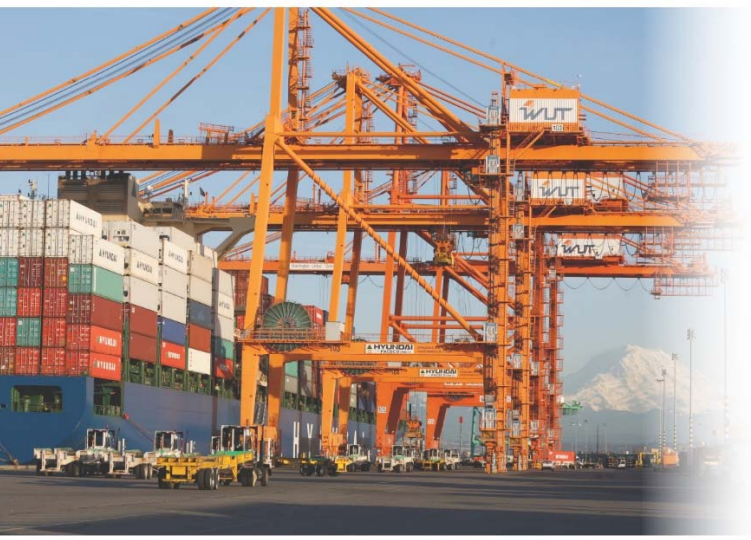

Groundwater Monitoring Report

Former Cascade Timber No. 3 Log Sort Yard

Port of Tacoma
Tacoma, Washington

Consent Decree No. 94-2-03590-3
Consent Decree Date: April 11, 1994
Monitoring Date: February 12, 2015

Prepared for
Port of Tacoma

April 3, 2015
19000-09

HARTCROWSER

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Prepared by
Hart Crowser, Inc.

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Contents

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Groundwater Monitoring Report

Former Cascade Timber No. 3 Log Sort Yard

Port of Tacoma

Tacoma, Washington

INTRODUCTION

This report summarizes the field activities and presents the results of the groundwater monitoring event Hart Crowser conducted on February 12, 2015, on behalf of the Port of Tacoma (Port) for the Former Cascade Timber No. 3 Log Sort Yard (site), located on the south-southeastern side of Maxwell Way between Port of Tacoma Road and Thorne Road in Tacoma, Washington (Figure 1).

Hart Crowser monitored groundwater in accordance with the requirements in Consent Decree 94-2-03590-3, dated April 11, 1994, issued to the Port by the Washington State Department of Ecology (Ecology). Removal of zinc from the site groundwater monitoring analyte list was approved in an email from Dom Reale (Ecology) to Mark Rettmann (Port) dated June 28, 2011. A memorandum of understanding (MOU) between Ecology and the Port issued on September 12, 2011, updated the monitoring frequency from every 12 months to every 18 months beginning February 2012. A copy of the MOU is in Appendix A.

SITE BACKGROUND

The site, situated southwest of the Blair Waterway in the Tacoma tideflats area, is a 10.73-acre section in the southwest portion of an industrially zoned parcel of land. The property was leased to the Cascade Timber Company and operated as a log sort yard from 1978 to 1984. In 1982, approximately 500 tons of slag generated by Asarco Incorporated of Tacoma, Washington, was placed on the southwest portion of the property as ballast material. The property is currently leased by Washington United Terminals and is operated as a truck queuing area and as a storage facility for empty shipping containers and chassis.

Ecology collected stormwater runoff samples at the site between November 1983 and June 1984 (Norton 1985). Analytical results indicated that metals in excess of the US Environmental Protection Agency (EPA) quality standards were leaving the site in stormwater. On October 8, 1991, Ecology and the Port entered into an Agreed Order to complete a remedial investigation/feasibility study (RI/FS). An RI/FS report was submitted to Ecology in June 1993, and Ecology issued a consent decree to perform the remedial action. Construction of a low-permeability asphalt cap and stormwater drainage system was completed in 1994. Monitoring wells MW-1 and MW-2 were installed to monitor the effectiveness of the remedial action.

In July 2003, it was discovered that the Port's two groundwater monitoring wells were damaged by a contractor working on site. Both wells were abandoned and replaced with new wells with the same designations (MW-1 and MW-2), in accordance with communications between Mr. Dom Reale of

Ecology and the Port. The monitoring well abandonment and replacement is documented in a report by Kennedy/Jenks Consultants titled Monitoring Replacement Report, Port of Tacoma Cascade Timber #3 Log Yard, dated February 2, 2004.

GROUNDWATER MONITORING

In compliance with the requirements of the consent decree, the Port monitors the wells to evaluate water quality at the facility and the effectiveness of the remedial action.

On February 12, 2015, Hart Crowser collected groundwater samples from monitoring wells MW-1 and MW-2 (well locations are shown on Figure 2). Groundwater samples from each well were collected using fresh disposable tubing and low-flow sampling techniques. In addition to the groundwater samples, one field duplicate (sample MW-3) was collected from monitoring well MW-2. The samples were field-filtered during collection using a 0.45-micron filter. The collected groundwater samples were placed in a cooler on ice and delivered to Analytical Resources, Inc. (ARI) under chain-of-custody protocol. Samples were analyzed for dissolved arsenic, copper, and lead by EPA Method 200.8. The groundwater sampling field logs are in Appendix B.

Analytical results show that performance standards were met for dissolved copper and lead in wells MW-1 and MW-2. Dissolved arsenic was detected in MW-1 and MW-2 at 57.7 and 41.6 µg/L, respectively, which exceed the cleanup level of 36 µg/L for arsenic. The analytical results are given in Table 1, and the laboratory report is in Appendix C. Plots of arsenic, copper, lead, and zinc concentrations versus time for the two wells are in Appendix D.

The groundwater level in each well was measured prior to sampling. Groundwater level was measured to the nearest hundredth of a foot as depth relative to the top of the well casing using a Solinst water level meter. Groundwater depth and elevation data are in Table 2. Plots of groundwater elevation versus time are in Appendix E.

RECOMMENDATIONS

The dissolved arsenic, copper, and lead concentrations in groundwater will continue to be monitored. The next groundwater monitoring event is scheduled for August 2016 to meet the 18-month frequency requirements of the MOU.

REFERENCES

Ecology 1994. Consent Decree 94-2-03590-3. Washington State Department of Ecology. April 1994.

Ecology 2011. Memorandum of Understanding, Former Log Yard Groundwater Monitoring and Cap Inspection. Washington State Department of Ecology. September 2011.

Kennedy/Jenks Consultants 2004. Monitoring Replacement Report, Port of Tacoma Cascade Timber #3 Log Yard. February 2, 2004.

Norton, D., and A. Johnson, 1985. Completion Report on WQIS Project 1 for the Commencement Bay Nearshore/Tideflats Remedial Investigation: Assessment of Log Sort Yards as Metal Sources to Commencement Bay Waterways, November 1983 to June 1984. Washington State Department of Ecology Memorandum. February 27, 1985.

\\seattlefs\projects\Notebooks\1900009_Cascade Timber GW Monitoring\Deliverables\Reports\Final GW Monitoring Report Feb 2015\Port of Tacoma 2015 GW Monit Rpt - CT - final.docx

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Table 1 - Groundwater Analytical Data
Former Cascade Timber No. 3 Log Sort Yard

Well ID	Date	Concentration in µg/L			
		Dissolved Arsenic	Dissolved Copper	Dissolved Lead	Dissolved Zinc
Groundwater Cleanup Levels [(a)] :		*36*	*2.9*	*8.5*	*86*
MW-1	11/28/94	**940**	**8**	<3	<20
MW-1	12/09/94	**220**	**4**	<3	<20
MW-1	12/01/95	**132**	**4**	<1	53
MW-1	12/13/96	**93**	**6**	<1	9
MW-1	12/09/97	**60**	2.1	2.4	12
MW-1	12/07/98	9.7	**11**	3.6	**510**
MW-1	12/22/99	21.0	2.5	<1	**99**
MW-1	10/11/00	**73**	<1	<0.5	4.7
MW-1	11/03/00	14.0	--	--	--
MW-1	11/16/01	7.02	**8.73**	<0.5	<4
MW-1	11/26/02	13.4	<2.5	<0.5	<2.5
MW-1	11/14/03	18.4	<1.0	<0.5	5.2
MW-1	10/29/04	32.4	<2.5	<2.5	12.2
MW-1	10/26/05	**46**	<2.5	<2.5	<2.5
MW-1	01/29/07	**93**	<2.0	<2.0	<5.0
MW-1	02/08/08	**140**	<0.55	<0.22	5.2J
MW-1	02/27/09	**57.2**	<0.5	<1	6
MW-1	02/04/10	**50.3**	0.6	<1	<4
MW-1	02/22/11	**158**	<0.5	<0.5	0.8
MW-1	02/13/12	**53**	<0.5	<0.5	--
MW-1	08/23/13	28.6	<0.5	<0.5	--
MW-1	02/12/15	**57.7**	0.7	<0.1	--
MW-2	11/28/94	10	**3**	<3	<20
MW-2	12/01/95	--	--	--	--
MW-2 (Duplicate)	12/01/95	**132**	**5**	<1	53
MW-2	12/13/96	3	**5**	<1	<83
MW-2 (Duplicate)	12/13/96	**76**	**41**	1	18
MW-2 (Duplicate)	12/09/97	**54**	**6.1**	2.4	43
MW-2	12/16/97	5	<2	<1	6
MW-2	12/07/98	2.3	1.8	5.1	**360**
MW-2 (Duplicate)	12/07/98	12	**13**	1.2	**600**
MW-2	12/22/99	4.4	<2	**23**	6.9
MW-2 (Duplicate)	12/22/99	19	**2.9**	<1	38
MW-2	10/11/00	<1	<1	<1	**99**
MW-2 (Duplicate)	10/11/00	**42**	<1	<0.5	6.5
MW-2	11/03/00	2	<1	**600**	8.3
MW-2 (Duplicate)	11/03/00	7	--	--	--

