TECHNICAL MEMORANDUM

LANDAU ASSOCIATES
ENVIRONMENTAL | GEOTECHNICAL | NATURAL RESOURCES

TO: Mohsen Kourehdar, Washington State Department of Ecology

cc: Alex Smith and Don Bache, Port of Olympia

FROM: Larry Beard, P.E., and Christine Kimmel, L.G.

DATE: April 25, 2013

RE: CORRECTED SEDIMENT QUALITY MONITORING RESULTS
2012 SEDIMENT PERFORMANCE MONITORING
CASCADE POLE SITE
OLYMPIA, WASHINGTON

This technical memorandum presents the results of a series of sediment quality investigations conducted at the Cascade Pole Site (Site) in Olympia, Washington. The Phase I sampling event was conducted in accordance with Amendment 1 to the Agreed Order No. DE 00TCPSR-753 issued between the Port of Olympia (Port) and the Washington State Department of Ecology (Ecology). The Phase II and Phase III sampling events were in follow-up to the analytical results from the Phase I sampling event.

As is discussed in the subsequent sections of this technical memorandum, a calculation error occurred in converting the dry weight analytical data to carbon normalized data for polycyclic aromatic hydrocarbons (PAHs), which resulted in incorrect concentrations significantly greater than the actual carbon normalized concentrations for the Phase I and Phase II data. This report presents corrected Phase I and Phase II data, and the subsequent Phase III data. The analytical results in this technical memorandum supersede previous data and associated interpretations presented to Ecology resulting from the 2012 5-year review sediment sampling event and the subsequent Phase II investigation.

SAMPLING ACTIVITIES

In October 2012, Landau Associates performed the Phase I sediment monitoring event stipulated under Amendment 1 to the Agreed Order, which requires sediment quality monitoring every 5 years following completion of the 2001/2002 sediment interim action. Within the multiple benefits line (MBL), 15 sediment cores were collected from the interior of the backfill layer that covers the dredged surface from the 2001/2002 sediment interim action. Surface grab samples (0-10 centimeters) were collected outside of the MBL from five locations (CP-16 through CP-20) along its perimeter.

The dry weight PAH analytical results were normalized to the sample total organic carbon (TOC) concentration to develop organic carbon normalized (OC) results. The incorrectly calculated surface sediment results from the Phase I event indicated elevated PAHs relative to the previous sampling events conducted in 2002 and 2007, and exceedance of the cleanup levels identified for the 2002 sediment interim action, which are based on the Sediment Management Standards (SMS) Sediment Quality Standards (SQS) and Cleanup Screening Level (CSL) values. As is discussed in the next section, while

SQS and CSL exceedances were present in some of the samples, an error in the carbon normalization calculation resulted in the reported concentrations being significantly higher than the actual concentrations.

Based on the incorrectly calculated exceedances observed during the Phase I event, a Phase II sampling event was conducted that included the collection of 17 surface samples for PAHs to evaluate the distribution of the PAHs in surface sediment, and to determine if the Site upland was a potential source of the elevated PAHs. Surface sediment samples had not been collected within the MBL since the sediment interim action was completed in 2002, so the purpose of the Phase II event was to evaluate the potential source of the PAHs release and release mechanism along with additional characterization of the distribution of the PAHs. The calculation error that occurred during the Phase I sampling event carried through the Phase II event, and PAHs were reported at significantly higher concentrations than the actual concentrations. The incorrectly calculated OC normalized PAH results of the Phase II sampling event were lower than the Phase I results, but SQS and CSL exceedances were still reported. However, the results did not strongly correlate to a release from the Site, or any other location.

Because the Phase II results did not identify a likely source for the elevated PAHs, additional characterization was conducted. The Phase III investigation was conducted to confirm the PAH surface sediment concentrations at the five original Phase I3 locations outside the MBL, and to collect sediment core samples at each of these locations to evaluate whether the elevated concentrations were originating from subsurface sediment in the vicinity of the original sampling locations.

The Phase III sampling event consisted of collecting five surface sediment samples and three composite subsurface samples representing 1 ft intervals to a maximum depth of 8 ft below the mudline. The Phase III samples coordinates were selected to correspond with the Phase 1 locations for CP-16 through CP-20. Analytical testing was conducted from the surface sediment sample and the first subsurface interval. The other subsurface samples were archived for potential follow-up testing. The Port was conducting a Budd Inlet sediment dioxin characterization study at the same time as the Phase III investigation, so the Phase III sampling was conducted in conjunction with the Budd Inlet dioxin study by the Port's consultant for that project, Anchor QEA.

