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MEMORANDUM

To:	Rebecca Lawson, Washington State Department of Ecology Olivia Romano, U.S. Army Corps of Engineers	**Date:**	February 24, 2011
From:	Dan Berlin, Anchor QEA, LLC Tom Wang, Anchor QEA, LLC	**Project:**	080166-01
Cc:	Joanne Snarski, Port of Olympia		
Re:	21-Month Final Monitoring Results - Berths 2 and 3 Interim Cleanup Action Pilot Study		

This memorandum summarizes the results of sediment chemistry monitoring and a bathymetric conditions survey performed in December 2010 by the Port of Olympia (Port) as part of the Berths 2 and 3 Interim Cleanup Action Pilot Study (Interim Action) in West Bay in Olympia, Washington. The 21-month monitoring effort is the last monitoring event required by the Monitoring Plan (Anchor Environmental 2009) contained in Agreed Order (AO) No. DE 6083 between the Port and the Washington State Department of Ecology (Ecology). Previous sampling was conducted 3, 9, and 15 months following completion of the Interim Action (Anchor QEA 2009a, 2010a, and 2010b, respectively). Sampling conducted as part of the Interim Action is documented in the Completion Report – Berths 2 and 3 Interim Action Cleanup (Anchor QEA 2009b). This memorandum also provides a summary of lessons learned from the project based on the monitoring data collected to date.

1 BACKGROUND

The Port entered into AO No. DE 6083 with Ecology to complete an interim cleanup action to address cleanup of West Bay sediments adjacent to the Port's Berths 2 and 3 in South Budd Inlet, Olympia, Washington, and to accomplish maintenance dredging to a minimum of -39 feet below mean lower low water (MLLW). The Interim Action was completed on March 3, 2009 with final placement of clean sand cover in the dredged area. Previous chemical sampling and bathymetric data collection was conducted prior to dredging (September 2008), following dredging (February 2009), and following placement of the clean sand cover (March 2009). Those results are included in the Completion Report (Anchor QEA 2009b). Sampling was also conducted 3 months following completion of the Interim Action, in June 2009 (Anchor QEA 2009a); 9 months following completion of the Interim Action, in December 2009 (Anchor QEA 2010a); and 15 months following completion of the Interim Action, in June 2010 (Anchor QEA 2010b).

The 15-month monitoring program was expanded beyond the required sampling based on requests from the U.S. Army Corps of Engineers (Corps) and Ecology to further evaluate the potential for sloughing/slumping of contaminated sediments at the toe of slope into the berth area. The additional monitoring components included Sediment Profile Imaging (SPI), additional surface sediment testing, including two additional ambient stations, and three subsurface cores along the pierface. The results of the 15-month monitoring were presented in the 15-month Monitoring Memo (Anchor QEA 2010b).

Additional monitoring activities for the 21-month monitoring program were discussed during a meeting with the Port, the Corps, and Ecology on October 29, 2010 in response to the Corps' letter regarding additional monitoring dated October 14, 2010. As a result of the meeting, it was agreed that the following monitoring activities would be conducted for the 21-month final monitoring program:

1. Bathymetry measurements using multibeam methodology (required as part of the Monitoring Plan, Anchor Environmental 2009)
2. Surface sediment sampling. Samples were collected from 0 to 10 centimeter (cm) and 0 to 2 cm intervals from each station. Testing was conducted for dioxin/furan, total organic carbon, grain size, and total solids from each of the 0 to 10 cm intervals (required as part of the Monitoring Plan, Anchor Environmental 2009). All 0 to 2 cm intervals were archived pending the results of the 0 to 10 cm interval testing. Surface sediment stations are listed below:
   a. Underpier area
      i. UP-20, UP-21, UP-22, UP-23B (required as part of the Monitoring Plan, Anchor Environmental 2009)
   b. Berth area
      i. BA-24, BA-25, BA-26, BA-27B (required as part of the Monitoring Plan, Anchor Environmental 2009)
      ii. BA-28, BA-29, BA-30, BA-31

c. Ambient
    i. BI-C16, BI-S37, AM-28 (required as part of the Monitoring Plan, Anchor Environmental 2009)
    ii. AM-50, AM-51

2 SEDIMENT MONITORING

Sediment sampling was conducted on December 8 and 9, 2010 for the 21-month monitoring event in accordance with the Monitoring Plan (Anchor Environmental 2009) and additional monitoring as described in Section 1. This section describes sampling methods and results of surface sediment testing.

2.1 Surface Sediment

Surface sediment testing was conducted in accordance with the Monitoring Plan (Anchor Environmental 2009) and as conducted during previous monitoring events. Coordinates of each location sampled in December 2010 are provided in Table 1. Surface sediment chemistry results are presented in Tables 2 and 3 and Figure 1. Laboratory results and validation reports are included in Attachments A and B, respectively.

The 0 to 2 cm and 0 to 10 cm samples from a single station were collected from the same grab, with each sample collected from separate parts of the grab (e.g., 0 to 2 cm from the left side and 0 to 10 cm from the right side). For the 0 to 2 cm samples, samples were collected from the material recently deposited on top of the sand cover. Similar to the findings from the 15-month monitoring and SPI images, the thickness of fine-grained sediments above the interface with the sand cover varied between 1 and 10 cm, with most stations in the range of approximately 3 to 4 cm. When the recently-deposited material was thicker than 2 cm, the top 0 to 2 cm was collected. When the thickness was less than 2 cm, the sample included only the recently-deposited material and not any of the sand cover.

Results of 0 to 10 cm surface sediment testing are presented in Table 2. Berth area samples were similar to the 15-month monitoring event. Concentrations in the berth area for required monitoring samples (BA-24, BA-25, BA-26, and BA-27B) ranged from 2.0 to 6.3 parts per trillion toxicity equivalency (TEQ) and averaged 5.6 TEQ. Berth area concentrations were similar to the 15-month monitoring event (5.4 TEQ) and slightly lower than the 9-month monitoring event (11.1 TEQ).

Berth area samples located at the toe of slope on the sloughed/slumped material averaged 8.9 TEQ and ranged from 3.8 to 13.4 TEQ. These samples were slightly higher than samples collected for required monitoring samples from the middle of the berth area (mean 5.6 TEQ) but lower than the 15-month monitoring event (13.4 TEQ).

Underpier samples ranged from 9.9 to 24.1 TEQ for the 21-month monitoring. The average of the underpier samples was 15.9 TEQ compared to 16.6 TEQ during the 15-month monitoring. Previous underpier monitoring result averages were 36.7 TEQ, 37.1 TEQ, and 38.9 TEQ during the 9-month, 3-month, and post-cover monitoring events, respectively.

Five ambient samples were collected during the 15-month and 21-month monitoring events (three ambient samples were collected during the 9-month, 3-month, and post-cover monitoring events). Ambient samples in the 21-month monitoring event ranged from 6.8 TEQ to 25.4 TEQ and averaged 13.7 TEQ. Average ambient concentrations during the 15-month, 9-month, 3-month, and post-cover monitoring events were 5.6 TEQ, 21.8 TEQ, 22.7 TEQ, and 23.8 TEQ, respectively. The 21-month monitoring results were higher than the 15-month monitoring event for each ambient location. The greatest increases were observed in AM-28 (from 1.8 TEQ in June 2010 to 20.0 TEQ in December 2010) and in AM-50 (from 14.0 TEQ in June 2010 to 25.4 TEQ in December 2010).

Although ambient stations increased in concentration between the 15-month and 21-month monitoring events, it is not expected that these elevated concentrations originated from the berth area or underpier area. The nearest berth area samples to AM-28 (BA-27B and BA-31) each declined in concentration between June 2010 and December 2010. Similarly, the nearest underpier sample (UP-23B) also declined in concentration between June 2010 and December 2010. Station AM-50 is located approximately 1,000 feet south of the berth area and is not likely to have been influenced by berth area concentrations.

Previous studies by Ecology indicated that the average sediment concentration in West Bay was 19.0 TEQ (SAIC 2008). With background sediment concentrations in that range, natural deposition and movement of sediments within West Bay would gradually increase berth area concentrations until equilibrated with surrounding background sediment concentrations. However, both 21-month and 15-month monitoring results have suggested that sediments with lower concentrations of dioxin have been deposited throughout West Bay, thus reducing average West Bay background surface sediment concentrations.