Table 1 - Groundwater Analytical Data
Former Cascade Timber No. 3 Log Sort Yard

Well ID	Date	Concentration in µg/L			
		Dissolved Arsenic	Dissolved Copper	Dissolved Lead	Dissolved Zinc
Groundwater Cleanup Levels [a] :		36	2.9	8.5	86
MW-2	11/13/00	--	--	**600**	--
MW-2 (Duplicate)	11/16/01	7.69	**10.2**	<0.5	<4
MW-2	11/19/01	1.19	<1	3.74	38.6
MW-2	11/26/02	<2.5	<2.5	**180**	3.36
MW-2 (Duplicate)	11/26/02	19.7	<2.5	<0.5	<2.5
MW-2	11/14/03	8.91	<1.0	<0.5	4.64
MW-2 (Duplicate)	11/14/03	18.5	<1.0	<0.5	3.97
MW-2	10/29/04	25.4	<2.5	<2.5	<5
MW-2 (Duplicate)	10/29/04	31.9	<2.5	<2.5	7.15
MW-2	10/26/05	**39**	<2.5	<2.5	<2.5
MW-2 (Duplicate)	10/26/05	32	<2.5	<2.5	<2.5
MW-2	01/29/07	34	<2.0	<2.0	<5.0
MW-2 (Duplicate)	01/29/07	35	<2.0	<2.0	<5.0
MW-2	02/08/08	24	0.78J	<0.22	5.1J
MW-2 (Duplicate)	02/08/08	**140**	<0.55	<0.22	6.0J
MW-2	02/27/09	32.6	1.6	<1	6
MW-2 (Duplicate)	02/27/09	32.9	1.5	<1	<4
MW-2	02/04/10	8.1	**4.1**	<1	<4
MW-2 (Duplicate)	02/04/10	18.2	5.4	<1	<4
MW-2	02/22/11	27.2	<0.5	<0.5	0.8
MW-2 (Duplicate)	02/22/11	26.9	0.5	<0.5	1.1
MW-2	02/13/12	16	0.5	<0.5	--
MW-2 (Duplicate)	02/13/12	16	0.6	<0.5	--
MW-2	08/23/13	4.1	<0.5	<0.5	--
MW-2 (Duplicate)	08/23/13	4.0	<0.5	<0.5	--
MW-2	02/12/15	**41.6**	2.0	0.1	--
MW-2 (Duplicate)	02/12/15	**40.7**	1.8	0.1	--
MW-3S	11/28/94	25	**28**	<3	<20
MW-3S	12/01/95	**54**	**3**	2	65
MW-3S	12/13/96	**190**	<2	3	9
MW-3S	12/09/97	**63**	2	4.2	**330**
MW-3S	12/07/98	**50**	**2.9**	2.2	<5
MW-3D	11/28/94	20	**7**	<3	<20
MW-3D	12/01/95	3	**4**	<1	35
MW-3D	12/13/96	4	**14**	<5	18

Table 1 - Groundwater Analytical Data
Former Cascade Timber No. 3 Log Sort Yard

Well ID	Date	Concentration in µg/L			
		Dissolved Arsenic	Dissolved Copper	Dissolved Lead	Dissolved Zinc
Groundwater Cleanup Levels [(a)] :		**36**	**2.9**	**8.5**	**86**
MW-3D	12/09/97	27	2.2	2	17
MW-3D	12/07/98	3	<2	<1	7.8

Notes:
Zinc analysis was discontinued in 2011 with Ecology approval dated June 28, 2011.
Groundwater samples were analyzed for dissolved metals by EPA Method 200.8.
Value in bold indicates concentration greater than groundwater cleanup level.
(a) Groundwater cleanup levels are based on EPA chronic marine water quality criteria (WAC 173-201A).
-- Not analyzed
<0.5 - Laboratory analytical result does not exceed laboratory quantitation limit.
J - Concentration is estimated.
ND - Not detected. No quantitation limit indicated.
µg/L - Micrograms per liter

Table 2 - Water Level Data
Former Cascade Timber No. 3 Log Sort Yard

Well ID	*Date*	*Top of Casing Elevation in Feet*	*Depth of Water below Top of Casing in Feet*	*Water Level Elevation in Feet*
MW-1	12/28/94	--	--	--
MW-1	12/09/94	--	--	--
MW-1	12/01/95	20.00	3.68	16.32
MW-1	12/13/96	20.00	3.98	16.02
MW-1	12/09/97	20.00	5.26	14.74
MW-1	12/07/98	20.00	4.71	15.29
MW-1	12/22/99	20.00	4.47	15.53
MW-1	10/11/00	20.00	6.58	13.42
MW-1	11/03/00	20.00	--	--
MW-1	11/16/01	20.00	4.35	15.65
MW-1	11/19/01	20.00	--	--
MW-1	11/26/02	20.00	6.58	13.42
MW-1	11/14/03	20.98	12.22	8.76
MW-1	10/29/04	20.98	12.31	8.67
MW-1	10/26/05	20.98	12.71	8.27
MW-1	01/29/07	20.98	11.83	9.15
MW-1	02/08/08	20.98	12.45	8.53
MW-1	02/27/09	20.98	12.18	8.80
MW-1	02/04/10	20.98	11.13	9.85
MW-1	02/22/11	20.98	11.54	9.44
MW-1	02/13/12	20.98	12.24	8.74
MW-1	09/23/13	20.98	12.23	8.75
MW-1	02/12/15	20.98	10.90	10.08
MW-2	12/28/94	--	--	--
MW-2	12/09/94	--	--	--
MW-2	12/01/95	18.12	4.60	13.52
MW-2	12/13/96	18.12	7.35	10.77
MW-2	12/09/97	18.12	13.66	4.46
MW-2	12/07/98	18.12	5.82	12.30
MW-2	12/22/99	18.12	7.21	10.91
MW-2	10/11/00	18.12	12.60	5.52
MW-2	11/03/00	18.12	--	--
MW-2	11/16/01	18.12	13.55	4.57
MW-2	11/19/01	18.12	6.32	11.80
MW-2	11/26/02	18.12	8.91	9.21
MW-2	11/14/03	19.91	10.02	9.89

Table 2 - Water Level Data
Former Cascade Timber No. 3 Log Sort Yard

Well ID	*Date*	*Top of Casing Elevation in Feet*	*Depth of Water below Top of Casing in Feet*	*Water Level Elevation in Feet*
MW-2	10/29/04	19.91	9.10	10.81
MW-2	10/26/05	19.91	9.74	10.17
MW-2	01/29/07	19.91	5.43	14.48
MW-2	02/08/08	19.91	10.10	9.81
MW-2	02/27/09	19.91	8.77	11.14
MW-2	02/04/10	19.91	12.19	7.72
MW-2	02/22/11	19.91	5.23	14.68
MW-2	02/13/12	19.91	6.23	13.68
MW-2	09/23/13	19.91	7.98	11.93
MW-2	02/12/15	19.91	4.76	15.15

Notes:
Top-of-casing elevations based on information provided by the Port of Tacoma to the previous consultant.
-- Not measured

