

**Groundwater Compliance Monitoring
Data Summary Report – August 2010**

318 State Avenue NE Property
Olympia, Washington

for
City of Olympia

October 1, 2010



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Suite 200
Tacoma, Washington 98402
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**Groundwater Compliance Monitoring
Data Summary Report – August 2010**

**318 State Avenue NE Property
Olympia, Washington**

File No. 0415-049-06

October 1, 2010

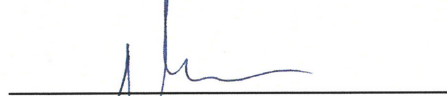
Prepared for:

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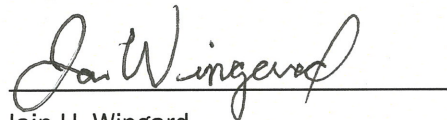
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INTRODUCTION

This data summary report presents the results of groundwater compliance monitoring performed by the City of Olympia (City) in August 2010 at the 318 State Avenue NE property in Olympia, Washington (Property) (Figure 1). Groundwater compliance monitoring at the Property is intended to monitor the natural attenuation of chlorinated organic solvents and associated degradation products identified as chemicals of concern (COCs) in groundwater after completion of the soil remedial action performed in September and October 2009. Remediation of soil and groundwater at the Property is being performed to support the goal of achieving a No Further Action (NFA) determination for the Property under the Washington State Department of Ecology (Ecology) Voluntary Cleanup Program (VCP).

The chlorinated solvents being monitored for natural attenuation as part of groundwater compliance monitoring include tetrachloroethene (PCE) and trichloroethene (TCE) as well as associated degradation products. Monitoring also includes measurement of water quality parameters that are indicators of the natural attenuation. Monitoring of chlorinated solvents, degradation products and natural attenuation parameters is being performed in accordance with the Groundwater Compliance Monitoring Plan (CMP) for the Property (GeoEngineers 2010a).

Groundwater monitoring performed in May 2010 also included analysis to assess potential impacts from the presence of an underground storage tank (UST) at the Property uncovered during the remedial action for soil (GeoEngineers, 2010b). Monitoring to assess potential impacts from the UST was performed in May 2010 in accordance with requirements presented in an email between Iain Wingard, GeoEngineers and Eugene Radcliff, Ecology dated May 11, 2010. Benzene was the only compound detected as a result of the additional analysis performed to assess the potential impacts from the UST. The detected benzene concentrations were an order of magnitude below the Model Toxics Control Act (MTCA) Method A groundwater cleanup levels (CULs). However, continued analysis for benzene was performed during the August 2010 groundwater compliance monitoring event at the request of Ecology.

Groundwater samples were collected on August 24 and 25, 2010 from eight monitoring wells that included MW-3, MW-4, MW-8, MW-9, MW-13 and MW-16 through MW-18 (Figure 2). These samples were submitted to TestAmerica Laboratories of Seattle, Washington, for analysis. Additionally, collection of data to estimate groundwater gradients at the Property was performed by measuring the water levels in all monitoring wells at the site. Groundwater samples were collected from selected monitoring wells and groundwater levels were measured in all wells at the site in accordance with the CMP for the Property (GeoEngineers, 2010a).

The following sections summarize the background for compliance monitoring, field sampling activities, groundwater gradients at the Property and results of groundwater sampling and analysis.

BACKGROUND

Remedial actions were performed in September and October 2009 to remove soil and fill with concentrations of volatile organic compounds (VOCs) including chlorinated solvents, metals and

carcinogenic polycyclic aromatic compounds (cPAHs) that were greater than MTCA CULs. Soil samples were subsequently collected from the boundary of remedial action areas to confirm removal of soil and fill with contaminant concentrations greater than cleanup levels. The results of the soil remedial action are presented in the Remedial Action Construction Report prepared for the Property (GeoEngineers, 2010c).

Compliance monitoring is being performed after completion of soil remedial actions to evaluate the concentrations and natural attenuation of chlorinated organic solvents in groundwater at the Property. The concentrations are compared to the MTCA groundwater CULs for unrestricted land use (ULU). The natural attenuation of chlorinated organic solvents is being monitored via quarterly monitoring that has included the following:

- Installation of two new monitoring wells in May 2010 during the first compliance groundwater monitoring event. Monitoring well MW-17 was installed within Contaminated Soil Zone 1 (CSZ 1) where soil remediation was performed in September and October 2009, and MW-18 was installed north of the CSZ 1 (Figure 2).
- Groundwater sampling at eight monitoring wells including MW-3, MW-4, MW-8, MW-9, MW-13 and MW-16 through MW-18.
- Analysis for chlorinated organic solvents and associated degradation products including PCE, TCE, 1,1-dichloroethene (1,1-DCE), cis-dichloroethene (cis-DCE), trans-dichloroethene (trans-DCE) and vinyl chloride (VC).
- Monitoring for indicators of natural attenuation including ferrous iron, sulfate, dissolved oxygen (DO), pH, electrical conductivity and oxidation-reduction potential (ORP).
- Monitoring of groundwater gradients by measuring water levels at all existing wells at the site.