As explained in the 15-month Monitoring Memo (Anchor QEA 2010b), Capitol Lake drawdowns occurred between December 9, 2009 and March 5, 2010 in an attempt to control invasive New Zealand mudsnails (General Administration 2010). The repeated flushing of Capitol Lake likely contributed to higher-than-normal sedimentation between the 9-month and 15-month sediment monitoring events. No further flushing events have occurred between the 15-month and 21-month monitoring events. Underpier area and berth area concentrations observed in the 21-month monitoring data continue to be similar to the 15-month monitoring concentrations, suggesting that Capitol Lake sediment deposited throughout West Bay continues to be present. Higher ambient concentrations may be the result of progressive equilibration and mixing of surficial sediments deposited from Capitol Lake with underlying sediments with concentrations similar to the previous bay-wide average (19.0 TEQ), or possibly attributed to other sources of dioxin/furan in West Bay.

3 BATHYMETRIC SURVEY RESULTS

Multibeam bathymetric surveys were conducted during the following events:

- Following placement of the sand cover – March 12, 2009
- 3 months following placement – June 24, 2009
- 9 months following placement – December 10, 2009
- 16 months following placement (underpier data was deemed inaccurate) – July 13, 2010
- 19 months following placement (underpier area only) – October 4, 2010
- 21 months following placement – December 14, 2010

All post-cover surveys were conducted by eTrac Engineering using a multibeam sonar system. The surveys included the dredged portions of the berth area as well as the underpier area, except for the October 2010 survey. The October 2010 survey was intended to re-survey the underpier area, which was deemed to be inaccurate as part of the July 2010 survey. The surveys were conducted in accordance with requirements presented in the Monitoring Plan (Anchor Environmental 2009).

Results of the December 2010 bathymetric survey are provided in Figures 2 through 8. Figure 2 presents a plan view of the bathymetry results along with cross section locations. Ten cross sections are presented in Figures 3 through 7. Figure 8 presents a comparison of the December 2010 survey with the July 2010 survey for the berth area and October 2010 for the underpier area.

During the December 2010 survey, multibeam bathymetric surveying was conducted throughout the entire Berths 2 and 3 area, as well as in the underpier area. Identical methods and equipment were used for each of the previous surveys using a base station and Real Time Kinematics (RTK) Global Positioning System (GPS). The RTK GPS provides horizontal positioning accuracy of 1 cm or less. The survey presented in Figures 2 through 8 provides RTK-quality horizontal GPS for all survey areas, including open water portions of the berth area, underpier areas, and adjacent to the pierface. Previous surveys had difficulty collecting RTK-quality horizontal GPS in the underpier and pierface areas due to the presence of cranes in the Berths 2 and 3 area and the unfavorable satellite constellation pattern during the time of survey. However, no problems of this nature were experienced during the December 2010 survey.

As part of the Interim Action, the area immediately adjacent to the pierface was dredged to between -40 and -41 feet MLLW; however, sloughing/slumping from the underpier slope resulted in an accumulation of material at the pierface shortly after the dredging was completed. The approach to dredge at the pierface to allow the slope to slough/slump in a controlled manner was discussed with Ecology during development of the Interim Action Plan. This approach was determined to be the most environmentally protective and present the least risk to the pile-supported structure. However, the slope sloughed/slumped less than expected during construction. As discussed with Ecology during plan development, this outcome meant that sloughing/slumping was likely to continue after dredging was complete until the slope reached equilibrium.

Table 4 provides a summary of bathymetry measurement comparisons between June/October 2010 and December 2010. Based on the cross sections from the December 2010 survey, sediment elevations at the pierface within the dredged berth area range from -31.9 to -36.2 feet MLLW. The mean depth was -34.8 feet MLLW. The mudline elevation along the pierface increased an average of 0.5 feet between June and December 2010 (Table 4).

The small increase in elevation along the pierface may be explained by additional sloughing/slumping from the underpier areas, as well as additional deposition at the toe of the slope from other areas. However, the underpier slope continues to become more even along the entire length of the underpier area, with less pronounced breakpoints in the slope. Based on the December 2010 survey data, the slope has reached, or has nearly reached, equilibrium. As shown in Table 4, there are no pronounced breakpoints in the slope angle for all but two cross sections (12+90 and 13+90). However, for each of these cross sections, the distance from the pierface to the break point in the slope did not change from the October 2010 survey. Because the underpier slope is generally continuous, approximate angles of repose can be estimated. Each cross section is approximately 1.5 horizontal to 1 vertical (1.5H:1V), except for cross section 13+90, which continues to be steeper with a slope angle of approximately 1H:1V.

The small decrease in water depth at the pierface is likely attributable to a small amount of sloughing/slumping and flattening of the underpier slope, but could also be the result of continued deposition at the toe of the slope. As discussed previously, the natural rate of deposition along the toe of the slope may be higher than in other areas of the berth, possibly due to natural West Bay circulation patterns or vessel movement. However, based on the observations in the 15-month monitoring event of low mixing of recent sediments with the sand cover, it does not appear that vessel movement is responsible for increased accumulation at the toe.

It is expected that water depths at the pierface will continue to decrease; however, the role of sloughing/slumping is expected to be minimal now that the slope has reached or has nearly reached equilibrium. The Port continues to use temporary mooring camels along the pierface as an interim measure to provide an offset from the toe of slope to allow berthing for vessels. The Port will continue to coordinate with Ecology and the Corps regarding any challenges posed to navigation by continued sediment accumulation in the berth area. The Port will also continue to coordinate with Ecology and the Corps to further evaluate the environmental need and/or benefit of dredging at the toe of the slope to remove material that has sloughed/slumped beyond the pierface.

4 SUMMARY OF LESSONS LEARNED

Monitoring following completion of the Interim Action has provided important information for use in development of future cleanup work at the Port. This section describes the key lessons learned as part of the Interim Action. While the site conditions at the Port are unique, considerations for issues such as slope sloughing/slumping, restricting dredge cut lifts, and residuals management cover effectiveness can be applied to other sediment remediation sites that deal with underpier contaminated sediment and dredging adjacent to marine structures.

4.1 Sloughing/Slumping of Underpier Sediment

The remedial approach approved by Ecology consisted of dredging adjacent to the pierface in a controlled fashion using restricted lift thicknesses. This approach was selected rather than allowing unrestricted dredge cut thickness adjacent to the pierface because dredging by controlled lifts was considered the most environmentally protective removal approach (i.e., minimize risk for uncontrolled underpier slope sloughing/slumping) and presented the least risk to the pile-supported structure. Some accumulation of sloughed/slumped material at the toe of slope adjacent to the pierface was expected to occur after dredging was completed. This material accumulated on top of the residuals management sand cover layer that was placed throughout the berth area immediately following dredging completion. This section describes the lessons learned with respect to slope stability and potential for redistribution of sloughed/slumped sediment.

4.1.1 Slope Stability

Based on the physical characteristics of the underpier slope material (loose, unconsolidated silts and sands), the expectation was that most of the underpier slope sloughing/slumping would occur during the dredging activities. However, the slope sloughed/slumped less than expected during construction. Possible reasons for the resulting oversteepened slope are listed below:

1. Underpier sediment was more cohesive than was indicated by physical characteristics.
2. Controlled dredging using restricted thickness lifts (i.e., 4 feet maximum dredge cut lifts) prevented the sediment from achieving an immediate unstable condition that would induce sloughing. While the intent of limiting the maximum dredge cut lift was to prevent a large, uncontrolled sloughing/slumping event, the overall goal was to induce controlled sloughing/slumping during dredging (i.e., smaller, localized sloughing/slumping).
3. Narrow pile bent spacing helped the underpier slope area remain more stable and helped to reduce sloughing/slumping.

