Groundwater Monitoring Report

Former Murray Pacific No. 2 Log Sort Yard

Port of Tacoma
Tacoma, WA

Prepared for
Port of Tacoma

October 14, 2016
Job No. 19000-10

HARTCROWSER

Groundwater Monitoring Report

Former Murray Pacific No. 2 Log Sort Yard

Port of Tacoma
Tacoma, WA

Consent Decree No. 94-2-099227
Consent Decree Date September 16, 1994
Monitoring Date: August 26, 2016

Prepared for
Port of Tacoma

October 14, 2016
Job No. 19000-10

Prepared by
Hart Crowser, Inc.

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Groundwater Monitoring Report

Former Murray Pacific No. 2 Log Sort Yard

Port of Tacoma

Tacoma, WA

1.0 INTRODUCTION

This report summarizes field activities and presents the results of the groundwater monitoring event Hart Crowser completed on August 26, 2016 on behalf of the Port of Tacoma (Port) at the Former Murray Pacific No. 2 Log Sort Yard (the site), located at 2407 Port of Tacoma Road in Tacoma, Washington (Figure 1).

Hart Crowser monitored groundwater in accordance with the procedures in the compliance monitoring plan dated December 1997 (Port of Tacoma 1997). The Washington State Department of Ecology (Ecology) approved sampling techniques and an updated groundwater monitoring analyte list in letters dated September 28, 2001; February 20, 2007; and October 26, 2009. Ecology approved removal of lead from the site analyte list in 2001, and removal of copper and zinc from the list in 2007. A memorandum of understanding (MOU) between Ecology and the Port, issued on September 12, 2011, updated the monitoring frequency from every 6 months to every 18 months beginning February 2012. A copy of the MOU is in Appendix A.

In June 2014, Ecology conducted a periodic review of post-cleanup site conditions and monitoring data to ensure that human health and the environment are being protected. The report on the review meets the intent of the consent decree, Section XXIII (Five-Year Review). The next five-year review is expected to be in June 2019.

2.0 SITE BACKGROUND

The site is adjacent to the Blair Waterway in Commencement Bay and was previously leased to the Murray Pacific Corporation (Murray Pacific) and operated as a log sort yard. Before 1970, the site was unleased and undeveloped. Currently, it is leased to Washington United Terminals and is used as a shipping container terminal.

Ecology collected stormwater runoff samples at the site between November 1983 and June 1984 (Norton 1985). Kennedy/Jenks Consultants performed a remedial investigation/feasibility study in 1993 as an independent action for the Port of Tacoma in compliance with Ecology's Model Toxics Control Act (MTCA). In September 1994, Ecology issued Consent Decree 94-2-09922-7 for the site. Monitoring wells MPC-1S, MPC-2S, and MPC-3D were abandoned when construction of a low-permeability asphalt cap and stormwater drainage system was completed in 1997. Three replacement monitoring wells (MW-X, MW-Y, and MW-Z) were installed in 1998 for compliance monitoring, which is still being performed to fulfill the requirements of the consent decree.

3.0 GROUNDWATER MONITORING

The purpose of the groundwater monitoring program is to assess groundwater quality at the facility to determine whether the remedial action is effective. On August 26, 2016, Hart Crowser collected groundwater samples from monitoring wells MW-X, MW-Y, and MW-Z. 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-W) was collected from monitoring well MW-X. 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 by EPA Method 200.8 for comparison to the groundwater cleanup levels established in Consent Decree 94-2-099227. The groundwater sampling field logs are in Appendix B.

Analytical results show that performance standards were met for dissolved arsenic in wells MW-X and MW-Z. Dissolved arsenic was detected in MW-X and MW-Z at 0.230 µg/L and 0.401 µg/L, respectively, which are below the cleanup level of 5 µg/L. Dissolved arsenic was detected in MW-Y at 8.62 µg/L, above the cleanup level of 5 µg/L. MW-Y is located approximately 250 feet from the Blair Waterway. The analytical results are in Table 1, and the laboratory report is in Appendix C. Plots of arsenic concentration versus time for the three wells are in Appendix D.

The condition of the wells was observed during the monitoring event. Significant sediment buildup was noted in MW-Z and the monument was full of water. The groundwater level was measured in each well prior to sampling. Groundwater levels were measured to the nearest hundredth of a foot as depth relative to the top of the well casing using a Waterline water level meter. Groundwater depth and elevation data are in Table 2.

4.0 RECOMMENDATIONS

Repairing or replacing the gasket in the lid of MW-Z is recommended to prevent infiltration of water and sediment into the monument.

The dissolved arsenic concentration in groundwater will continue to be monitored. The next groundwater monitoring event is scheduled for February 2018 to meet the 18-month frequency requirements of the MOU.

5.0 REFERENCES

Ecology 1994. Consent Decree 94-2-09922-7. Washington State Department of Ecology. September 1994.

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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.

Port of Tacoma 1997. Compliance Monitoring Plan: Murray Pacific Log Sort Yard Number 2/Hyundai Merchant Marine Project. Revised December 1997.

L:\Notebooks\1900010_Murray Pacific GW Monitoring\Deliverables\Reports\Final GW Monitoring Report\Port of Tacoma 2016 GW Monitoring Rpt_MP.docx

Table 1 - Groundwater Analytical Data
Former Murray Pacific No. 2 Log Sort Yard

Well ID	Date	Concentration in µg/L			
		Dissolved Arsenic	Dissolved Copper	Dissolved Lead	Dissolved Zinc
Groundwater Cleanup Levels [(a)]:		***5***	***2.9***	***8.5***	***86***
MW-X	07/22/98	**20**	**3.2**	0.52	8.9
MW-X (Duplicate)	07/22/98	3.4	**3.3**	ND	8
MW-X	01/21/99	0.98	ND	ND	23
MW-X (Duplicate)	01/21/99	0.52	ND	ND	18
MW-X	07/20/99	**7.7**	2.2	ND	79
MW-X (Duplicate)	07/20/99	**8.7**	2	ND	71
MW-X	02/24/00	4.5	2.2	ND	**86**
MW-X (Duplicate)	02/24/00	4.8	2.3	ND	**100**
MW-X	07/27/00	4.9	1.4	ND	5.5
MW-X (Duplicate)	07/27/00	**5.4**	1.6	ND	4.4
MW-X	07/17/01	4.4	1.2	ND	50
MW-X (Duplicate)	07/17/01	4.3	ND	ND	64
MW-X	01/16/02	3.88	1.5	--	ND
MW-X (Duplicate)	01/16/02	4.15	1.9	--	7.93
MW-X	07/16/02	**5.06**	1.53	--	1.29
MW-X (Duplicate)	07/16/02	**5.33**	1.95	--	2.6
MW-X	01/13/03	4.97	ND	--	ND
MW-X (Duplicate)	01/13/03	4.73	ND	--	ND
MW-X	07/15/03	4.81	ND	--	ND
MW-X (Duplicate)	07/15/03	4.97	ND	--	ND
MW-X	02/04/04	**9.22**	1.32	--	5.46
MW-X (Duplicate)	02/04/04	**8.9**	1.17	--	6.23
MW-X	08/02/04	**8.24**	2.61	--	18.6
MW-X (Duplicate)	08/02/04	**7.45**	1.49	--	14.7
MW-X	07/26/05	**5.37**	ND	--	ND
MW-X (Duplicate)	07/26/05	**6.26**	**3.57**	--	7.44
MW-X	08/11/06	3	ND	--	ND
MW-X (Duplicate)	08/11/06	ND	ND	--	--
MW-X	01/29/07	**6.7**	ND	ND	ND
MW-X	02/08/08	3.1	--	--	--
MW-X (Duplicate)	02/08/08	1.9 J	--	--	--
MW-X	09/12/08	0.7	--	--	--
MW-X (Duplicate)	09/12/08	0.9	--	--	--
MW-X	02/27/09	0.6	--	--	--
MW-X (Duplicate)	02/27/09	0.6	--	--	--
MW-X	07/23/09	0.7	--	--	--
MW-X (Duplicate)	07/23/09	0.4	--	--	--
MW-X	02/04/10	<0.5	--	--	--
MW-X (Duplicate)	02/04/10	<0.5	--	--	--

