



City of Bothell™

Public Works Department

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Bothell, WA 98011

LETTER OF TRANSMITTAL

Phone (425) 806-6800
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Date: May 9, 2017

Company: Department of Ecology
Attn: Sunny Becker NWRO Toxics
Address: Cleanup Program 3190 - 160th SE
Bellevue, WA 98008

From: Nduta Mbuthia, Project Engineer, Capital Projects Division

Attached please find: Electronic copy of:-

1) Letter Report (5/8/2017) - YR 4, QTR 1 Groundwater Monitoring Report for Riverside Site

- | | |
|---|---|
| <input type="checkbox"/> For your information/files | <input type="checkbox"/> For your action |
| <input checked="" type="checkbox"/> At your request | <input type="checkbox"/> Approved as noted |
| <input type="checkbox"/> Returned for correction | <input type="checkbox"/> Please return all copies |
| <input type="checkbox"/> Other: | |

Comments: N/A



May 8, 2017

HWA Project No. 2007 098- 2012

Ms. Sunny Becker
Washington Department of Ecology
Toxics Cleanup Program, Northwest Regional Office
3190 - 160th SE Bellevue, WA 98008

Subject: **GROUND WATER MONITORING RESULTS
YEAR 4, QUARTER 1 – APRIL 2017
Riverside HVOC Site
Bothell, Washington**

Dear Ms. Becker:

This report describes quarterly ground water monitoring results at the Riverside HVOC Site, hereafter referred to as “the Site”, located in downtown Bothell, Washington.

Ground water remediation is being performed as an interim action, in response to tetrachloroethene (PCE) and its degradation products in shallow ground water at concentrations exceeding Model Toxics Control Act (MTCA) Method A cleanup levels. The interim action is being performed in accordance with the Interim Action Work Plan (IAWP) dated January 7, 2013 and per the scope of work set forth in Amendment 2 to Agreed Order DE 6295, dated April 19, 2013, between the City of Bothell (City) and the Washington State Department of Ecology (Ecology). Remediation is being performed via pump-and-treat methods, which includes ground water extraction and discharge to the sanitary sewer via King County Industrial Waste Discharge permit 4268-01. The remediation system currently includes six active extraction wells (EW-1 through EW-6) and 11 monitoring wells (RMW-4 through RMW-13 and BC-3).

Figure 1 shows a site plan with well locations. Ground water monitoring and remediation activities are described below.

GROUND WATER REMEDIATION ACTIVITIES

The ground water extraction and treatment system began operation in December 2013 and is still operating. Ground water extraction from the remediation system is measured via a totalizing flow meter placed in the effluent pipe that discharges to the King County sanitary sewer.

Quarterly discharge reports are submitted to King County Industrial Waste Division using standard forms provided by King County. The quarterly discharge report for this

quarter is attached for reference (Appendix A). Effluent samples were collected from extraction wells EW-1 through EW-6 during the last round of sampling. In addition, each quarter of sampling included collection of a sample from the combined discharge effluent from the remediation system. Sampling dates for extraction wells are shown in Table 1.

COMPLIANCE GROUND WATER MONITORING

This section describes performance monitoring of ground water performed during the interim action.

- First year (2014) ground water monitoring events were performed in April, June, September and December 2014.
- Second year (2015) ground water monitoring events were performed in March, June, September, and December 2015.
- Third year (2016) ground water monitoring events were performed in March, June, September, and December 2016/early January 2017.
- Fourth year (2017) ground water monitoring event was performed in April, with three subsequent rounds remaining and tentatively scheduled for June, September, and December 2017.

All monitoring events have included sampling some wells on a quarterly basis and some wells on a semi-annual basis in accordance with the IAWP (see Table 1).

Performance monitoring is performed to confirm that the interim action has attained cleanup standards. Performance monitoring includes collection of ground water samples from the extraction wells and selected monitoring wells, as described in Table 1 (excerpted from the IAWP).

Performance monitoring samples are analyzed for halogenated volatile organic compounds (HVOCs) and field parameters (temperature, dissolved oxygen, oxygen reduction potential, specific conductivity, and pH).

GROUND WATER ANALYTICAL RESULTS

Analytical results for ground water samples are summarized in Table 2. Figures 2, 3, and 4 show graphs of HVOCs over time as follows:

- Figure 2 - Monitoring wells, PCE vs time
- Figure 3 - Extraction wells, PCE vs time
- Figure 4 - RMW-7 HVOCs vs. time

Sampling events in September 2009 and May 2013 provide ground water chemistry data from when the wells were installed, and base-line ground water chemistry data prior to initial operation of the ground water treatment system. Review of analytical results for monitoring well samples provides the following observations:

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- HVOC concentrations in the monitoring wells, including RMW-7 at the point of compliance near the river, had decreased from 2009 to 2013, before the treatment system was installed.
- After the treatment system was started in December 2013, PCE and trichloroethene (TCE) concentrations in monitoring well RMW-7 have changed seasonally, but generally show decreasing concentrations. The concentration of degradation product cis 1,2-dichloroethene ((cis) 1,2-DCE) has also decreased, with seasonal fluctuations, while vinyl chloride (VC) concentrations have generally remained within the same range. Results from this most recent quarter show a significant decrease in both (cis) 1,2-DCE and VC, however as mentioned above, this may be because of seasonal changes.