As discussed with Ecology during plan development, the post-dredge oversteepened underpier slope indicated that sloughing/slumping was likely to occur after dredging and placement of the residuals management cover layer was completed, and continue until the slope reached a more stable slope equilibrium. The monitoring results suggest that the majority of slope sloughing/slumping occurred within the first 9 months, with continued limited sloughing/slumping after that period of time, as measured by increased elevations at the pierface and a flattening of the underpier slope. The underpier slope appears to have reached or nearly reached equilibrium, suggesting that limited additional slope sloughing/slumping would be expected to occur over time.

As discussed in the Interim Action Plan, a second dredge event was anticipated and authorized by the Corps' permit to be conducted the following construction season. However, due to concerns from the Corps that sediment that had sloughed/slumped to the toe of slope was spreading to other parts of the berth area, this permit was suspended and removal of the sloughed/slumped toe material was not conducted.

If removal of the sloughed/slumped material had occurred during the following construction season, the material that had sloughed/slumped from the underpier area would have been removed. However, based on the behavior of the slope during and after dredging, completion of dredging at the pierface during the following dredge season would have resulted in a large elevation difference of sediment in the underpier area from the required dredge elevation in the berth area. This elevation difference would have likely resulted in additional underpier sloughing/slumping following the second dredge event. However, it is probable that the accumulation of underpier material at the toe of slope adjacent to the pierface would likely be less than that which sloughed/slumped following the initial dredge event.

For future contaminated sediment dredging at the Port's terminal, a potential dredging strategy for material adjacent to the pierface may include contingency planning for a second dredge pass within 15 to 17 months of the first dredge event to remove sloughed/slumped material from the toe of slope. A residuals management cover layer could be placed following the initial dredge event if required; however, underpier sloughed/slumped material is likely to later accumulate on this cover layer. Alternatively, placement of the residuals management cover layer could be placed following completion of the second dredge event, or if a second dredge event is not conducted, after the slope reaches a state of equilibrium.

4.1.2 Potential for Redistribution of Sloughed/Slumped Sediment

Sloughed/slumped sediment from the underpier area does not appear to have redistributed significantly beyond approximately 10 feet from the pierface. SPI photos from the 15-month monitoring event indicate the presence of dark gray fine-grained sediments (similar to that observed underpier) on top of the sand cover material within 10 feet of the pierface (Anchor QEA 2010b). However, for SPI locations located 15 feet or more away from the pierface, no distinct dark gray fine-grained sediment was consistently observed on top of the sand cover material, nor was there presence of lighter brown fine-grained sediment (which was indicative of un-dredged sediment). Vessel activities in the berth area, which are actively limited through Port and pilot institutional controls, do not appear to have redistributed sloughed/slumped sediment throughout other portions of the berth area.

4.2 Residuals Management Cover Layer

The residuals management cover layer was required by Ecology to address potential anti-degradation concerns, and to ensure that the biologically active zone provided a viable substrate for benthic biota post-dredging. This layer further ensured that risks to human health and the environment have not increased due to dredging activities. This additional post-construction action ensured that all existing beneficial uses in Budd Inlet continued to be protected and maintained.

As agreed upon by Ecology, the cover layer was not intended as an isolation cap and, therefore, some mixing of the residuals management cover layer with the underlying exposed surface post-dredging was expected. As discussed in the Completion Report (Anchor QEA 2009), SPI surveys verified complete cover placement throughout the dredge area. Results of the 15-month monitoring indicated that low to moderate mixing of the sand cover layer with underlying un-dredged sediment appears to have occurred as a result of either vessel operations within the berth area, or natural mixing through bioturbation and/or currents. Based on surface sediment concentrations observed in the berth area since cover placement, the residuals management cover layer continues to contribute to viable substrate for benthic biota in the berth area.

4.3 Influence of Capitol Lake

The surface sediment dioxin concentrations in berth area, underpier, and ambient stations decreased significantly between the 9-month and 15-month surveys, likely because of multiple flushing events of Capitol Lake. Previous measurements of dioxin within Capitol Lake sediment ranged from 1.9 to 3.9 TEQ (SAIC 2008). This low dioxin-concentration sediment from the lake is thought to have been deposited throughout West Bay as a result of the flushing events, thus reducing average West Bay sediment concentrations. Additional drawdowns of the lake may occur in an effort to manage for invasive New Zealand mudsnails. If additional drawdowns occur, sedimentation rates are likely to be higher than typically is experienced in West Bay, and West Bay sediment concentrations are likely to remain low. If normal management of the Capitol Lake dam returns, the potential exists that surface concentrations within West Bay may tend to increase toward historical background concentrations, potentially due to various sources of dioxin that tend to be present in urban areas.

4.4 Sedimentation Patterns

Previous studies of circulation and sediment transport patterns of West Bay suggest that the Port berth area experiences higher sediment deposition rates than other parts of West Bay. A circulation model was developed by Ecology that was summarized in a draft report in October 2008 and was provided to the Port by Ecology Engineer Mindy Roberts. A sediment transport model of West Bay and Capitol Lake was developed by the U.S. Geologic Service (USGS) as part of the Deschutes Estuary Restoration Feasibility project. The results of simulations completed by USGS to evaluate various restoration alternatives for the Deschutes River Estuary also suggest net flow to the north along the east side of West Bay, with higher predicted net sedimentation along the Port's terminal (USGS 2008). Sedimentation rates are likely to be higher than other parts of West Bay in the area adjacent to the Port's marine terminal, likely requiring additional dredging activities in the future. Any future evaluation of remedial alternatives along the Port's terminal should consider sedimentation patterns and rates in this area.

4.5 Depth of Contamination at Pierface

Subsurface coring along the pierface conducted as part of the 15-month monitoring effort revealed deeper contamination than previously thought to exist (Anchor QEA 2010b). This finding suggests that the area in the vicinity of BA-102 and BA-103 (Figure 1) has likely been dredged to at least -44 to -46 feet MLLW at some point in the past, which allowed for sediments with elevated dioxin concentrations to accumulate. Lithology indicating native sediment was also found at a deeper elevation than expected. As a consequence, if additional dredging is to be considered for the area adjacent to the pierface, subsurface dioxin concentrations will need to be evaluated at depths greater than -46 feet MLLW to determine the vertical extent of dioxin contamination. Future remediation to remove deeper dioxin contamination will need to be carefully coordinated with slope and structural considerations to avoid potentially causing major slope sloughing/slumping that could resuspend contaminated sediment and/or result in adverse impacts to existing structures.

5 NEXT STEPS

The Port anticipates meeting with Ecology to discuss next steps, including future cleanup activities in Berths 2 and 3 and along other parts of the Port's marine terminal. The Port will contact Ecology to identify appropriate steps to plan and initiate additional studies in this area.

6 REFERENCES

Anchor Environmental, L.L.C. 2009. Water Quality Monitoring and Sediment Sampling Plan. Prepared for the Port of Olympia. January.

Anchor QEA, LLC. 2009a. Memorandum Summarizing 3-Month Monitoring Results - Berths 2 and 3 Interim Cleanup Action Pilot Study. Prepared for the Port of Olympia. September.

Anchor QEA, LLC. 2009b. Completion Report – Berths 2 and 3 Interim Action Cleanup. Prepared for the Port of Olympia. June.

Anchor QEA, LLC. 2010a. Memorandum Summarizing 9-Month Monitoring Results - Berths 2 and 3 Interim Cleanup Action Pilot Study. Prepared for the Port of Olympia. March.

Anchor QEA, LLC. 2010b. Memorandum Summarizing 15-Month Monitoring Results - Berths 2 and 3 Interim Cleanup Action Pilot Study. Prepared for the Port of Olympia. September.

SAIC. 2008. Sediment Characterization Study, Budd Inlet, Olympia, WA, Final Data Report. Prepared for the Washington State Department of Ecology. March 12.

USGS. 2008. Incorporation of Fine-Grained Sediment Erodibility Measurements into Sediment Transport Modeling, Capitol Lake, Washington. Prepared by the U.S. Department of the Interior, U.S. Geological Survey. Open-File Report 2008-1340.