CORRECTED ANALYTICAL RESULTS

As previously indicated, it was discovered during the data tabulation and review process for the Phase III data that the Microsoft Excel macro used for converting the dry weight PAH results to organic carbon normalized data was corrupted and produced incorrect results. The corrupted formulas were stripped of the conversion factors that converted microgram per kilogram (ug/kg) dry weight to milligram per kilogram (mg/kg) OC and the percent organic carbon to fractional organic carbon, which significantly

overestimated the PAH concentrations for both the Phase I and Phase II events that were previously submitted to Ecology.

The corrected Phase I, Phase II PAH data, and the Phase III data, are summarized in Tables 1 through 3, respectively. The distribution of PAH SQS and CSL exceedances based on the corrected data are shown on Figures 1 and 2 for the Phase I and Phase II investigations, respectively. The analytical results for the Phase III event (surface and subsurface) are shown on Figure 3.

The corrected analytical results for the Phase I event indicate naphthalene concentrations at three locations (CP-17, CP-18, and the duplicate sample from CP-20) above the SQS; naphthalene concentrations at CP-17 and CP-20 (duplicate sample) were also above the CSL. Acenaphthene concentrations were detected above both the SQS and CSL at CP-17, and above the SQS at CP-20. Analytical results for CP-17 and CP-20 indicate other PAH compounds at concentrations above the SQS were fluorene, phenanthrene (CP-17), 2-methylnaphthalene (CP-17), and fluoranthene (CP-17). In addition to the elevated individual PAH compounds, total low molecular weight PAHs (LPAHs) were reported above the SQS at CP-17 and the duplicate sample for CP-20. Total high molecular weight PAHs (HPAHs) were reported at concentrations below the SQS and CSL at all Phase I locations.

The results of the Phase II sampling event indicate no PAH concentrations above either the SQS or the CSL. The Phase II results indicate that elevated surface sediment PAHs have a limited areal distribution that is not indicative of a release from the Site uplands. However, the Phase II data do not indicate a potential source for the elevated PAH concentrations.

The results of the Phase III sampling event indicate that naphthalene and acenaphthene were present in surface sediment at concentrations above the SQS at CP-17 and CP-18, although the concentrations were lower than the original Phase I results. No other individual PAH compounds, LPAHs, or HPAHs were reported at concentrations above either the SQS or the CSL for the other four surface samples (three samples and one duplicate sample). Additionally, no PAHs exceeded the SQS or CSL values in the subsurface samples collected from the 1 to 2 ft sample interval. No deeper core samples were tested due to the lack of elevated concentrations in the 1 to 2 ft interval.

CONCLUSIONS

Based on the corrected analytical results from Phase I, II, and II sampling events, localized surface sediment contamination in the LPAH range is present along the perimeter of the MLB, outside of the area dredged during the 2001/2002 sediment interim action. However, the surface sediment contamination is well bounded both vertically and laterally, and does not appear to be related to Site upland releases. The most recent (Phase III) round of surface sediment monitoring showed a marked reduction in elevated LPAH-range concentrations, particularly for the only locations (CP-17 and CP-20) that exhibited CSL exceedances in the Phase I results. This trend, in conjunction with the areal

distribution of low PAH concentrations exhibited by the Phase II investigation results, suggests that the elevated surface sediment concentrations detected at CP-17, CP-18, and CP-20 during the Phase I investigation, and CP-17 and CP-18 during the Phase III investigation, are likely to decline to below SQS criteria through natural recovery processes. The source of these elevated PAH concentrations are not known, but the areal distribution in surface sediment indicates that the Site uplands is not a likely source.