Additionally, analysis for arsenic is being performed as part of groundwater compliance monitoring to provide additional information concerning arsenic concentrations in the area.

Ecology also requested that groundwater be analyzed for constituents associated with a petroleum hydrocarbon release during the May 2010 groundwater compliance monitoring event to evaluate the potential impacts from a UST uncovered at the Property during the remedial action for soil. The request was made by Ecology during a meeting between representatives of the City and Ecology held on May 10, 2010. The sampling and analysis requirements to assess potential impacts from the former UST were documented in an email from Iain Wingard, GeoEngineers to Eugene Radcliff, Ecology dated May 11, 2010.

The additional analyses requested by Ecology to assess potential impacts from the former UST in the May 11, 2010 email were performed during the May 2010 compliance monitoring event (GeoEngineers, 2010b). Gasoline-, diesel- and oil-range petroleum hydrocarbons, cPAHs, toluene, ethylbenzene, xylenes, 1,2-dibromoethane (EDB), 1,2-dichloroethene (EDC), methyl tert-butyl ether (MTBE), lead and polychlorinated biphenyls (PCBs) were not detected in the groundwater samples at reporting limits less than MTCA Method A CULs. Only benzene was detected in two samples at concentrations well below the MTCA Method A groundwater CUL. Based on the May 2010 sample results, no additional monitoring is necessary to assess potential impacts from the UST or petroleum hydrocarbons at the Property. However, Ecology requested in an email from Eugene

Radcliff of Ecology to Iain Wingard of GeoEngineers dated July 19, 2010 that compliance groundwater monitoring continue to include benzene during the August 2010 monitoring event. Therefore, groundwater compliance monitoring performed in August 2010 included analysis for benzene but did not include any additional analyses related to UST assessment.

FIELD ACTIVITIES

Groundwater compliance monitoring samples were collected on August 24 and 25, 2010 using low-flow/low-turbidity sampling techniques to minimize the suspension of particulates in the samples. Groundwater samples were obtained from the wells using dedicated submersible electric pumps (Whale Pump Brand) with dedicated flexible vinyl tubing. Groundwater was pumped at approximately 0.5 liters per minute from the approximate mid-point of the screened interval to collect the samples.

Water quality parameters were measured during purging using a Horiba U-22 with a flow-through-cell. The measured water quality parameters included electrical conductivity, DO, pH, turbidity, ORP, salinity, total dissolved solids (TDS) and temperature. Groundwater samples were collected once the water quality parameters varied by less than 10 percent on three consecutive measurements. All field measurements were documented on the field logs.

Following well purging, the flow-through-cell was disconnected and the groundwater samples were collected in appropriate laboratory-prepared and -provided containers. The samples were placed into a cooler with ice and delivered to TestAmerica Laboratory in Seattle, Washington, for analysis following appropriate chain-of-custody (COC) procedures. Purge water was stored in labeled 55-gallon drums for future off-site disposal. The groundwater samples were submitted for the following analyses to provide results for the groundwater compliance monitoring analytes specified in the CMP and benzene as requested by Ecology:

- VOCs by Environmental Protection Agency (EPA) Method 8260
- Total metals by EPA Method 6020
- Sulfate by EPA Method 300.0

Ferrous iron was measured in the field using a Hach field test kit and the results were recorded on the field logs prior to sample collection.

GROUNDWATER GRADIENTS

Information necessary to estimate groundwater gradients at the Property were obtained during the August 2010 sampling event by collecting depth to water measurements at all existing monitoring wells. The depth to water measurements were collected from all existing monitoring wells within a close timeframe (i.e., within approximately 20 minutes) prior to performing any groundwater sampling. The groundwater gradients measured in August 2010 continue to indicate a north to northeast groundwater flow direction (Figure 3), which is generally consistent with previous groundwater gradients measured at the Property.

ANALYTICAL RESULTS

The results from groundwater sample collection and analysis performed in August 2010 are summarized in the following sections. The results for the analyses specified in the CMP are presented followed by the results for benzene.

