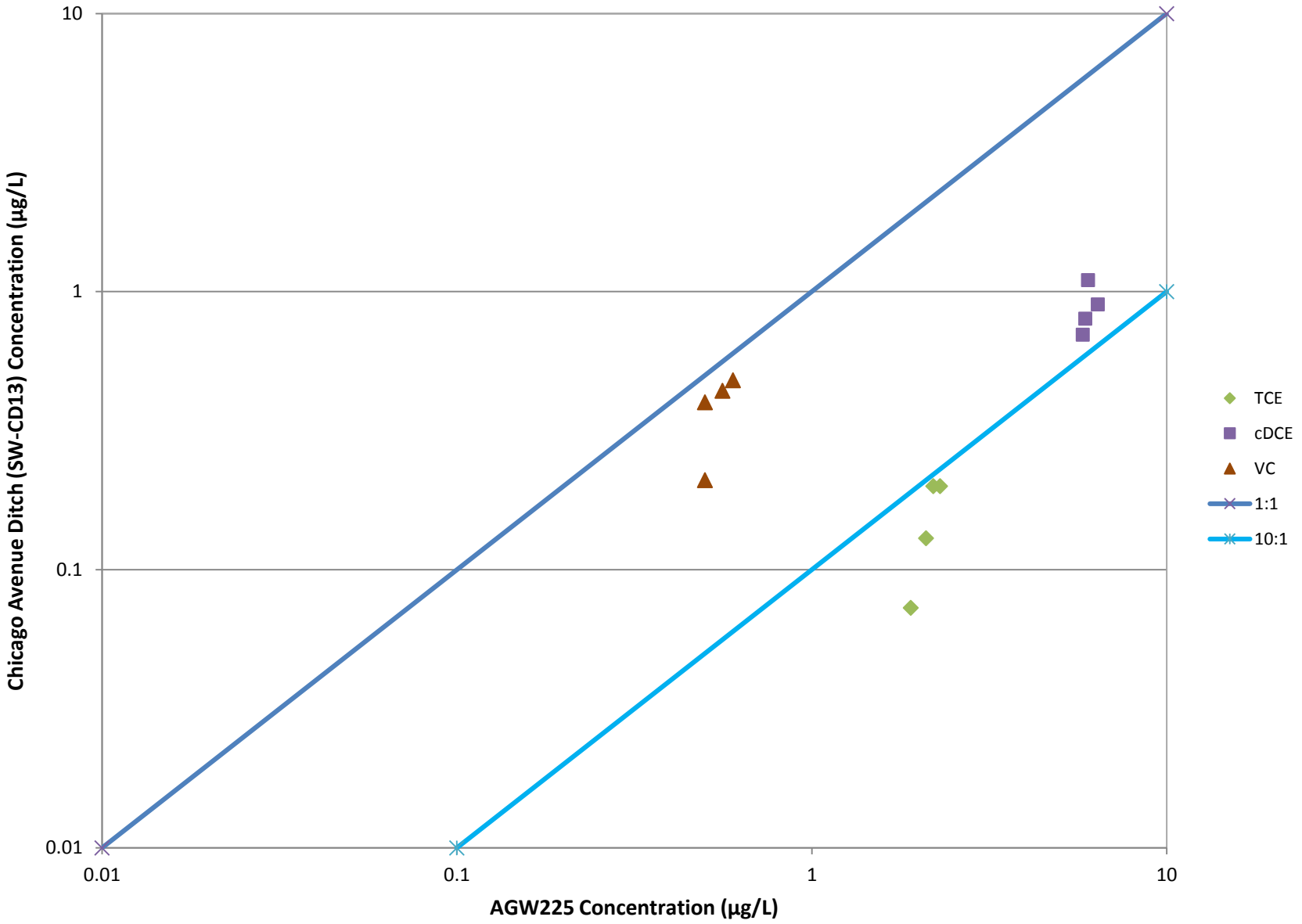
Boeing Auburn
Remedial Investigation
Auburn, Washington