Table 1 - Groundwater Analytical Data
Former Murray Pacific No. 2 Log Sort Yard

Well ID	Date	Concentration in µg/L			
		Dissolved Arsenic	Dissolved Copper	Dissolved Lead	Dissolved Zinc
Groundwater Cleanup Levels [(a)] :		***5***	***2.9***	***8.5***	***86***
MW-X	09/17/10	<0.5	--	--	--
MW-X (Duplicate)	09/17/10	<0.5	--	--	--
MW-X	02/15/11	<0.5	--	--	--
MW-X (Duplicate)	02/15/11	<0.5	--	--	--
MW-X	02/14/12	<0.5	--	--	--
MW-X (Duplicate)	02/14/12	<0.5	--	--	--
MW-X	08/23/13	1.4	--	--	--
MW-X (Duplicate)	08/23/13	1.3	--	--	--
MW-X	02/12/15	3.0	--	--	--
MW-X (Duplicate)	02/12/15	3.0	--	--	--
MW-X	08/26/16	0.217	--	--	--
MW-X (Duplicate)	08/26/16	0.230	--	--	--
MW-Y	07/22/98	**15**	2	1.7	8.5
MW-Y	01/21/99	0.52	ND	ND	24
MW-Y	07/20/99	3	ND	ND	73
MW-Y	02/24/00	2	ND	ND	**94**
MW-Y	07/27/00	ND	ND	ND	ND
MW-Y	07/17/01	**8**	ND	ND	23
MW-Y	01/16/02	**13.1**	ND	--	6.92
MW-Y	07/16/02	**18.7**	0.584	--	2.77
MW-Y	01/13/03	**9.49**	ND	--	ND
MW-Y	07/15/03	**16.5**	ND	--	ND
MW-Y	02/04/04	**8.45**	2.45	--	9.64
MW-Y	08/02/04	**7.64**	ND	--	12.9
MW-Y	07/26/05	**10.7**	ND	--	ND
MW-Y	08/11/06	**13**	ND	--	ND
MW-Y	01/29/07	**7**	ND	--	ND
MW-Y	02/08/08	**9.3**	--	--	--
MW-Y	09/12/08	**8.9**	--	--	--
MW-Y	02/27/09	**7.4**	--	--	--
MW-Y	07/23/09	2.3	--	--	--
MW-Y	02/04/10	**10.9**	--	--	--
MW-Y	09/17/10	**26.6**	--	--	--
MW-Y	02/15/11	3.3	--	--	--
MW-Y	02/14/12	**19**	--	--	--
MW-Y	08/23/13	**7.4**	--	--	--
MW-Y	02/12/15	**6.5**	--	--	--
MW-Y	08/26/16	**8.62**	--	--	--

Table 1 - Groundwater Analytical Data
Former Murray Pacific No. 2 Log Sort Yard

Well ID	Date	Concentration in µg/L			
		Dissolved Arsenic	Dissolved Copper	Dissolved Lead	Dissolved Zinc
Groundwater Cleanup Levels [(a)] :		***5***	***2.9***	***8.5***	***86***
MW-Z	07/22/98	**6.5**	ND	0.84	3.7
MW-Z	01/22/99	ND	ND	ND	16
MW-Z	07/20/99	**30**	2.3	ND	68
MW-Z	02/24/00	**11**	2.3	0.52	44
MW-Z	07/27/00	**11**	1.9	ND	ND
MW-Z	07/17/01	**7.3**	1.4	ND	16
MW-Z	01/16/02	**5.68**	1.84	--	5.69
MW-Z	07/16/02	**5.99**	2.25	--	3.3
MW-Z	01/13/03	**5.1**	**2.92**	--	ND
MW-Z	07/15/03	**5.12**	ND	--	ND
MW-Z	02/04/04	**8.62**	1.62	--	6.62
MW-Z	08/02/04	**8.41**	2.07	--	14.3
MW-Z	07/26/05	**5.88**	ND	--	ND
MW-Z	08/11/06	2.6	ND	--	ND
MW-Z	01/29/07	**14**	ND	--	ND
MW-Z	02/08/08	3.4	--	--	--
MW-Z	09/12/08	0.6	--	--	--
MW-Z	02/27/09	0.8	--	--	--
MW-Z	07/23/09	0.4	--	--	--
MW-Z	02/04/10	<0.5	--	--	--
MW-Z	09/17/10	0.6	--	--	--
MW-Z	02/15/11	2.9	--	--	--
MW-Z	02/14/12	<0.5	--	--	--
MW-Z	08/23/13	1.9	--	--	--
MW-Z	02/12/15	3.1	--	--	--
MW-Z	08/26/16	0.401	--	--	--

Notes:

Lead analysis was discontinued in 2001, and copper and zinc analyses were discontinued in 2008 with Ecology approval respectively dated September 28, 2001, and February 20, 2007.

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 established in Consent Decree 94-2-09922-7.

-- 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 Murray Pacific No. 2 Log Sort Yard

Well ID	*Date*	*Water Level in Feet [(a)]*
MW-X	07/22/98	10.62
MW-X	01/21/99	10.08
MW-X	07/20/99	10.14
MW-X	02/24/00	10.09
MW-X	07/27/00	10.76
MW-X	07/17/01	11.02
MW-X	01/16/02	10.97
MW-X	07/16/02	10.78
MW-X	01/13/03	10.95
MW-X	07/15/03	10.90
MW-X	02/04/04	10.80
MW-X	08/02/04	11.00
MW-X	07/26/05	10.93
MW-X	08/11/06	10.84
MW-X	01/29/07	10.72
MW-X	02/08/08	10.14
MW-X	09/12/08	11.80
MW-X	02/27/09	11.12
MW-X	07/23/09	11.05
MW-X	02/04/10	10.90
MW-X	09/17/10	10.89
MW-X	02/15/11	10.70
MW-X	02/14/12	11.85
MW-X	08/23/13	10.91
MW-X	02/12/15	10.69
MW-X	08/26/16	10.83
MW-Y	07/22/98	9.48
MW-Y	01/21/99	8.18
MW-Y	07/20/99	9.37
MW-Y	02/24/00	9.15
MW-Y	07/27/00	9.56
MW-Y	07/17/01	9.70
MW-Y	01/16/02	9.51
MW-Y	07/16/02	9.42
MW-Y	01/13/03	9.77
MW-Y	07/15/03	9.72
MW-Y	02/04/04	9.41
MW-Y	08/02/04	9.86
MW-Y	07/26/05	9.84
MW-Y	08/11/06	9.79
MW-Y	01/29/07	9.70