Table 1
21-Month Post-Cover Surface Sediment Sample Locations

Station ID		Water Depth (feet MLLW)	Actual Coordinates[1]			
			Latitude (°N)	Longitude (°W)	Northing (feet)	Easting (feet)
Underpier	PO-UP-20-SE	19.3	47.0534	122.9057	636401	1040845
	PO-UP-21-SE	21.6	47.0541	122.9058	636659	1040823
	PO-UP-22-SE	21.3	47.0547	122.9059	636862	1040809
	PO-UP-23B-SE	16.4	47.0552	122.9060	637071	1040794
Berth Area	PO-BA-24-SE	40.2	47.0533	122.9060	636378	1040783
	PO-BA-25-SE	40.5	47.0538	122.9061	636549	1040769
	PO-BA-26-SE	42.6	47.0546	122.9061	636858	1040767
	PO-BA-27B-SE	40.7	47.0552	122.9063	637066	1040729
	PO-BA-28-SE	37.1	47.0534	122.9058	636391	1040819
	PO-BA-29-SE	38.8	47.0538	122.9059	636556	1040809
	PO-BA-30-SE	35.9	47.0546	122.9060	636852	1040788
	PO-BA-31-SE	39.4	47.0552	122.9061	637066	1040767
Ambient	PO-AM-28-SE	40.7	47.0557	122.9067	637244	1040636
	BI-S37	34.6	47.0548	122.9073	636930	1040464
	BI-C16	35.3	47.0537	122.9065	636533	1040649
	PO-AM-50-SE	19.8	47.0504	122.9056	635310	1040838
	PO-AM-51-SE	38.9	47.0523	122.9059	636004	1040788

Notes:
1 Washington South Zone, NAD 83 geographic and state plane coordinates – U.S. survey feet

Table 2
21-Month Post-Cover Sediment Chemistry Results

	Berth Area								Underpier Area				Ambient Samples				
Station ID	**BA-24**	**BA-25**	**BS-26**	**BA-27B**	**BA-28**	**BA-29**	**BA-30**	**BA-31**	**UP-20**	**UP-21**	**UP-22**	**UP-23B**	**BI-C16**	**BI-S37**	**AM-28**	**AM-50**	**AM-51**
Sample Date	**12/8/2010**	**12/8/2010**	**12/8/2010**	**12/8/2010**	**12/8/2010**	**12/8/2010**	**12/8/2010**	**12/8/2010**	**12/8/2010**	**12/8/2010**	**12/8/2010**	**12/8/2010**	**12/8/2010**	**12/8/2010**	**12/8/2010**	**12/8/2010**	**12/8/2010**
Depth	**0 - 10 cm**	**0 - 10 cm**	**0 - 10 cm**	**0 - 10 cm**	**0 - 10 cm**	**0 - 10 cm**	**0 - 10 cm**	**0 - 10 cm**	**0 - 10 cm**	**0 - 10 cm**	**0 - 10 cm**	**0 - 10 cm**	**0 - 10 cm**	**0 - 10 cm**	**0 - 10 cm**	**0 - 10 cm**	**0 - 10 cm**
Conventional Parameters (pct)																	
Total organic carbon	**1.5 J**	**2 J**	**0.64 J**	**1.1 J**	**6.2 J**	**4.9 J**	**6.6 J**	**5.6 J**	**6.9**	**4.2**	**3.9 J**	**7.2 J**	**3.4**	**3.7**	**3.6**	**3.4**	**3.9**
Total solids	**57**	**53**	**73**	**61**	**31**	**30**	**31**	**26**	**27**	**26**	**29**	**37**	**29**	**28**	**28**	**33**	**27**
Grain Size (pct)																	
Cobbles	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Gravel	**13**	**17**	**29**	**17**	**39**	**25**	**39**	**5.4**	**12**	**0.7**	**1.5**	**11**	**0.1**	**0.1**	**0.2**	**0.5**	**0.1**
Sand	**59**	**48**	**62**	**61**	**12**	**12**	**8.2**	**4.2**	**18**	**10**	**6.6**	**45**	**6.8**	**2.2**	**5**	**8**	**1.4**
Silt	**19**	**25**	**6.2**	**15**	**30**	**44**	**37**	**55**	**50**	**70**	**74**	**29**	**64**	**77**	**72**	**70**	**76**
Clay	**8.5**	**9.9**	**2.9**	**6.3**	**20**	**19**	**16**	**36**	**20**	**19**	**17**	**15**	**29**	**21**	**22**	**22**	**23**
Total Fines (silt + clay)	**27.5**	**34.9**	**9.1**	**21.3**	**50**	**63**	**53**	**91**	**70**	**89**	**91**	**44**	**93**	**98**	**94**	**92**	**99**
Dioxin Furans (ng/kg)																	
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	0.233 U	0.147 U	0.0867 U	0.244 U	0.234 U	0.453 U	0.312 U	0.563 U	**0.835**	0.26 U	0.398 U	0.393 U	**0.401**	**0.561**	0.863 U	0.634 U	0.289 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	0.939 U	**0.926**	0.55 U	0.722 U	0.822 U	1.58 U	**0.986**	**2.03**	**4.58**	1.47 U	2.15 U	**1.85**	**1.22**	**1.21**	**2.7**	**3.56**	**0.963**
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	**1.79**	1.46 U	**0.707**	**1.29**	1.12 U	**2.72**	**2.27**	**3.32**	7.16 U	3.01 U	**3.82**	**3.02**	**1.89**	**2.36**	**5.32**	**6.03**	**1.53**
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	**8.47**	**7.77**	3.19 U	**6.68**	**5.45**	**10.9**	**10.4**	**15.3**	**25.7**	**9.92**	**19.3**	**13.9**	**9.57**	**9.87**	**26**	**32.1**	**7.99**
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	**4.88**	**3.88**	**1.72**	**3.28**	**2.93**	**6.78**	**5.4**	**7.97**	16.1 U	**5.22**	9.67 U	**7.46**	**4.76**	5.26 U	**13**	**16.2**	**4.01**
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	**192**	**188**	**75.4**	**157**	**141**	**341**	**298**	**385**	**827**	**498**	**729**	**463**	**228**	**210**	**543**	**746**	**201**
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	**1610**	**1520**	**582**	**1200**	**1270**	**3100**	**2730**	**2860**	**7600 J**	**5430**	**7160 J**	**3680**	**1770**	**1380**	**3900**	**6040 J**	**1760**
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	**1.05**	1.14 U	**0.678**	**0.695**	0.828 U	**1.33**	1.63 U	**1.51**	**2.12**	**1.12**	**1.5**	**1.19**	**1.43**	**1.46**	**3.97**	**2.65 J**	**1.29**
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	0.706 U	**0.694**	0.304 U	**0.512**	0.51 U	**1.01**	0.788 U	**1.28**	**2.47**	**0.75**	1.27 U	**1.33**	0.867 U	**1.01**	**2.59**	**2.9**	**0.752**
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	**1.47**	**1.42**	**0.628**	**1.09**	**0.952**	**2.06**	**2.11**	**3.09**	**4.33**	**1.65**	**2.63**	**3.61**	**1.79**	**1.91**	**4.51**	**5.31**	**1.61**
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	**3.82**	**4.03**	**1.47**	**3.12**	**2.28**	**5.58**	**5.05**	**8.26**	**10.8**	**4.77**	**7.09**	**8.82**	**4.24**	**3.9**	**11.8**	**12.7**	**3.39**
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	**1.63**	**1.65**	**0.72**	**1.11**	**1.02**	2.24 U	**2.02**	**3.24**	**5.1**	1.72 U	**2.74**	**3.23**	**2.03**	**1.97**	**4.75**	**6.21**	**1.37**
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	**0.812**	**0.98**	0.348 U	0.61 U	**0.538**	**1.24**	**1.11**	**1.91**	**2.04**	0.795 U	**2.01**	2.36 U	**1.15**	1.34 U	**2.3**	**3.03**	**0.911**
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	**2.48**	**2.48**	**1.07**	**1.96**	**1.57**	**3.32**	**3.14**	**4.66**	**6.28**	2.3 U	**4.69**	**4.21**	**2.89**	**3.03**	**8.29**	**9.41**	**2.25**
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	**52.2**	**49.8**	**22.3**	**43**	**34.1**	**78.2**	**68**	**97.5**	**139**	**57.1**	**103**	**87.2**	**59.8**	**58.4**	**158**	**189**	**47.9**
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	**2.16**	**2.34**	1.1 U	**1.78**	**1.48**	**3.34**	**3.12**	**4.21**	**6.56**	**3.13**	**5.16**	**4.83**	**3.07**	**2.29**	**6.83**	**8**	**2.5**
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	**118**	**103**	**46.9**	**82.1**	**96.2**	**200**	**198**	**200**	**404**	**178**	**331**	**332**	**104**	**71.5**	**258**	**349**	**89.1**
Total Tetrachlorodibenzo-p-dioxin (TCDD)	**6.5**	**3.84**	**1.59**	**5.03**	**2.1**	**4.93**	**4.01**	**11**	**13.6**	**3.99**	**8.49**	**6.88**	**9.37**	**5.62**	**25.2**	**21.2**	**5.01**
Total Pentachlorodibenzo-p-dioxin (PeCDD)	**11.6**	**12.4**	**5.29**	**10.2**	**5.24**	**20.3**	**15.9**	**30.7**	**41.1**	**11.6**	**22.8**	**20.6**	**19.5**	**31**	**63.6**	**60.1**	**12.3**
Total Hexachlorodibenzo-p-dioxin (HxCDD)	**78.4**	**70.3**	**21.9**	**63.8**	**51.8**	**117**	**105**	**149**	**244**	**191**	**197**	**181**	**92**	**271**	**256**	**285**	**83.7**
Total Heptachlorodibenzo-p-dioxin (HpCDD)	**631**	**638**	**218**	**471**	**559**	**1530**	**1180**	**1230**	**3740**	**3420**	**3260**	**1760**	**793**	**767**	**1640**	**2500**	**868**
Total Tetrachlorodibenzofuran (TCDF)	**5.51 J**	**4 J**	**1.75 J**	**4.48 J**	**3.45 J**	**7.76 J**	**9.23**	**11.4 J**	**13.5 J**	**5.56 J**	**8.65**	**9.15**	**8.88**	**6.02**	**15.3**	**24.5 J**	**4.41 J**
Total Pentachlorodibenzofuran (PeCDF)	**5.62**	**7.86**	**2.51**	**5.86**	**4.69**	**11.8**	**10.2**	**15.8**	**27.1**	**7.52**	**10**	**15**	**10.1**	**10.6**	**28.6**	**32**	**9.06**
Total Hexachlorodibenzofuran (HxCDF)	**60.4**	**57.7**	**22.8**	**46.1**	**36.7**	**78.1**	**76.1**	**117**	**156**	**56.3**	**109**	**117**	**67.2**	**63.2**	**183**	**222**	**52**
Total Heptachlorodibenzofuran (HpCDF)	**178**	**167**	**71.2**	**143**	**126**	**282**	**265**	**339**	**506**	**235**	**408**	**389**	**205**	**178**	**530**	**658**	**165**
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 0)	**5.9**	**6.3**	**2.0**	**4.6**	**3.8**	**9.1**	**9.1**	**13.4**	**24.1**	**9.9**	**15.5**	**13.9**	**8.4**	**7.8**	**20.0**	**25.4**	**6.8**