Review of analytical results for extraction well samples provides the following observations and trends:

- HVOC concentrations in the four original extraction wells after the treatment system was started have changed seasonally, but have generally remained within the same range.
- Wells EW-1, EW-2, and EW-3 have generally contained PCE and/or TCE exceeding the MTCA Method A cleanup levels. EW-3 has also exhibited concentrations of (cis) 1,2-DCE) and/or VC that exceed the MTCA Method A cleanup levels. Other HVOC degradation products have either been non-detect or detected at concentrations below the MTCA cleanup levels.
- Out of the four original extraction wells, well EW-4 has the lowest HVOC concentrations, with PCE concentrations ranging from below MTCA cleanup levels to non-detect in the four previous rounds of sampling. TCE in EW-4 has been detected below the MTCA cleanup level for the last nine rounds of sampling. Except for VC, other degradation products detected in EW-4 have either been non-detect or below the MTCA cleanup levels. VC has been detected above cleanup levels since pumping started in EW-4.
- The PCE and VC concentrations in EW-5 was above the MTCA cleanup level. Other degradation products were either below cleanup levels or non-detect in EW-5. PCE, TCE, and DCE were detected at concentrations below the MTCA cleanup levels in EW-6 while other degradation products were non-detect in this well. As this was the second round of monitoring of these new extraction wells, trends for these wells can not be determined.

GROUND WATER TREATMENT SYSTEM PERFORMANCE DATA

Treatment system performance data is collected on at least a monthly basis.

Total discharge to-date is 9,050,000 gallons based on totalizer readings at the discharge

outlet to the sanitary sewer. Average flows have been around 10,000 to 15,000 gallons per day.

CONCLUSIONS AND RECOMMENDATIONS

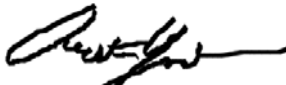
Analytical results of the quarterly monitoring indicate all extraction wells have been and continue to recover HVOC-impacted ground water. Analytical results indicate decreasing trends in HVOC concentrations at EW-4, BC-3 and RMW-7, suggesting some shrinking of the plume, although the generally similar concentrations in the other wells suggest a steady state condition, where HVOCs from upgradient areas may be replacing ground water pumped from the system. The new extraction wells (EW-5 and 6) show very little change between quarters, with HVOC impacts in both wells but only EW-5 with concentrations above cleanup levels; however, it is too early to discern a trend from these wells. The extraction system is, however, acting as a barrier and capturing HVOC-impacted ground water that might otherwise be discharging into the river, as intended.

In summary, the analytical results from the ground water monitoring and extraction wells show that the treatment system is effectively collecting HVOC-impacted ground water. We recommend continued operation of the treatment system. No augmentation or modifications of the system appear warranted other than what is needed as part of normal operation and maintenance.




We appreciate the opportunity to provide our services to you on this project. Please feel free to contact me if you have any questions or need additional information.

Sincerely,
HWA GEOSCIENCES INC.



Austin York
Geologist



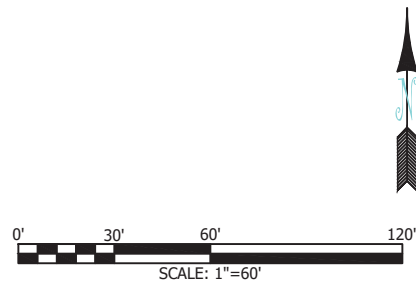
Arnie Sugar, LG, LHG
Principal Hydrogeologist

Attachments:

- Table 1, Performance Monitoring per the IAWP
- Table 2, Ground water analytical results, including new wells
- Figure 1, Site plan
- Figure 2, Monitoring wells, PCE vs time
- Figure 3, Extraction wells, PCE vs time
- Figure 4, MW-7 HVOCs vs. time
- Figure 5: HVOCs in Ground water
- Appendix A: King County Industrial Waste Report

