TECHNICAL MEMORANDUM

LANDAU ASSOCIATES
ENVIRONMENTAL | GEOTECHNICAL | NATURAL RESOURCES

TO: Jim Bet, The Boeing Company

FROM: Jennifer Wynkoop and Sarah Fees

DATE: June 19, 2014

RE: ALGONA NEIGHBORHOOD DITCH SAMPLING INVESTIGATION
BOEING AUBURN FACILITY
AUBURN, WASHINGTON

INTRODUCTION

This technical memorandum presents and evaluates surface water data collected from ditches in the northern residential area of Algona, Washington as part of the remedial investigation (RI) for The Boeing Company (Boeing) Auburn Fabrication Division property (facility) located in Auburn, Washington. The RI is part of the corrective action requirements documented in an Agreed Order (Order; No. DE 01HWTRNR-3345) dated August 14, 2002 and the First Amended Agreed Order dated February 21, 2006 both between Washington State Department of Ecology (Ecology) and Boeing. The Order includes a requirement to conduct an RI under Ecology's oversight. The location of the Boeing Auburn property and the project area (i.e., northern Algona residential area) are shown on Figure 1.

This ditch sampling investigation was conducted to address surface water data gaps as part of the RI in accordance with the *City of Algona Yard and Ditch Surface Water Sampling Work Plan*, (work plan; Landau Associates 2013a). The first draft of this work plan was submitted on April 11, 2013. Ecology provided comments and requested a revised work plan on May 16, 2013 (Ecology 2013a). The final draft of this work plan along with a response to Ecology comments were submitted on June 6, 2013. Ecology conditionally approved this work plan on September 25, 2013 (Ecology 2013b). In accordance with Ecology's conditions, Boeing submitted a response to Ecology's comments and a draft technical memorandum, *Screening Levels for Yard and Ditch Surface Water* (Landau Associates 2013b). The technical memorandum evaluated trichloroethene (TCE) and vinyl chloride (VC) screening levels for two exposure scenarios: 1) reasonable maximum exposure for children in a residential setting and 2) reasonable maximum exposure for workers who clean the ditches. Ecology approved screening levels for TCE and VC (Ecology 2013c) based on the most protective screening level for each compound. Additionally, Ecology clarified that these screening levels apply to yards and ditches in the project area. The northern Algona ditch surface water screening levels for TCE and VC are shown in the table below.

Compound	Screening Level (µg/L)
TCE	58
VC	98

µg/L = micrograms per liter

The yard and ditch sampling work plan was implemented in two phases. Phase I included roadside ditch samples and Phase II included residential ponded yard water samples. This report includes the results from the ditch samples. Yard sampling results will be presented in a separate technical memorandum. The scope of the ditch sampling investigation consisted of collecting grab samples from standing water in roadside ditches in the project area. There were 22[1] ditch segments identified on February 28, 2013 when Landau Associates performed a windshield survey of surface water in the project area. The project area was identified to coincide with the direct-push investigation area (Landau Associates 2013c) in the northern Algona residential area.

The investigation objectives identified in the work plan are as follows:

1. To evaluate whether volatile organic compounds (VOCs) in groundwater are discharging to shallow surface water features within Algona
2. To assist with interpretation of shallow groundwater data collected in Algona as part of the direct-push shallow groundwater investigation (Landau Associates 2013c)
3. To assist with scoping a surface water sampling program to evaluate risks to human health and ecological receptors[2].

BACKGROUND

Boeing has been implementing RI activities to characterize the nature and extent of two VOC groundwater plumes (western plume and Area 1 plume) that originate on the Boeing facility and extend off site to the north and northwest. The primary VOC constituents of concern in offsite groundwater are TCE, cis-1,2-dichloroethene (cis-1,2-DCE), trans-1,2-dichloroethene (trans-1,2-DCE), and VC.

In January 2013, results from groundwater investigation work showed that VOC impacts extend west from the facility into the northeast corner of the Algona residential area. A direct-push investigation took place in April 2013 to more fully characterize the extent of groundwater contamination in the project area (Landau Associates 2013c).

Groundwater and surface water interaction northwest of the Boeing facility is complex. In places, groundwater is located within a few feet of the ground surface. Consequently, many of the surface water

[1] Originally, there were 23 ditch segments identified in the work plan; however, only 22 ditch segments were shown on the figure. There was not a ditch segment 4 in the original work plan document.

[2] Potential surface water receptors and exposure pathways were identified by Ecology in comments on the first draft of the yard and ditch sampling work plan (Ecology 2013a).

features, such as ditches, appear to intersect groundwater and may represent groundwater discharge locations. Groundwater discharge to ditches can result in the presence of VOCs in surface water. This conceptual model is supported by the detection of low concentrations of VOCs in several ditches in the project area near the groundwater plume. Additionally, water level observations in shallow monitoring wells suggest that groundwater levels are higher than the surface water levels in some ditches, indicating a hydraulic gradient from groundwater to the ditches. Groundwater discharge also has an influence on groundwater flow direction and contributes to the westerly component of shallow groundwater flow in northern Algona.

SUMMARY OF FIELD INVESTIGATION ACTIVITIES

The ditch sampling field investigation was conducted in accordance with the work plan (Landau Associates 2013a). All samples were located in public rights-of-way; the City of Algona issued a permit for ditch sampling on October 30, 2013. Ecology mailed a flyer to the residents of Algona informing them of the ditch sampling program (Ecology 2013d). The ditch sampling field investigation was conducted on November 25 and 26, 2013. Sampling was conducted during a dry period, with no trace of precipitation occurring in the previous 5 days (King County website 2013). Sampling was targeted for a relatively dry period to minimize the influence of stormwater during sample collection.