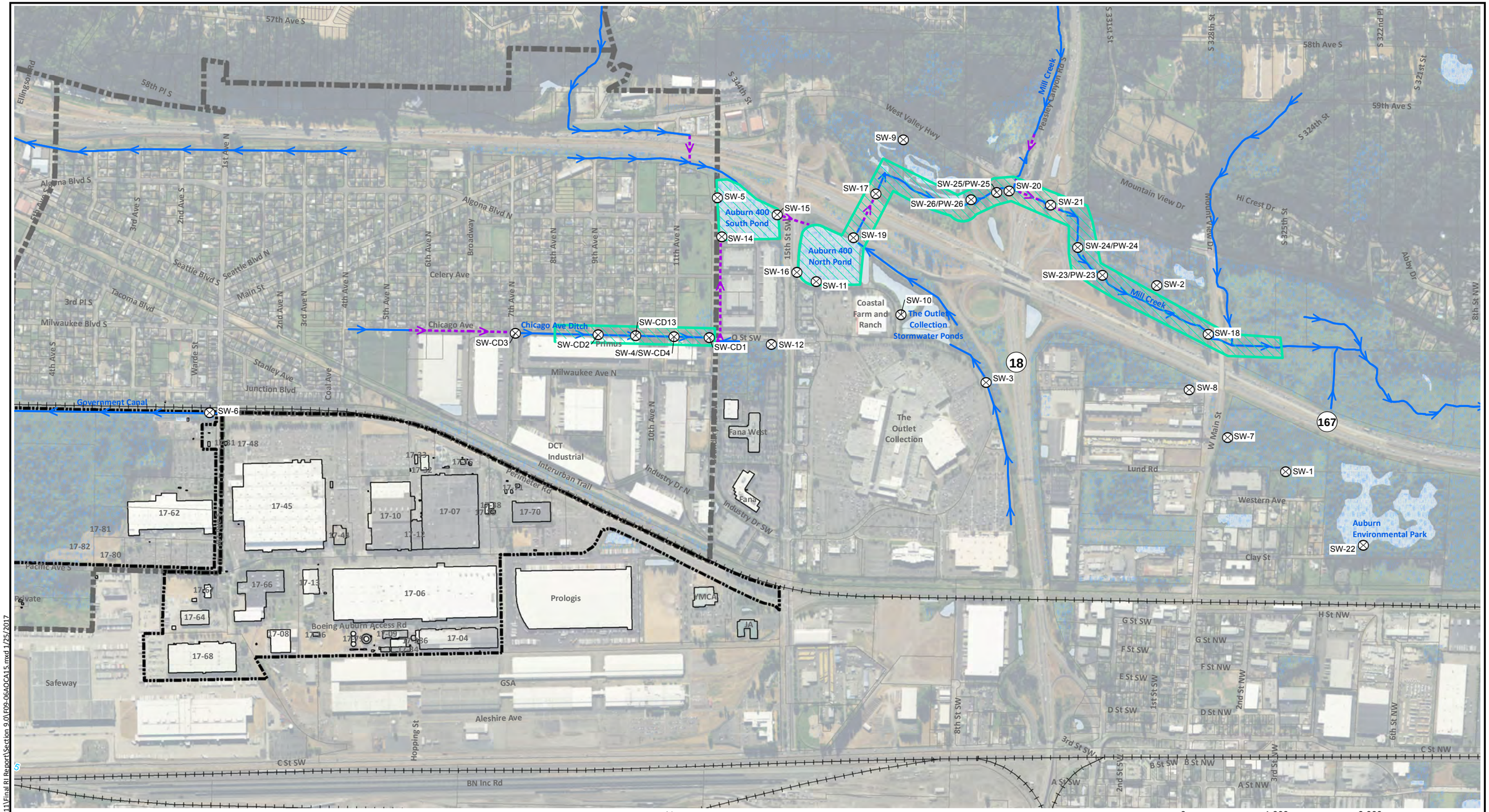
Volatile Organic Compound Time Series Plot SW-CD4

Figure
9-4



LANDAU ASSOCIATES

Boeing Auburn Remedial Investigation Auburn, Washington	**Chicago Avenue Ditch and Groundwater Concentration Comparison**	Figure 9-5



Legend

- Surface Water Sample
- Wetland Areas
- Open Waterways
- Piped Waterways
- Boeing Property
- City Limits
- AOC A-15

Notes

1. Surface water sampling locations are designated by SW. Pore water sampling locations are designated by PW.
2. The locations of surface water features are approximate.
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

N

0 1,000 2,000

Scale in Feet

Base Map Source: Geometrix 2003; Parcel Data Source: King County 2015; Aerial Photo Source: Esri World Imagery.