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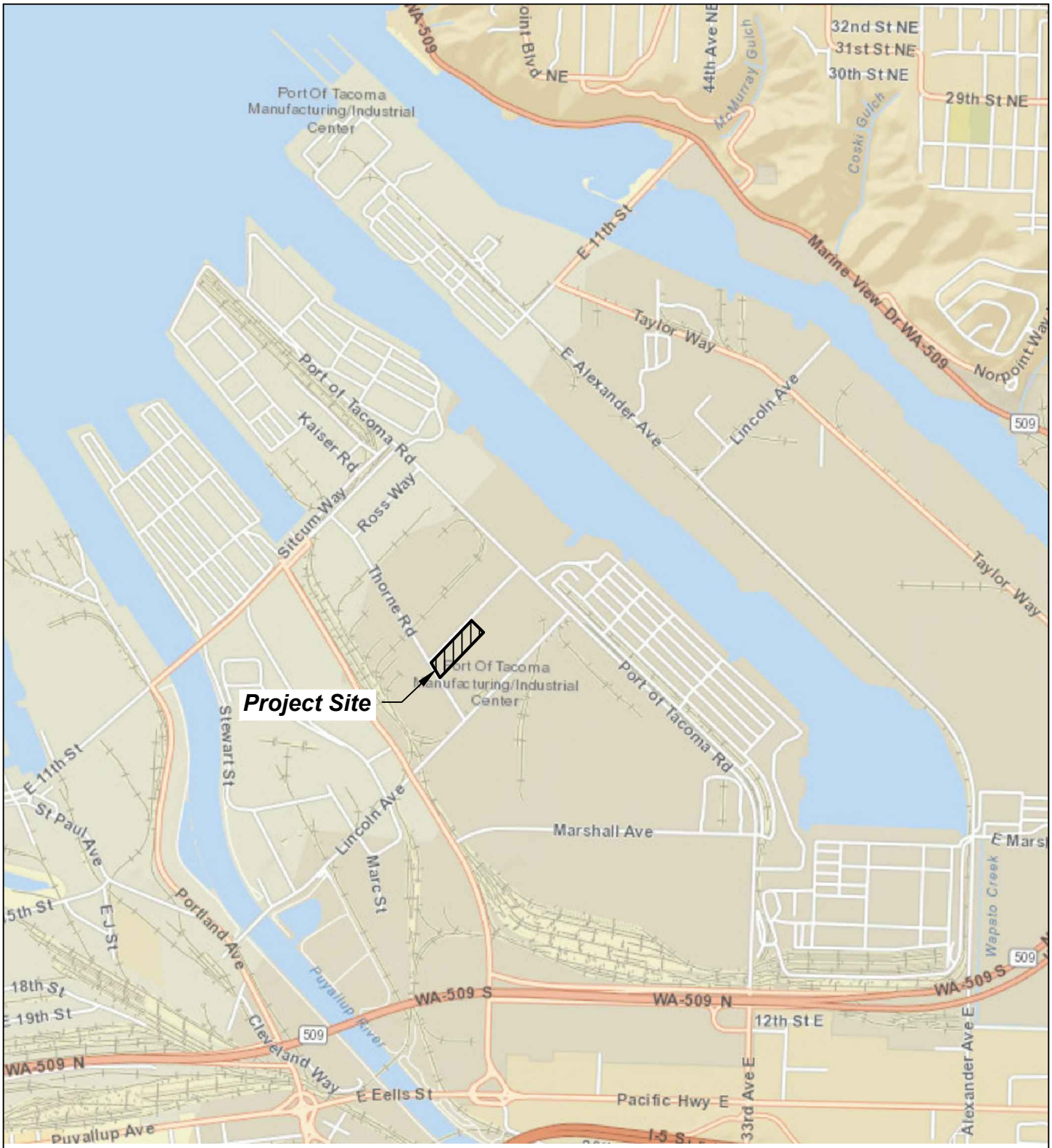

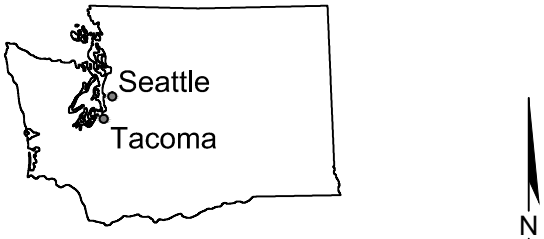

N

0 2000 4000

Scale in Feet

Source: Base map prepared from ArcGIS Online, 2014.

Former Cascade Timber No. 3 Log Sort Yard
Port of Tacoma

Vicinity Map

19000-09 3/15

HARTCROWSER

Figure
1

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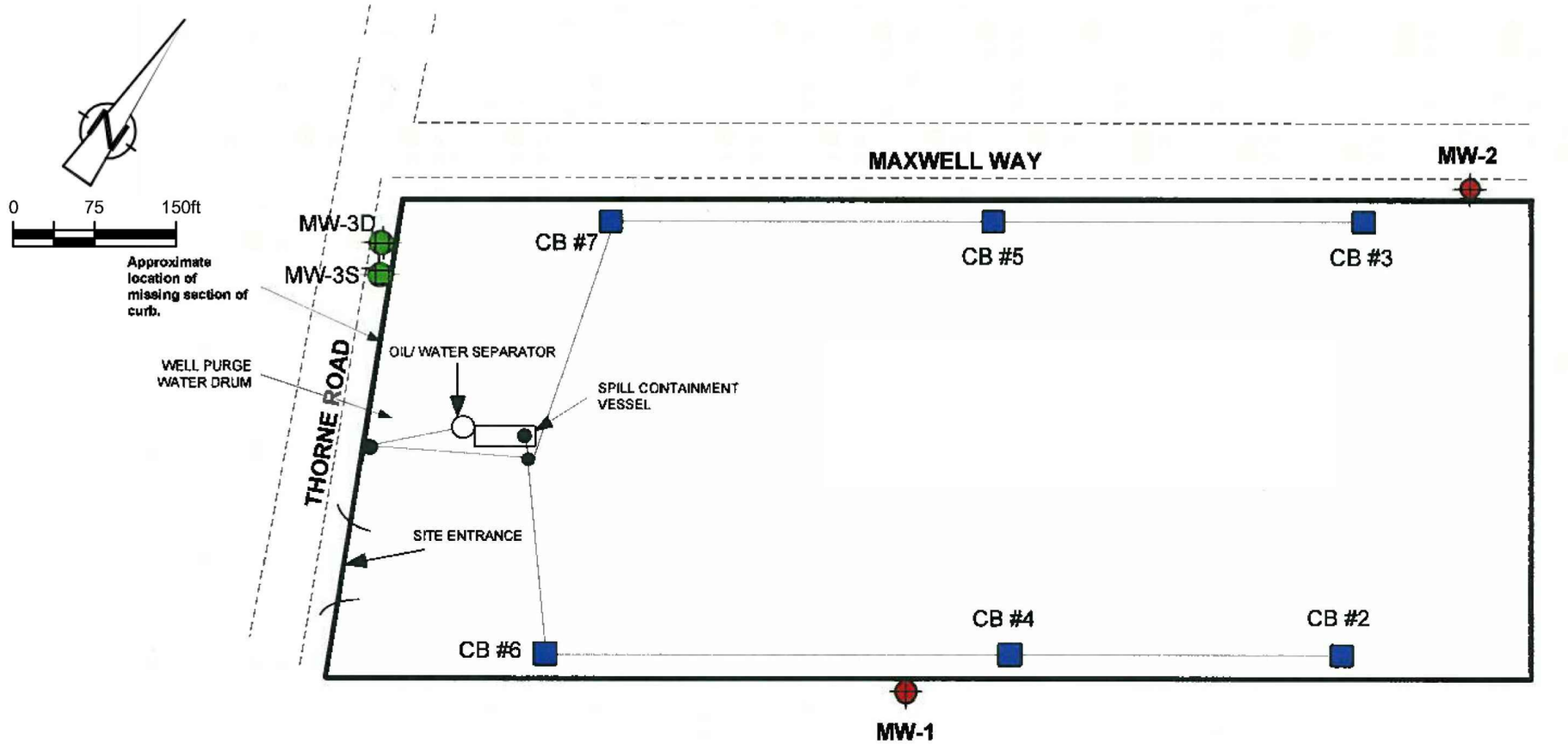

LEGEND

- GROUNDWATER MONITORING WELL (e.g. MW-1)
- CATCH BASIN (e.g. CB# 2)
- MANHOLE
- ABANDONED MONITORING WELL

Former Cascade Timber No. 3 Log Sort Yard
Port of Tacoma

Site Plan

19000-09 3/15

HARTCROWSER

Figure **2**

Source: Kennedy/Jenks Consultants Figure 2.

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APPENDIX A
Memorandum of Understanding

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6.4 Memorandum of Understanding

MEMORANDUM OF UNDERSTANDING

Former Log Yard Groundwater Monitoring and
Cap Inspection

This Memorandum of Understanding (MOU) is entered into this 12 day of September 2011 between the Washington State Department of Ecology ("Ecology") and the Port of Tacoma ("Port") (collectively the "Parties") to memorialize the Parties' agreement to modify the requirements for future groundwater monitoring and cap inspection frequencies for five Port sites, as set forth below.

These sites affected by this agreement are Cascade Timber No. 3, Murray Pacific No. 2, Wasser Winters, Portac, and Louisiana-Pacific (aka Pony Lumber) ("Monitored Sites").

Each Monitored Site was cleaned up under an administrative agreement between Ecology and the Port, either as an original party or successor interest, as follows: Cascade Timber No. 3, Murray Pacific No. 2, and Wasser Winters were cleaned up under Consent Decrees, Louisiana-Pacific under an Enforcement Order, and Portac under a pre-Model Toxics Control Act (MTCA) Order On Consent (cumulatively referred to as: "Ecology Orders"). Portac, Inc. was also a respondent to the Portac Order on Consent along with the Port.