Algona Ditches

There were 22 ditches identified for sampling in the work plan. During sampling, an additional ditch segment was identified on the east side of Celery Avenue between Boundary Boulevard and 11th Avenue North. This ditch location was numbered ditch 4 because there was no ditch 4 identified in the work plan. During the field visit, staff observed that no ditch was present at the location of ditch 23 identified in the work plan. Ditches 10, 19, and 20 were identified, but were dry during sampling, so no sample was collected. Ditch 20 was identified on the north side of 8th Avenue North instead of on the south side as it was shown in the work plan. One surface water sample was collected from each ditch segment that contained water from the deepest, most easily accessible location along the ditch. Sampling locations were recorded with a GPS and photographed. The ditch segments identified during sampling along with sampling locations are presented on Figure 2.

Surface Water Samples

A total of 19 surface water samples and one duplicate sample were collected. Surface water samples were collected using a composite liquid waste sampler (COLIWASA) when the water column thickness was greater than 4 inches. When the water column thickness was less than 4 inches, a stainless

steel ladle was used to collect the water sample. COLIWASA samplers were dedicated and disposed of after one use. Ladles were decontaminated by a manual wash with Alconox® solution followed by a de-ionized water rinse.

Samples were collected no more than 2 inches above the bottom of the ditch and at least 2 inches below the water surface. If less than 4 inches of water was present, the sample was collected from the approximate mid-point of the water column. The approximate water column thickness was measured with a measuring tape and was recorded on the sample collection form. Field parameters (pH, conductivity, dissolved oxygen, temperature, and oxidation-reduction potential) were measured at the time of sampling by submerging a multi-parameter probe (YSI 556 MPS) directly into the surface water. The multi-parameter probe was decontaminated between sampling locations.

Samples were collected in laboratory-provided 40-milliliter volatile organic analysis (VOA) glass vials preserved with hydrochloric acid. Five VOA containers of water were collected at each sample location. Samples were preserved in a cooler on ice and submitted under chain-of-custody protocols to Eurofins Lancaster Laboratories, Inc. of Lancaster, Pennsylvania. Samples were analyzed for VOCs by Environmental Protection Agency (EPA) Method 8260. Selected ion monitoring (SIM) analysis was performed for tetrachloroethene (PCE), TCE, and VC for the lowest achievable reporting limits, as requested by Ecology (Ecology 2013c). Trip blanks, blind duplicates and matrix spike/matrix spike duplicate samples were analyzed for quality assurance.

Surface water samples were analyzed on a 3-day turnaround time. Once results were received, data quality assurance and validation were performed to evaluate laboratory accuracy and precision. In accordance with the work plan (Landau Associates 2013a), a table of results was provided to Ecology on December 12, 2013 (within 10 days after receipt of sample results).

ANALYTICAL RESULTS

TCE was detected in 5 of the 19 ditch samples and ranged in concentration from 0.022 µg/L to 1.5 µg/L. VC was detected in 8 of the 19 surface water samples and ranged in concentration from 0.070 µg/L to 0.3 µg/L. Cis-1,2-DCE was detected in 5 of the 19 samples and ranged in concentration from 0.2 µg/L to 1.4 µg/L. Trans-1,2-DCE was not detected in any of the samples. TCE and VC concentrations do not exceed Ecology-approved screening levels at any of the sample locations. Concentrations of cis-1,2-DCE do not exceed the screening level at any of the sample locations as discussed below.

No VOCs were detected at two sample locations. The remaining locations had detections of VOCs that appear to be unrelated to the groundwater plume (i.e., acetone, toluene, PCE, and carbon disulfide). These results are discussed further in the following section. Ditch sampling locations and concentrations of VOCs of concern are shown on Figure 2. Detections of TCE are shown with the TCE

concentration plume on Figure 3 and detections of VC are shown with the VC concentration plume on Figure 4. The TCE and VC concentration plumes are shown in Figures 3 and 4 as contours of chemical concentrations in groundwater. Ditch sampling surface water results are presented in Table 1, and results for detected constituents are presented in Table 2.

DISCUSSION

Detections of TCE, cis-1,2-DCE, and VC in ditch surface water generally coincide with the location of the groundwater plume in the northeast corner of the project area. Other VOCs detected in the project area include acetone, toluene, PCE, and carbon disulfide. All of the compounds detected were at levels below screening levels shown in Table 2.

Two samples with detections of VC, SWRD-12 and SWRD-13, are outside of the groundwater plume area and the detected VC does not appear to be related to the groundwater plume. These two sample locations also had detections of PCE, which is not detected in groundwater in the plume area. The VC detections in these locations could be related to the breakdown of PCE from a different source. Additional groundwater monitoring wells are planned to be installed in northern Algona in 2014 and will provide additional data that may help clarify whether the source of the VC at sample locations SWRD-12 and SWRD-13 could be a results of chemicals in the groundwater plume. Potential sources of PCE are discussed below.