Table 1 summarizes the results for the chemical analyses performed as part of groundwater compliance monitoring in August 2010. Table 1 also includes the results from groundwater compliance monitoring performed in May 2010 for comparison purposes. Table 2 summarizes water quality and natural attenuation parameter measurements collected in August 2010 and also includes the results from May 2010 for comparison. Finally, Appendix A contains the laboratory analytical reports and Appendix B contains the Data Quality Assessment Report presenting the results of data validation of the chemical analyses performed in August 2010.

Groundwater Compliance Monitoring Analyses

Natural Attenuation Parameters

The geochemical indicators of natural attenuation (ferrous iron, sulfate, DO, electrical conductivity, pH, temperature and ORP) collected in August 2010 generally indicate that reducing groundwater conditions were present during the August monitoring event (Table 2). During the August 2010 monitoring event, the indicators suggested that reductive conditions generally existed in areas upgradient, crossgradient and downgradient of where soil remedial actions were performed in 2009. The data also indicate that the groundwater conditions became more reducing between May and August 2010. A comparison of the results between these two periods indicates there was a general increase in ferrous iron concentrations and a general decrease in sulfate concentrations in groundwater samples collected around the soil remedial action area. Similarly, a general reduction in DO concentrations between these two periods downgradient of the soil remedial action area also suggests more reducing conditions. The more reducing conditions are likely related to seasonal changes in groundwater conditions and a reduced amount of surface water infiltration at the Property.

Chlorinated Organic Solvents and Associated Degradation Products

TCE, cis-DCE, trans-DCE and VC were detected in samples collected from the Property in August 2010 (Table 1). The detected concentrations of TCE, cis-DCE and trans-DCE continue to be well below the MTCA groundwater CULs.

VC was detected in the groundwater samples collected from monitoring wells MW-8, MW-16 and MW-18 during the August 2010 sampling event at concentrations greater than the MTCA Method A CUL (Figure 4). VC concentrations were less than the MTCA Method A CUL in all other groundwater samples collected in August 2010.

Arsenic

Arsenic was either not detected or detected at concentrations less than MTCA Method A CUL during the August 2010 monitoring event, except for at monitoring wells MW-4 and MW-13. The concentrations of arsenic in MW-4 and MW-13 were greater than the MTCA Method A CUL.

Benzene

Benzene was detected in samples collected from MW-16 and MW-18 at concentrations that were an order of magnitude below the MTCA Method A groundwater CUL. Benzene was not detected in all other groundwater samples collected in August 2010.

DISCUSSION

The results of the August 2010 compliance monitoring indicate that the concentrations of chlorinated solvents and associated degradation products detected in August are generally less than the results detected during the May 2010 groundwater monitoring event in samples collected within (i.e., MW-17), upgradient (i.e., MW-04) and crossgradient (i.e., MW-03) from the remedial action area for soil (Table 1). The results also indicate that the concentrations of chlorinated solvents and associated degradation products are similar between May and August 2010 in groundwater samples collected downgradient of the soil remedial action area (i.e., MW-08, MW-16 and MW-18). It is plausible that the more reductive conditions observed at the Property during August were more conducive to the degradation of TCE to DCE and less conducive to the degradation of VC. It is anticipated that weaker reducing conditions (i.e., more oxidative conditions) will return during the fall and winter seasons that will be more conducive to the degradation of VC, reducing observed VC concentrations in groundwater.

Arsenic was detected at concentrations greater than the MTCA Method A CUL in groundwater collected from monitoring wells MW-4 and MW-13. The concentration of arsenic was highest in groundwater collected upgradient of the Property at monitoring well MW-13 (Table 1). The arsenic concentration decreased by an order of magnitude and was only slightly greater than the MTCA Method A CUL in groundwater from monitoring well MW-4 located on the southern Property boundary. Arsenic concentrations were less than the CUL in groundwater from all other monitoring locations. The arsenic concentration at MW-13 indicates that there is a potential upgradient source or regional background conditions affecting arsenic concentrations, which is consistent with the results from previous groundwater monitoring events. The results continue to support the position that arsenic is not a chemical of concern for the 318 State Avenue Property.

Benzene was detected in groundwater samples collected downgradient of the soil remedial action area (i.e., MW-16 and MW-18) during the August 2010 monitoring event. The August 2010 benzene concentrations are similar to the May 2010 concentrations and are an order of magnitude below the MTCA Method A CUL. Benzene has never been detected at a concentration greater than the MTCA Method A CUL in groundwater samples collected from the site. The results support the position that benzene is not a chemical of concern for the Property.