ATTACHMENTS

Figure 1 – Phase I Surface Sediment Locations
Figure 2 – Phase II Surface Sediment Locations
Figure 3 – Phase III Surface Sediment Locations
Table 1 – Phase I-Corrected Surface Sediment Results (OC Normalized)
Table 2 – Phase II-Corrected Surface Sediment Results (OC Normalized)
Table 3 – Phase III-Verification Surface Sediment Results (OC Normalized)

| V:\021\039\090\099\Phased Investigation TM\Figure 1_2_3 TM.dwg (A) "Figure 1" 4/12/2013

Legend

2012/2013 Surface Sediment Sample Location

Notes

1. Locations shown in black indicate LPAHs and HPAHs concentrations below the SQS.
2. Locations shown in **RED** indicate total LPAH or individual PAH concentrations above the SQS but below the CSL.
3. Highlighted locations indicate individual PAH concentrations above the CSL.
4. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Source: Port of Olympia 2012, Magedorn, Inc. 2002

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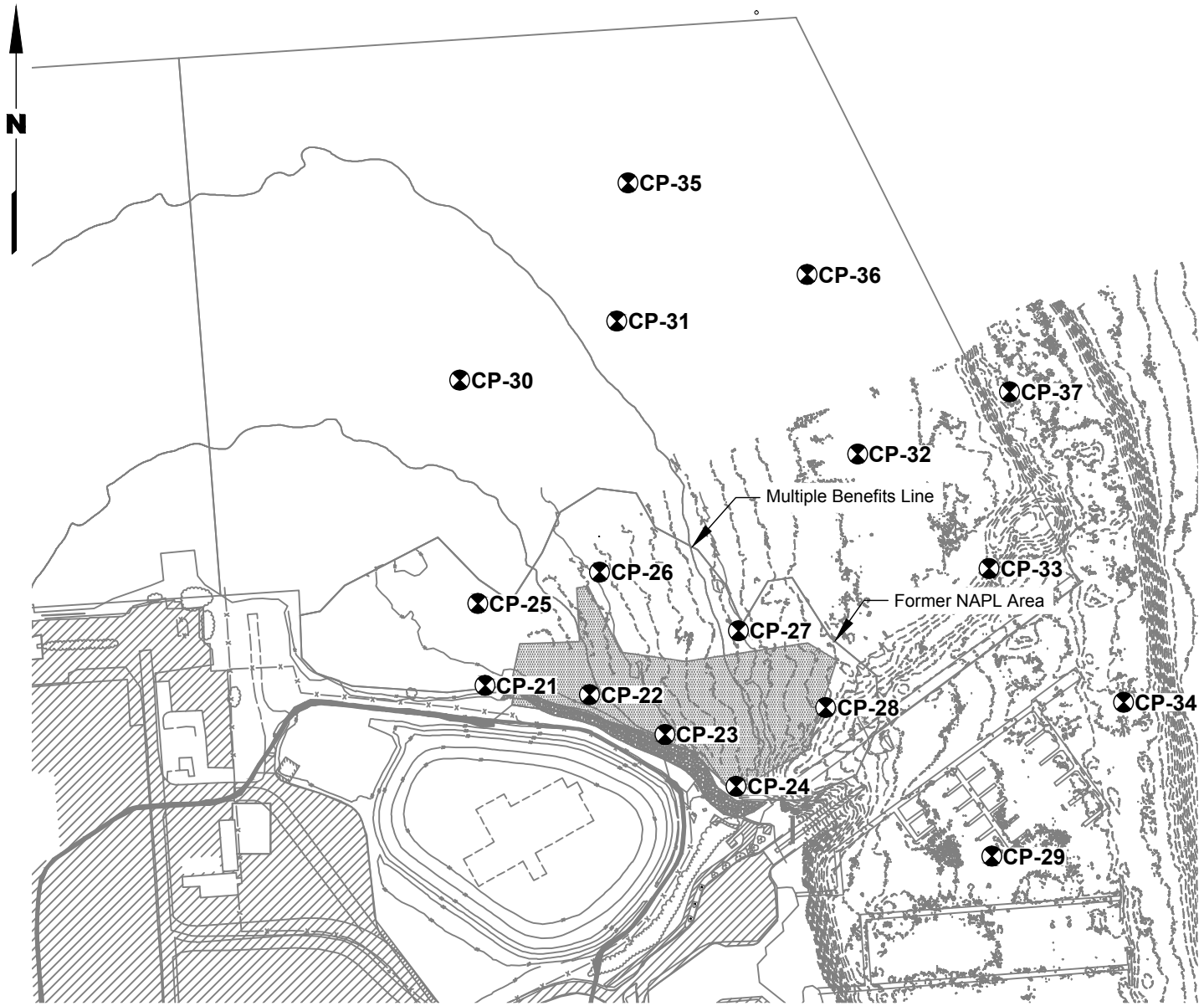
0 300 600
Scale in Feet