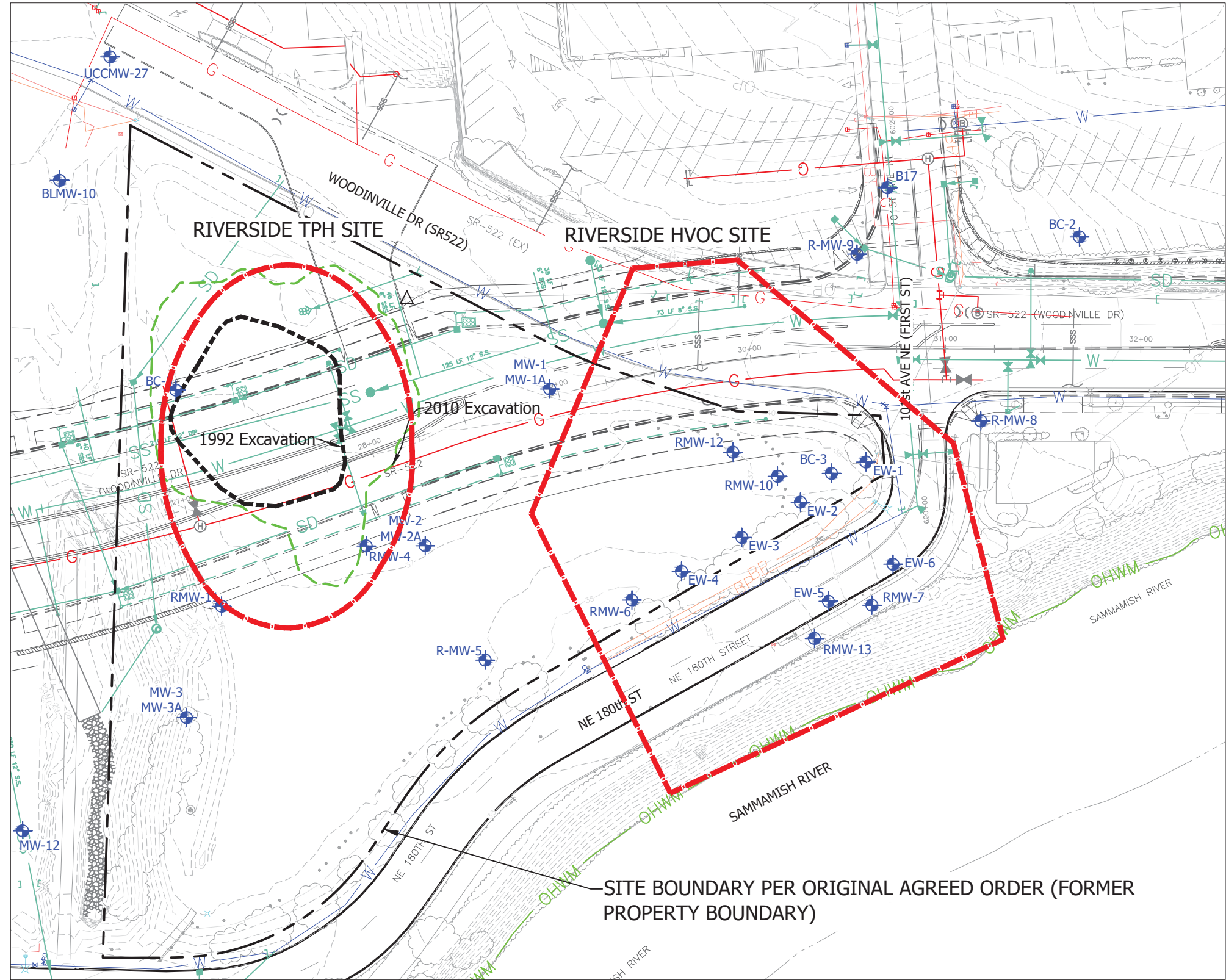
Table 1
Performance Monitoring
Bothell Riverside Site

Sample Type	Sampling Location	Sampling Frequency / Rationale
Preliminary Point of Compliance	Extraction well 1 Extraction well 2 Extraction well 3 Extraction well 4 Extraction well 5 (added 12/16) Extraction well 6 (added 12/16) RMW-7	Quarterly for one year, then modify based on results and consultation with Ecology (e.g. move to semi-annual if concentrations stabilize)
Combined discharge	Combined discharge at sewer manhole or manifold	As required by KCIWD permit
Nearby wells	BC-3 RMW-4 RMW-5 RMW-6 RMW-8 RMW-9 RMW-10 RMW-12 (added 12/16) RMW-13 (added 12/16)	Semi-annual for one year, then modify based on results and consultation with Ecology to check for water quality impacts due to pumping



EXPLANATION OF SYMBOLS

- APPROXIMATE EXTENT OF 2010 CLEANUP EXCAVATION
- APPROXIMATE EXTENT OF 1990'S CLEANUP
- APPROXIMATE PROPERTY BOUNDARY
- SITE BOUNDARY
- RMW-13 MONITORING WELL LOCATIONS
- EW-13 EXTRACTION WELL LOCATIONS