The next round of groundwater compliance monitoring is scheduled to be performed in November 2010 in accordance with the CMP.

REFERENCES

GeoEngineers 2010a, Groundwater Compliance Monitoring Plan, 318 State Avenue NE, Olympia, Washington, April 16, 2010.

GeoEngineers 2010b, Groundwater Compliance Monitoring Data Summary Report – May 2010,
318 State Avenue NE, Olympia, Washington, July 16, 2010.

GeoEngineers 2010c, Remedial Action Construction Report, 318 State Avenue NE, Olympia,
Washington, January 5, 2010.

LIMITATIONS

This Groundwater Monitoring Report has been prepared for use by the City of Olympia. GeoEngineers has performed these services in general accordance with the scope and limitations of our proposal.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with the generally accepted environmental science practices for groundwater monitoring in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

TABLE 1

SUMMARY OF GROUNDWATER COMPLIANCE MONITORING PARAMETERS¹ - AUGUST 2010

318 STATE AVENUE SITE
OLYMPIA, WASHINGTON

Analyte	Units	Location	MW-13		MW-04		MW-17		MW-09		MW-03		MW-8				MW-16		MW-18	
		Sample ID:	MW13-052510-W	MW13-082410-W	MW4-052510-W	MW4-082410-W	MW17-052410-W	MW17-082410-W	MW9-052510-W	MW9-082410-W	MW3-052410-W	MW3-082510-W	MW8-052410-W	DUP-1-052410-W ²	MW8-082510-W	DUP-1-082510-W ²	MW16-052410-W	MW16-082510-W	MW18-052410-W	MW18-082510-W
		Sample Date:	05/25/10	08/24/10	05/25/10	08/24/10	05/24/10	08/24/10	05/25/10	08/24/10	05/24/10	08/25/10	05/24/10	05/24/10	08/25/10	08/25/10	05/24/10	08/25/10	05/24/10	08/25/10
		MTCA Method A Cleanup Level																		
Volatile Organic Compounds																				
Tetrachloroethene	µg/l	5	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Trichloroethene	µg/l	5	0.1 U	0.1 U	0.28	0.14	0.26 J	0.1 U	0.1 U	0.1 U	0.48	0.26	0.1 U	0.1 U	0.1 U	0.1 U	0.44	0.46	0.62	0.25
1,1-Dichloroethene	µg/l	4,000,000 ³	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Cis-1,2-Dichloroethene	µg/l	800,000 ³	0.1 U	0.1 U	0.11	0.14	0.1 UJ	0.11	0.1 U	0.1 U	0.14	0.11	0.1 U	0.1 U	0.1 U	0.1 U	0.2	0.32	0.28	0.22
Trans-1,2-Dichloroethene	µg/l	1,600,000 ³	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.18	0.34	0.16	0.13
Vinyl Chloride	µg/l	0.2	0.02 U	0.02 U	0.12	0.074	0.084 J	0.025	0.02 U	0.02 U	0.48	0.12	0.21	0.23	0.29	0.31	0.76	1.0	2.3	1.9
Benzene	µg/l	5	NA	0.1 U	NA	0.1 U	0.17 J	0.1 U	NA	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.12	0.2	0.19
Total Metals																				
Arsenic	mg/L	0.005	0.0041 J	0.058 J	0.0045 J	0.0051 J	0.0031 J	0.002 UJ	0.0016 J	0.002 UJ	0.002 J	0.002 UJ	0.0027 J	0.0027 J	0.0045 J	0.002 UJ	0.0019 J	0.002 UJ	0.0038 J	0.0028 J

Notes:

¹ The parameters presented are the groundwater compliance monitoring parameters specified in the Groundwater Compliance Monitoring Plan (GeoEngineers 2010) and benzene as requested by Ecology in an email from Eugene Radcliff, Ecology to Iain Wingard, GeoEngineers dated July 19, 2010.

² Sample DUP-1-052410-W is a field duplicate of sample MW8-052410-W and sample DUP-1-082510-W is a field duplicate of sample MW8-082510-W.

³ A MTCA Method A groundwater cleanup level has not been established; therefore, the MTCA Method B groundwater cleanup level has been provided.

MTCA = Model Toxics Control Act

µg/l = microgram per liter

mg/L = milligram per liter

U = The analyte was not detected at a concentration greater than the identified reporting limit

J = The analyte concentration is estimated

UJ = The analyte was not detected at a concentration greater than the identified reporting limit and the reporting limit concentration is estimated

NA = Not analyzed

Bold indicates analyte was detected

Green shading indicates sample results for current quarter of monitoring.