LANDAU ASSOCIATES

Boeing Auburn Remedial Investigation Auburn, Washington	**Extent of AOC A-15**	Figure 9-6

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Table 9-1
Surface Water Results: Algona Ditches
Boeing Auburn Remedial Investigation
Auburn, Washington

Detected Analyte	Sample Location: / Screening Level (a)	SW-CD1 9/17/2012	SW-CD2 Max	SW-CD2 Date	SW-CD2 Most Recent	SW-CD2 Date	SW-CD3 9/7/2012
VOLATILES (µg/L)							
Acetone	7200 (b)	5 U	ND	--	5 U	9/5/2014	5 U
Chloroform	55	0.2 U	ND	--	0.2 U	9/5/2014	0.2 U
cis-1,2-Dichloroethene	16 (b)	**1.1**	**0.3**	5/30/2014	0.2 U	9/5/2014	0.2 U
Tetrachloroethene	2.9	0.02 U	ND	--	0.2 U	9/5/2014	0.02 U
Toluene	130	0.2 U	ND	--	0.2 U	9/5/2014	0.2 U
Trichloroethene	58	**1.3**	**0.068**	2/27/2014	0.2 U	9/5/2014	0.2 U
Vinyl Chloride	15	**0.059**	**0.43**	2/27/2014	**0.1**	9/5/2014	0.02 U

Detected Analyte	Sample Location: / Screening Level (a)	SW-CD4/SW-4 Max	SW-CD4/SW-4 Date	SW-CD4/SW-4 Most Recent	SW-CD4/SW-4 Date	SW-CD13 Max	SW-CD13 Date	SW-CD13 Most Recent	SW-CD13 Date
VOLATILES (µg/L)									
Acetone	7200 (b)	**6.4**	8/27/2014	5.0 U	9/23/2015	ND	--	5 U	12/2/2014
Chloroform	55	**0.4**	8/27/2014	0.2 U	9/23/2015	ND	--	0.2 U	12/2/2014
cis-1,2-Dichloroethene	16 (b)	**1.5**	9/17/2012	**0.8**	9/23/2015	**1.2**	12/2/2014	**1.2**	12/2/2014
Tetrachloroethene	2.9	**0.032**	6/20/2012	0.2 U	9/23/2015	ND	--	0.2 U	12/2/2014
Toluene	130	**0.2**	5/30/2014	0.2 U	9/23/2015	ND	--	0.2 U	12/2/2014
Trichloroethene	58	**1.7**	9/5/2014	**1.3**	9/23/2015	**0.13**	2/27/2014	0.2 U	12/2/2014
Vinyl Chloride	15	**0.4**	12/5/2013	**0.088**	9/23/2015	**0.54**	12/2/2014	**0.54**	12/2/2014

Detected Analyte	Sample Location: / Screening Level (a)	SWRD-01 11/25/2013	SWRD-02 11/25/2013	SWRD-03 11/25/2013	SWRD-04 11/26/2013	SWRD-05 11/25/2013	SWRD-06 11/25/2013	SWRD-07 11/25/2013	SWRD-08 11/25/2013
VOLATILES (µg/L)									
Acetone	7200 (b)	5 U	**8**	5 U	**12**	**5.4**	**5.2**	**5.2**	**7.6**
Chloroform	55	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
cis-1,2-Dichloroethene	16 (b)	**0.6**	**0.4**	0.2 U	**0.2**	**1.4**	0.2 U	0.2 U	0.2 U
Tetrachloroethene	2.9	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Toluene	130	**1.2**	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**0.8**
Trichloroethene	58	**0.8**	**0.19**	0.02 U	**0.045**	**1.5**	**0.022**	0.02 U	0.02 U
Vinyl Chloride	15	**0.3**	**0.085**	0.02 U	**0.13**	**0.26**	**0.07**	0.02 U	0.02 U

Detected Analyte	Sample Location: / Screening Level (a)	SWRD-09 11/25/2013	SWRD-11 11/25/2013	SWRD-12 11/25/2013	SWRD-13 11/25/2013	SWRD-14 11/25/2013	SWRD-15 11/25/2013	SWRD-16 11/25/2013	SWRD-17 11/25/2013
VOLATILES (µg/L)									
Acetone	7200 (b)	**7.9**	**6.9**	**6.6**	**6.1**	**10**	**17**	**5.9**	5 U
Chloroform	55	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
cis-1,2-Dichloroethene	16 (b)	0.2 U	0.2 U	**0.3**	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Tetrachloroethene	2.9	0.02 U	0.02 U	**0.15**	**0.12**	0.02 U	0.02 U	0.02 U	0.02 U
Toluene	130	0.2 U	**0.2**	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**2.8**
Trichloroethene	58	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Vinyl Chloride	15	0.02 U	**0.3**	**0.2**	**0.14**	0.02 U	0.02 U	0.02 U	0.02 U