Cascade Pole Site
Olympia, Washington

Phase I
Surface Sediment Locations

Figure
1

| V:\021\039\090\099\Phased Investigation TM\Figure 1_2_3 TM.dwg (A) "Figure 2" 4/12/2013



Legend

2012/2013 Surface Sediment Sample Location

Notes

1. Locations shown in black indicate LPAHs and HPAHs concentrations below the SQS.
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Source: Port of Olympia 2012, Magedorn, Inc. 2002

LANDAU ASSOCIATES

0 300 600
Scale in Feet

Cascade Pole Site
Olympia, Washington

Phase II
Surface Sediment Locations

Figure
2

| V:\021\039\090\099\Phased Investigation TM\Figure 1_2_3 TM.dwg (A) "Figure 3" 4/12/2013

Legend

2012/2013 Surface Sediment Sample Location

Notes

1. Locations shown in black indicate LPAHs and HPAHs concentrations below the SQS.
2. Locations shown in **RED** indicate individual PAH concentrations above the SQS but below the CSL.
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Source: Port of Olympia 2012, Magedorn, Inc. 2002

LANDAU ASSOCIATES

0 300 600
Scale in Feet

Cascade Pole Site
Olympia, Washington

Phase III
Surface Sediment Locations

Figure
3

TABLE 1
CORRECTED PHASE I SURFACE SEDIMENT RESULTS (OC NORMALIZED)
CASCADE POLE SITE
PORT OF OLYMPIA, WASHINGTON

	SMS Criteria		Agreed Order Sample Results-Phase I					
	Sediment Quality Standard (a)	Cleanup Screening Level (b)	CP-16-M2 VO23L 10/15/2012	CP-17-M2 VO23M 10/15/2012	CP-18-M2 VO23P 10/15/2012	CP-19-M2 VO23O 10/15/2012	CP-20-M2 VO23K 10/15/2012	Dup of CP-20-M2 DUP-1 VO23N 10/15/2012
PAHs (mg/kg OC)								
Naphthalene	99	170	**20.2**	**358.2**	**121.5**	**15.8**	**35.0** J	**335.9** J
Acenaphthylene	66	66	**0.8** J	**6.9**	**3.4**	**0.8**	**2.0** J	**5.8**
Acenaphthene	16	57	**2.3**	**59.0**	**15.9**	**1.8**	**4.2** J	**40.6** J
Fluorene	23	79	**2.2**	**53.7**	**11.2**	**2.0**	**3.3** J	**39.8** J
Phenanthrene	100	480	**6.0**	**104.5**	**30.8**	**8.9**	**17.7** J	**78.1** J
Anthracene	220	1,200	**2.7**	**51.5**	**12.1**	**4.6**	**3.5** J	**37.5** J
2-Methylnaphthalene	38	64	**5.6**	**38.8**	**15.9**	**2.1**	**3.7** J	**27.3** J
LPAH (c,d)	370	780	**34.1** J	**633.8**	**195.0**	**33.9**	**65.8** J	**537.8** J
Fluoranthene	160	1,200	**6.6**	**179.1**	**32.7**	**6.9**	**27.7** J	**117.2** J
Pyrene	1,000	1,400	**6.7**	**306.0**	**42.1**	**10.5**	**23.8** J	**179.7** J
Benzo(a)anthracene	110	270	**1.9**	**38.8**	**6.4**	**12.5**	**5.8** J	**21.9** J
Chrysene	110	460	**2.3**	**89.6**	**8.3**	**17.1**	**10.8** J	**36.7** J
Total Benzofluoranthenes	230	450	**5.6**	**97.0**	**14.0**	**16.1**	**16.2** J	**67.2** J
Benzo(a)pyrene	99	210	**3.9**	**50.0**	**6.1**	**7.9**	**6.9** J	**32.8** J
Indeno(1,2,3-cd)pyrene	34	88	**1.8**	**16.4**	**2.6**	**2.4**	**3.1** J	**12.5** J
Dibenz(a,h)anthracene	12	33	1.5 U	**7.5**	1.8 U	**1.0**	**1.1** J	**4.6**
Benzo(g,h,i)perylene	31	78	**2.6**	**18.7**	**2.9**	**2.3**	**3.5** J	**13.3** J
HPAH (c,e,f)	960	5,300	**31**	**803**	**115**	**77**	**99** J	**486** J
CONVENTIONALS (%)								
Total Organic Carbon (SW9060M)	10 (g)	10 (g)	1.24	1.34	1.07	3.04	2.60	1.28
Total Solids (SM2540B)	---	---	67.90	61.40	67.60	49.50	44.00	61.20