Gray shading indicates concentration is greater than cleanup level

TABLE 2
SUMMARY OF GROUNDWATER QUALITY PARAMETERS¹ - AUGUST 2010
318 STATE AVENUE SITE
OLYMPIA, WASHINGTON

Location ID	Sample Date	Ferrous Iron (mg/l)	Sulfate (mg/l)	Dissolved Oxygen (mg/l)	pH	Conductivity (uS/m)	Salinity (%)	Total Dissolved Solids (g/l)	Turbidity (NTU)	Temperature (C)	ORP ² (mv)	Water Level (ft btoc)
MW-13	05/25/10	2.2	6.0	1.23	8.34	156,000	0.1	1	4.74	14.4	-97	2.91
	08/24/10	3.8	1.6	2.21	6.58	999,000	0	0.72	4.16	21.07	-115	3.82
MW-04	05/25/10	4.5	6.7	1.34	7.34	59,500	0	0.38	0.99	13.9	-80	3.29
	08/24/10	3.6	1.2 U	0.72	6.15	645,000	0	0.41	1.82	21.12	-75	4.23
MW-17	05/24/10	0.0	31.0	1.78	7	45,700	0	0.3	2.49	13.5	-23	3.83
	08/24/10	0.0	28.0	0.58	7.04	999,000	0	0.79	9.03	21.5	54	4.53
MW-09	05/25/10	1.6	9.1	1.22	8.8	99,900	0	0.6	0.96	14.8	-157	3.65
	08/24/10	2.2	1.2 U	0.99	6.74	1,450,000	0.1	0.9	1.48	23.16	-89	4.44
MW-03	05/24/10	0.9	7.5	4.38	9.79	272,000	0.1	1.4	0.89	16.2	-211	4.27
	08/25/10	1.4	1.2 U	0.31	6.96	750,000	0	0.48	0.94	21.32	-133	4.99
MW-08	05/24/10	0.3	10.0	1.30	8.45	245,000	0.1	1.6	0.73	14.9	-145	3.45
	08/25/10	3.0	2.5	0.11	7.06	692,000	0	0.44	1.25	21.68	-155	4.50
MW-16	05/24/10	0.0	20.0	2.44	8.19	26,600	0	0.17	2.9	15.1	-116	4.24
	08/25/10	0.4	42.0	0.04	7.26	698,000	0	0.44	1.2	21.91	-106	5.02
MW-18	05/24/10	0.0	34.0	3.92	9.16	90,000	0	0.5	1.9	14.3	-194	4.39
	08/25/10	0.2	11.0	0.00	6.81	719,000	0	0.46	4.12	21.82	-75	5.09

Notes:

¹ Groundwater quality parameters also include the analytes ferrous iron and sulfate to evaluate and monitor natural attenuation.

² ORP field readings are considered to be an estimate.

ORP = Oxidation/reduction potential

mg/l = milligrams per liter

g/l = grams per liter

% = percent

U = The analyte was not detected at a concentration greater than the identified reporting limit

NTU = nephelometric turbidity unit

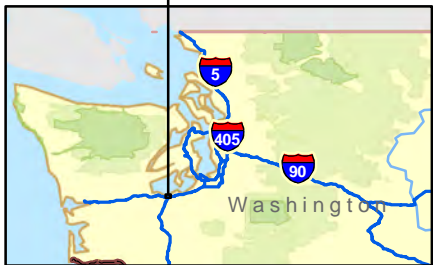
Green shading indicates sample results for current quarter of monitoring

ft btoc = feet below the top of monitoring well casing

mv = Millivolts

uS/m = microSiemens per meter

C = celcius



Notes:

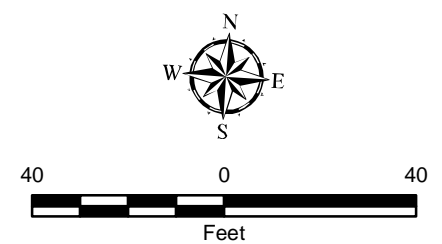
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2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. It is unlawful to copy or reproduce all or any part thereof, whether for personal use or resale, without permission.