PCE, acetone, toluene, and carbon disulfide were detected in some ditch samples; however, the detections do not appear to be related to the groundwater plume. Shallow wells in the project area (AGW224, AGW225, AGW226, and AGW228) do not have detections of these constituents. Groundwater samples collected in the ditch sampling area during the direct-push drilling in April 2013 also did not have detections of PCE, toluene, or carbon disulfide. Acetone was detected at three direct-push locations; however, these locations did not have detections of TCE, cis-1,2-DCE, or VC, so the acetone is not related to the groundwater plume. The detections of PCE are likely related to releases from other anthropogenic sources to stormwater runoff. A U.S. Geological Survey (USGS) study found that PCE was commonly detected in stormwater runoff in urban areas (Lopez and Bender 1998). Acetone and toluene can be formed biogenically through fermentation and other microbial processes (NCASI 2011). Stormwater can also be a source of acetone and toluene in surface water samples. In a study done by the USGS, toluene was the most commonly detected VOC in stormwater (Lopez and Bender 1998). Acetone is known to be present in automobile exhaust which could result in its deposition on roadways and subsequently in stormwater (ATSDR 1994). Carbon disulfide is naturally occurring; sources include wetlands, oceans, and microbial activity in soils (ATSDR 1996). The roadside ditches are part of the

stormwater system, so stormwater runoff is a likely source of PCE, acetone, toluene, and carbon disulfide, and the detections of these constituents do not appear to be related to the groundwater plume.

CONCLUSIONS AND RECOMMENDATIONS

The ditch surface water data in the northeast corner of residential Algona appear to be correlated with shallow groundwater data, indicating that groundwater containing TCE, cis-1,2-DCE, or VC may be entering ditches in this area. Detections of other VOCs and detections of VC at two locations outside of the northeast corner do not appear to be correlated with the groundwater plume. Detections of all constituents are below screening levels, meaning the concentrations of VOCs in the ditches do not pose a health concern.

Currently, no further ditch sampling in the Algona residential area is recommended. However, Boeing is continuing quarterly sampling at the Chicago Avenue ditch along the western boundary of the Algona residential area. Boeing also plans to continue sampling a series of monitoring wells and is planning to install additional monitoring wells in the Algona residential area. The need for additional ditch sampling in the Algona residential area will be re-assessed if groundwater or surface water VOC concentrations in the project area increase or if the groundwater plume expands significantly.

SEF/JWW/jrc

REFERENCES

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ATSDR. 1994. *Toxicological Profile for Acetone.* U.S. Department of Health and Human Services, Public Health Service. Agency for Toxic Substance and Disease Registry. May.

Ecology 2013a. Letter: *Ecology comments on the Draft "City of Algona Yard and Ditch Surface Water Sampling Work Plan" dated April 11, 2913, WAD 0413371330, State FS ID: 2018.* From Robin Harrover, Washington State Department of Ecology to James Bet, The Boeing Company. May 16.

Ecology 2013b. Letter: *Ecology Approval (reference WAD 041337130, State FS ID: 2018): City of Algona Yard and Ditch Surface Water Sampling Work Plan, dated June 6, 2013, and Memorandum – Response to Ecology Comments on the Draft City of Algona Yard and Ditch Surface Water Sampling Work Plan, dated June 6, 2013*. From Robin Harrover, Washington State Department of Ecology to James Bet, The Boeing Company. September 25.

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Landau Associates 2013a. Work plan: *City of Algona Yard and Ditch Surface Water Sampling Work Plan, Boeing Auburn Facility, Auburn, Washington*. Prepared for The Boeing Company. June 6.

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Landau Associates 2013c. Technical Memorandum: *Algona Neighborhood Direct-Push Boring Investigation, Boeing Auburn Facility, Auburn, Washington*. Prepared for The Boeing Company. May 28.