Notes:

Bold = Detected result

J = Estimated value

U = Compound analyzed, but not detected above detection limit

Totals are calculated as the sum of all detected results (U=0). If all results are not detected, the highest reporting limit value is reported as the sum.

Toxicity Equivalency (TEQ) values as of 2005, World Health Organization.

Level III data validation applied

Table 3
2009-2010 Post-Cover Surface Sediment Results

	Post-Cover Survey (March 2009)	3-Month Post-Cover Survey (June 2009)	9-Month Post-Cover Survey (December 2009)	15-Month Post-Cover Survey (June 2010)	21-Month Post-Cover Survey (December 2010)
Underpier Area					
UP-20	**39.4**	**39.0**	**33.4**	**13.4**	**24.1**
UP-21	**46.0**	**37.3**	**43.9**	**8.9**	**9.9**
UP-22	**32.3**	**36.2**	**32.1**	**16.0**	**15.5**
UP-23B	**37.8**	**36.0**	**37.4**	**28.0**	**13.9**
Average	**38.9**	**37.1**	**36.7**	**16.6**	**15.9**
Berth Area					
BA-24	**0.1**	**4.7**	**11.7**	**5.9**	**5.9**
BA-25	**0.5**	**1.8**	**4.6**	**2.8**	**6.3**
BA-26	**0.0**	**1.5**	**1.1 / 35.2 ***	**6.0**	**2.0**
BA-27B	**0.0**	**1.7**	**17.1**	**7.4**	**4.6**
Average	**0.2**	**2.4**	**11.1 #**	**5.4**	**5.6**
Berth Area-Toe of Slope					
BA-28	-	-	-	**7.4**	**3.8**
BA-29	-	-	-	**14.3**	**9.1**
BA-30	-	-	-	**9.1**	**9.1**
BA-31	-	-	-	**22.8**	**13.4**
Average	-	-	-	**13.4**	**8.9**
Ambient Samples					
BI-C16	**24.7**	**21.3**	**22.7**	**3.9**	**8.4**
BI-S37	**23.3**	**22.9**	**21.7**	**2.2**	**7.8**
AM-28	**23.3**	**23.8**	**21.0**	**1.8**	**20.0**
AM-50	-	-	-	**14.0**	**25.4**
AM-51	-	-	-	**6.0**	**6.8**
Average	**23.8**	**22.7**	**21.8**	**5.6**	**13.7**

Notes:

TEQ values calculated using World Health Organization (2005)

* A field duplicate was collected at BA-26

Average for Berth Area samples was calculated using the mean of the duplicate samples collected at BA-26