Data Sources: 2008 Shaded Relief from ESRI, 2008 Topographic Maps from National Geographic Society
 Projection: NAD_1983_StatePlane_Washington_North_FIPS_4601_Feet
 Datum: D_North_American_1983

Vicinity Map	
318 State Avenue NE Olympia, Washington	
	Figure 1



- Legend**
- MW-03 Monitoring Well Sampled for Groundwater Analysis and used to Monitor Groundwater Gradients
 - MW-01 Monitoring Well used to Monitor Groundwater Gradients
 - CSZ 1 Contaminated Soil Zones (CSZ) Remediated in September-October 2009
 - Approximate Property Boundary



**Groundwater Compliance
Monitoring Locations**

318 State Avenue NE
Olympia, Washington

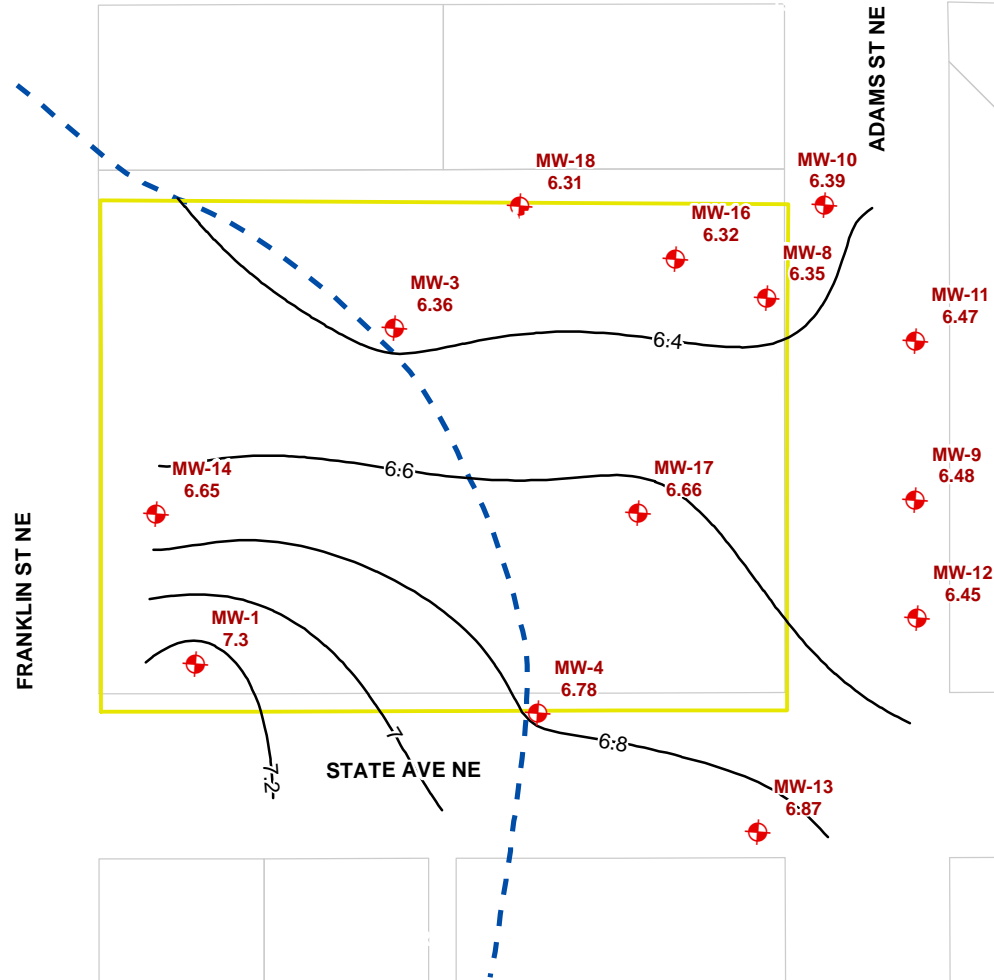
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Figure 2

Notes:
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Data Sources: Approximate Property Boundary from Thurston County parcels (revised by GeoEngineers). Aerial photograph (2009) from Thurston County Data Center. Data Frame Rotated 356 degrees.
 Projection: NAD_1983_StatePlane_Washington_South_FIPS_4602_Feet
 Datum: D_North_American_1983

OLYMPIA AVENUE NE



MW-3
6.36

GeoEngineers Monitoring Well Location, ID and Groundwater Elevations (August 2010) based on mean sea level

Approximate Property Boundary

Parcel Boundary

Historic Shoreline



Potentiometric Surface Map - August 24, 2010 Measurements

318 State Avenue NE
Olympia, Washington



Figure 3

Reference: Approximate Property Boundary from Thurston County parcels (revised by GeoEngineers). Parcels from Thurston County.