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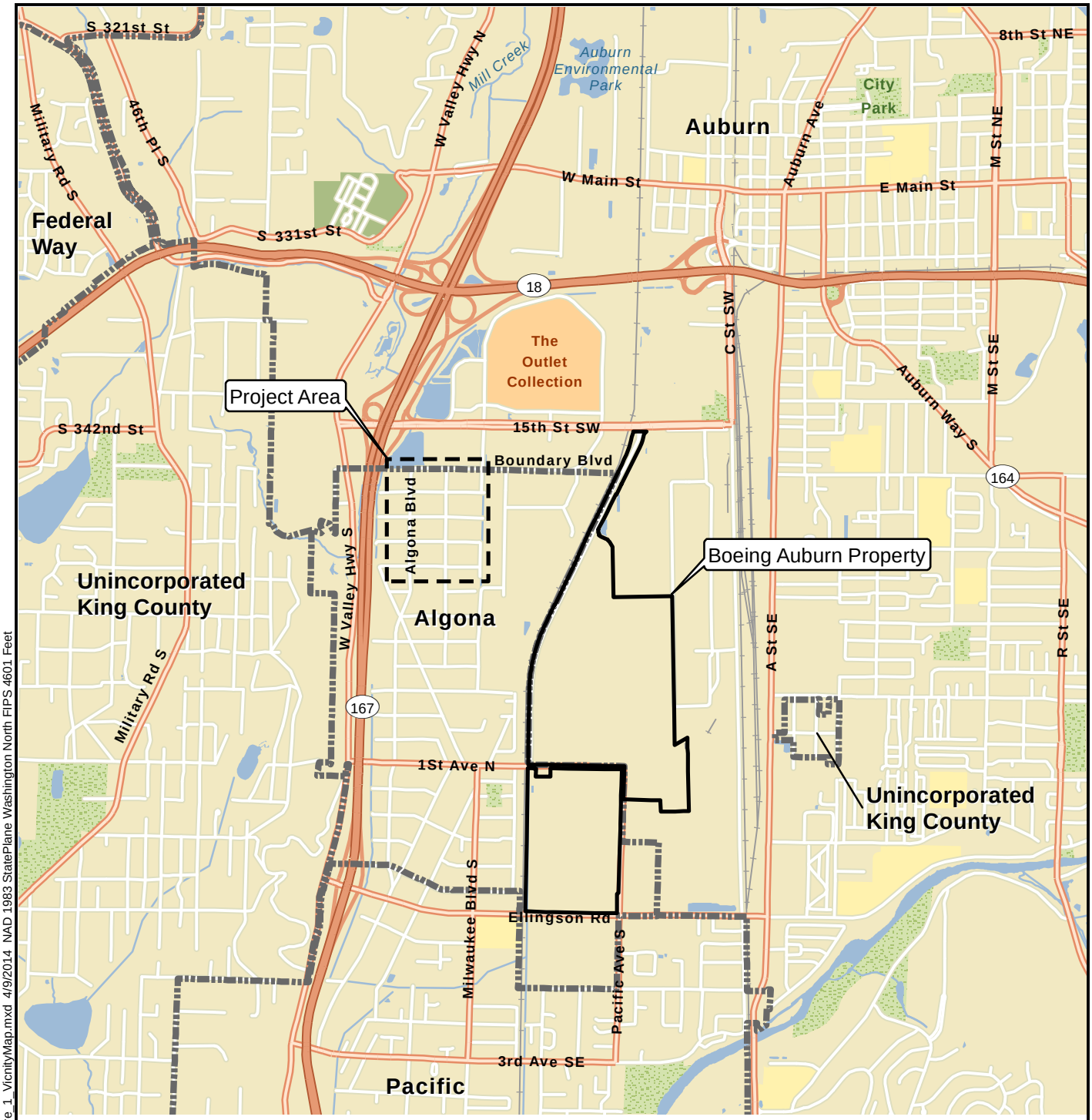
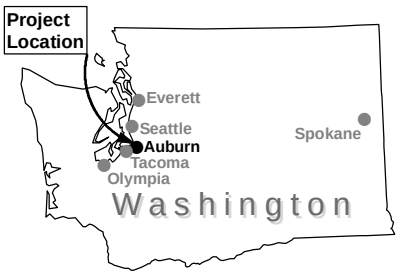
NCASI. 2011. *The Potential for Biogenic Formation of Acetone, Methyl Ethyl Ketone, and Toluene in Pulp and Paper Mill Residuals*. Technical Bulletin No. 989. Research Triangle Park, NC: National Council for Air and Stream Improvement, Inc. July.

ATTACHMENTS

Figure 1: Vicinity Map
Figure 2: Ditch Sampling Detections
Figure 3: Shallow Zone TCE Plume
Figure 4: Shallow Zone Vinyl Chloride Plume

Table 1: Surface Water Analytical Results
Table 2: Surface Water Detections





Data Source: Esri 2012

G:\Projects\025\164\110\101\Ditch Sampling TM\Figure_1_VicinityMap.mxd 4/9/2014 NAD 1983 StatePlane Washington North FIPS 4601 Feet

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Boeing Auburn Auburn, Washington	**Vicinity Map**	Figure 1

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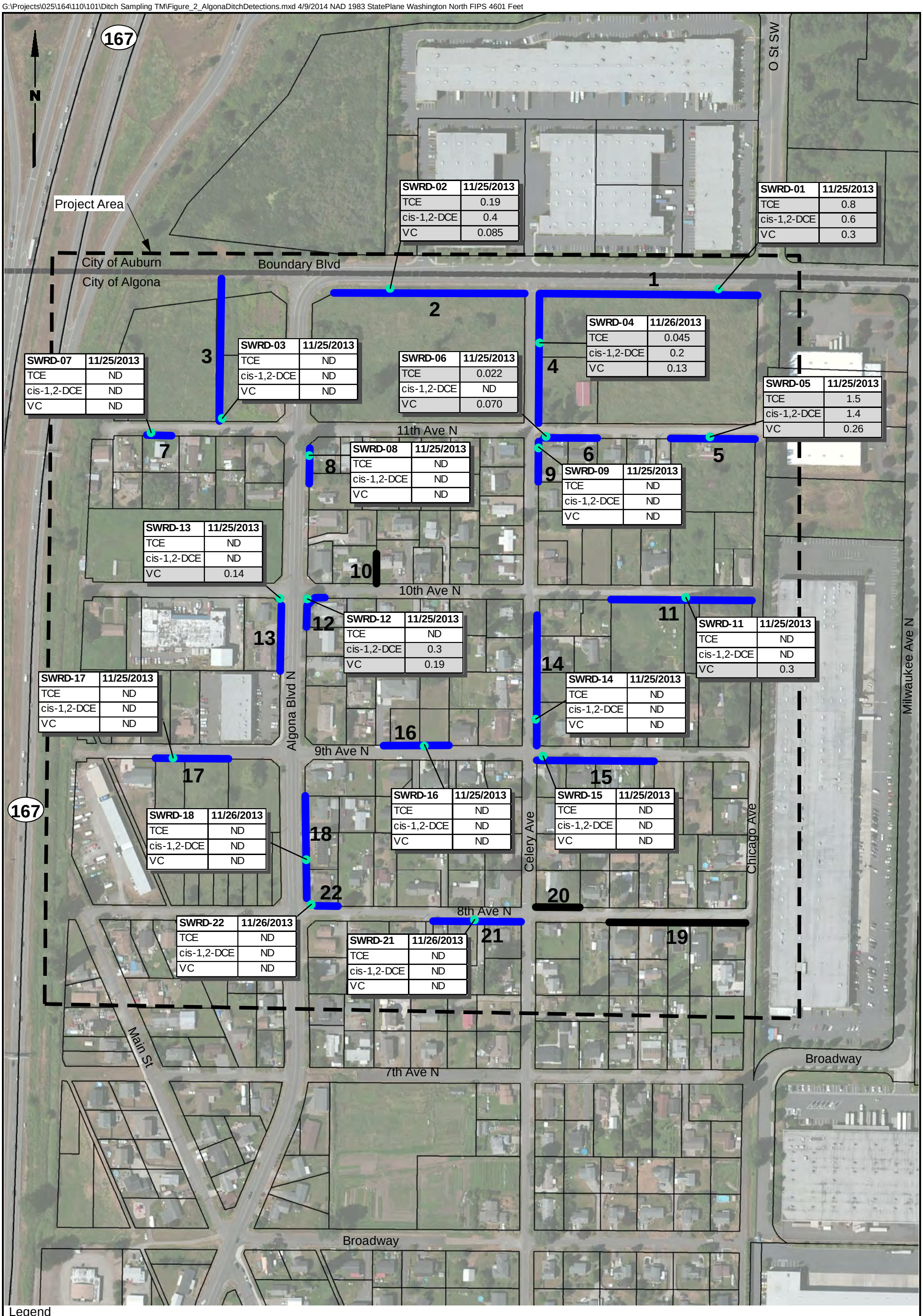