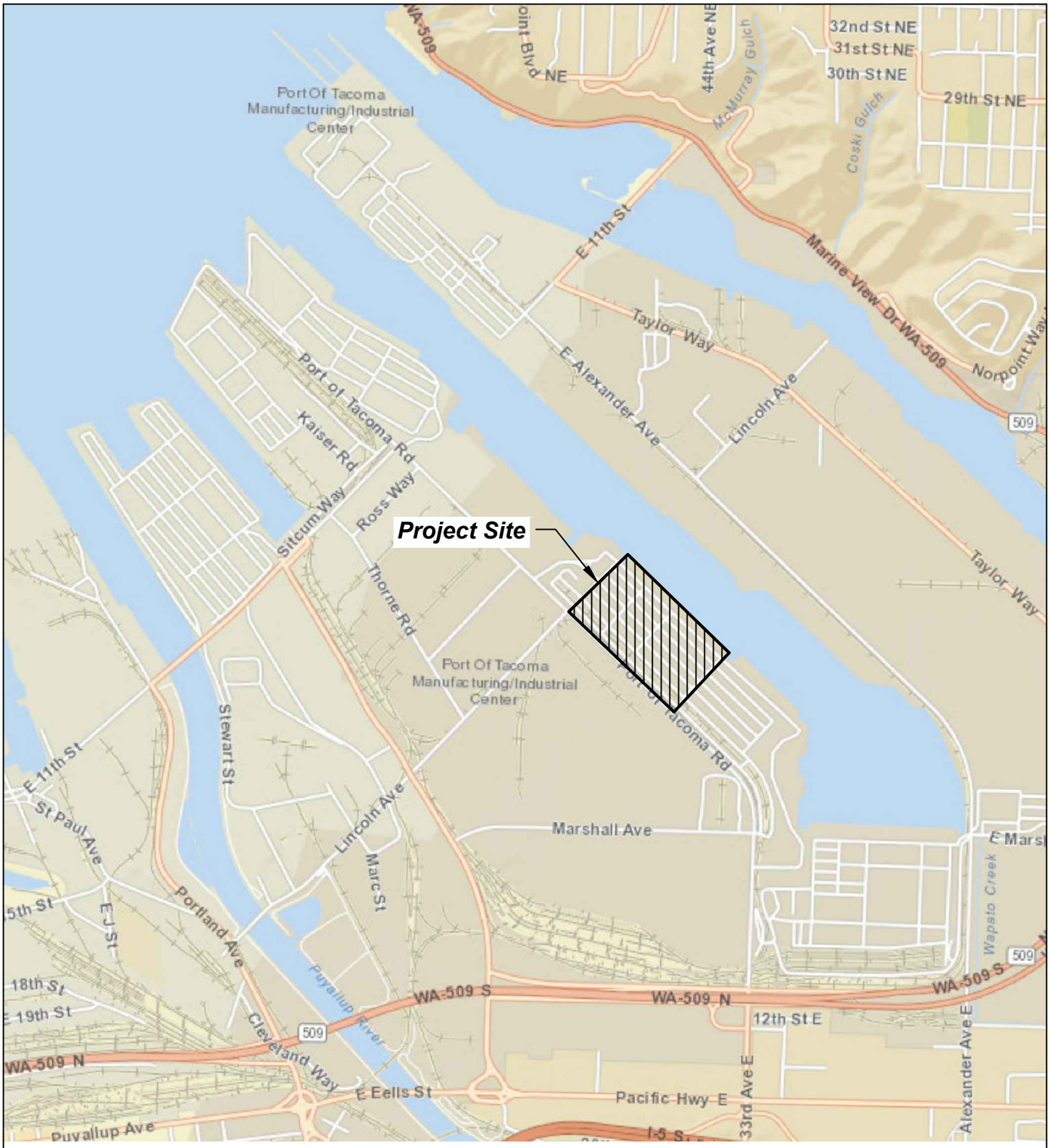
Table 2 - Water Level Data
Former Murray Pacific No. 2 Log Sort Yard

Well ID	*Date*	*Water Level in Feet [(a)]*
MW-Y	02/08/08	9.46
MW-Y	09/12/08	9.73
MW-Y	02/27/09	9.58
MW-Y	07/23/09	9.62
MW-Y	02/04/10	9.41
MW-Y	09/17/10	9.56
MW-Y	02/15/11	9.3
MW-Y	02/14/12	9.95
MW-Y	08/23/13	9.43
MW-Y	02/12/15	9.38
MW-Y	08/26/16	9.71
MW-Z	07/22/98	15.35
MW-Z	01/21/99	12.01
MW-Z	07/20/99	13.07
MW-Z	02/24/00	12.27
MW-Z	07/27/00	13.29
MW-Z	07/17/01	12.48
MW-Z	01/16/02	13.28
MW-Z	07/16/02	12.71
MW-Z	01/13/03	28.10
MW-Z	07/15/03	12.92
MW-Z	02/04/04	12.15
MW-Z	08/02/04	13.17
MW-Z	07/26/05	13.38
MW-Z	08/11/06	13.26
MW-Z	01/29/07	13.17
MW-Z	02/08/08	12.54
MW-Z	09/12/08	13.13
MW-Z	02/27/09	13.14
MW-Z	07/23/09	13.36
MW-Z	02/04/10	11.5
MW-Z	09/17/10	12.51
MW-Z	02/15/11	11.62
MW-Z	02/14/12	12.95
MW-Z	08/23/13	13.23
MW-Z	02/12/15	11.64
MW-Z	08/26/16	12.65

Notes

(a) Water levels are expressed as feet below top of casing.

TOC elevation is not available.



0 2000 4000

Scale in Feet

N

Source: Base map prepared from ArcGIS Online, 2014.