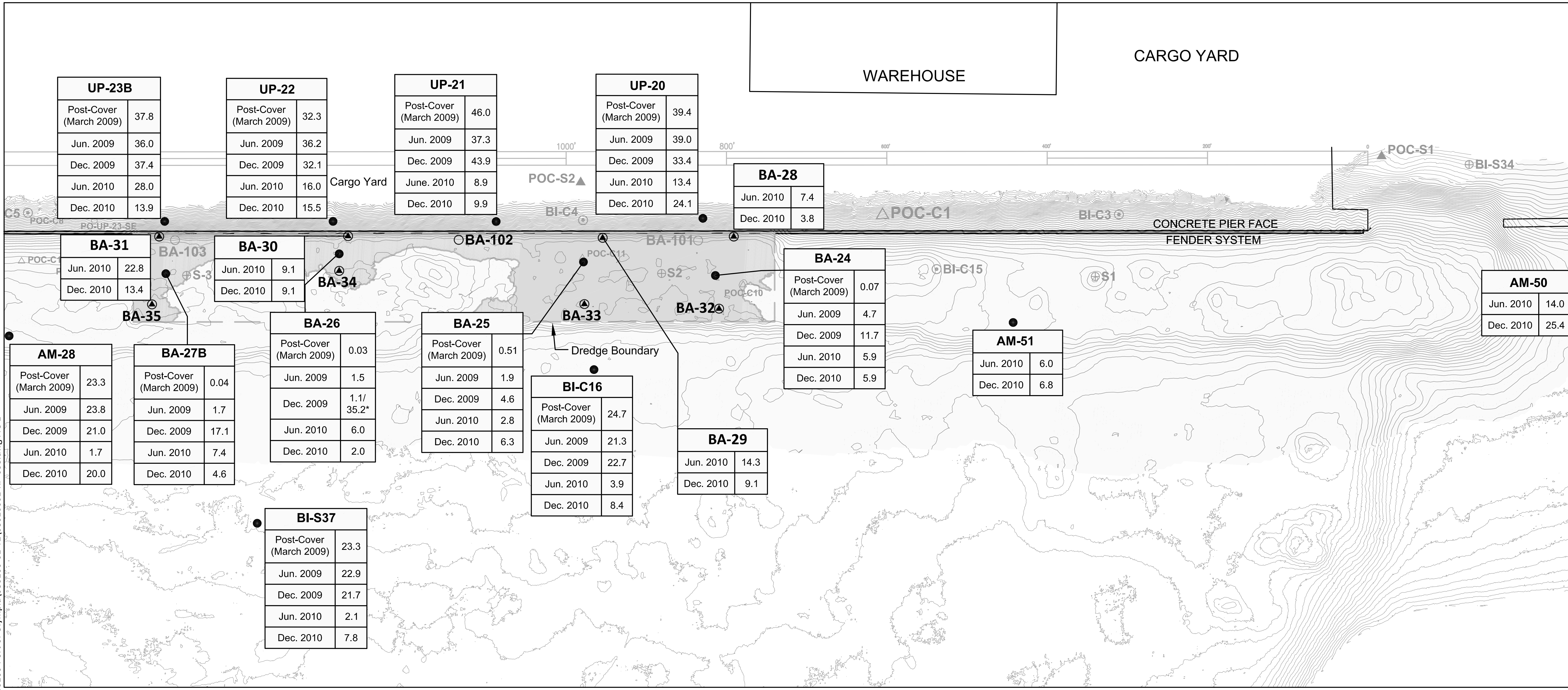
Table 4
Bathymetry Comparison

	Post-Construction Elevation (feet MLLW)					Change in Mudline Elevation at Pierface (feet)	Distance Under Pier to Top of Sloughed Slope (from fender line; feet)					Increase in Lateral Distance to Top of Sloughed Slope (feet)	Final Approximate Angle of Repose
	Post-Cover	3-Month Survey	9-Month Survey	15-Month Survey*	21-Month Survey								
	Mar 9, 2009	Jun 24, 2009	Dec 10, 2009	Jun 21, 2010	Dec 14, 2010	Jun 2010 - Dec 2010	Mar 9, 2009	Jun 24, 2009	Dec 10, 2009	Oct 4, 2010*	Dec 14, 2010	Oct 2010-Dec 2010	Dec 14, 2010
Cross Section													
7+40	**-35.2**	**-34.9**	**-34.5**	-34.6	-34.3	**0.3**	**7.0**	**8.0**	**16.5**	**27.0**	**continuous**	**NA**	**1.5:1**
7+90	**-39.9**	**-38.2**	**-37.1**	-36.6	-35.8	**0.8**	**11.0**	**11.5**	**14.5**	**30.0**	**continuous**	**NA**	**1.5:1**
8+90	**-37.6**	**-37.3**	**-36.6**	-35.1	-35.8	**-0.7**	**9.0**	**11.0**	**13.0**	**24.0**	**continuous**	**NA**	**1.5:1**
9+70	**-35.6**	**-36.6**	**-35.3**	-36.6	-34.9	**1.7**	**1.5**	**8.5**	**11.5**	**27.0**	**continuous**	**NA**	**1.5:1**
10+90	**-37.7**	**-36.2**	**-35.9**	-34.9	-35.1	**-0.2**	**12.0**	**12.0**	**15.0**	**27.0**	**continuous**	**NA**	**1.5:1**
11+90	**-39.6**	**-37.5**	**-37.3**	-36.7	-36.2	**0.5**	**4.0**	**7.5**	**10.0**	**18.0**	**continuous**	**NA**	**1.5:1**
12+90	**-36.8**	**-35.9**	**-35.3**	-34.8	-34.1	**0.7**	**13.0**	**13.0**	**18.0**	**26.0**	**26.0**	**0.0**	**1.5:1**
13+90	**-37.7**	**-36.7**	**-35.9**	-35.2	-35.3	**-0.1**	**10.0**	**10.0**	**10.0**	**27.0**	**27.0**	**0.0**	**1:1**
14+90	**-39.0**	**-36.6**	**-36.1**	-35.3	-34.5	**0.8**	**7.0**	**8.0**	**8.5**	**19.0**	**continuous**	**NA**	**1.5:1**
15+40	**-31.8**	**-30.2**	**-30.9**	-33.1	-31.9	**1.2**	**0.0**	**0.0**	**9.0**	**26.0**	**continuous**	**NA**	**1.5:1**
Minimum	**-39.9**	**-38.2**	**-37.3**	**-36.7**	**-36.2**	**-0.7**	**0.0**	**0.0**	**8.5**	**18.0**	**---**	**---**	**---**
Average	**-37.1**	**-36.0**	**-35.5**	**-35.3**	**-34.8**	**0.5**	**7.5**	**9.0**	**12.6**	**25.1**	**---**	**---**	**---**
Maximum	**-31.8**	**-30.2**	**-30.9**	**-33.1**	**-31.9**	**1.7**	**13.0**	**13.0**	**18.0**	**30.0**	**---**	**---**	**---**

Notes:

* Because of the uncertainty of the accuracy of the July 13, 2010 multibeam survey at the pierface and underpier, an additional multibeam survey was conducted on October 4, 2010. For the 15-month post-construction elevations, the mudline elevations at the pierface are provided using leadline data collected on June 21, 2010, and the underpier distances are compared only to the October 4, 2010 survey.

NA = Distance underpier to the top of the sloughed slope is not available because the slope is continuous.



K:\Jobs\080166-Port of Olympia\080166-01-T2\08016601-RP-038.dwg FIG 1
Feb 16, 2011 1:52pm dholmer

LEGEND:

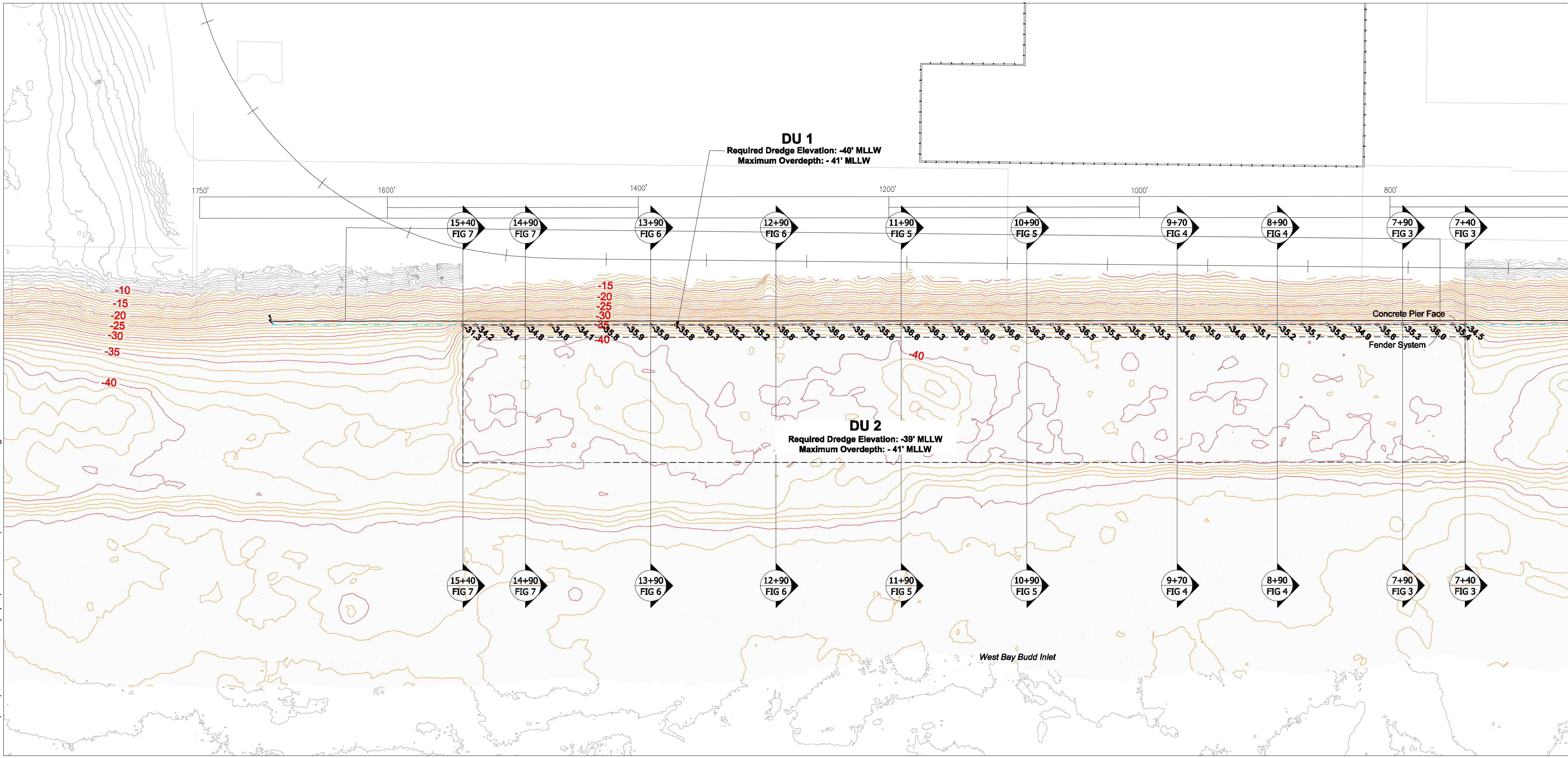
- Dredged Area
- BA-27 ● Required Sediment Grab Location
- BA-31 ◬ Supplemental Surface Sediment Location
- BA-103 ○ 2010 Subsurface Core Location
- S4 ⊕ Core Sample - DMMP 2006
- BI-C4 ⊙ Core Sample - Ecology 2007
- POC-S2 ▲ Surface Sample - Port 2007
- POC-S5 △ Core Sample - Port 2007
- PO-UP-22-SE ○ Core Sample - Port 2008
- PO-BA-27-SE • Core Sample - Port 2008