Legend

- Ditch Samples
- 22 Wet Ditch Segment and Designation
- 10 Dry Ditch Segment and Designation (No Sample Collected)
- Project Area

Notes

1. All concentrations shown in µg/L.
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 250 500

Scale in Feet

Data Sources: King County GIS 2013; Esri World Imagery.

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Auburn, Washington

Algona Ditch Detections

Figure 2

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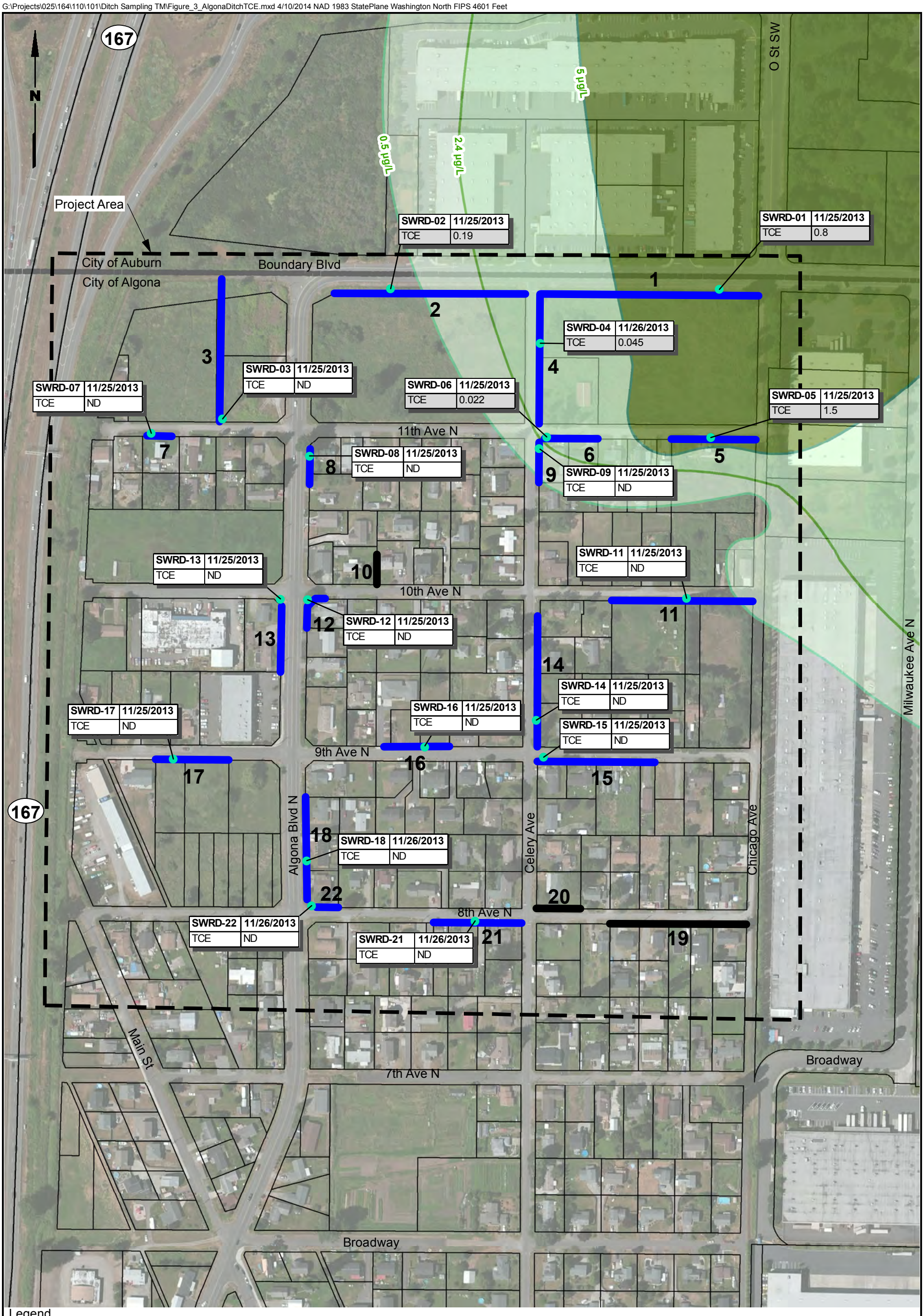