Former Murray Pacific No. 2 Log Sort Yard
Port of Tacoma

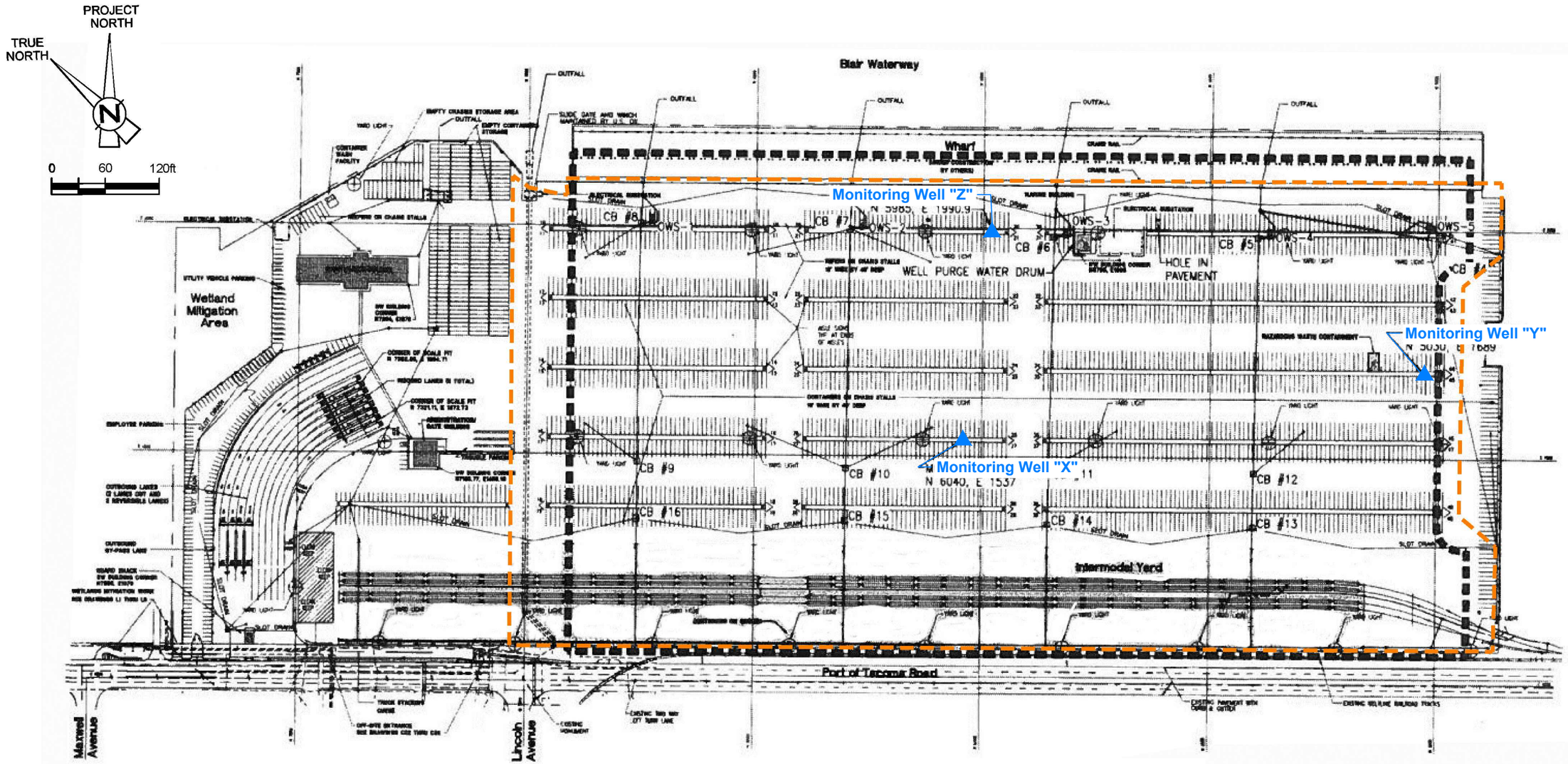
Vicinity Map

19000-10 10/16

HARTCROWSER

Figure
1

EAL 10/3/16 1900010-001.dwg



Former Murray Pacific No. 2 Log Sort Yard
Port of Tacoma

Site Plan

19000-10 10/16

HARTCROWSER

Figure **2**

EAL 10/13/16 1900010-002.dwg

Source: Kennedy/Jenks Consultants Figure 2.

APPENDIX A
Memorandum of Understanding

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

APPENDIX B
Groundwater Monitoring Field Logs

8/26/16 @ 1133

DUP: @ 1139

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

PROJECT	MURRAY PACIFIC	DATE/TIME SAMPLED	8/26/16
JOB NO.	19000-08	TIDALLY INFLUENCED	YES ✓ NO
PROJECT MANAGER	M. DAGEL	WELL DEPTH IN FEET	
FIELD REPS	N. GALVIN	SCREENED INTERVAL IN FEET	

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

WELL DEPTH		CASING VOLUME IN GALLONS	0.38
DEPTH TO SEDIMENT (DTS) IN FEET	13.19	[2" diam = x .163 gal/ft	4" diam = x .653 gal/ft]
DEPTH TO WATER (DTW) IN FEET	10.83	PURGE VOLUME IN GALLONS	1.15
(DTS – DTW)	2.36	ACTUAL PURGE IN GALLONS	~2.25

Time	No. of Gallons Purged	pH	Temp in °C	Conduct in ____	Diss. Oxygen in ____	Turbidity	ORP in ____	Comments: quality, recovery, color, odor, sheen, accumulated silt/sand
1119	~0.5	7.04	18.48	6198	0.01	0.3	-57	CLEAR, NO/NS V.SL. YELLOW-ORANGE
1123	~1	6.95	18.38	6202	0	0.8	-71	" " "
1126	~1.5	6.89	18.22	6220	0	0.3	-85	" " "
1130	~2	6.86	18.16	6359	0	0.4	-93	" " "
sample: 1133								

Comments:

	Method	Pumping Rate in GPM	Depth of Equip. in Feet
Purge	PERISTALTIC	< 2L/MIN	~12
Sample	"	"	"

Boils dry? Yes ____ No X

At no. of casing volumes ____

Purge Water Disposal Method/Volume

ON SITE DRUM

(2) Sampling Data

Bottle Type	# of Containers	Analyses	Preserv.	Filter
0.5 L PE	2	TDSS, AS	N/A	0.45

Total number of Bottles 2

Duplicate Sample I.D. MW-W @ 1139

Field Blank I.D. —

Rinseate Sample I.D. —

(3) Field Equipment

Type/Brand/Serial No./Material Units

Pump Type/Tubing Type	PERISTALTIC 1/8" PE	Temp/pH/E.C. meter	INSITU 9500
Bailer Type	—	Water Level Probe	WATERLINE
Filter Type	GEOTECH 0.45 µm	Other	

(4) Well Conditions

OK ☒ Not OK ☐ Explain

8/26/16 @ 1241

HARTCROWSER Groundwater Sampling Data - Well I.D. MW-4

PROJECT	MURRAY PACIFIC	DATE/TIME SAMPLED	8/26/16
JOB NO.	19000-08	TIDALLY INFLUENCED	YES ✓ NO
PROJECT MANAGER	M. DAGEL	WELL DEPTH IN FEET	
FIELD REPS	N. GALVIN	SCREENED INTERVAL IN FEET	

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

WELL DEPTH		CASING VOLUME IN GALLONS	0.80
DEPTH TO SEDIMENT (DTS) IN FEET	14.62	[2" diam = x .163 gal/ft	4" diam = x .653 gal/ft]
DEPTH TO WATER (DTW) IN FEET	9.71	PURGE VOLUME IN GALLONS	2.4
(DTS – DTW)	4.91	ACTUAL PURGE IN GALLONS	~2.5

Time	No. of Gallons Purged	pH	Temp in °C	Conduct in ____	Diss. Oxygen in ____	Turbidity	ORP in ____	Comments: quality, recovery, color, odor, sheen, accumulated silt/sand
1155	~0.5	7.31	14.27	4094	0.10	3.7	-116	CLEAR, V.SL. YELLOW-ORANGE TINT NO/VSL. SHEEN
1158	1	7.11	18.41	4207	0.03	3.0	-132	" " "
1202	1.5	6.95	18.30	4334	0.03	2.4	-141	" " "
1206	2	6.86	18.25	4433	0.0	1.8	-145	" " "
sample: 1211	2.5	6.80	18.30	4499	0.0	3.0	-148	