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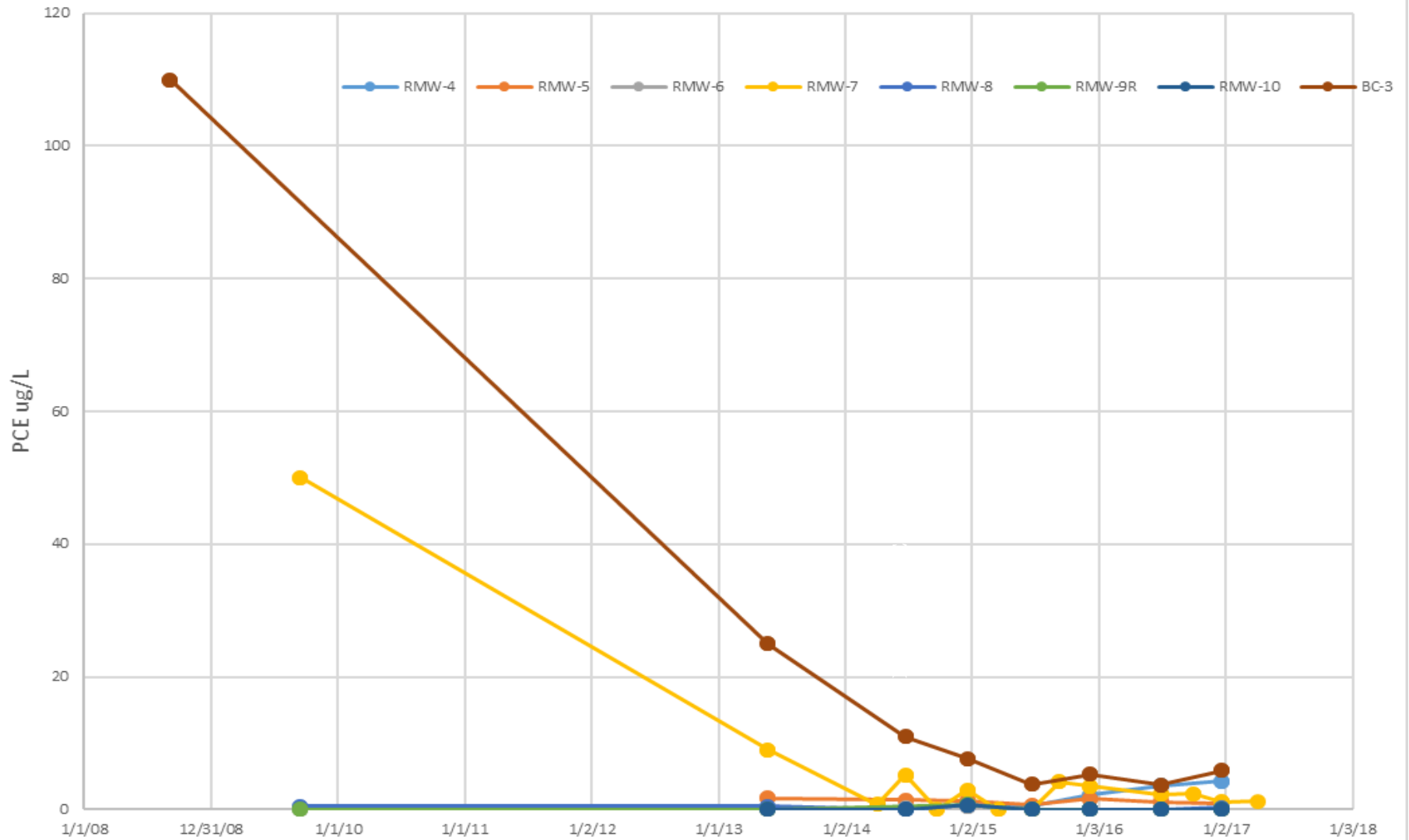
**BOTHELL RIVERSIDE HVOC SITE
BOTHELL, WASHINGTON**

**Site Plan
Showing Well
Locations**

DRAWN BY EFK
CHECK BY NK
DATE
1.26.17

FIGURE NO.
1
PROJECT NO.
2007-098 T2012

RIVERSIDE MONITORING WELLS PCE (ug/L)



HWA GEOSCIENCES INC.

MONITORING WELLS PCE (UG/L)