Each Monitored Site addressed similar contaminants of concern (COCs), which included arsenic, copper, lead, and zinc. However, each Ecology Order had site-specific requirements with respect to cleanup levels, and cap and groundwater monitoring frequencies.

In Spring 2010, the Port initiated a request to Ecology to standardize the monitoring requirements for the Monitored Sites in an effort to align the timing of the periodic monitoring/ inspections at the sites so that the Port may better align a contractor to do the work all at once, as required.

In August 2010, to supplement the information already provided to Ecology, the Port provided Ecology with a tour of the Monitored Sites. As part of the tour, Ecology inspected the type and condition of the caps; the current site uses, specifically on the capped areas, and the locations and conditions of existing monitoring wells and stormwater basins.

Ecology has reviewed the information provided by the Port, as well as observations made during the site tour, and has chosen to provide a response in the form of this MOU.

This MOU was created for the Parties to understand and agree upon the requirements associated with Ecology's response, and to memorialize the decisions made with respect to each of the Port's requests.

In preparing this MOU, Ecology took into account, for each site, the type and condition of the cap and stormwater collection system, the adequacy of the groundwater monitoring system, and the recent groundwater compliance history.

Based on the above, Ecology and the Port agree as follows:

A. CAP MONITORING FREQUENCY

1. The Port may standardize the cap monitoring (inspection and reporting) frequency for the Monitored Sites to 30 months as requested. However, the following shall also occur:

   - During the site tours, Ecology noted that some of the stormwater basins were in better condition than others. Stormwater basins at each of the Monitored Sites should be inspected quarterly and cleaned out as needed, such that they are continuously operational.

   - Any unanticipated breaches of the cap for any of the Monitored Sites shall be reported to Ecology and repaired as soon as practicable. As per the respective Ecology Orders, the Port shall provide Ecology with a plan for each of the sites that summarizes intended action and reporting by the Port for unanticipated cap breaches.

   - Advance notice shall be provided and prior approval shall be obtained from Ecology for any planned cap breaches and repairs that are not otherwise permitted under the respective Ecology Order for each Monitored Site.

   - Minor cracking and normal wear and tear shall be repaired and reported as anticipated by and according to each Monitored Site's Ecology Order.

   - The appropriate Ecology Site Manager shall be informed, in writing, of any changes in site use on capped areas.

2. The next cap monitoring for the Monitored Sites based on this new 30-month frequency shall be February 2012, which corresponds to the next 30-month groundwater monitoring event for Wasser Winters described below. Unless changed by Ecology, all future cap monitoring for the Monitored Sites shall occur every 30 months beginning February 2012 to coincide with the groundwater monitoring that is intended to target alternating wet and dry seasons.

B. GROUNDWATER MONITORING FREQUENCY

1. The Port may standardize the groundwater monitoring frequency for each of the Monitored Sites as requested, which included the following:

   - Cascade Timber No. 3 – 18 months (formerly 12 months).
   - Murray Pacific No. 2 – 18 months (formerly 6 months).
   - Wasser Winters – No change (currently 30 months).
   - Portac – No change (currently discontinued).
   - Louisiana-Pacific – 30 months (formerly 24 months wet/dry).

2. The next groundwater monitoring for the Monitored Sites shall be conducted in February 2012. Unless changed by Ecology, all future groundwater monitoring for the Monitored Sites shall occur according to the frequency identified above beginning February 2012.

C. EFFECT OF MODIFICATION

1. Except as modified herein, all provisions of the Original Ecology Orders for each Monitored Site as existing and as may have been amended, including addressing any potential data compliance issues, remain in full force and effect.

2. A copy of this MOU shall be filed with the Ecology Project Manager for each of the Monitored Sites.

John Wolfe
Chief Executive Officer
Port of Tacoma

9.1.11
Date

Rebecca S. Lawson, P.E., LHG
Section Manager, Toxics Cleanup Program
Southwest Regional Office
Washington State Department of Ecology

9/12/2011
Date

cc:
Jason Jordan – Port of Tacoma
Mark Rettmann – Port of Tacoma
William Evans – Port of Tacoma
Leslee Connor – Port of Tacoma
Scott Hooton – Port of Tacoma
Dom Reale – Ecology
Marv Coleman – Ecology
Guy Barrett – Ecology
James DeMay – Ecology
Scott Rose – Ecology
Rebecca Lawson – Ecology

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APPENDIX B
Groundwater Monitoring Field Logs

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1315

HARTCROWSER Groundwater Sampling Data - Well I.D. MW-1

PROJECT	Cascade Timber	DATE/TIME SAMPLED	2/12/2015: 1315
JOB NO.	19000-09	TIDALLY INFLUENCED	YES X NO ___
PROJECT MANAGER	M. Dagel	WELL DEPTH IN FEET	___
FIELD REPS	M. Smith	SCREENED INTERVAL IN FEET	___

(1) Purging Data/Field Measurements: *All Measurements Relative to Top of Casing (TOC)*

WELL DEPTH	___	CASING VOLUME IN GALLONS	0.82
DEPTH TO SEDIMENT (DTS) IN FEET	15.92	[2" diam = x .163 gal/ft	4" diam = x .653 gal/ft]
DEPTH TO WATER (DTW) IN FEET	10.90	PURGE VOLUME IN GALLONS	2.45
(DTS – DTW)	5.02	ACTUAL PURGE IN GALLONS	4.0

Time	No. of Gallons Purged	pH	Temp in °C	Conduct in mS/cm	Diss. Oxygen in mg/L	Turbidity	Comments: quality, recovery, color, odor, sheen, ORP accumulated silt/sand
1239	0	7.94	17.35	0.2280	6.86	33.7	-217 Slightly Turbid, No odor, No sheen, No silt
1247	~1	6.81	11.21	0.3378	0.23	0.3	-266 " Goes to clear "
1256	~2	6.57	11.24	0.3365	0.08	0.1	-276 " "
1305	~3	6.50	11.13	0.3332	0.04	0.1	-280 " "
sample: 1314	~4	6.44	11.16	0.3328	0.01	-0.1	-284 " "

Comments: - Stick up monument, 2.05' from top of casing to ground surface

	Method	Pumping Rate in GPM	Depth of Equip. in Feet
Purge	Low-flow	0.11	~11.0
Sample	"	"	"

Boils dry? Yes ___ No X

At no. of casing volumes ___

Purge Water Disposal Method/Volume: On-Site

(2) Sampling Data

Bottle Type	# of Containers	Analyses	Preserv.	Filter
0.5L Poly	1	Diss. As, Cu, Pb Method 200.8	HNO_3	Yes

Total number of Bottles: 1

Duplicate Sample I.D.: NA

Field Blank I.D.: NA

Rinseate Sample I.D.: NA

(3) Field Equipment — Type/Brand/Serial No./Material Units

Pump Type/Tubing Type	Peristaltic	Temp/pH/E.C. meter	In-Situ
Bailer Type	NA	Water Level Probe	Solinst
Filter Type	Geotech 0.45 micron disposable	Other	___

(4) Well Conditions

OK ☐ Not OK ☒ Explain: No Lock

1412

HARTCROWSER Groundwater Sampling Data - Well I.D. MW-2

PROJECT	Cascade Timber	DATE/TIME SAMPLED	2/12/2015 : 1412
JOB NO.	19000-09	TIDALLY INFLUENCED	YES X NO ___
PROJECT MANAGER	M. Dagel	WELL DEPTH IN FEET	___
FIELD REPS	M. Smith	SCREENED INTERVAL IN FEET	___

(1) Purging Data/Field Measurements: *All Measurements Relative to Top of Casing (TOC)*

WELL DEPTH	___	CASING VOLUME IN GALLONS	2.10
DEPTH TO SEDIMENT (DTS) IN FEET	17.64	[2" diam = x .163 gal/ft 4" diam = x .653 gal/ft]	
DEPTH TO WATER (DTW) IN FEET	4.76	PURGE VOLUME IN GALLONS	6.30
(DTS – DTW)	12.88	ACTUAL PURGE IN GALLONS	8.0

	Time	No. of Gallons Purged	pH	Temp in °C	Conduct in mS/cm	Diss. Oxygen in mg/L	Turbidity	ORP	Comments: quality, recovery, color, odor, sheen, accumulated silt/sand
	1327	0	6.52	13.13	0.4212	4.51	16.1	-205	Slightly Turbid, No odor/sheen/silt
	1339	~2	6.46	12.10	0.4210	0.08	4.5	-266	" "
	1348	~4	6.44	11.91	0.4288	-0.00	3.0	-281	" Goes to clear "
	1359	~6	6.46	11.79	0.4291	-0.03	2.6	-287	" ↓ "
sample:	1410	~8	6.46	11.80	0.4264	-0.04	2.1	-289	" ✓ "

Comments: - Stick up Monument, 1.90' from top of casing to ground surface

~~Location not accurate on site map. Appx. 100 ft W-SW of Planed location~~ PRS 4/16/15

	Method	Pumping Rate in GPM	Depth of Equip. in Feet
Purge	Low-flow	0.19	~12.5
Sample	"	"	"

Boils dry? Yes ___ No X

At no. of casing volumes ___

Purge Water Disposal Method/Volume

On-Site

(2) Sampling Data

Bottle Type	# of Containers	Analyses	Preserv.	Filter
0.5 L Poly	2	Diss. As, Cu, Pb method 200.8	HNO_3	Yes

Total number of Bottles 2

Duplicate Sample I.D. MW-3 (1425)

Field Blank I.D. NA

Rinseate Sample I.D. NA

(3) Field Equipment — Type/Brand/Serial No./Material Units

Pump Type/Tubing Type	Peristaltic	Temp/pH/E.C. meter	In-Situ
Bailer Type	NA	Water Level Probe	Solinst
Filter Type	Geotech 0.45 micron disposable	Other	

(4) Well Conditions

OK ☐ Not OK ☒ Explain No lock

APPENDIX C
Laboratory Report
Analytical Resources, Inc.