Comments:

	Method	Pumping Rate in GPM	Depth of Equip. in Feet
Purge	PERISTALTIC	<2 L/MIN	~11
Sample			

Boils dry? Yes _____ No _____

At no. of casing volumes _____

Purge Water Disposal Method/Volume

ON SITE DRUM

(2) Sampling Data

Bottle Type	# of Containers	Analyses	Preserv.	Filter
0.5L PE	1	DISS. AS	N/A	0.45µm

Total number of Bottles 1

Duplicate Sample I.D. —

Field Blank I.D. —

Rinseate Sample I.D. —

(3) Field Equipment

	Type/Brand/Serial No./Material Units		
Pump Type/Tubing Type	PERISTALTIC / ⅛" PE	Temp/pH/E.C. meter	INSITU 9500
Bailer Type	—	Water Level Probe	WATERLINE
Filter Type	GEOTECH 0.45 µm	Other	

(4) Well Conditions

OK ☒ Not OK ☐ Explain

8/26/16 @ 1100

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

PROJECT	MURRAY PACIFIC	DATE/TIME SAMPLED	8/26/16
JOB NO.	19000-08	TIDALLY INFLUENCED	YES ✓ NO
PROJECT MANAGER	M. DAGEL	WELL DEPTH IN FEET	
FIELD REPS	N. GALVIN	SCREENED INTERVAL IN FEET	

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

WELL DEPTH		CASING VOLUME IN GALLONS	2.50
DEPTH TO SEDIMENT (DTS) IN FEET	27.96	[2" diam = x .163 gal/ft	4" diam = x .653 gal/ft]
DEPTH TO WATER (DTW) IN FEET	12.65	PURGE VOLUME IN GALLONS	7.5
(DTS – DTW)	15.31	ACTUAL PURGE IN GALLONS	~5

Time	No. of Gallons Purged	pH	Temp in °C	Conduct in µS/cm	Diss. Oxygen in mg/L	Turbidity	ORP in mV	Comments: quality, recovery, color, odor, sheen, accumulated silt/sand
1033	~0.5	7.33	15.26	9502	0.16	3.3	-126	CLEAR, V.SL. YELLOW-ORANGE TINT. NO/SHEEN
1043	~2	6.81	14.93	8548	0.04	17.3	-175	" "
1049	~3	6.73	14.87	8209	0	29.7	-174	* TURBIDITY VALUES SUSPECT
1057	~4	6.71	14.83	7712	0	24.9	-175	" "
sample: 1100								

V. SL. SHEEN

Comments: SEDIMENT ACCUMULATION IN BOTTOM OF WELL.

	Method	Pumping Rate in GPM	Depth of Equip. in Feet
Purge	PERISTALTIC	<2L/MIN	~14
Sample	"	"	"

Boils dry? Yes ____ No X

At no. of casing volumes ____

Purge Water Disposal Method/Volume: ON SITE DRUM

(2) Sampling Data

Bottle Type	# of Containers	Analyses	Preserv.	Filter
0.5 L POLY	1	DISS. AS.	NA	YES

Total number of Bottles: 1

Duplicate Sample I.D.: —

Field Blank I.D.: —

Rinseate Sample I.D.: —

(3) Field Equipment

Type/Brand/Serial No./Material Units

Pump Type/Tubing Type	PERISTALTIC / 1/8" PE	Temp/pH/E.C. meter	IN SITU 9500
Bailer Type	—	Water Level Probe	WATERLINE
Filter Type	GEOTECH 0.45 µm	Other	

(4) Well Conditions

OK ☐ Not OK ☒ Explain: H2O IN MONUMENT ABOVE J-PLUG

APPENDIX C
Laboratory Report
Analytical Resources, Inc.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

14 September 2016

Mark Dagel
Hart Crowser
3131 Elliott Ave Suite 600
Seattle, WA 98121

RE: Murray Pacific

Please find enclosed sample receipt documentation and analytical results for samples from the project referenced above.

Sample analyses were performed according to ARI's Quality Assurance Plan and any provided project specific Quality Assurance Plan. Each analytical section of this report has been approved and reviewed by an analytical peer, the appropriate Laboratory Supervisor or qualified substitute, and a technical reviewer.

Should you have any questions or problems, please feel free to contact us at your convenience.

Associated Work Order(s)	Associated SDG ID(s)
16H0258	N/A

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed in the enclose Narrative. ARI, an accredited laboratory, certifies that the report results for which ARI is accredited meets all the reqirements of the accrediting body. A list of certified analyses, accreditations, and expiration dates is included in this report.

Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or his/her designee, as verified by the following signature.

Analytical Resources, Inc.

Amanda Volgardsen For Kelly Bottem, Client Services Manager

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Cert# 100006

PJLA Testing
Accreditation # 66169

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Sample Custody Record

16H0258

6.1°C

PG. 1 of 1

Samples Shipped to: ARI

HARTCROWSER

Hart Crowser, Inc.
1700 Westlake Avenue North, Suite 200
Seattle, Washington 98109-6212
Office: 206.324.9530 • Fax 206.328.5581

JOB 19000-08 LAB NUMBER

PROJECT NAME MURRAY PACIFIC

HART CROWSER CONTACT N. GALVIN
M. DAGEL

SAMPLED BY: MWG

LAB NO.	SAMPLE ID	DESCRIPTION	DATE	TIME	MATRIX	REQUESTED ANALYSIS: Diss. As (200.8) *	NO. OF CONTAINERS	OBSERVATIONS/COMMENTS/ COMPOSITING INSTRUCTIONS
	MW-Z		8/26/16	1100	H2O	X	1	
	MW-X		"	1133	"	X	1	
	MW-W		"	1139	"	X	1	
	MW-Y		"	1211	"	X	1	

RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE: Nicholas Galvin	8/26/16	SIGNATURE: Sustin Meyer	8/26/16
PRINT NAME: Nicholas Galvin	TIME: 1520	PRINT NAME:	TIME: 1520
COMPANY: Hart Crowser		COMPANY: ARI	
RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE	TIME	SIGNATURE	TIME
PRINT NAME		PRINT NAME	
COMPANY		COMPANY	

SPECIAL SHIPMENT HANDLING OR STORAGE REQUIREMENTS:

* DISS AS SAMPLES ARE FIELD FILTERED

TOTAL NUMBER OF CONTAINERS

SAMPLE RECEIPT INFORMATION
CUSTODY SEALS: ☐YES ☐NO ☐N/A
GOOD CONDITION ☐YES ☐NO
TEMPERATURE _____
SHIPMENT METHOD: ☐HAND ☐COURIER ☐OVERNIGHT

COOLER NO.: STORAGE LOCATION:

See Lab Work Order No. _____
for Other Contract Requirements

TURNAROUND TIME:
☐ 24 HOURS ☐ 1 WEEK
☐48 HOURS ☒STANDARD
☐72 HOURS OTHER _____

White and Yellow Copies to Lab Pink to Project Manager Lab to Return White Copy to Hart Crowser Gold to Sample Custodian