BOTHELL RIVERSIDE HVOC SITE
BOTHELL, WASHINGTON

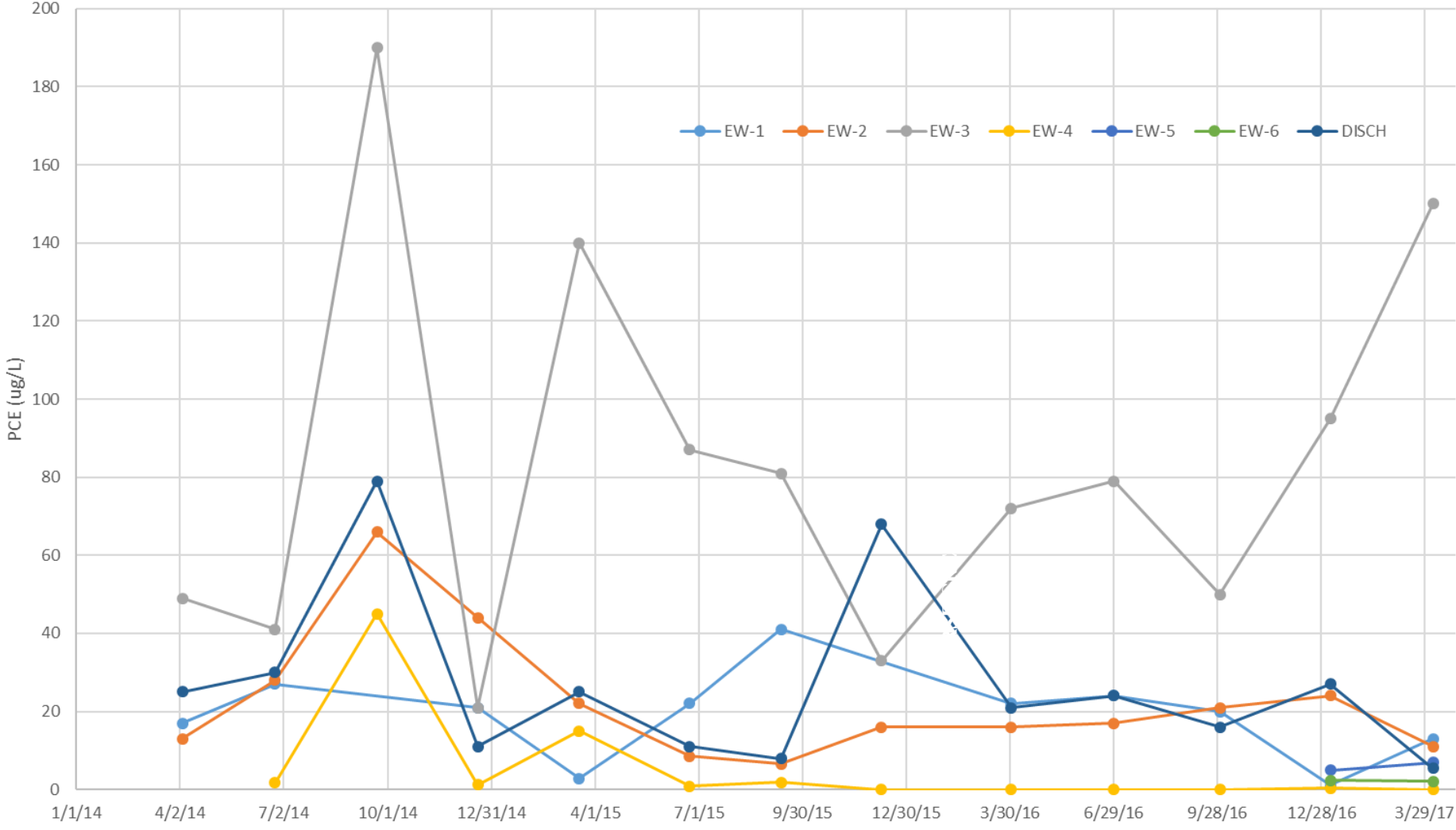
FIGURE NO.

2

PROJECT NO

2007-098

RIVERSIDE EXTRACTION WELLS PCE (ug/L)