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for double-sided printing.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

February 18, 2015

Peter Smiltins
Hart Crowser, Inc.
1700 Westlake Avenue N. Suite 200
Seattle, WA 98109-3256

RE: Client Project: Cascade Timber 19000-09
ARI Job No.: ZW40

Dear Peter:

Please find enclosed the original Chain-of-Custody (COC) record, sample receipt documentation, and the final data for samples from the project referenced above. Analytical Resources, Inc. (ARI) received three water samples in good condition February 12, 2015. The samples were received with a cooler temperatures of 5.4°C, and 4.1 °C. For further details regarding sample receipt, please refer to the enclosed Cooler Receipt Form and Preservation Verification sheet.

The samples were analyzed for dissolved arsenic, copper, and lead, as requested.

There were no anomalies associated with the analysis of these samples.

An electronic copy of this package will be kept on file at ARI. Should you have any questions or concerns, please feel free to contact us at your convenience.

Sincerely,

ANALYTICAL RESOURCES, INC.

Amanda Volgardsen
for
Kelly Bottem
Client Services Manager
kellyb@arilabs.com
206/695-6211
Enclosures

cc: eFile ZW40

4611 South 134th Place, Suite 100 • Tukwila WA 98168 • **206-695-6200** • **206-695-6201** fax

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: 2W40	Turn-around Requested: Standard
ARI Client Company: Hart Crowser	Phone: (206)826-4634
Client Contact: Peter Smiting	
Client Project Name: Cascade Timber	
Client Project #: 19000-09	Samplers: Matthew Smith

Page: 1	of 1
Date: 2/12/2015	Ice Present? Y
No. of Coolers: 2	Cooler Temps: 5.4, 4.1

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)
www.arilabs.com

Sample ID	Date	Time	Matrix	No Containers	Analysis Requested: Diss. As, Cu, Pb method 200.8	Notes/Comments
MW-1	2/12/2015	1315	Water	1	X	
MW-2	"	1412	"	1	X	
MW-3	"	1425	"	1	X	

Comments/Special Instructions	Relinquished by (Signature)	Received by. (Signature)	Relinquished by (Signature)	Received by. (Signature)
	Printed Name: Matthew Smith	Printed Name: A. Volgardsen	Printed Name	Printed Name:
	Company: Hart Crowser	Company: ARI	Company	Company
	Date & Time: 2/12/2015 : 1516	Date & Time: 2/12/15 1516	Date & Time	Date & Time

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

2W40 - 090902

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: Hart Crowser | Project Name: Cascade Timber

COC No(s): _____ (NA) | Delivered by: Fed-Ex UPS Courier Hand Delivered Other: _____

Assigned ARI Job No. ZW40 | Tracking No: _____ (NA)

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler?	YES	(NO)
Were custody papers included with the cooler?	(YES)	NO
Were custody papers properly filled out (ink, signed, etc.)	(YES)	NO

Temperature of Cooler(s) (°C) (recommended 2.0-6.0 °C for chemistry): 5.4 4.1 ___ ___ ___ ___

Time: 1516

If cooler temperature is out of compliance fill out form 00070F | Temp Gun ID#: 90270195

Cooler Accepted by: AV Date: 2/12/15 Time: 1516

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler?		YES	(NO)
What kind of packing material was used?	Bubble Wrap (Wet Ice) Gel Packs (Baggies) Foam Block Paper Other: _____		
Was sufficient ice used (if appropriate)?	NA	(YES)	NO
Were all bottles sealed in individual plastic bags?		(YES)	NO
Did all bottles arrive in good condition (unbroken)?		(YES)	NO
Were all bottle labels complete and legible?		(YES)	NO
Did the number of containers listed on COC match with the number of containers received?		(YES)	NO
Did all bottle labels and tags agree with custody papers?		(YES)	NO
Were all bottles used correct for the requested analyses?		(YES)	NO
Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs)...	NA	(YES)	NO
Were all VOC vials free of air bubbles?	(NA)	YES	NO
Was sufficient amount of sample sent in each bottle?		(YES)	NO
Date VOC Trip Blank was made at ARI	(NA)		

Was Sample Split by ARI: (NA) YES Date/Time: _____ Equipment: _____ Split by: _____

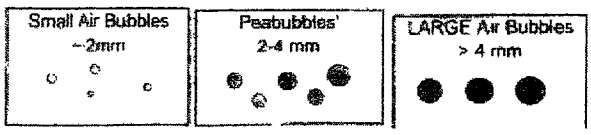
Samples Logged by: AV Date: 2/12/15 Time: 1627

** ***Notify Project Manager of discrepancies or concerns*** **

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Additional Notes, Discrepancies, & Resolutions:

By: Date:



Small → "sm" (< 2 mm)
Peabubbles → "pb" (2 to < 4 mm)
Large → "lg" (4 to < 6 mm)
Headspace → "hs" (> 6 mm)

PRESERVATION VERIFICATION 02/12/15
Page 1 of 1

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: **ZW40**

Inquiry Number: NONE
Analysis Requested: 02/13/15
Contact: Smiltins, Peter
Client: Hart Crowser, Incorporated
Logged by: AV
Sample Set Used: Yes-481
Validatable Package: No
Deliverables:

PC: Kelly
VTSR: 02/12/15

Project #: 19000-09
Project: Cascade Timber
Sample Site:
SDG No:
Analytical Protocol: In-house

LOGNUM ARI ID	CLIENT ID	CN >12	WAD >12	NH3 <2	COD <2	FOG <2	MET <2	PHEN <2	PHOS <2	TKN <2	NO23 <2	TOC <2	S2 >9	TPHD <2	Fe2+ <2	DMET FLT	DOC FLT	PARAMETER	ADJUSTED TO	LOT NUMBER	AMOUNT ADDED	DATE/BY
15-2796 **ZW40A**	MW-1						DIS pass									Y						
15-2797 **ZW40B**	MW-2						DIS pass									Y						
15-2798 **ZW40C**	MW-3						DIS pass									Y						

h9000 : 9hmZ

Checked By AV Date 2/12/15

Sample ID Cross Reference Report

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: ZW40
Client: Hart Crowser, Incorporated
Project Event: 19000-09
Project Name: Cascade Timber

	Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1.	MW-1	ZW40A	15-2796	Water	02/12/15 13:15	02/12/15 15:16
2.	MW-2	ZW40B	15-2797	Water	02/12/15 14:12	02/12/15 15:16
3.	MW-3	ZW40C	15-2798	Water	02/12/15 14:25	02/12/15 15:16

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Data Reporting Qualifiers

Effective 2/14/2011

Inorganic Data

U	Indicates that the target analyte was not detected at the reported concentration
*	Duplicate RPD is not within established control limits
B	Reported value is less than the CRDL but ≥ the Reporting Limit
N	Matrix Spike recovery not within established control limits
NA	Not Applicable, analyte not spiked
H	The natural concentration of the spiked element is so much greater than the concentration spiked that an accurate determination of spike recovery is not possible
L	Analyte concentration is ≤5 times the Reporting Limit and the replicate control limit defaults to ±1 RL instead of the normal 20% RPD

Organic Data

U	Indicates that the target analyte was not detected at the reported concentration
*	Flagged value is not within established control limits
B	Analyte detected in an associated Method Blank at a concentration greater than one-half of ARI's Reporting Limit or 5% of the regulatory limit or 5% of the analyte concentration in the sample.
J	Estimated concentration when the value is less than ARI's established reporting limits
D	The spiked compound was not detected due to sample extract dilution
E	Estimated concentration calculated for an analyte response above the valid instrument calibration range. A dilution is required to obtain an accurate quantification of the analyte.
Q	Indicates a detected analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20%RSD, <20%Drift or minimum RRF).