U = Indicates the compound was not detected at the reported concentration.
J = Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
Bold = Detected compound.
Box = Exceeds SQS
Shade = Exceeds CSL

(a) SMS Sediment Quality Standard (Chapter 173-204 WAC).
(b) SMS Cleanup Screening Level (Chapter 173-204 WAC).
(c) Where chemical criteria in this table represent the sum of individual compounds or isomers, the following methods shall be applied:
  (i) Where chemical analyses identify an undetected value for every individual compound/isomer, then the single highest detection limit shall represent the sum of the respective compounds/isomers.
  (ii) Where chemical analyses detect one or more individual compounds/isomers, only the detected concentrations will be added to represent the group sum.
(d) The LPAH criterion represents the sum of the following "low molecular weight polynuclear aromatic hydrocarbon" compounds: naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene. The LPAH criterion is not the sum of the criteria values for the individual LPAH compounds listed.
(e) The total benzofluoranthenes criterion represents the sum of the concentrations of the "B," "J," and "K" isomers.
(f) The HPAH criterion represents the sum of the following "high molecular weight polynuclear aromatic hydrocarbon" compounds: fluoranthene, pyrene, benzo(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenz(a,h)anthracene, and benzo(g,h,i)perylene. The HPAH criterion is not the sum of the criteria values for the individual HPAH compounds as listed.
(g) DMMP clarification paper and SMS technical information memorandum: Management of Wood Waste Under Dredged Material Management Program and the SMS Cleanup Program.