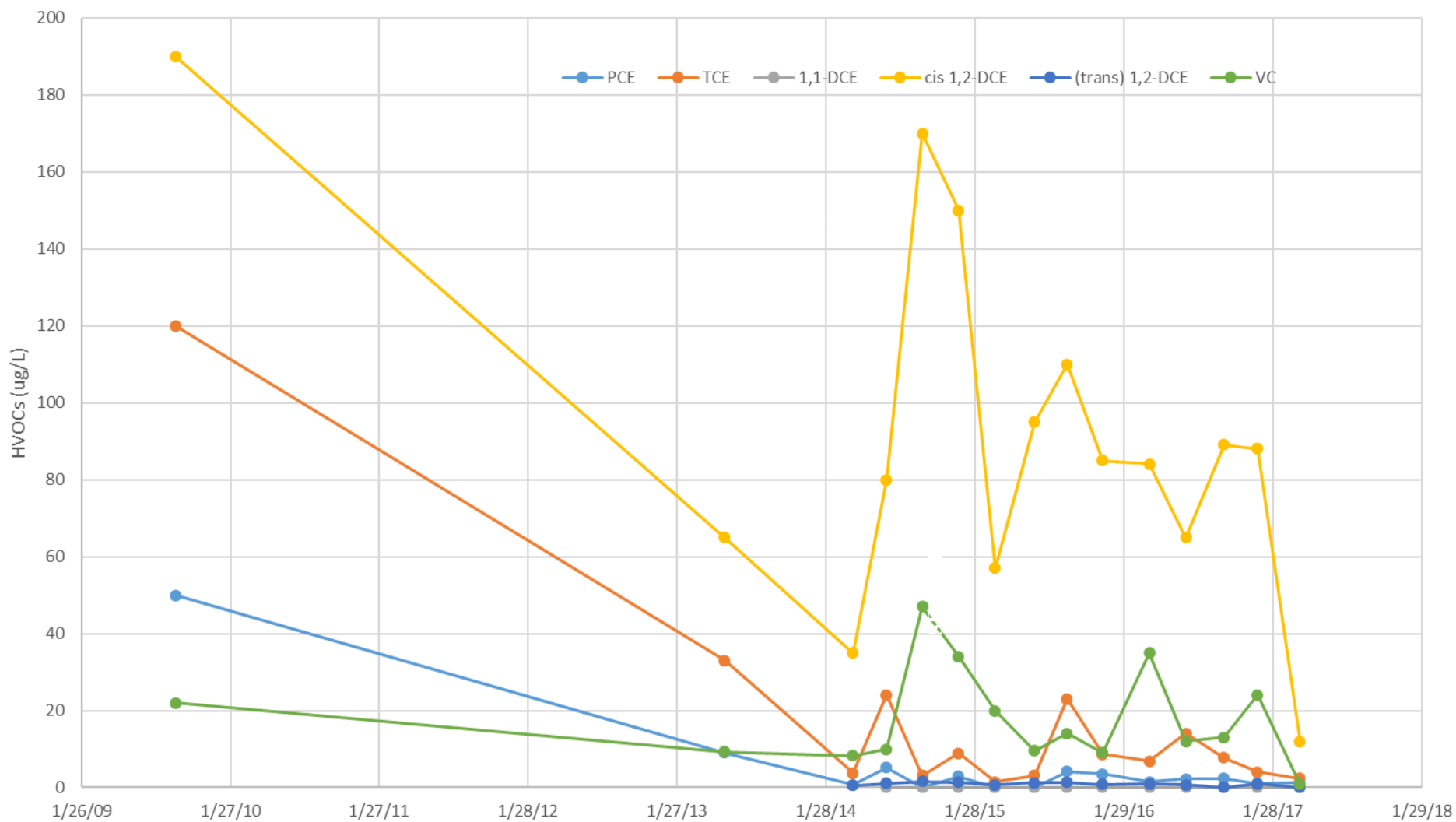


HWA GEOSCIENCES INC.

EXTRACTION WELLS PCE (UG/L)
 BOTHELL RIVERSIDE HVOC SITE
 BOTHELL, WASHINGTON

FIGURE NO.
3
 PROJECT NO
 2007-098

RMW-7 HVOCs/Time



HWA GEOSCIENCES INC.

RMW-7 HVOCs (UG/L)

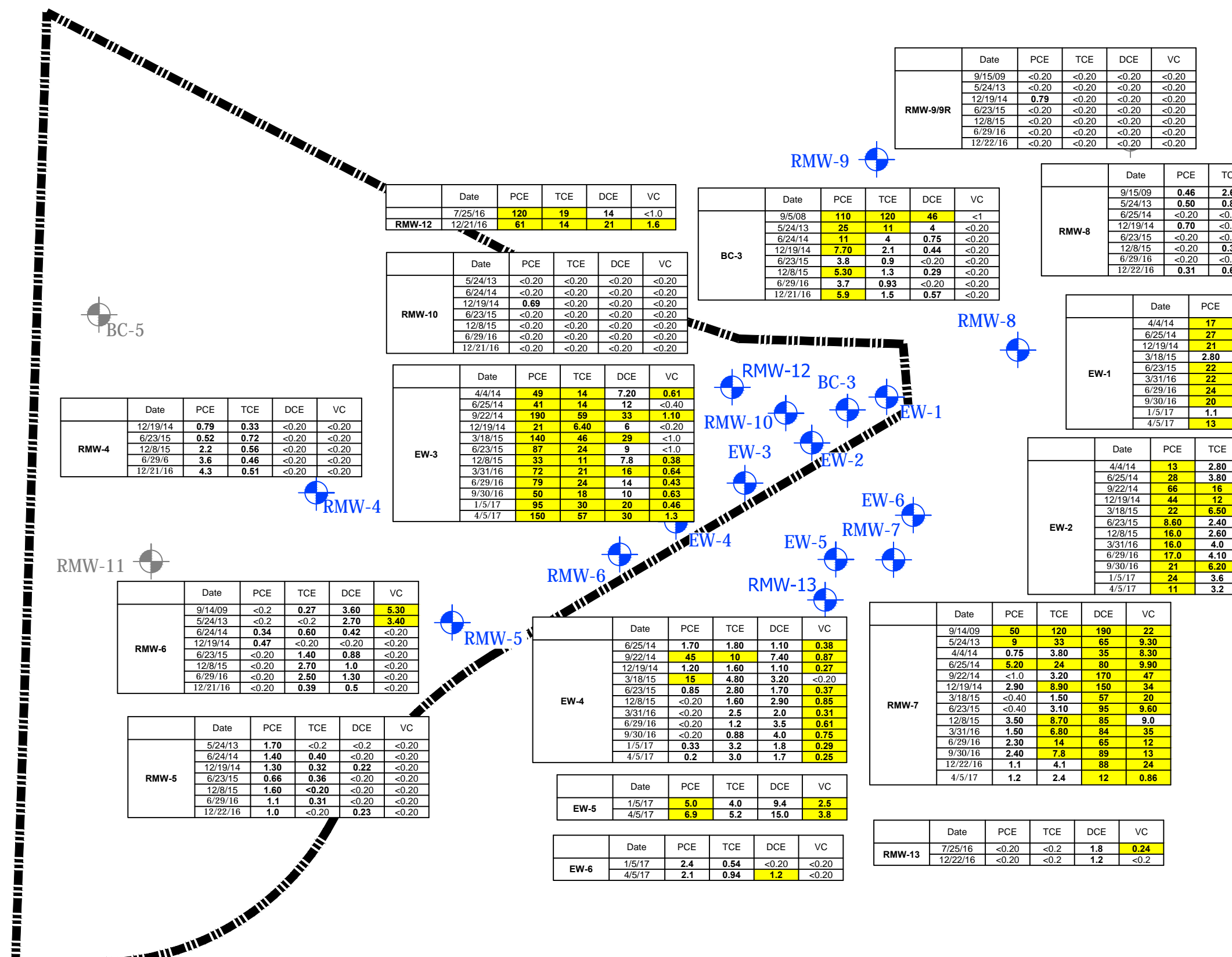
BOTHELL RIVERSIDE HVOC SITE
BOTHELL, WASHINGTON

FIGURE NO.