Table 9-1
Surface Water Results: Algona Ditches
Boeing Auburn Remedial Investigation
Auburn, Washington

Detected Analyte	Sample Location: / Screening Level (a)	SWRD-18 11/26/2013	SWRD-21 11/26/2013	SWRD-22 11/26/2013
VOLATILES (µg/L)				
Acetone	7200 (b)	**18**	5 U	5 U
Chloroform	55	0.2 U	0.2 U	0.2 U
cis-1,2-Dichloroethene	16 (b)	0.2 U	0.2 U	0.2 U
Tetrachloroethene	2.9	0.02 U	0.02 U	**0.042**
Toluene	130	**0.3**	0.2 U	0.2 U
Trichloroethene	58	0.02 U	0.02 U	0.02 U
Vinyl Chloride	15	0.02 U	0.02 U	0.02 U

Notes:

1. Surface water sampling locations from the Chicago Avenue ditch are idenitifed by the SW-CD prefix; locations from roadside ditches are identified by the SWRD prefix.
2. Sample locations SWRD-10, SWRD-19, and SWRD-20 did not have a sample collected due to the ditch segment being dry at time of sampling.
3. Surface water results presented are either concentrations from a one time sampling event or maximum concentration detected and most recent concentration detected (as of December 2015).
4. **Bold** text indicates detected analyte.

(a) Screening levels presented are for Area D. For additional information regarding screening levels, see Section 5.0.

(b) MTCA Method B standard formula value for groundwater as drinking water is provided for reference only, this is not a screening level. No surface water criteria available.

Abbreviations/Acronyms:

-- = not applicable
NA = screening level not available
µg/L = micrograms per liter

Table 9-2
Surface Water Results: Algona Ponded Yard Water
Boeing Auburn Remedial Investigation
Auburn, Washington

Detected Analyte	Sample Location: / Screening Level (a)	SWYP-01 1/16/2014	SWYP-02 1/16/2014	SWYP-03 1/16/2014	SWYP-04 1/16/2014	SWYP-05 1/16/2014	SWYP-06 1/16/2014
VOLATILES (µg/L)							
cis-1,2-Dichloroethene	16 (b)	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	58	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Vinyl Chloride	15	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U

Detected Analyte	Sample Location: / Screening Level (a)	SWYP-07 1/16/2014	SWYP-08 1/16/2014	SWYP-09 1/16/2014	SWYP-10 1/16/2014	SWYP-11 1/16/2014	SWYP-12 3/13/2014
VOLATILES (µg/L)							
cis-1,2-Dichloroethene	16 (b)	1 U	1 U	1 U	1 U	1 U	**1**
Trichloroethene	58	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	**0.055**
Vinyl Chloride	15	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	**0.039**

Notes:

1. Surface water sampling locations from ponded yard water are identified by the SWYP prefix.
2. Surface water results presented are concentrations from a one time sampling event.
3. **Bold** text indicates detected analyte.

(a) Screening levels presented are for Area D. For additional information regarding screening levels, see Section 5.0.

(b) MTCA Method B standard formula value for groundwater as drinking water is provided for reference only, this is not a screening level. No surface water criteria available.

Abbreviations/Acronyms:

µg/L = micrograms per liter

NA = Screening level not available

Table 9-3
Surface Water Results: Auburn Stormwater Features
Boeing Auburn Remedial Investigation
Auburn, Washington

Detected Analyte	Sample Location: / Screening Level (a)	SW-3 Max	SW-3 Date	SW-3 Most Recent	SW-3 Date	SW-5 6/20/2012	SW-10 Max	SW-10 Date	SW-10 Most Recent	SW-10 Date
VOLATILES (µg/L)										
Acetone	7200 (b)	ND	--	5 U	3/24/2014	**5.6**	ND	--	5 U	3/24/2014
cis-1,2-Dichloroethene	16 (b)	ND	--	0.2 U	3/24/2014	0.2 U	ND	--	0.2 U	3/24/2014
Tetrachloroethene	2.9	**0.02**	6/20/2012	0.2 U	3/24/2014	**0.1**	**0.032**	6/19/2012	0.2 U	3/24/2014
Toluene	130	**0.4**	6/20/2012	0.2 U	3/24/2014	**1.5**	ND	--	0.2 U	3/24/2014
Trichloroethene	58	ND	--	0.2 U	3/24/2014	0.2 U	ND	--	0.2 U	3/24/2014
Vinyl Chloride	98	ND	--	0.02 U	3/24/2014	0.02 U	ND	--	0.02 U	3/24/2014