Notes:

- The locations of all features shown are approximate.
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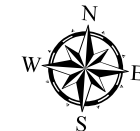


Legend

- MW-03 Monitoring Well Sampled for Groundwater Analysis and used to Monitor Groundwater Gradients
- MW-01 Monitoring Well used to Monitor Groundwater Gradients
- Vinyl Chloride at concentrations greater than MTCA Method A (0.2 ug/L)
- Arsenic at concentrations greater than MTCA Method A (0.005 mg/L)
- CSZ 1 Contaminated Soil Zones (CSZ) Remediated in September-October 2009
- Approximate Property Boundary

MW -13		
Arsenic	August-10	0.058 J mg/L
MW -04		
Arsenic	August-10	0.0051 J mg/L
MW -08/DUPLICATE		
Vinyl Chloride	August-10	0.29/ 0.31 ug/L
MW -16		
Vinyl Chloride	August-10	1.0 ug/L
MW -18		
Vinyl Chloride	August-10	1.9 ug/L

* Results for metals given as total.



Notes:
 1. MTCA = Model Toxics Control Act, mg/L = milligrams per liter, ug/L = micrograms per liter
 2. The locations of all features shown are approximate.
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 Datum: D_North_American_1983

Chemical Analytical Results Exceeding Groundwater Compliance Criteria

318 State Avenue NE
 Olympia, Washington



Figure 4



APPENDIX A
Laboratory Reports (Included on Attached CD)



APPENDIX B
Data Quality Assessment

DATA QUALITY ASSESSMENT SUMMARY
VOLATILE ORGANIC COMPOUNDS BY METHOD SW8260,
SULFATE ANIONS BY METHOD SW300.0,
TOTAL ARSENIC BY METHOD SW6020

TestAmerica Laboratory SDG	Samples Validated (Bold indicates the sample was qualified)
580-21227-1	MW3-082510-W, MW4-082410-W, MW8-082510-W, MW9-082410-W, MW13-082410-W, MW16-082510-W, MW17-082410-W, MW18-082510-W, DUP-1-082510-W

PROJECT: 318 CITY OF OLYMPIA (0415-049-06)

This report documents the results of an Environmental Protection Agency (EPA) level 2a data validation of analytical data from the analyses of groundwater samples and the associated laboratory and field quality control (QC) samples. The review included the following:

- Chain of Custody
- Holding Times
- Surrogates
- Method and Trip Blanks
- Laboratory Control Samples
- Matrix Spikes/Matrix Spike Duplicates
- Laboratory and Field Duplicates
- Interference Check Standards (as referenced in the laboratory case narrative)

DATA PACKAGE COMPLETENESS

TestAmerica, located in Tacoma, Washington, analyzed the groundwater samples evaluated as part of this data validation review. The laboratory provided all required deliverables for the validation according to the National Functional Guidelines. The laboratory followed adequate corrective action processes and all identified anomalies were discussed in the case narrative.

The following sections discuss the data. Based on the review, qualification of the laboratory data was performed in association with a holding time outlier and interference check sample contamination.

OBJECTIVE

The objective of the data validation was to review laboratory analytical procedures and quality control (QC) results to evaluate whether:

- The samples were analyzed using well-defined and acceptable methods that provide detection limits below applicable regulatory criteria;

- The precision and accuracy of the data are well defined and sufficient to provide defensible data; and
- The quality assurance/quality control (QA/QC) procedures utilized by the laboratory meet acceptable industry practices and standards.

Eight (8) groundwater samples and one field duplicate were analyzed by one or more of the analytical methods listed in the title of this appendix:

DATA QUALITY ASSESSMENT SUMMARY

The results for each of the QC elements are summarized below. The data assessment was performed using guidance in the USEPA Contract Laboratory Program *National Functional Guidelines for Inorganic Data Review* (USEPA, 2002) and USEPA Contract Laboratory Program *National Functional Guidelines for Organic Data Review* (USEPA, 2008).

Chain-of-Custody Documentation

Chain-of-custody (COC) forms were provided with the laboratory analytical reports. There were no anomalies noted on the COC forms; proper COC protocols appear to have been followed for this sampling event.

Holding Times

The holding time is defined as the time that elapses between sample collection and sample analysis. Maximum holding time criteria exist for each analysis to help ensure that the analyte concentrations found at the time of analysis reflect the concentration present at the time of sample collection. Established holding times were met for all analyses.

Surrogate Recoveries

A surrogate compound is a compound that is chemically similar to the analytes of interest, but unlikely to be found in any environmental sample. Surrogates are used for organic analyses and are added to all samples, standards and blanks to serve as an accuracy and specificity check of each analysis. The surrogates are added at a known concentration and percent recoveries are calculated following analysis. All surrogate recoveries for field samples were within the laboratory control limits.