WORK ORDER

16H0258

Client: Hart Crowser	**Project Manager: Kelly Bottem**
Project: Murray Pacific	**Project Number: Murray Pacific**

Preservation Confirmation

Container ID	Container Type	pH
16H0258-01 A	HDPE NM, 500 mL	>2 Fa.
16H0258-02 A	HDPE NM, 500 mL	
16H0258-03 A	HDPE NM, 500 mL	
16H0258-04 A	HDPE NM, 500 mL	

TR
Preservation Confirmed By

8-26-16
Date

Reviewed By

Date

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: Hart Crowser

Project Name: Murray Pacific

COC No(s): _____ NA

Delivered by: Fed-Ex UPS Courier Hand Delivered Other: _____

Assigned ARI Job No: 16H0258

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)	6.1	
Time: _____		

If cooler temperature is out of compliance fill out form 00070F

Temp Gun ID#: D90527-6

Cooler Accepted by: JM Date: 8-26-16 Time: 1529

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: TR Date: 8-26-16 Time: 1621

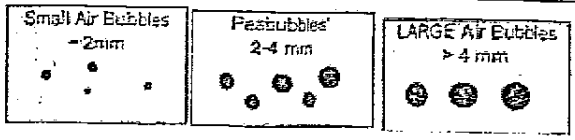
** *Notify Project Manager of discrepancies or concerns* **

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

Additional Notes, Discrepancies, & Resolutions:

Sample labels indicate that samples are field filtered but containers are un-preserved.

By: TR Date: 8-26-16



Small → "sm" (< 2 mm)

Peabubbles → "pb" (2 to < 4 mm)

Large → "lg" (4 to < 6 mm)

Headspace → "hs" (> 6 mm)

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Temperature Compliance Form

Cooler#: 1 Temperature(°C): 6.1

Sample ID	Bottle Count	Bottle Type
All samples over 6.1°C		

Cooler#: Temperature(°C):

Sample ID	Bottle Count	Bottle Type

Cooler#: Temperature(°C):

Sample ID	Bottle Count	Bottle Type

Cooler#: Temperature(°C):

Sample ID	Bottle Count	Bottle Type

Completed by: JM Date: 6-26-16 Time: 1520

Hart Crowser	Project: Murray Pacific	
3131 Elliott Ave Suite 600	Project Number: Murray Pacific	**Reported:**
Seattle, WA 98121	Project Manager: Mark Dagel	14-Sep-2016 10:23

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
MW-Z	16H0258-01	Water	26-Aug-2016 11:00	26-Aug-2016 15:20
MW-X	16H0258-02	Water	26-Aug-2016 11:33	26-Aug-2016 15:20
MW-W	16H0258-03	Water	26-Aug-2016 11:39	26-Aug-2016 15:20
MW-Y	16H0258-04	Water	26-Aug-2016 12:11	26-Aug-2016 15:20

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Hart Crowser	Project: Murray Pacific	
3131 Elliott Ave Suite 600	Project Number: Murray Pacific	**Reported:**
Seattle, WA 98121	Project Manager: Mark Dagel	14-Sep-2016 10:23

Case Narrative

Analytical Resources, Inc. (ARI) received four water samples in good condition on August 26, 2016. The samples were received with a cooler temperature of 6.1ºC. For further details regarding sample receipt, please refer to the enclosed Cooler Receipt Form and Preservation Verification sheet.

The samples were analyzed for Dissolved Metals, as requested on the COC.

Arsenic was detected in the method blank below ARI's reporting limits. The method blank has been flagged with a "J" qualifier.

There were no other irregularities associated with the analysis.

Hart Crowser	Project: Murray Pacific	
3131 Elliott Ave Suite 600	Project Number: Murray Pacific	**Reported:**
Seattle, WA 98121	Project Manager: Mark Dagel	14-Sep-2016 10:23

MW-Z

16H0258-01 (Water)

Metals and Metallic Compounds (dissolved)

Method: EPA 200.8 UCT-KED
Instrument: ICPMS2

Analyzed: 29-Aug-2016 18:45

Sample Preparation: Preparation Method: REN EPA 600/4-79-020 4.1.4 HNO3 matrix
Preparation Batch: BEH0598 Sample Size: 25 mL
Prepared: 29-Aug-2016 Final Volume: 25 mL

Analyte	CAS Number	Dilution	Reporting Limit	Result	Units	Notes
Arsenic, Dissolved	7440-38-2	1	0.200	**0.401**	ug/L	

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Hart Crowser	Project: Murray Pacific	
3131 Elliott Ave Suite 600	Project Number: Murray Pacific	**Reported:**
Seattle, WA 98121	Project Manager: Mark Dagel	14-Sep-2016 10:23

MW-X

16H0258-02 (Water)

Metals and Metallic Compounds (dissolved)

Method: EPA 200.8 UCT-KED
Instrument: ICPMS2
Analyzed: 29-Aug-2016 18:50

Sample Preparation: Preparation Method: REN EPA 600/4-79-020 4.1.4 HNO3 matrix
Preparation Batch: BEH0598 Sample Size: 25 mL
Prepared: 29-Aug-2016 Final Volume: 25 mL

Analyte	CAS Number	Dilution	Reporting Limit	Result	Units	Notes
Arsenic, Dissolved	7440-38-2	1	0.200	**0.217**	ug/L	

Hart Crowser	Project: Murray Pacific	
3131 Elliott Ave Suite 600	Project Number: Murray Pacific	**Reported:**
Seattle, WA 98121	Project Manager: Mark Dagel	14-Sep-2016 10:23

MW-W

16H0258-03 (Water)

Metals and Metallic Compounds (dissolved)

Method: EPA 200.8 UCT-KED
Instrument: ICPMS2

Analyzed: 29-Aug-2016 18:55

Sample Preparation: Preparation Method: REN EPA 600/4-79-020 4.1.4 HNO3 matrix
Preparation Batch: BEH0598 Sample Size: 25 mL
Prepared: 29-Aug-2016 Final Volume: 25 mL

Analyte	CAS Number	Dilution	Reporting Limit	Result	Units	Notes
Arsenic, Dissolved	7440-38-2	1	0.200	**0.230**	ug/L	

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Hart Crowser	Project: Murray Pacific	
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Seattle, WA 98121	Project Manager: Mark Dagel	14-Sep-2016 10:23

MW-Y

16H0258-04 (Water)

Metals and Metallic Compounds (dissolved)

Method: EPA 200.8 UCT-KED
Instrument: ICPMS2

Analyzed: 29-Aug-2016 19:34

Sample Preparation: Preparation Method: REN EPA 600/4-79-020 4.1.4 HNO3 matrix
Preparation Batch: BEH0598 Sample Size: 25 mL
Prepared: 29-Aug-2016 Final Volume: 25 mL

Analyte	CAS Number	Dilution	Reporting Limit	Result	Units	Notes
Arsenic, Dissolved	7440-38-2	1	0.200	**8.62**	ug/L	