4

PROJECT NO

2007-098



	Date	PCE	TCE	DCE	VC
RMW-9/9R	9/15/09	<0.20	<0.20	<0.20	<0.20
	5/24/13	<0.20	<0.20	<0.20	<0.20
	12/19/14	0.79	<0.20	<0.20	<0.20
	6/23/15	<0.20	<0.20	<0.20	<0.20
	12/8/15	<0.20	<0.20	<0.20	<0.20
	6/29/16	<0.20	<0.20	<0.20	<0.20
	12/22/16	<0.20	<0.20	<0.20	<0.20

	Date	PCE	TCE	DCE	VC
RMW-12	7/25/16	120	19	14	<1.0
	12/21/16	61	14	21	1.6

	Date	PCE	TCE	DCE	VC
BC-3	9/5/08	110	120	46	<1
	5/24/13	25	11	4	<0.20
	6/24/14	11	4	0.75	<0.20
	12/19/14	7.70	2.1	0.44	<0.20
	6/23/15	3.8	0.9	<0.20	<0.20
	12/8/15	5.30	1.3	0.29	<0.20
	6/29/16	3.7	0.93	<0.20	<0.20
12/21/16	5.9	1.5	0.57	<0.20	

	Date	PCE	TCE	DCE	VC
RMW-8	9/15/09	0.46	2.60	1.30	<0.2
	5/24/13	0.50	0.85	0.44	<0.2
	6/25/14	<0.20	<0.20	<0.20	<0.20
	12/19/14	0.70	<0.20	<0.20	<0.20
	6/23/15	<0.20	<0.20	<0.20	<0.20
	12/8/15	<0.20	0.39	0.47	<0.20
	6/29/16	<0.20	<0.20	<0.20	<0.20
	12/22/16	0.31	0.66	0.37	<0.20

	Date	PCE	TCE	DCE	VC
RMW-10	5/24/13	<0.20	<0.20	<0.20	<0.20
	6/24/14	<0.20	<0.20	<0.20	<0.20
	12/19/14	0.69	<0.20	<0.20	<0.20
	6/23/15	<0.20	<0.20	<0.20	<0.20
	12/8/15	<0.20	<0.20	<0.20	<0.20
	6/29/16	<0.20	<0.20	<0.20	<0.20
12/21/16	<0.20	<0.20	<0.20	<0.20	

	Date	PCE	TCE	DCE	VC
EW-1	4/4/14	17	3	1.20	<0.20
	6/25/14	27	8.10	6.50	<0.20
	12/19/14	21	2.60	0.82	<0.20
	3/18/15	2.80	0.27	<0.20	<0.20
	6/23/15	22	2	0.95	<0.20
	3/31/16	22	2.8	2.5	<0.20
	6/29/16	24	4.2	4.5	<0.20
	9/30/16	20	2.0	2.3	<0.20
1/5/17	1.1	<0.20	<0.20	<0.20	
4/5/17	13	1.2	0.85	<0.20	

	Date	PCE	TCE	DCE	VC
RMW-4	12/19/14	0.79	0.33	<0.20	<0.20
	6/23/15	0.52	0.72	<0.20	<0.20
	12/8/15	2.2	0.56	<0.20	<0.20
	6/29/16	3.6	0.46	<0.20	<0.20
	12/21/16	4.3	0.51	<0.20	<0.20

	Date	PCE	TCE	DCE	VC
EW-3	4/4/14	49	14	7.20	0.61
	6/25/14	41	14	12	<0.40
	9/22/14	190	59	33	1.10
	12/19/14	21	6.40	6	<0.20
	3/18/15	140	46	29	<1.0
	6/23/15	87	24	9	<1.0
	12/8/15	33	11	7.8	0.38
	3/31/16	72	21	16	0.64
	6/29/16	79	24	14	0.43
	9/30/16	50	18	10	0.63
	1/5/17	95	30	20	0.46
4/5/17	150	57	30	1.3	

	Date	PCE	TCE	DCE	VC
EW-2	4/4/14	13	2.80	1.50	<0.20
	6/25/14	28	3.80	1.50	<0.20
	9/22/14	66	16	12	<0.40
	12/19/14	44	12	12	<0.40
	3/18/15	22	6.50	4.30	<0.20
	6/23/15	8.60	2.40	1.80	<0.20
	12/8/15	16.0	2.60	2.40	<0.20
	3/31/16	16.0	4.0	3.70	<0.20
	6/29/16	17.0	4.10	3.20	<0.20
	9/30/16	21	6.20	5.6	<0.20
	1/5/17	24	3.6	1.7	<0.20
4/5/17	11	3.2	2.2	<0.20	

	Date	PCE	TCE	DCE	VC
RMW-6	9/14/09	<0.2	0.27	3.60	5.30
	5/24/13	<0.2	<0.2	2.70	3.40
	6/24/14	0.34	0.60	0.42	<0.20
	12/19/14	0.47	<0.20	<0.20	<0.20
	6/23/15	<0.20	1.40	0.88	<0.20
	12/8/15	<0.20	2.70	1.0	<0.20
	6/29/16	<0.20	2.50	1.30	<0.20
12/21/16	<0.20	0.39	0.5	<0.20	