Legend

- Ditch Samples
- 22 Wet Ditch Segment and Designation
- 10 Dry Ditch Segment and Designation (No Sample Collected)
- Project Area
- TCE Contour = > 5.0 µg/L
- TCE Contour = > 2.4 µg/L
- TCE Contour = ≥ 0.5 µg/L

0 250 500

Scale in Feet

Notes

1. All concentrations shown in µg/L.
2. ND = Non-Detect
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Sources: King County GIS 2013; Esri World Imagery.

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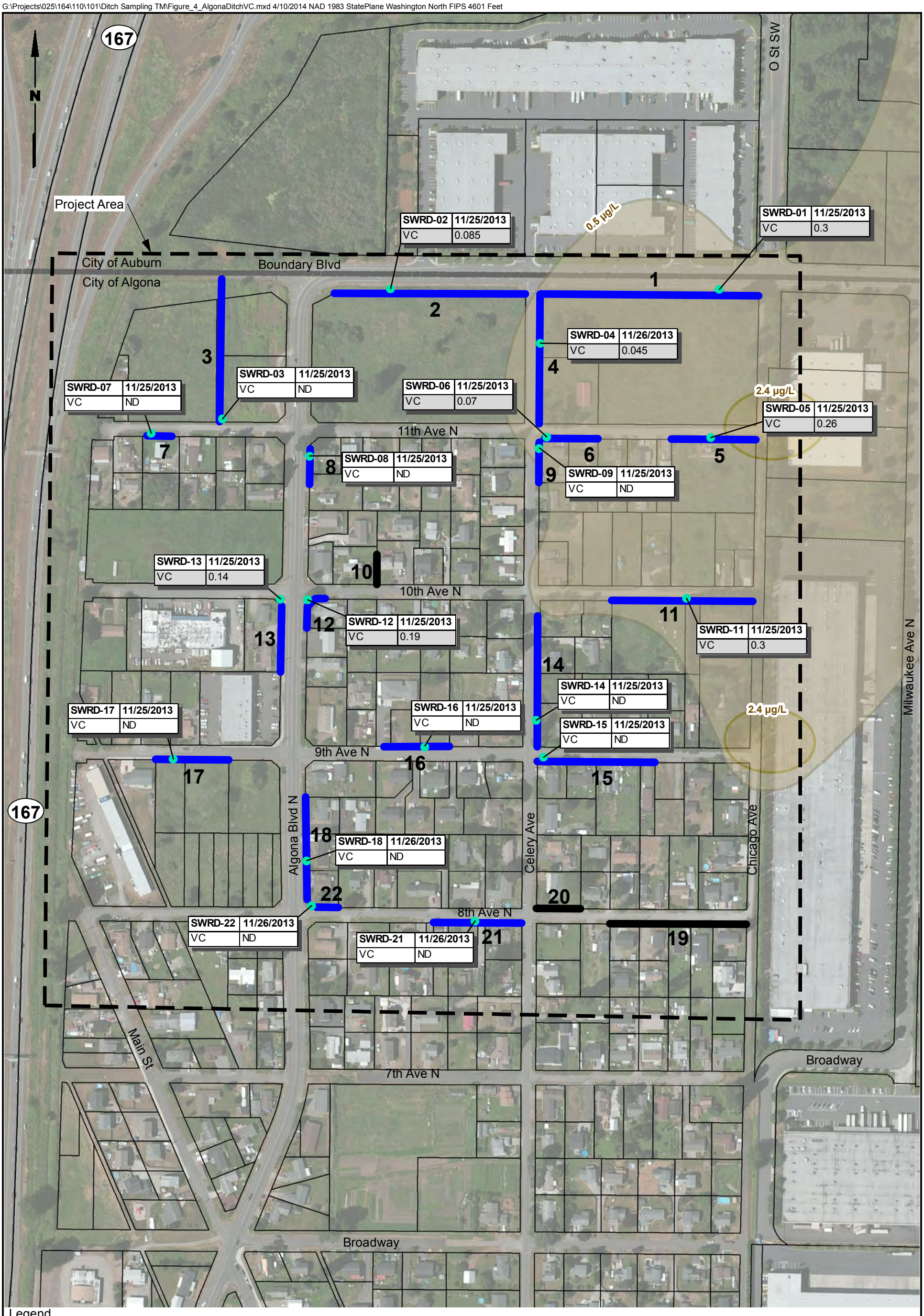
Boeing Auburn Auburn, Washington	**Ditch TCE Concentrations and Shallow Zone Groundwater Concentration Plume (December 2013)**	Figure 3

G:\Projects\025\164\110\101\Ditch Sampling TM\Figure_4_AlgonaDitchVC.mxd 4/10/2014 NAD 1983 StatePlane Washington North FIPS 4601 Feet



Legend

- Ditch Samples
- 22 Wet Ditch Segment and Designation
- 10 Dry Ditch Segment and Designation (No Sample Collected)
- Project Area
- Vinyl Chloride Contour = > 5.0 µg/L
- Vinyl Chloride Contour = > 2.4 µg/L
- Vinyl Chloride Contour = ≥ 0.5 µg/L

0 250 500
Scale in Feet

Data Sources: King County GIS 2013; Esri World Imagery.