TABLE 2
CORRECTED PHASE II SURFACE SEDIMENT RESULTS (OC NORMALIZED)
CASCADE POLE SITE
PORT OF OLYMPIA, WASHINGTON

	SMS Criteria		Verification Sample Results-Phase II																
	Sediment Quality Standard (a)	Cleanup Screening Level (b)	CP-21 VY94J 1/8/2013	CP-22 VY94I 1/8/2013	CP-23 VY94H 1/8/2013	CP-24 VY94G 1/8/2013	CP-25 VY94F 1/8/2013	CP-26 VY94A 1/8/2013	CP-27 VY94B 1/8/2013	CP-28 VY94C 1/8/2013	Dup of CP-28 DUP-1 VY94K 1/8/2013	CP-29 VY94D 1/8/2013	CP-30 VY94L 1/8/2013	CP-31 VY94M 1/8/2013	CP-32 VY94N 1/8/2013	CP-33 VY94O 1/8/2013	CP-34 VY94E 1/8/2013	CP-35 WD00A 1/9/2013	CP-36 WD00B 1/9/2013	CP-37 WD00C 1/9/2013
PAHs (mg/kg OC)																			
Naphthalene	99	170	1.7 U	**13.5**	**7.1**	**2.0**	**40.0**	**4.9**	**0.7**	**0.4**	**0.5**	**3.8**	**7.6**	**46.5**	**19.1**	**7.5**	**2.7**	**14.2**	**16.9**	**2.2**
Acenaphthylene	66	66	1.7 U	**0.3** J	**0.1** J	**0.2**	**0.8**	**0.2** J	0.2 U	0.2 U	**0.1** J	**0.6**	**0.4** J	**2.1**	**1.4**	**0.7**	**0.3**	0.2 U	**1.7**	0.1 U
Acenaphthene	16	57	1.7 U	**2.7**	**1.0**	**0.4**	**7.1**	**0.8**	**0.2** J	**0.1** J	**0.1** J	**0.9**	**1.3**	**8.8**	**2.8**	**1.0**	**0.4**	**1.4**	**2.0**	**0.3**
Fluorene	23	79	1.7 U	**1.9**	**0.8**	**0.4**	**6.0**	**0.7**	**0.2** J	**0.1** J	**0.1** J	**0.9**	**1.1**	**5.6**	**1.8**	**0.8**	**0.4**	**1.1**	**1.5**	**0.3**
Phenanthrene	100	480	1.7 U	**5.1**	**1.6**	**1.5**	**15.0**	**2.2**	**0.5**	**0.5**	**0.9**	**5.5**	**3.7**	**14.0**	**5.9**	**2.7**	**1.6**	**3.2**	**5.0**	**1.1**
Anthracene	220	1,200	1.7 U	**2.5**	**0.8**	**0.6**	**7.9**	**1.0**	**0.2**	**0.2**	**0.3**	**2.0**	**1.3**	**5.7**	**2.1**	**1.0**	**0.6**	**1.7**	**1.9**	**0.5**
2-Methylnaphthalene	38	64	1.7 U	**1.3**	**0.8**	**0.4**	**3.7**	**0.7**	**0.2** J	**0.1** J	**0.2** J	**1.1**	**1.1**	**8.1**	**2.2**	**1.1**	**0.5**	**2.0**	**2.7**	**0.4**
LPAH (c,d)	370	780	1.7 U	**25.9** J	**11.6** J	**5.2**	**76.8**	**9.8** J	**1.8** J	**1.2** J	**2.1** J	**13.6**	**15.3** J	**82.7**	**33.0**	**13.7**	**6.1**	**21.6**	**29.0**	**4.4**
Fluoranthene	160	1,200	1.7 U	**4.7**	**1.6**	**3.5**	**13.6**	**2.6**	**0.7** J	**0.8** J	**5.5** J	**12.5**	**3.8**	**14.0**	**4.3**	**3.6**	**1.4**	**4.6**	**5.8**	**2.9**
Pyrene	1,000	1,400	**4.1**	**6.9**	**2.6**	**4.4**	**15.0**	**4.1**	**1.2**	**1.3** J	**5.9** J	**12.0**	**5.7**	**24.6**	**10.9**	**5.3**	**2.7**	**7.3**	**8.5**	**3.2**
Benzo(a)anthracene	110	270	**0.9** J	**2.2**	**0.7**	**1.0**	**5.9**	**0.9**	**0.2**	**0.3**	**0.7**	**2.8**	**0.9**	**4.0**	**2.0**	**1.5**	**1.0**	**1.4** J	**2.0** J	**0.7** J
Chrysene	110	460	**3.7**	**6.1**	**1.0**	**3.9**	**12.9**	**1.3**	**0.3**	**0.5** J	**2.1** J	**6.0**	**1.2**	**5.9**	**3.0**	**1.8**	**1.5**	**2.8**	**3.5**	**1.1**
Total Benzofluoranthenes	230	450	**6.3**	**4.7**	**1.8**	**3.0**	**10.0**	**2.4**	**0.8**	**1.0** J	**3.1** J	**9.0**	**2.6**	**10.5**	**6.4**	**4.5**	**3.1**	**3.6**	**3.8**	**2.0**
Benzo(a)pyrene	99	210	**1.4** J	**1.7**	**0.5**	**0.8**	**4.1**	**0.8**	**0.3**	**0.3**	**0.6**	**2.6**	**0.8**	**4.2**	**2.2**	**1.5**	**1.0**	**1.2**	**1.6**	**0.6**
Indeno(1,2,3-cd)pyrene	34	88	1.7 U	**1.1**	**0.4**	**0.6**	**2.7**	**0.5**	**0.2**	**0.2**	**0.5**	**1.3**	**0.7**	**2.6**	**1.5**	**0.9**	**0.7**	**0.6**	**0.8**	**0.4**
Dibenz(a,h)anthracene	12	33	1.7 U	**0.3** J	**0.1** J	**0.1** J	**1.0**	**0.2** J	0.2 U	0.2 U	**0.1** J	**0.3**	0.4 U	**0.7**	**0.4**	**0.2**	**0.2**	**0.2** J	**0.2**	**0.1** J
Benzo(g,h,i)perylene	31	78	1.7 U	**1.2**	**0.4**	**0.6**	**2.7**	**0.6**	**0.3**	**0.2**	**0.5**	**1.3**	**0.9**	**3.2**	**1.6**	**0.9**	**0.9**	**0.8**	**1.1**	**0.5**
HPAH (c,e,f)	960	5,300	**16** J	**29** J	**9.0** J	**18** J	**68**	**13** J	**4.1**	**4.5**	**19.1** J	**47.7**	**16.6**	**69.8**	**32.2**	**20.2**	**12.4**	**22.5**	**27.3**	**11.6**
CONVENTIONALS (%)																			
Total Organic Carbon (SW9060M)	10 (g)	10 (g)	0.268	0.890	3.36	2.51	1.40	1.97	2.57	2.87	2.19	2.00	1.04	1.14	2.20	3.58	3.57	2.18	2.60	3.74
Total Solids (SM2540B)	---	---	87.40	76.90	66.80	63.00	66.30	74.10	80.40	79.30	79.50	25.40	73.40	65.00	44.00	44.10	31.30	49.90	48.90	29.70