	Date	PCE	TCE	DCE	VC
EW-4	6/25/14	1.70	1.80	1.10	0.38
	9/22/14	45	10	7.40	0.87
	12/19/14	1.20	1.60	1.10	0.27
	3/18/15	15	4.80	3.20	<0.20
	6/23/15	0.85	2.80	1.70	0.37
	12/8/15	<0.20	1.60	2.90	0.85
	3/31/16	<0.20	2.5	2.0	0.31
	6/29/16	<0.20	1.2	3.5	0.61
	9/30/16	<0.20	0.88	4.0	0.75
	1/5/17	0.33	3.2	1.8	0.29
4/5/17	0.2	3.0	1.7	0.25	

	Date	PCE	TCE	DCE	VC
RMW-7	9/14/09	50	120	190	22
	5/24/13	9	33	65	9.30
	4/4/14	0.75	3.80	35	8.30
	6/25/14	5.20	24	80	9.90
	9/22/14	<1.0	3.20	170	47
	12/19/14	2.90	8.90	150	34
	3/18/15	<0.40	1.50	57	20
	6/23/15	<0.40	3.10	95	9.60
	12/8/15	3.50	8.70	85	9.0
	3/31/16	1.50	6.80	84	35
	6/29/16	2.30	14	65	12
	9/30/16	2.40	7.8	89	13
	12/22/16	1.1	4.1	88	24
4/5/17	1.2	2.4	12	0.86	

	Date	PCE	TCE	DCE	VC
RMW-5	5/24/13	1.70	<0.2	<0.2	<0.20
	6/24/14	1.40	0.40	<0.20	<0.20
	12/19/14	1.30	0.32	0.22	<0.20
	6/23/15	0.66	0.36	<0.20	<0.20
	12/8/15	1.60	<0.20	<0.20	<0.20
	6/29/16	1.1	0.31	<0.20	<0.20
12/22/16	1.0	<0.20	0.23	<0.20	

	Date	PCE	TCE	DCE	VC
EW-5	1/5/17	5.0	4.0	9.4	2.5
	4/5/17	6.9	5.2	15.0	3.8

	Date	PCE	TCE	DCE	VC
EW-6	1/5/17	2.4	0.54	<0.20	<0.20
	4/5/17	2.1	0.94	1.2	<0.20

	Date	PCE	TCE	DCE	VC
RMW-13	7/25/16	<0.20	<0.2	1.8	0.24
	12/22/16	<0.20	<0.2	1.2	<0.2

EXPLANATION OF SYMBOLS

RIVERSIDE WELLS MONITORED

RIVERSIDE EXTRACTION WELL LOCATIONS

PCE = Tetrachloroethene (µg/L)
TCE = Trichloroethene (µg/L)
DCE = (cis)1,2- Dichloroethene (µg/L)
VC = Vinyl chloride (µg/L)

ORIGINAL PARCELS



HWA GEOSCIENCES INC.

**BOTHELL RIVERSIDE HVOC SITE
 BOTHELL WASHINGTON**

**HVOCs MONITORING
 GROUND WATER**

DRAWN BY <u>EFK</u>	FIGURE NO. 5
CHECK BY <u>NK</u>	PROJECT NO.
11.07.16	2007-098 T2012

APPENDIX A

**YEAR 2016 QUARTERLY KING COUNTY INDUSTRIAL WASTE
REPORTS**



Industrial Waste Quarterly Self-Monitoring Report

King County

Send to: King County Industrial Waste
130 Nickerson Street, Suite 200
Seattle, WA 98109-1658
Phone 206-263-3000 / FAX 206-263-3001
Email: info.KCIW@kingcounty.gov

Company Name: Bothell, City of - Riverside Groundwater Remediation Site

This form is available at www.kingcounty.gov/industrialwaste.

Please specify year: **2017**


QUARTER 1

Sample Site No.: IW1175A

Permit/DA No.: 4268-01

Month	Sample Date	Sample Type C (Composite) G (Grab) BC (Batch)	1,2-Dichloro-ethylene (Total cis & trans) (µg/l)	Tetrachloro-ethylene (PCE) (µg/l)	Trichloro-ethylene (TCE) (µg/l)	Vinyl Chloride (µg/l)	1,1-Dichloro-ethane (µg/l)	Settleable Solids (ml/L)	Discharge Volume on sample day (gallons)	Total Monthly Flow (gallons)
January										
	Total volume discharged for January									592,380
February										
	Total volume discharged for February									209,187
March										
	3/31/16	G	2.4	5.4	2.3	0.32	<0.20	0	14,390	
	Total volume discharged for March									449,360

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. I further certify that all data requiring a laboratory analysis were analyzed by a Washington State Department of Ecology accredited laboratory for each parameter tested

Arnie Sugar, Designated rep. for City of Bothell

Signature of Principal Executive or Authorized Agent
Date 4 / 14 / 17

Due date: First quarter report is due by April 15 each year.