Notes
1. All concentrations shown in µg/L.
2. ND = Non-Detect
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

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Boeing Auburn
Auburn, Washington

Ditch Vinyl Chloride Concentrations and Shallow Zone Groundwater Concentration Plume (December 2013)

Figure 4

TABLE 1
DITCH SAMPLING ANALYTICAL RESULTS
SURFACE WATER ANALYTICAL RESULTS
ALGONA, WASHINGTON

	SWRD-01	SWRD-02	Dup of SWRD-02 SWRD-900	SWRD-03	SWRD-04	SWRD-05	SWRD-06
	1436777	1436777	1436777	1436777	1437114	1436774	1436777
	7292933	7292931	7292932	7292927	7295194	7292915	7292928
	11/25/2013	11/25/2013	11/25/2013	11/25/2013	11/26/2013	11/25/2013	11/25/2013
VOLATILES (µg/L)							
EPA Method SW8260C							
Acetone	5.0 U	**8.0**	**5.2**	5.0 U	**12**	**5.4**	**5.2**
Benzene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Bromodichloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromoform	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromomethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Butanone	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Carbon Disulfide	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	**1.2**	0.5 U
Carbon Tetrachloride	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroform	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dibromochloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1-Dichloroethene	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	**0.6**	**0.4**	**0.4**	0.2 U	**0.2**	**1.4**	0.2 U
trans-1,2-Dichloroethene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichloropropane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
cis-1,3-Dichloropropene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
trans-1,3-Dichloropropene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Ethylbenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Hexanone	5.0 U	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	5.0 U
Methylene Chloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Styrene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2,2-Tetrachloroethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Tetrachloroethene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Toluene	**1.2**	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1,2-Trichloro-1,2,2-trifluoroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,1-Trichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-Trichloroethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Trichloroethene	**0.8**	0.2 U	0.2 U	0.2 U	0.2 U	**1.4**	0.2 U
Trichlorofluoromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl Acetate	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl Chloride	**0.3**	0.2 U	0.2 U	0.2 U	0.2 U	**0.2**	0.2 U
m,p-Xylene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
o-Xylene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
VOLATILES (µg/L)							
EPA Method 8260C SIM							
Tetrachloroethene	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U
Trichloroethene	**0.79**	**0.19**	**0.18**	0.020 U	**0.045**	**1.5**	**0.022**
Vinyl Chloride	**0.18**	**0.085**	**0.066**	0.020 U	**0.13**	**0.26**	**0.070**

TABLE 1
DITCH SAMPLING ANALYTICAL RESULTS
SURFACE WATER ANALYTICAL RESULTS
ALGONA, WASHINGTON

	SWRD-07 1436777 7292930 11/25/2013	SWRD-08 1436774 7292916 11/25/2013	SWRD-09 1436777 7292929 11/25/2013	SWRD-11 1436774 7292920 11/25/2013	SWRD-12 1436774 7292918 11/25/2013	SWRD-13 1436774 7292917 11/25/2013	SWRD-14 1436774 7292922 11/25/2013
VOLATILES (µg/L)							
EPA Method SW8260C							
Acetone	**5.2**	**7.6**	**7.9**	**6.9**	**6.6**	**6.1**	**10**
Benzene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Bromodichloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromoform	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromomethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Butanone	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Carbon Disulfide	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Carbon Tetrachloride	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroform	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dibromochloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1-Dichloroethene	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	0.2 U	0.2 U	0.2 U	0.2 U	**0.3**	0.2 U	0.2 U
trans-1,2-Dichloroethene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichloropropane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
cis-1,3-Dichloropropene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
trans-1,3-Dichloropropene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Ethylbenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Hexanone	5.0 U	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	5.0 U
Methylene Chloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Styrene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2,2-Tetrachloroethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Tetrachloroethene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Toluene	0.2 U	**0.8**	0.2 U	**0.2**	0.2 U	0.2 U	0.2 U
1,1,2-Trichloro-1,2,2-trifluoroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,1-Trichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-Trichloroethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Trichloroethene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Trichlorofluoromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl Acetate	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl Chloride	0.2 U	0.2 U	0.2 U	**0.3**	**0.2**	0.2 U	0.2 U
m,p-Xylene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
o-Xylene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
VOLATILES (µg/L)							
EPA Method 8260C SIM							
Tetrachloroethene	0.020 U	0.020 U	0.020 U	0.020 U	**0.15**	**0.12**	0.020 U
Trichloroethene	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U
Vinyl Chloride	0.020 U	0.020 U	0.020 U	**0.2**	**0.19**	**0.14**	0.020 U