S Indicates an analyte response that has saturated the detector. The calculated concentration is not valid; a dilution is required to obtain valid quantification of the analyte

NA The flagged analyte was not analyzed for

NR Spiked compound recovery is not reported due to chromatographic interference

NS The flagged analyte was not spiked into the sample

M Estimated value for an analyte detected and confirmed by an analyst but with low spectral match parameters. This flag is used only for GC-MS analyses

M2 The sample contains PCB congeners that do not match any standard Aroclor pattern. The PCBs are identified and quantified as the Aroclor whose pattern most closely matches that of the sample. The reported value is an estimate.

N The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"

Y The analyte is not detected at or above the reported concentration. The reporting limit is raised due to chromatographic interference. The Y flag is equivalent to the U flag with a raised reporting limit.

EMPC Estimated Maximum Possible Concentration (EMPC) defined in EPA Statement of Work DLM02.2 as a value "calculated for 2,3,7,8-substituted isomers for which the quantitation and /or confirmation ion(s) has signal to noise in excess of 2.5, but does not meet identification criteria" **(Dioxin/Furan analysis only)**

C The analyte was positively identified on only one of two chromatographic columns. Chromatographic interference prevented a positive identification on the second column

P The analyte was detected on both chromatographic columns but the quantified values differ by ≥40% RPD with no obvious chromatographic interference

X Analyte signal includes interference from polychlorinated diphenyl ethers. **(Dioxin/Furan analysis only)**

Z Analyte signal includes interference from the sample matrix or perfluorokerosene ions. **(Dioxin/Furan analysis only)**

Geotechnical Data

A The total of all fines fractions. This flag is used to report total fines when only sieve analysis is requested and balances total grain size with sample weight.

F Samples were frozen prior to particle size determination

SM Sample matrix was not appropriate for the requested analysis. This normally refers to samples contaminated with an organic product that interferes with the sieving process and/or moisture content, porosity and saturation calculations

SS Sample did not contain the proportion of "fines" required to perform the pipette portion of the grain size analysis

W Weight of sample in some pipette aliquots was below the level required for accurate weighting

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: MW-1
SAMPLE

Lab Sample ID: ZW40A
LIMS ID: 15-2796
Matrix: Water
Data Release Authorized:
Reported: 02/18/15

QC Report No: ZW40-Hart Crowser, Incorporated
Project: Cascade Timber
19000-09
Date Sampled: 02/12/15
Date Received: 02/12/15

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	µg/L	Q
200.8	02/13/15	200.8	02/16/15	**7440-38-2**	**Arsenic**	0.2	**57.7**	
200.8	02/13/15	200.8	02/16/15	**7440-50-8**	**Copper**	0.5	**0.7**	
200.8	02/13/15	200.8	02/17/15	7439-92-1	Lead	0.1	0.1	U

U-Analyte undetected at given LOQ
LOQ-Limit of Quantitation

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: MW-2
SAMPLE

Lab Sample ID: ZW40B
LIMS ID: 15-2797
Matrix: Water
Data Release Authorized:
Reported: 02/18/15

QC Report No: ZW40-Hart Crowser, Incorporated
Project: Cascade Timber
19000-09
Date Sampled: 02/12/15
Date Received: 02/12/15

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	µg/L	Q
200.8	02/13/15	200.8	02/16/15	**7440-38-2**	**Arsenic**	0.2	**41.6**	
200.8	02/13/15	200.8	02/16/15	**7440-50-8**	**Copper**	0.5	**2.0**	
200.8	02/13/15	200.8	02/17/15	**7439-92-1**	**Lead**	0.1	**0.1**	

U-Analyte undetected at given LOQ
LOQ-Limit of Quantitation

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: MW-3
SAMPLE

Lab Sample ID: ZW40C
LIMS ID: 15-2798
Matrix: Water
Data Release Authorized:
Reported: 02/18/15

QC Report No: ZW40-Hart Crowser, Incorporated
Project: Cascade Timber
19000-09
Date Sampled: 02/12/15
Date Received: 02/12/15

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	µg/L	Q
200.8	02/13/15	200.8	02/16/15	**7440-38-2**	**Arsenic**	0.2	**40.7**	
200.8	02/13/15	200.8	02/16/15	**7440-50-8**	**Copper**	0.5	**1.8**	
200.8	02/13/15	200.8	02/17/15	**7439-92-1**	**Lead**	0.1	**0.1**	

U-Analyte undetected at given LOQ
LOQ-Limit of Quantitation

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS **Sample ID: METHOD BLANK**

Lab Sample ID: ZW40MB
LIMS ID: 15-2798
Matrix: Water
Data Release Authorized:
Reported: 02/18/15

QC Report No: ZW40-Hart Crowser, Incorporated
Project: Cascade Timber
19000-09
Date Sampled: NA
Date Received: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	µg/L	Q
200.8	02/13/15	200.8	02/16/15	7440-38-2	Arsenic	0.2	0.2	U
200.8	02/13/15	200.8	02/16/15	7440-50-8	Copper	0.5	0.5	U
200.8	02/13/15	200.8	02/17/15	7439-92-1	Lead	0.1	0.1	U

U-Analyte undetected at given LOQ
LOQ-Limit of Quantitation

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS **Sample ID: LAB CONTROL**

Lab Sample ID: ZW40LCS
LIMS ID: 15-2798
Matrix: Water
Data Release Authorized:
Reported: 02/18/15

QC Report No: ZW40-Hart Crowser, Incorporated
Project: Cascade Timber
19000-09
Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Arsenic	200.8	25.6	25.0	102%	
Copper	200.8	25.2	25.0	101%	
Lead	200.8	26.9	25.0	108%	

Reported in µg/L

N-Control limit not met
Control Limits: 80-120%

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APPENDIX D
Plots of Arsenic, Copper, Lead, and Zinc Concentrations Versus Time

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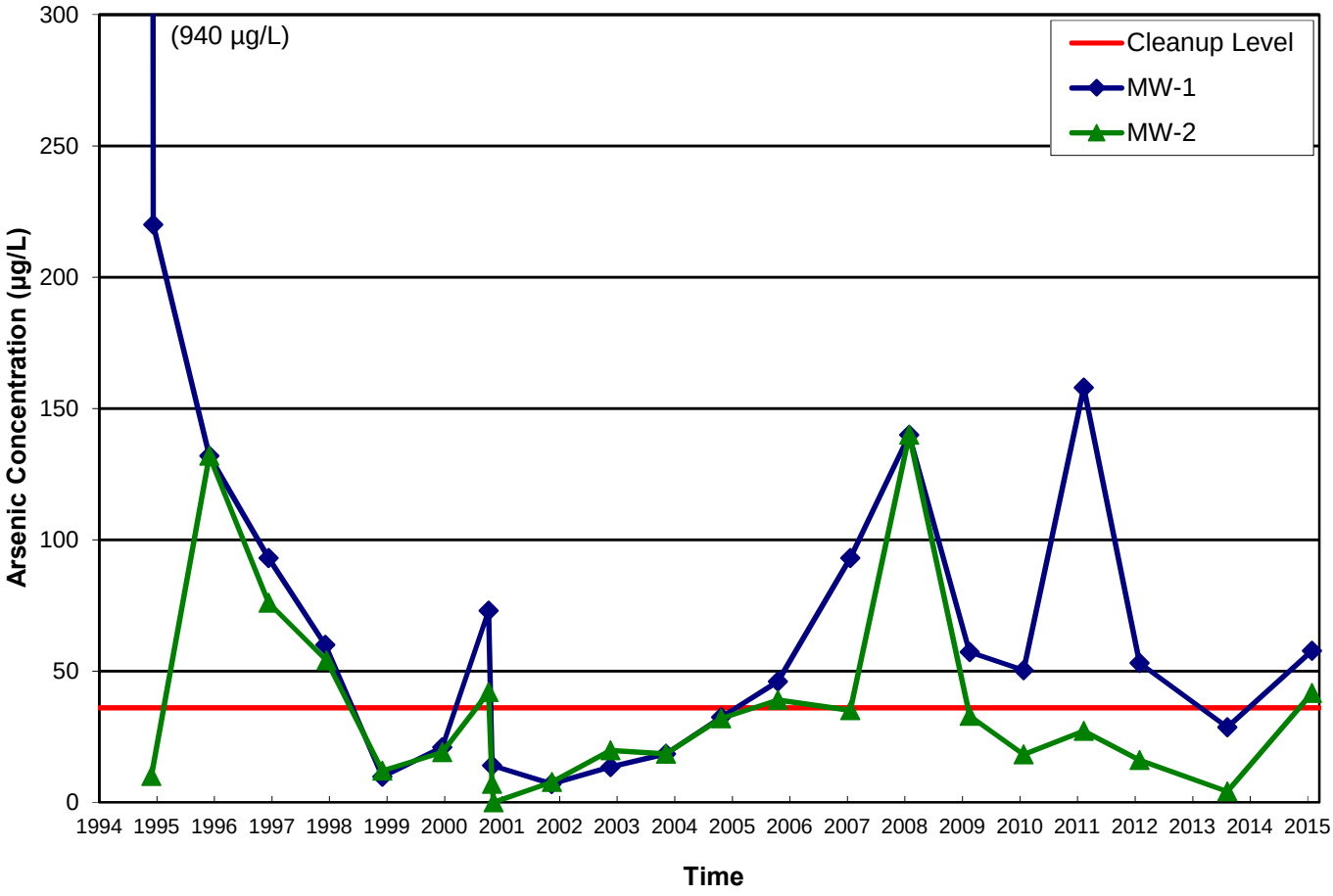


Note:
For sampling events that included a duplicate sample for dissolved arsenic analysis, the greater analytical result for the two samples is plotted (see Table 1).