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Hart Crowser	Project: Murray Pacific	
3131 Elliott Ave Suite 600	Project Number: Murray Pacific	**Reported:**
Seattle, WA 98121	Project Manager: Mark Dagel	14-Sep-2016 10:23

Metals and Metallic Compounds (dissolved) - Quality Control

Batch BEH0598 - REN EPA 600/4-79-020 4.1.4 HNO3 matrix

Instrument: ICPMS2

QC Sample/Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Blank (BEH0598-BLK1)			Prepared: 29-Aug-2016 Analyzed: 29-Aug-2016 18:30							
Arsenic	ND	0.200	ug/L							U
LCS (BEH0598-BS1)			Prepared: 29-Aug-2016 Analyzed: 29-Aug-2016 19:15							
Arsenic	25.2	0.200	ug/L	25.0		101	80-120			

Hart Crowser	Project: Murray Pacific	
3131 Elliott Ave Suite 600	Project Number: Murray Pacific	**Reported:**
Seattle, WA 98121	Project Manager: Mark Dagel	14-Sep-2016 10:23

Certified Analyses included in this Report

Analyte	Certifications
EPA 200.8 UCT-KED in Water	
Arsenic-75a	NELAP,WADOE,WA-DW,DoD-ELAP
Arsenic-75b	NELAP,WADOE,WA-DW,DoD-ELAP

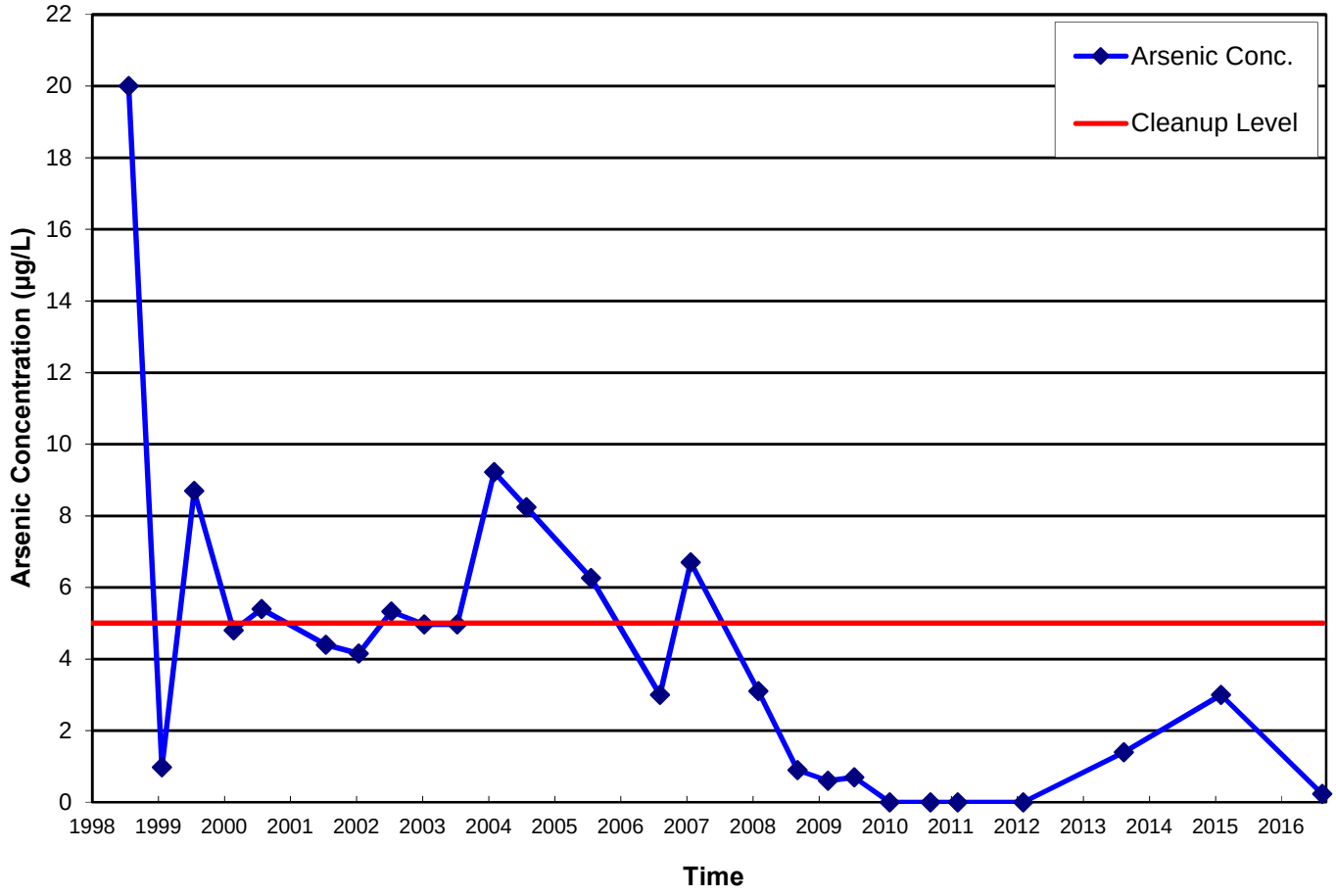
Code	Description	Number	Expires
ADEC	Alaska Dept of Environmental Conservation	UST-033	05/06/2017
CALAP	California Department of Public Health CAELAP	2748	02/28/2018
DoD-ELAP	DoD-Environmental Laboratory Accreditation Program	66169	03/30/2017
NELAP	ORELAP - Oregon Laboratory Accreditation Program	WA100006	05/11/2017
WADOE	WA Dept of Ecology	C558	06/30/2017
WA-DW	Ecology - Drinking Water	C558	06/30/2017

Hart Crowser	Project: Murray Pacific	
3131 Elliott Ave Suite 600	Project Number: Murray Pacific	**Reported:**
Seattle, WA 98121	Project Manager: Mark Dagel	14-Sep-2016 10:23

Notes and Definitions

U	This analyte is not detected above the applicable reporting or detection limit.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
[2C]	Indicates this result was quantified on the second column on a dual column analysis.

APPENDIX D
Plots of Arsenic Concentration Versus Time



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 Murray Pacific No. 2 Log Sort Yard
Port of Tacoma