0 125
Scale in Feet

HORIZONTAL DATUM: Horizontal datum is Washington State Plane - South Zone (NAD 83(91)), U.S. survey feet.
VERTICAL DATUM: Vertical datum is Mean Lower Low Water (MLLW).
NOTES:
1. Bathymetric survey provided by eTrac, dated December 14, 2010.
2. Contour interval is 1 foot.
3. * Field Duplicate.
4. Data are Total Dioxin/Furan TEQ 2005 (Mammal) (U=0) in ng/kg.
5. Surface sediment is 0 - 10 cm.

ANCHOR QEA

Figure 1
Post-Construction Dioxin Concentrations through December 2010
Berth 2 and 3 Interim Cleanup Action Pilot Study
Port of Olympia



K:\Jobs\080166-Port of Olympia\080166-01-T2\08016601-RP-041.dwg FIG 2

Feb 14, 2011 11:27am dholmer

HORIZONTAL DATUM: Washington State Plane - South Zone (NAD 83(91)), U.S. Survey Feet.

VERTICAL DATUM: NOS Mean Lower Low Water (MLLW).

SURVEY: Bathymetric Survey Provided by eTrac, dated July 13, 2010 (gray) and December 14, 2010 (orange).

NOTE: Contour Interval is 1 Foot.

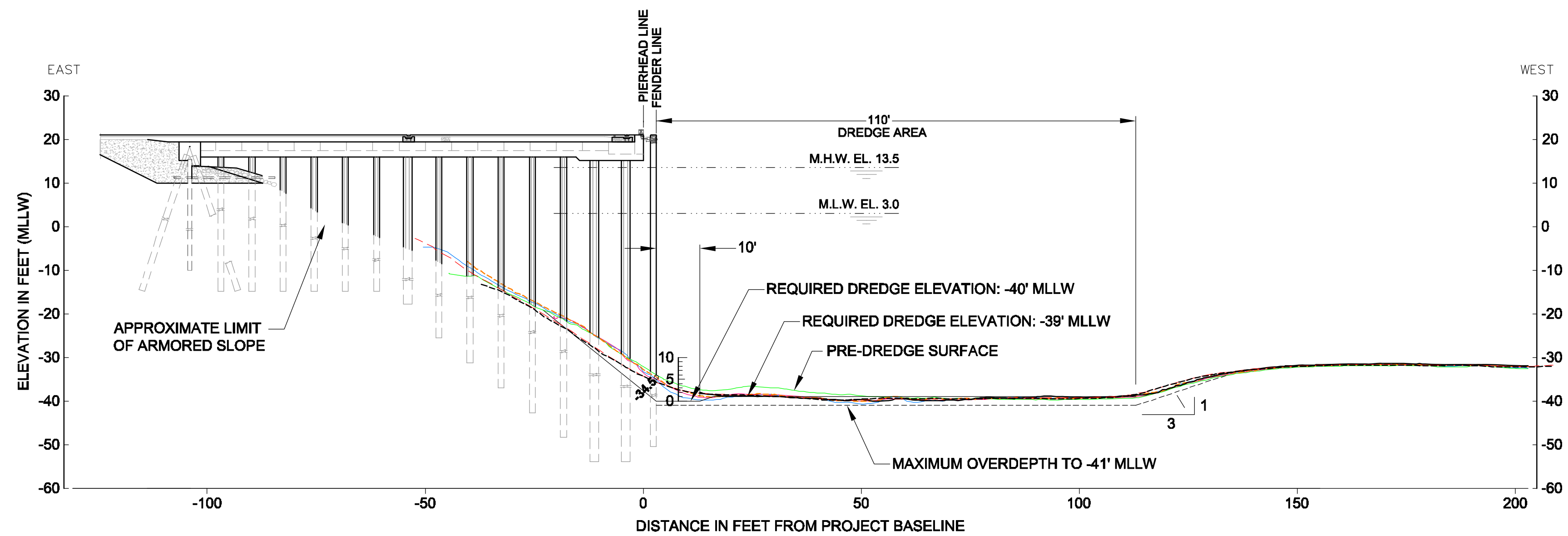
LEGEND:

- Fender Line
- Pierhead Line
- Contours
- Rail Line
- Dredge Area
- 33.1 Leadline Elevation in Feet (December 12, 2010)

0 80
Scale in Feet

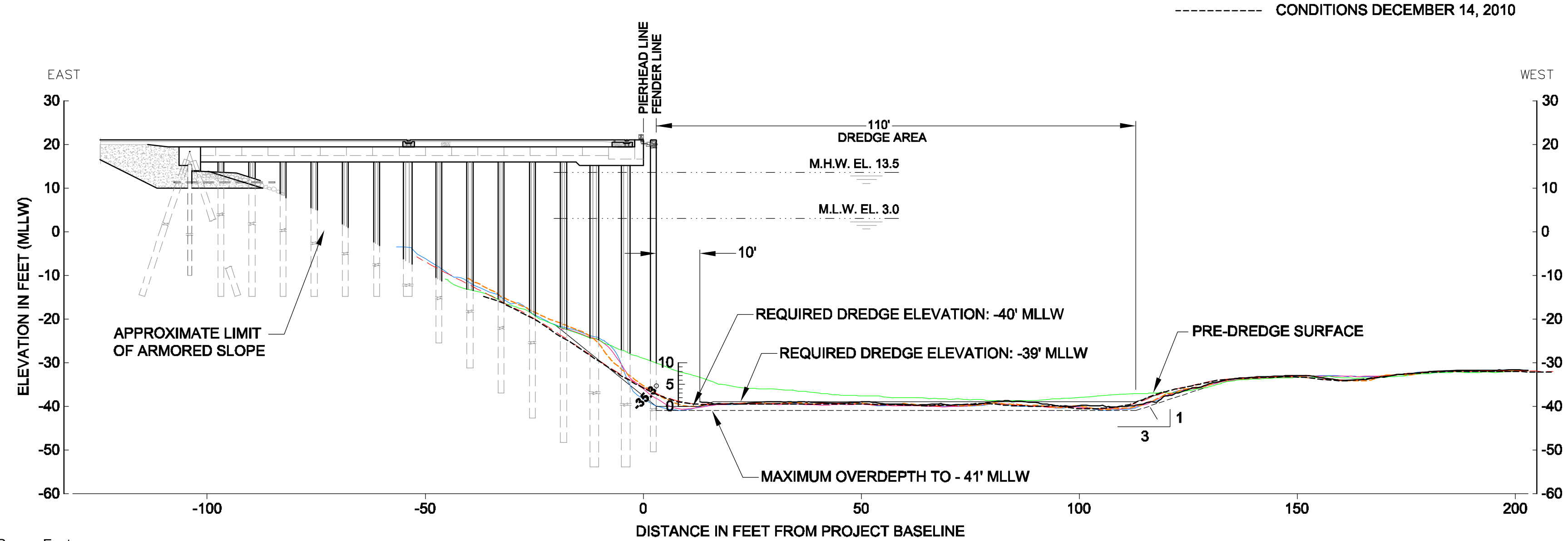
ANCHOR QEA

Figure 2
21-Month Post-Dredge Bathymetry
Berths 2 and 3 Interim Cleanup Action Pilot Study
Port of Olympia