Former Cascade Timber No. 3 Log Sort Yard
Port of Tacoma

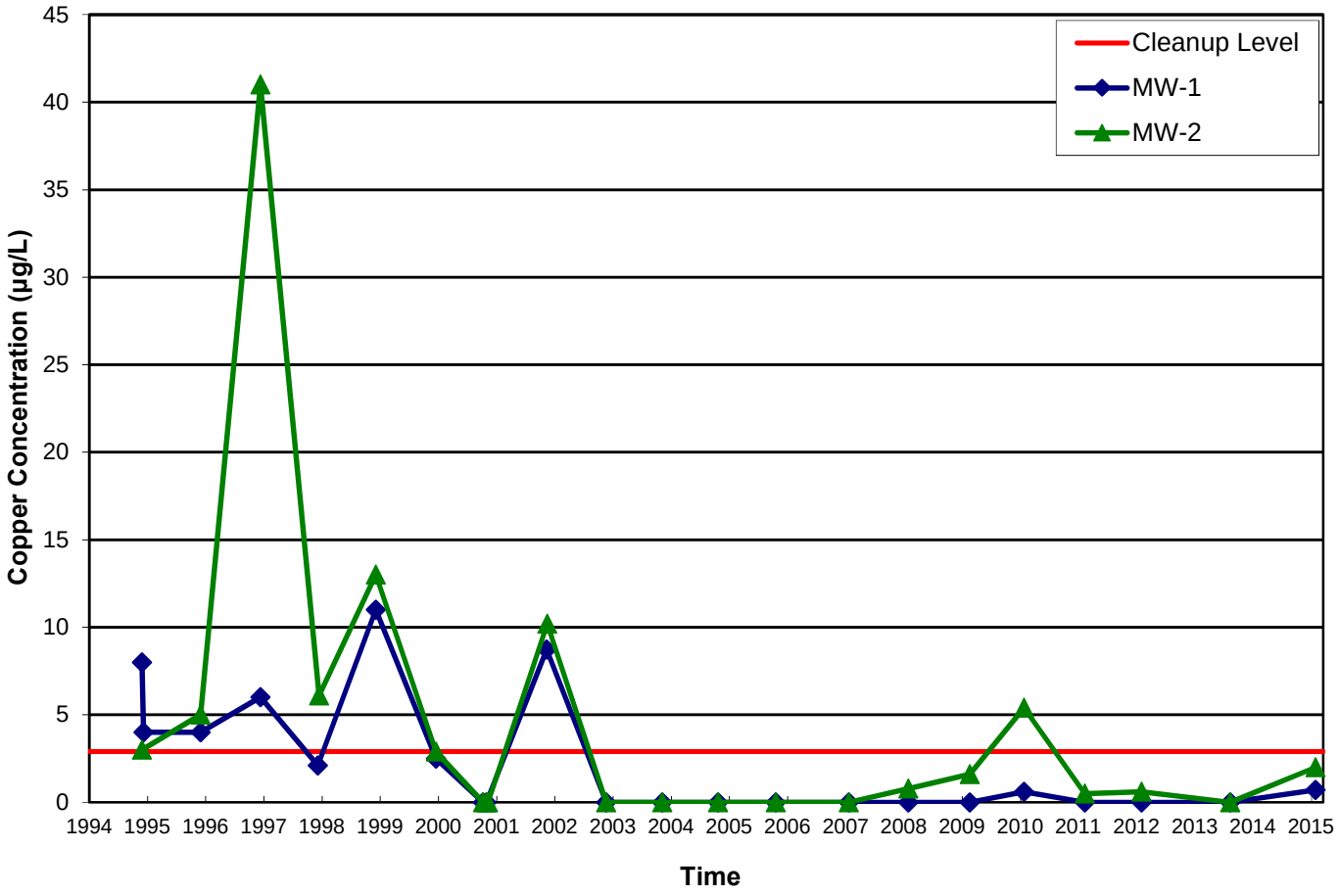
MW-1 and MW-2 Arsenic Concentration

19000-09 3/15

HARTCROWSER

Figure
D-1

PRS 03/06/15 1900009\D1.xls



Note:
For sampling events that included a duplicate sample for dissolved copper analysis, the greater analytical result for the two samples is plotted (see Table 1).

Former Cascade Timber No. 3 Log Sort Yard
Port of Tacoma

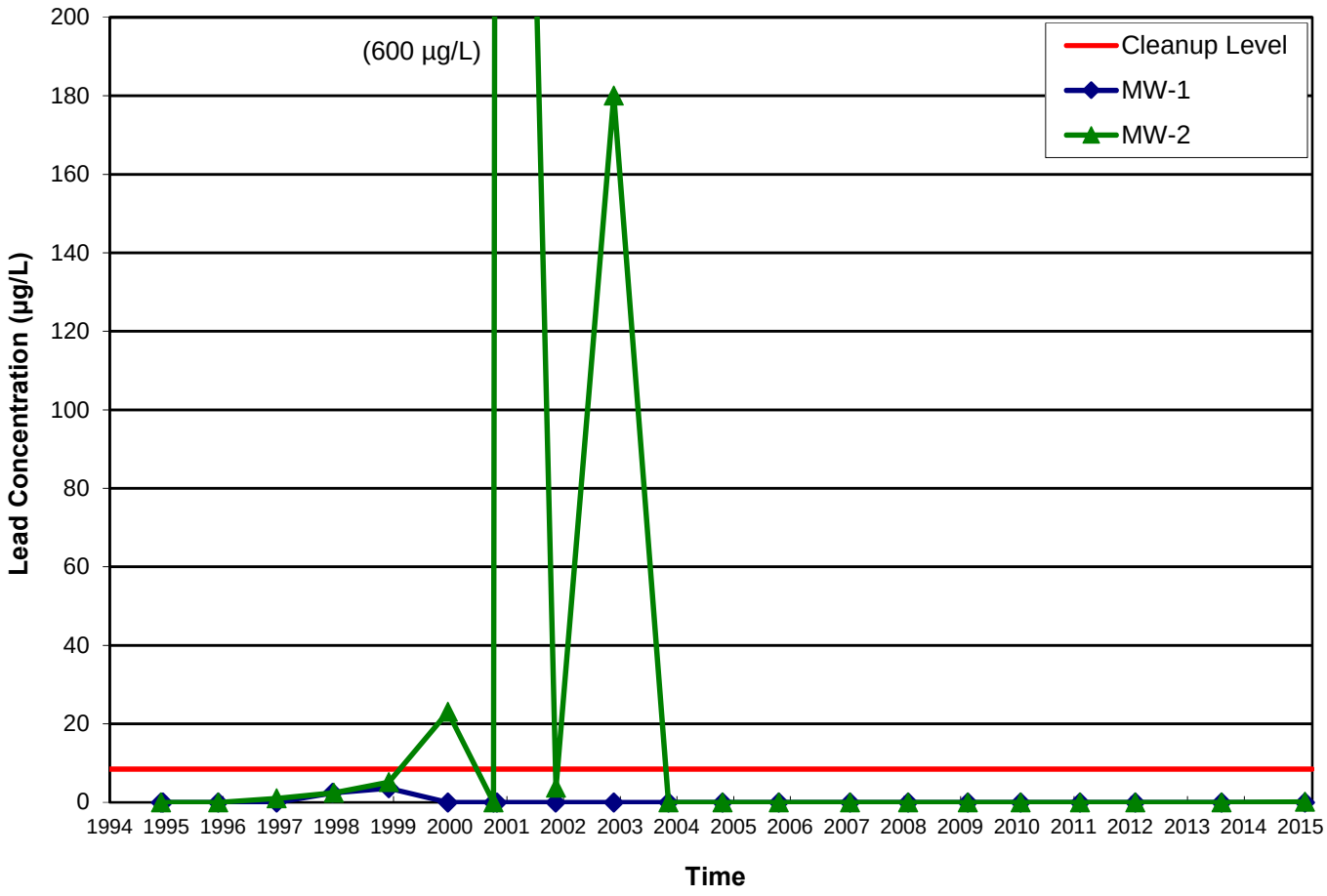
MW-1 and MW-2 Copper Concentration

19000-09 3/15

HARTCROWSER

Figure
D-2

PRS 03/06/15 1900009\D2.xls



Note:
For sampling events that included a duplicate sample for dissolved lead analysis, the greater analytical result for the two samples is plotted (see Table 1).