TABLE 1
DITCH SAMPLING ANALYTICAL RESULTS
SURFACE WATER ANALYTICAL RESULTS
ALGONA, WASHINGTON

	SWRD-15	SWRD-16	SWRD-17	SWRD-18	SWRD-21	SWRD-22
	1436774	1436774	1436774	1437114	1437114	1437114
	7292921	7292923	7292924	7295196	7295197	7295195
	11/25/2013	11/25/2013	11/25/2013	11/26/2013	11/26/2013	11/26/2013
VOLATILES (µg/L)						
EPA Method SW8260C						
Acetone	**17**	**5.9**	5.0 U	**18**	5.0 U	5.0 U
Benzene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Bromodichloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromoform	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromomethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Butanone	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Carbon Disulfide	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Carbon Tetrachloride	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroform	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dibromochloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1-Dichloroethene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
cis-1,2-Dichloroethene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
trans-1,2-Dichloroethene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichloropropane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
cis-1,3-Dichloropropene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
trans-1,3-Dichloropropene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Ethylbenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Hexanone	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
Methylene Chloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Styrene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2,2-Tetrachloroethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Tetrachloroethene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Toluene	0.2 U	0.2 U	**2.8**	**0.3**	0.2 U	0.2 U
1,1,2-Trichloro-1,2,2-trifluoroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,1-Trichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-Trichloroethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Trichloroethene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Trichlorofluoromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl Acetate	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl Chloride	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
m,p-Xylene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
o-Xylene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
VOLATILES (µg/L)						
EPA Method 8260C SIM						
Tetrachloroethene	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	**0.042**
Trichloroethene	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U
Vinyl Chloride	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U

Bold = Detected compound.
U = Indicates the compound was not detected at the reported concentration.
µg/L = micrograms per liter

TABLE 2
DITCH SAMPLING ANALYTICAL RESULTS
SURFACE WATER DETECTIONS
ALGONA, WASHINGTON

	Screening level	SWRD-01 1436777 7292933 11/25/2013	SWRD-02 1436777 7292931 11/25/2013	Dup of SWRD-02 SWRD-900 1436777 7292932 11/25/2013	SWRD-03 1436777 7292927 11/25/2013	SWRD-04 1437114 7295194 11/26/2013	SWRD-05 1436774 7292915 11/25/2013	SWRD-06 1436777 7292928 11/25/2013	SWRD-07 1436777 7292930 11/25/2013	SWRD-08 1436774 7292916 11/25/2013	SWRD-09 1436777 7292929 11/25/2013	SWRD-11 1436774 7292920 11/25/2013	SWRD-12 1436774 7292918 11/25/2013	SWRD-13 1436774 7292917 11/25/2013
VOLATILES (µg/L)														
EPA Method SW8260C														
Acetone	7200 (a)	5.0 U	**8.0**	**5.2**	5.0 U	**12**	**5.4**	**5.2**	**5.2**	**7.6**	**7.9**	**6.9**	**6.6**	**6.1**
Carbon Disulfide	800 (a)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	**1.2**	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
cis-1,2-Dichloroethene	16 (a)	**0.6**	**0.4**	**0.4**	0.2 U	**0.2**	**1.4**	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**0.3**	0.2 U
Toluene	1300 (b)	**1.2**	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**0.8**	0.2 U	**0.2**	0.2 U	0.2 U
Trichloroethene	58 (c)	**0.8**	0.2 U	0.2 U	0.2 U	0.2 U	**1.4**	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Vinyl Chloride	98 (c)	**0.3**	0.2 U	0.2 U	0.2 U	0.2 U	**0.2**	0.2 U	0.2 U	0.2 U	0.2 U	**0.3**	**0.2**	0.2 U
VOLATILES (µg/L)														
EPA Method 8260C SIM														
Tetrachloroethene	0.69 (b)	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	**0.15**	**0.12**
Trichloroethene	58 (c)	**0.79**	**0.19**	**0.18**	0.020 U	**0.045**	**1.5**	**0.022**	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U
Vinyl Chloride	98 (c)	**0.18**	**0.085**	**0.066**	0.020 U	**0.13**	**0.26**	**0.070**	0.020 U	0.020 U	0.020 U	**0.2**	**0.19**	**0.14**

TABLE 2
DITCH SAMPLING ANALYTICAL RESULTS
SURFACE WATER DETECTIONS
ALGONA, WASHINGTON

	Screening level	SWRD-14 1436774 7292922 11/25/2013	SWRD-15 1436774 7292921 11/25/2013	SWRD-16 1436774 7292923 11/25/2013	SWRD-17 1436774 7292924 11/25/2013	SWRD-18 1437114 7295196 11/26/2013	SWRD-21 1437114 7295197 11/26/2013	SWRD-22 1437114 7295195 11/26/2013
VOLATILES (µg/L)								
EPA Method SW8260C								
Acetone	7200 (a)	**10**	**17**	**5.9**	5.0 U	**18**	5.0 U	5.0 U
Carbon Disulfide	800 (a)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
cis-1,2-Dichloroethene	16 (a)	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Toluene	1300 (b)	0.2 U	0.2 U	0.2 U	**2.8**	**0.3**	0.2 U	0.2 U
Trichloroethene	58 (c)	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Vinyl Chloride	98 (c)	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
VOLATILES (µg/L)								
EPA Method 8260C SIM								
Tetrachloroethene	0.69 (b)	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	**0.042**
Trichloroethene	58 (c)	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U
Vinyl Chloride	98 (c)	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U

Bold = Detected compound.
EPA = Environmental Protection Agency
U = Indicates the compound was not detected at the reported concentration.
µg/L = micrograms per liter

(a) Screening level based on MTCA Method B standard formula value for groundwater as drinking water. No surface water criteria available.
(b) Screening level based on National Recommended Water Quality Criteria for human health for the consumption of water and organisms.
(c) Ecology-approved screening level for Algona ditches based on site-specific exposure criteria (Ecology 2013c).