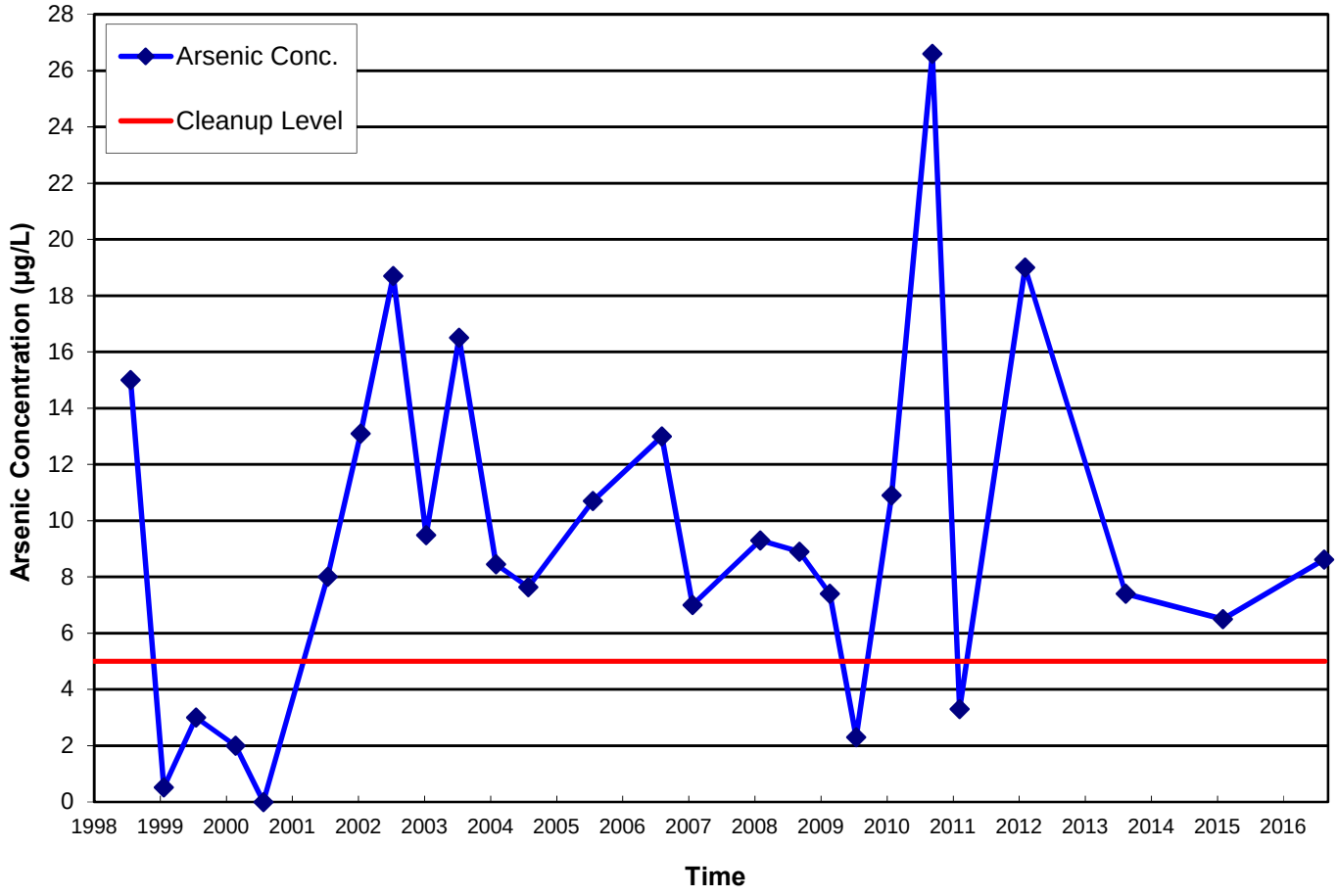
MW-X Arsenic Concentration

19000-10 08/16

HARTCROWSER

Figure
D-1

PRS 03/04/15 1900008\E1.xls



Former Murray Pacific No. 2 Log Sort Yard
Port of Tacoma

MW-Y Arsenic Concentration

19000-10 08/16

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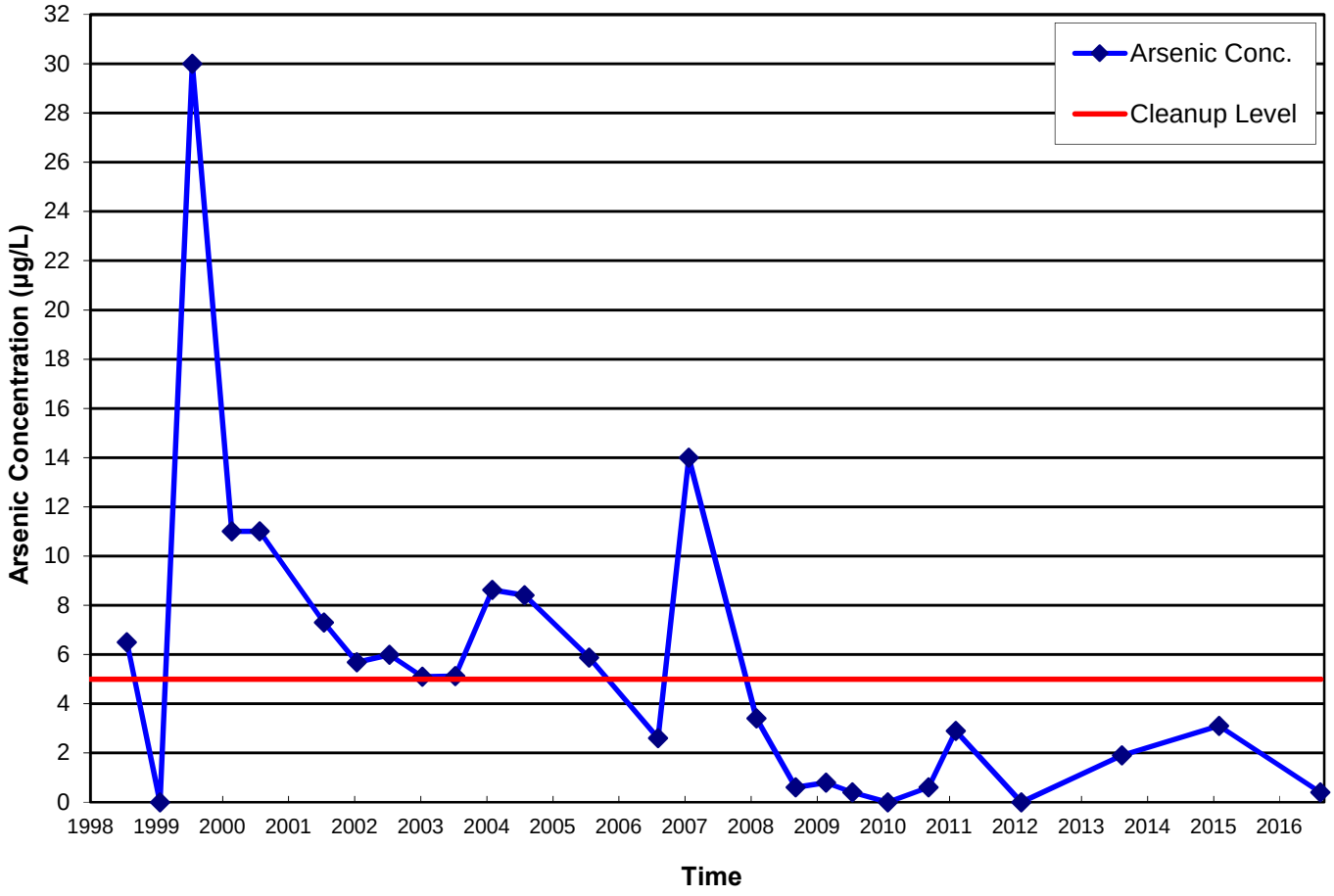
Figure

D-2

PRS 03/04/15 1900008\E2.xls



Former Murray Pacific No. 2 Log Sort Yard
Port of Tacoma

MW-Z Arsenic Concentration

19000-10 08/16

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Figure

D-3

PRS 03/04/15 1900008\E3.xls