Detected Analyte	Sample Location: / Screening Level (a)	SW-11 6/9/2012	SW-12 Max	SW-12 Date	SW-12 Most Recent	SW-12 Date	SW-14 Max	SW-14 Date	SW-14 Most Recent	SW-14 Date
VOLATILES (µg/L)										
Acetone	7200 (b)	5 U	ND	--	5 U	4/2/2014	5.0 U	9/23/2015	5.0 U	9/23/2015
cis-1,2-Dichloroethene	16 (b)	**0.5**	ND	--	0.2 U	4/2/2014	**0.8**	3/24/2014	**0.5**	9/23/2015
Tetrachloroethene	2.9	**0.029**	ND	--	0.2 U	4/2/2014	0.2 U	9/23/2015	0.2 U	9/23/2015
Toluene	130	**1.8**	**1.9**	7/2/2013	0.2 U	4/2/2014	**0.2**	9/23/2015	**0.2**	9/23/2015
Trichloroethene	58	0.2 U	ND	--	0.2 U	4/2/2014	**1**	7/2/2013	**0.8**	9/23/2015
Vinyl Chloride	98	**0.087**	ND	--	0.02 U	4/2/2014	**0.2**	9/5/2014	**0.056**	9/23/2015

Detected Analyte	Sample Location: / Screening Level (a)	SW-15 Max	SW-15 Date	SW-15 Most Recent	SW-15 Date	SW-16 Max	SW-16 Date	SW-16 Most Recent	SW-16 Date
VOLATILES (µg/L)									
Acetone	7200 (b)	ND	--	5 U	9/5/2014	ND	--	5.0 U	9/23/2015
cis-1,2-Dichloroethene	16 (b)	ND	--	0.2 U	9/5/2014	**1.5**	7/2/2013	**0.4**	9/23/2015
Tetrachloroethene	2.9	ND	--	0.2 U	9/5/2014	ND	--	0.2 U	9/23/2015
Toluene	130	**0.8**	7/2/2013	**0.3**	9/5/2014	**0.8**	9/23/2015	**0.8**	9/23/2015
Trichloroethene	58	ND	--	0.2 U	9/5/2014	**1.1**	7/2/2013	**0.2**	9/23/2015
Vinyl Chloride	98	ND	--	0.02 U	9/5/2014	**0.32**	9/5/2014	**0.023**	9/23/2015

Table 9-3
Surface Water Results: Auburn Stormwater Features
Boeing Auburn Remedial Investigation
Auburn, Washington

Detected Analyte	Sample Location: Screening Level (a)	SW-19 Max	Date	Most Recent	Date
VOLATILES (µg/L)					
Acetone	7200 (b)	ND	--	5 U	9/5/2014
cis-1,2-Dichloroethene	16 (b)	ND	--	0.2 U	9/5/2014
Tetrachloroethene	2.9	ND	--	0.2 U	9/5/2014
Toluene	130	**19**	9/5/2014	**19**	9/5/2014
Trichloroethene	58	ND	--	0.2 U	9/5/2014
Vinyl Chloride	98	**0.13**	9/5/2014	**0.13**	9/5/2014

Notes:

1. Surface water sampling locations are idenitifed by the SW prefix.
2. Surface water results presented are either concentrations from a one time sampling event or maximum concentration detected and most recent concentration detected (as of December 2015).
3. **Bold** text indicates detected analyte.

(a) Screening levels presented are for Area C. For additional information regarding screening levels, see Section 5.0.

(b) MTCA Method B standard formula value for groundwater as drinking water is provided for reference only, this is not a screening level. No surface water criteria available.