Method Blanks

Method blanks are analyzed to ensure that laboratory procedures and reagents do not introduce measurable concentrations of the analytes of interest. Method blanks were analyzed with each batch of samples, at a frequency of 1 per 20 samples. For all sample batches, method blanks for all applicable methods were analyzed at the required frequency. None of the analytes of interest were detected above the reporting limits in any of the method blanks.

Matrix Spikes/Matrix Spike Duplicates (MS/MSD)

Because the actual analyte concentration in an environmental sample is not known, the accuracy of a particular analysis is usually inferred by performing a matrix spike (MS) analysis. One aliquot of sample is analyzed in the normal manner, and then a second aliquot of the sample is spiked with a known amount of analyte concentration and analyzed. From these analyses, a percent recovery (%R) is calculated. Matrix spike duplicates (MSD) analyses are generally performed for organic analyses as a precision check.



For inorganics methods, the matrix spike (referred to as a “spiked sample”) is typically followed by a post spike sample if any element recoveries were outside the control limits in the “spike sample”. In this case, it was not necessary to analyze a post spike sample as there were no positive results in the “spiked sample”.

Matrix spike analyses should be performed once per analytical batch or every 20 field samples, whichever is more frequent. The recovery criteria for matrix spikes and laboratory control samples are specified in the laboratory documents as are the relative percent difference values. The frequency requirements were met for all analyses and the %R/RPD values were within the proper control limits.

Laboratory Control Samples/Laboratory Control Sample Duplicates (LCS/LCSD)

A laboratory control sample is essentially a blank sample that is spiked with a known amount of analyte concentration and analyzed. It is to be treated much like a matrix spike, without the possibility for matrix interference. As there is no actual sample matrix in the analysis, the analytical expectations for accuracy and precision are usually more rigorous and qualification would apply to all samples in the batch, instead of the parent sample only.

Laboratory control sample analyses should be performed once per analytical batch or every 20 field samples, whichever is more frequent. The recovery criteria for laboratory control samples are specified in the laboratory documents as are the relative percent difference values. The frequency requirements were met for all analyses, and the %R/RPD values were within the proper control limits.

Laboratory Duplicates (Metals and Anions only)

Internal laboratory duplicate analyses are performed to monitor the precision of the analyses. Two separate aliquots of a sample are analyzed as distinct samples in the laboratory, and the RPD between the two results is calculated. Duplicate analyses should be performed once per analytical batch. If one or more of the samples used has a concentration greater than five times the reporting limit for that sample, the absolute difference is used instead of the RPD.

Laboratory duplicates were analyzed at the proper frequency and the specified acceptance criteria were met in all cases.

Field Replicates/Duplicates

Field duplicate samples were collected and analyzed along with the reviewed sample batches. The duplicate samples were analyzed for the same parameters as the associated parent samples. As mentioned above for the laboratory duplicates the RPD is used as the criteria for assessing precision, unless one or more of the samples used has a concentration greater than five times the reporting limit for that sample, the absolute difference is used instead of the RPD.

Sample DUP-1-082510-W: This sample was a field duplicate of Sample MW8-082510-W. Arsenic was detected in Sample MW8-082510-W, but not in Sample DUP-1-082510. As the absolute difference was greater than the reporting limit, the positive results and reporting limits for all associated samples were qualified as estimated (J/UJ).

Interference Check Standard

The metals ICP/MS analysis requires the use of an interference check sample which verifies the instruments ability to overcome isobaric interferences (unrelated ions with the same mass as the target ions) typical of those found in environmental samples. The check standard consists of two solutions



which are to be analyzed consecutively before every analytical batch. The purpose of the first solution is to determine whether any unspiked interferences exist in the analysis, the purpose of the second solution is to determine whether the accuracy of the instrumentation is consistent with a known spiked concentration of a target analyte.

All Samples: The laboratory found that the first solution described above exhibited trace amounts of contamination for arsenic. The percent recovery (%R) of the second solution was within the control limits for all analytical batches. The positive results and reporting limits for arsenic were qualified as estimated (J/UJ) to signify a potential bias in the data.

OVERALL ASSESSMENT

As was determined by this data validation, the laboratory followed the specified analytical methods. Accuracy was acceptable, as demonstrated by the surrogate, LCS/LCSD, and MS/MSD %R values. Precision was acceptable, as demonstrated by the field duplicate, laboratory duplicate, LCS/LCSD and MS/MSD RPD and absolute difference values.

Data were qualified as estimated because of field duplicate and interference check standard outliers.

In general, the data are acceptable for use as qualified.