U = Indicates the compound was not detected at the reported concentration.
J = Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
Bold = Detected compound.
Box = Exceeds SQS
Shade = Exceeds CSL

(a) SMS Sediment Quality Standard (Chapter 173-204 WAC).
(b) SMS Cleanup Screening Level (Chapter 173-204 WAC).
(c) Where chemical criteria in this table represent the sum of individual compounds or isomers, the following methods shall be applied:
  (i) Where chemical analyses identify an undetected value for every individual compound/isomer, then the single highest detection limit shall represent the sum of the respective compounds/isomers.
  (ii) Where chemical analyses detect one or more individual compounds/isomers, only the detected concentrations will be added to represent the group sum.
(d) The LPAH criterion represents the sum of the following "low molecular weight polynuclear aromatic hydrocarbon" compounds: naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene. The LPAH criterion is not the sum of the criteria values for the individual LPAH compounds listed.
(e) The total benzofluoranthenes criterion represents the sum of the concentrations of the "B," "J," and "K" isomers.
(f) The HPAH criterion represents the sum of the following "high molecular weight polynuclear aromatic hydrocarbon" compounds: fluoranthene, pyrene, benzo(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenz(a,h)anthracene, and benzo(g,h,i)perylene. The HPAH criterion is not the sum of the criteria values for the individual HPAH compounds as listed.
(g) DMMP clarification paper and SMS technical information memorandum: Management of Wood Waste Under Dredged Material Management Program and the SMS Cleanup Program.