Former Cascade Timber No. 3 Log Sort Yard
Port of Tacoma

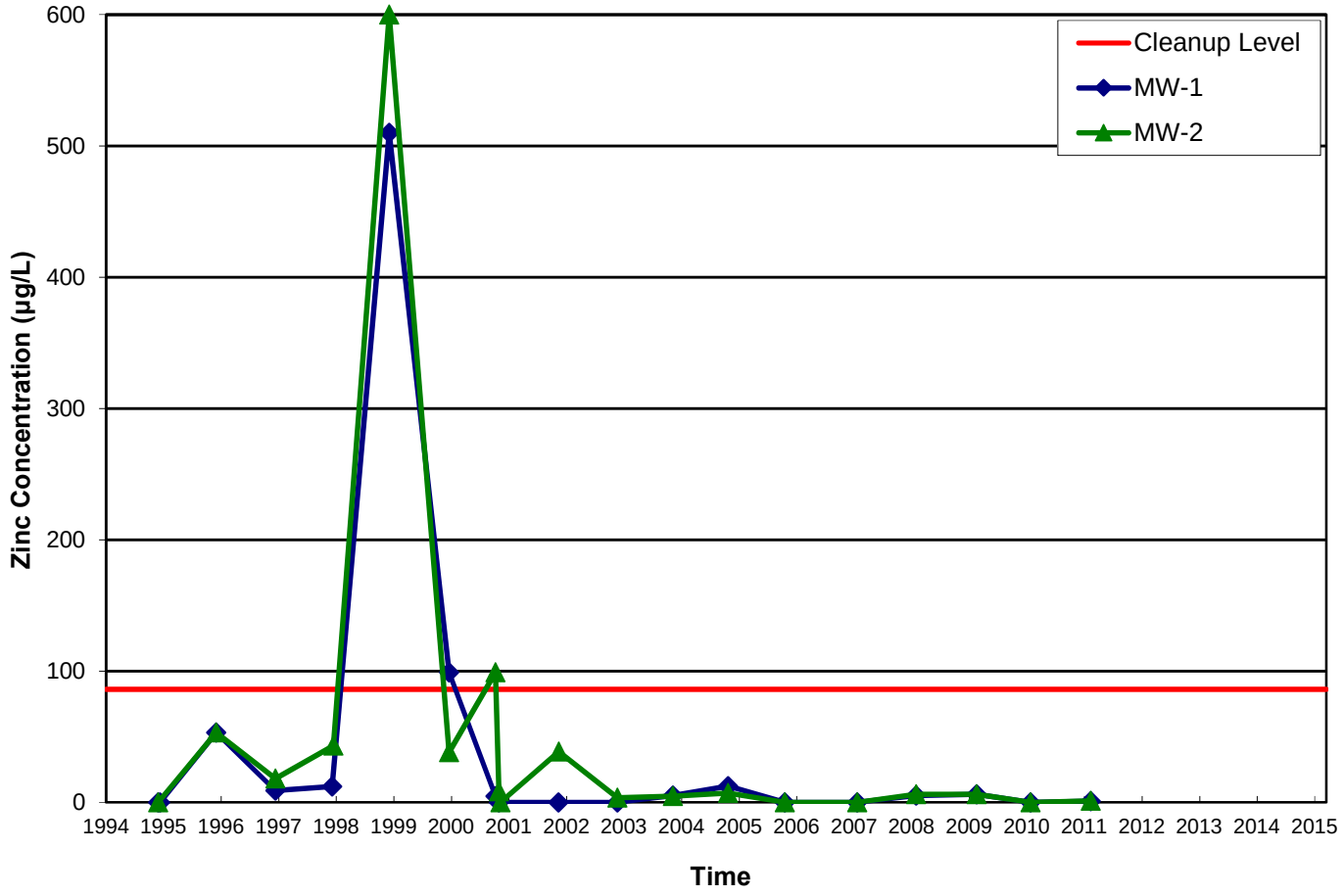
MW-1 and MW-2 Lead Concentration

19000-09 3/15

HARTCROWSER

Figure
D-3

PRS 03/06/15 1900009\D3.xls



Note:
For sampling events that included a duplicate sample for dissolved zinc analysis, the greater analytical result for the two samples is plotted (see Table 1).

Zinc analysis was discontinued in 2011 with Ecology approval dated June 28, 2011.

Former Cascade Timber No. 3 Log Sort Yard
Port of Tacoma

MW-1 and MW-2 Zinc Concentration

19000-09 3/15

HARTCROWSER

Figure
D-4

PRS 03/06/15 1900009\D4.xls

APPENDIX E
Plot of Groundwater Elevations Versus Time

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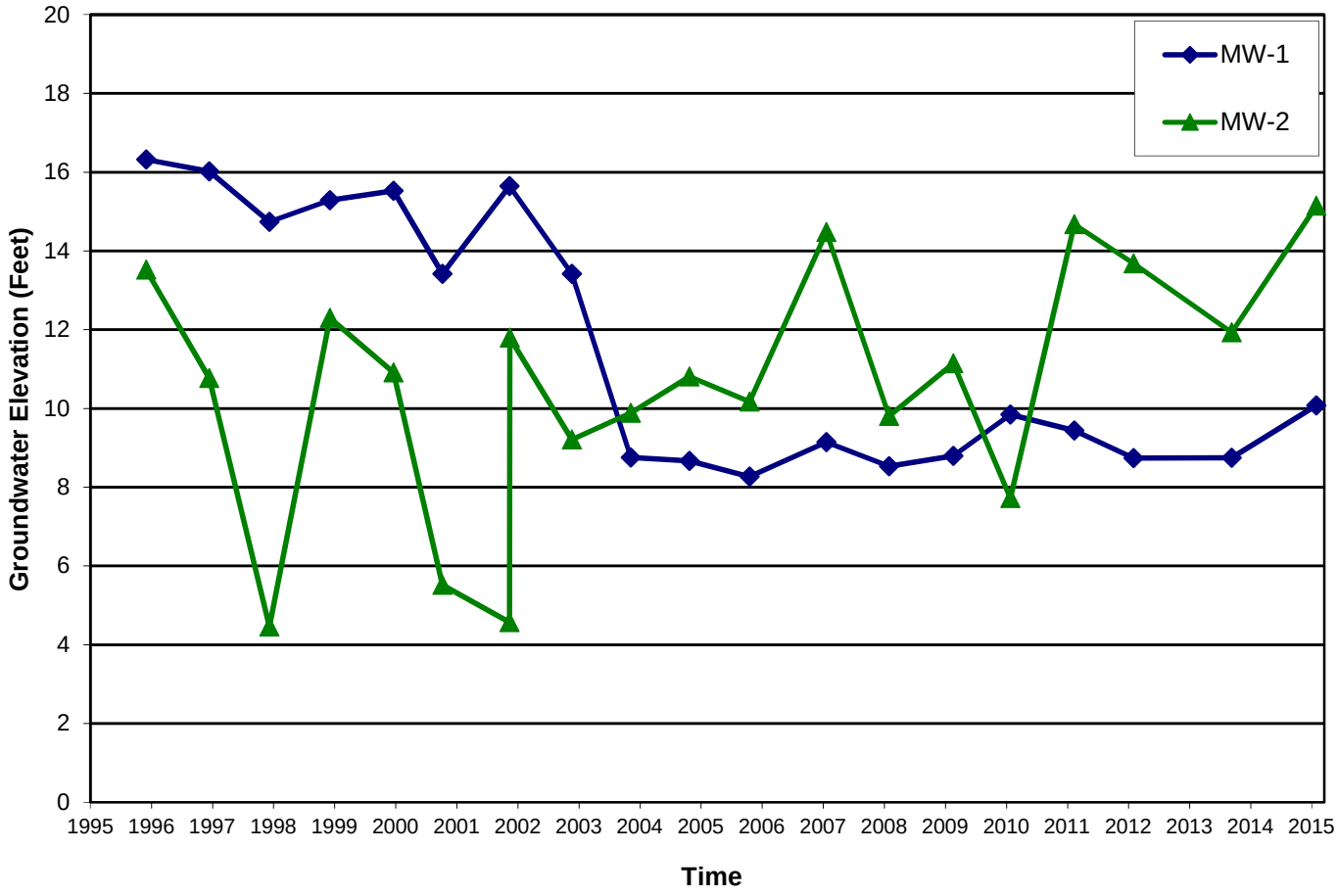

Former Cascade Timber No. 3 Log Sort Yard
Port of Tacoma

MW-1 and MW-2 Groundwater Elevation

19000-09 3/15

HARTCROWSER

Figure

E-1

PRS 03/06/15 1900009\E1.xls

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