Abbreviations/Acronyms:

-- = not applicable
µg/L = micrograms per liter
NA = screening level not available

Table 9-4
Surface Water Results: Auburn Wetlands
Boeing Auburn Remedial Investigation
Auburn, Washington

Detected Analyte	Sample Location: / Screening Level (µg/L) (a)	SW-1 6/19/2012	SW-6 6/20/2012	SW-7 6/19/2012	SW-8 6/19/2012	SW-9 6/19/2012
VOLATILES (µg/L)						
Acetone	7200 (b)	**12**	5 U	**17**	5 U	5 U
cis-1,2-Dichloroethene	16 (b)	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Toluene	130	**4.2**	0.2 U	**1.5**	**3.3**	**0.5**
Vinyl Chloride	0.18	0.02 U	0.02 U	0.04 U	0.02 U	0.04 U

Detected Analyte	Sample Location: / Screening Level (µg/L) (a)	SW-17 Max	SW-17 Date	SW-17 Most Recent	SW-17 Date	SW-20 Max	SW-20 Date	SW-20 Most Recent	SW-20 Date
VOLATILES (µg/L)									
Acetone	7200 (b)	ND	--	5.0 U	9/23/2015	ND	--	5.0 U	9/23/2015
cis-1,2-Dichloroethene	16 (b)	**0.2**	7/2/2013	0.2 U	9/23/2015	ND	--	0.2 U	9/23/2015
Toluene	130	**2**	9/23/2015	**2**	9/23/2015	**2.4**	9/23/2015	**2.4**	9/23/2015
Vinyl Chloride	0.18	**0.063**	7/2/2013	0.020 U	9/23/2015	ND	--	0.020 U	9/23/2015

Detected Analyte	Sample Location: / Screening Level (µg/L) (a)	SW-22 3/24/2014	SW-25 9/24/2015	SW-26 9/24/2015
VOLATILES (µg/L)				
Acetone	7200 (b)	**5.8**	5.0 U	5.0 U
cis-1,2-Dichloroethene	16 (b)	0.2 U	0.2 U	0.2 U
Toluene	130	**6.6**	**6.3**	**4.0**
Vinyl Chloride	0.18	0.02 U	0.020 U	0.020 U

Notes:

1. Surface water sampling locations are identified by the SW prefix.
2. Surface water results presented are either concentrations from a one time sampling event or maximum concentration detected and most recent concentration detected (as of December 2015).
3. **Bold** text indicates detected analyte.

(a) Screening levels presented are for Area B. For additional information regarding screening levels, see Section 5.0.

(b) MTCA Method B standard formula value for groundwater as drinking water is provided for reference only, this is not a screening level. No surface water criteria available.

Abbreviations/Acronyms:

-- = not applicable
µg/L = micrograms per liter
NA = screening level not available
U = Indicates the compound was undetected at the reported concentration.

Table 9-5
Surface Water Results: Mill Creek
Boeing Auburn Remedial Investigation
Auburn, Washington

Detected Analyte	Sample Location: Screening Level (a)	SW-2 6/19/2012	SW-18 Max	SW-18 Date	SW-18 Most Recent	SW-18 Date
VOLATILES (µg/L)						
Toluene	57	0.2 U	**0.4**	7/2/2013	**0.3**	9/23/2015

Detected Analyte	Sample Location: Screening Level (a)	SW-21 Max	SW-21 Date	SW-21 Most Recent	SW-21 Date	SW-23 9/24/2015
VOLATILES (µg/L)						
Toluene	57	**0.4**	9/5/2014	**0.4**	9/5/2014	**0.8**

Detected Analyte	Sample Location: Screening Level (a)	SW-24 9/24/2015
VOLATILES (µg/L)		
Toluene	57	0.2 U

Notes:

1. Surface water sampling locations are identified by the SW prefix.
2. Surface water results presented are either concentrations from a one time sampling event or maximum concentration detected and most recent concentration detected (as of December 2015).
3. **Bold** text indicates detected analyte.

(a) Screening levels presented are for Area A. For additional information regarding screening levels, see Section 5.0.

Table 9-6
Sediment Pore Water Results
Boeing Auburn Remedial Investigation
Auburn, Washington

Detected Analyte	Sample Location: / Screening Level (a)	PW-23 9/24/2015	PW-24 9/24/2015	PW-25 9/24/2015	PW-26 9/24/2015
VOLATILES (µg/L)					
Acetone	7200 (b)	**17**	**19**	**14**	**19**

Notes:

1. Sediment pore water sampling locations are identified by the PW prefix.
2. Sediment pore water results presented are concentrations from a one time sampling event.
3. **Bold** text indicates detected analyte.

(a) Groundwater screening levels used for sediment pore water.

(b) MTCA Method B standard formula value for groundwater as drinking water is provided for reference only, this is not a screening level. No surface water criteria available.

Abbreviations/Acronyms:

-- = not applicable
µg/L = micrograms per liter
NA = screening level not available
U = the compound was undetected at the reported concentration.