TABLE 3
PHASE III-VERIFICATION SURFACE SEDIMENT RESULTS (OC NORMALIZED)
CASCADE POLE SITE
PORT OF OLYMPIA, WASHINGTON

	SMS Criteria		Surface Sediment Samples						Subsurface Sediment Samples					
	Sediment Quality Standard (a)	Cleanup Screening Level (b)	CP16-0-10 WG94E 3/8/2013	CP17-0-10 WG94D 3/8/2013	CP18-0-10 WG94A 3/8/2013	Dup of CP18-0-10 CP18DUP-0-10 WG94F 3/8/2013	CP19-0-10 WG94B 3/8/2013	CP20-0-10 WG94C 3/8/2013	CP-16-1-2 WF91B 3/4/2013	CP-17-1-2 WF91A 3/4/2013	CP-18-1-2 WF91F 3/4/2013	CP-19-1-2 WF91E 3/4/2013	CP-20-1-2 WF91C 3/4/2013	Dup of CP-20 CP-20-1-2DUP WF91D 3/4/2013
PAHs (mg/kg OC)														
Naphthalene	99	170	**12.1**	**71.5**	**106.8**	**93.3**	**20.8** J	**21.3**	**12.1**	**20.3**	**69.9**	**40.4**	**1.9** J	**2.8** J
Acenaphthylene	66	66	**0.8**	**1.1**	**2.2**	**2.6**	**0.8**	**1.4**	**2.2**	**0.4** J	**0.8**	**6.3**	**0.2**	**0.1** J
Acenaphthene	16	57	**2.4**	**18.7**	**14.6**	**11.5**	**3.2** J	**3.0**	**1.6**	**4.4**	**3.3**	**4.4**	**0.3** J	**0.7** J
Fluorene	23	79	**2.1**	**13.0**	**11.7**	**8.5**	**2.5** J	**2.3**	**1.6**	**3.7**	**1.9**	**5.7**	**0.4**	**0.5**
Phenanthrene	100	480	**5.9**	**17.9**	**23.3**	**18.3**	**5.5** J	**6.9**	**6.4**	**4.7**	**4.6**	**18.3**	**1.5**	**1.3**
Anthracene	220	1,200	**3.1**	**11.4**	**12.6**	**9.6**	**2.5** J	**3.0**	**2.2**	**3.5**	**2.3**	**5.4**	**0.6**	**0.5**
2-Methylnaphthalene	38	64	**1.9**	**6.1**	**12.6**	**10.6**	**3.0**	**2.3**	**2.2**	**3.1**	**3.6**	**6.0**	**0.3** J	**0.6** J
LPAH (c,d)	370	780	**26.4**	**133.7**	**171.2**	**143.8**	**35.3**	**37.9**	**26.0**	**37.0**	**82.8**	**80.5**	**4.9**	**5.8**
Fluoranthene	160	1,200	**8.6**	**27.6**	**30.1**	**28.8**	**7.6**	**12.2**	**8.3**	**8.9**	**8.7**	**17.3**	**1.7**	**1.1**
Pyrene	1,000	1,400	**9.5**	**27.6**	**39.8**	**40.4**	**12.8**	**16.3**	**11.2**	**9.8**	**9.5**	**23.1**	**2.3**	**1.5**
Benzo(a)anthracene	110	270	**1.8**	**6.5**	**6.5**	**6.3**	**4.5** J	**6.4**	**2.0**	**2.0**	**2.6**	**3.9**	**0.6**	**0.6**
Chrysene	110	460	**2.1**	**8.9**	**7.7**	**8.7**	**5.2** J	**7.2**	**2.1**	**2.1**	**2.6**	**4.2**	**0.6** J	**1.2** J
Total Benzofluoranthenes	230	450	**3.7**	**12.2**	**13.6**	**15.4**	**10.4** J	**10.8**	**3.7**	**3.6**	**4.6**	**8.3**	**1.0**	**1.0**
Benzo(a)pyrene	99	210	**1.3**	**4.4**	**4.7**	**5.3**	**4.2** J	**5.8**	**1.6**	**1.3**	**1.9**	**3.9**	**0.5**	**0.5**
Indeno(1,2,3-cd)pyrene	34	88	**0.8**	**2.4**	**2.0**	**2.7**	**2.0** J	**3.3**	**0.9**	**0.6**	**0.9**	**2.2**	**0.2**	**0.2**
Dibenz(a,h)anthracene	12	33	**0.2** J	**0.7**	**0.6**	**0.8**	**0.6**	**0.8**	0.4 U	0.4 U	0.5 U	**0.5** J	0.2 U	**0.1** J
Benzo(g,h,i)perylene	31	78	**1.0**	**2.8**	**3.1**	**3.5**	**2.0** J	**3.9**	**1.5**	**1.0**	**1.2**	**3.4**	**0.2**	**0.2**
HPAH (c,e,f)	960	5,300	**29.0**	**93.2**	**108.0**	**111.8**	**49.2**	**66.5**	**31.2**	**29.3**	**32.1**	**66.8**	**7.1**	**6.5**
CONVENTIONALS (%)														
Total Organic Carbon (SW9060M)	10 (g)	10 (g)	1.16	1.23	1.03	1.04	2.89	3.62	2.66	1.65	0.988	2.80	0.868 J	1.52 J
Total Solids (SM2540B)	---	---	69.50	60.30	64.40	63.60	46.40	42.30	78.90	65.90	76.50	43.70	48.20	48.70

U = Indicates the compound was not detected at the reported concentration.
J = Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
Bold = Detected compound.
Box = Exceeds SQS
Shade = Exceeds CSL

(a) SMS Sediment Quality Standard (Chapter 173-204 WAC).
(b) SMS Cleanup Screening Level (Chapter 173-204 WAC).
(c) Where chemical criteria in this table represent the sum of individual compounds or isomers, the following methods shall be applied:
  (i) Where chemical analyses identify an undetected value for every individual compound/isomer, then the single highest detection limit shall represent the sum of the respective compounds/isomers.
  (ii) Where chemical analyses detect one or more individual compounds/isomers, only the detected concentrations will be added to represent the group sum.
(d) The LPAH criterion represents the sum of the following "low molecular weight polynuclear aromatic hydrocarbon" compounds: naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene. The LPAH criterion is not the sum of the criteria values for the individual LPAH compounds listed.
(e) The total benzofluoranthenes criterion represents the sum of the concentrations of the "B," "J," and "K" isomers.
(f) The HPAH criterion represents the sum of the following "high molecular weight polynuclear aromatic hydrocarbon" compounds: fluoranthene, pyrene, benzo(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenz(a,h)anthracene, and benzo(g,h,i)perylene. The HPAH criterion is not the sum of the criteria values for the individual HPAH compounds as listed.
(g) DMMP clarification paper and SMS technical information memorandum: Management of Wood Waste Under Dredged Material Management Program and the SMS Cleanup Program.