7+40 FIG 1 CROSS SECTION
SCALE: 1" = 40'

- PRE-DREDGE MARCH 27, 2008
- POST-COVER MARCH 9, 2009
- CONDITIONS JUNE 24, 2009
- CONDITIONS DECEMBER 10, 2009
- CONDITIONS JULY 13, 2010
- CONDITIONS OCTOBER 4, 2010
- CONDITIONS DECEMBER 14, 2010



7+90 FIG 1 CROSS SECTION
SCALE: 1" = 40'

LEGEND:

33.1 Leadline Elevation in Feet (December 12, 2010)

HORIZONTAL DATUM: Washington State Plane - South Zone (NAD 83(91)), U.S. Survey Feet.
VERTICAL DATUM: NOS Mean Lower Low Water (MLLW).
SURVEYS:

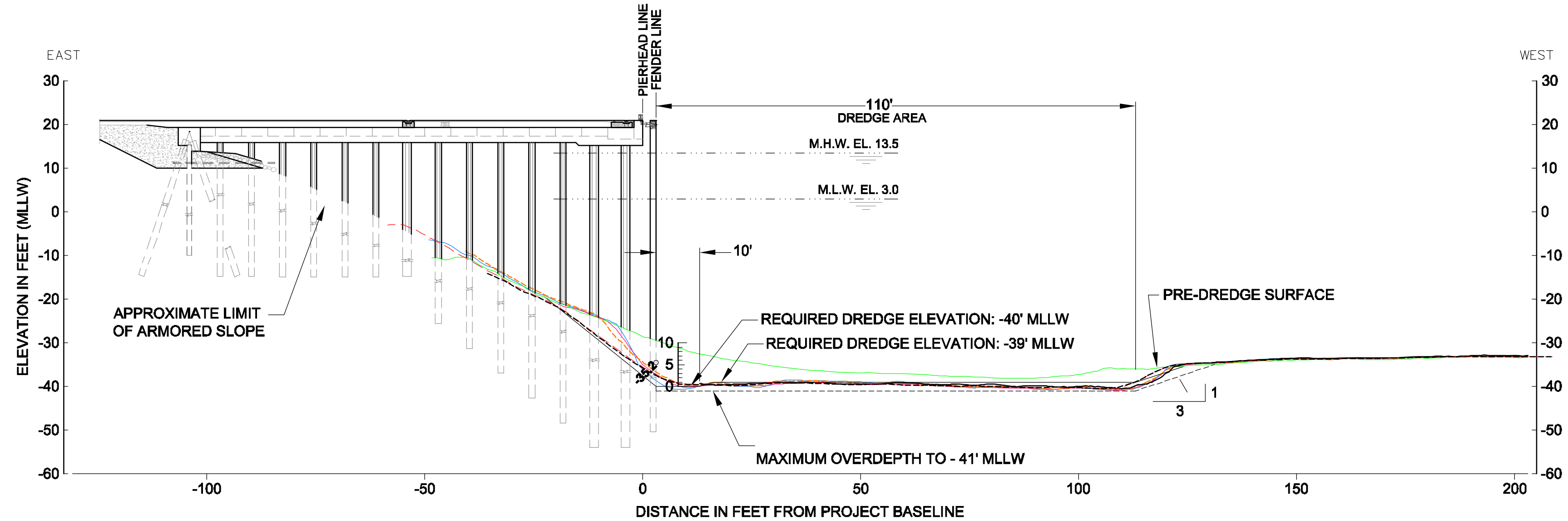
1. Pre-dredge survey provided by David Evans and Associates, Inc., dated March 27, 2008.
2. Post construction survey provided by eTrac, dated March 9, 2009.
3. 3-month conditions survey provided by eTrac, dated June 24, 2009.
4. 9-month conditions survey provided by eTrac, dated December 10, 2009.
5. 15-month conditions survey provided by eTrac, dated July 13, 2010 in berthing areas and October 4, 2010 in underpier area.
6. 21-month conditions survey provided by eTrac, dated December 14, 2010.

0 40
Scale in Feet

K:\Jobs\080166-Port of Olympia\080166-01-T2\08016601-RP-041.dwg FIG 3
Feb 14, 2011 11:32am dholmer

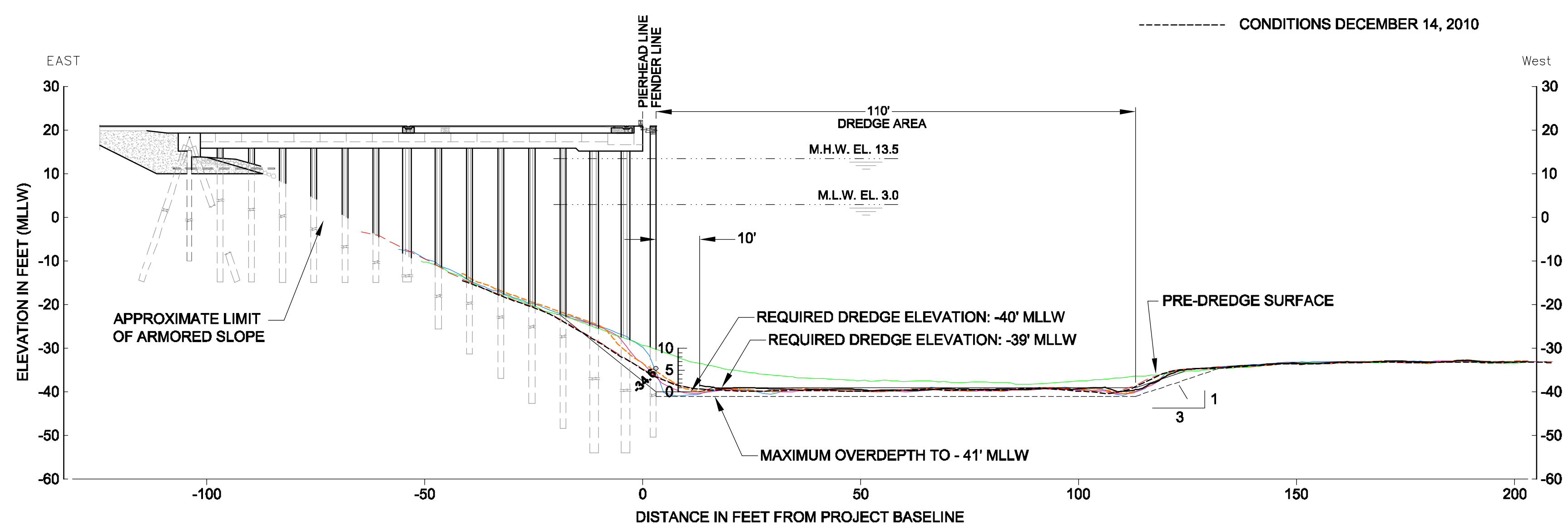
Figure 3
Cross Sections 7+40 and 7+90
Berths 2 and 3 Interim Cleanup Action Pilot Study
Port of Olympia

ANCHOR QEA



8+90 CROSS SECTION
FIG 1 SCALE: 1" = 40'

PRE-DREDGE MARCH 27, 2008
POST-COVER MARCH 9, 2009
CONDITIONS JUNE 24, 2009
CONDITIONS DECEMBER 10, 2009
CONDITIONS JULY 13, 2010
CONDITIONS OCTOBER 4, 2010
CONDITIONS DECEMBER 14, 2010



9+70 CROSS SECTION
FIG 1 SCALE: 1" = 40'

LEGEND:

33.1 Leadline Elevation in Feet (December 12, 2010)

HORIZONTAL DATUM: Washington State Plane - South Zone (NAD 83(91)), U.S. Survey Feet.
VERTICAL DATUM: NOS Mean Lower Low Water (MLLW).
SURVEYS:

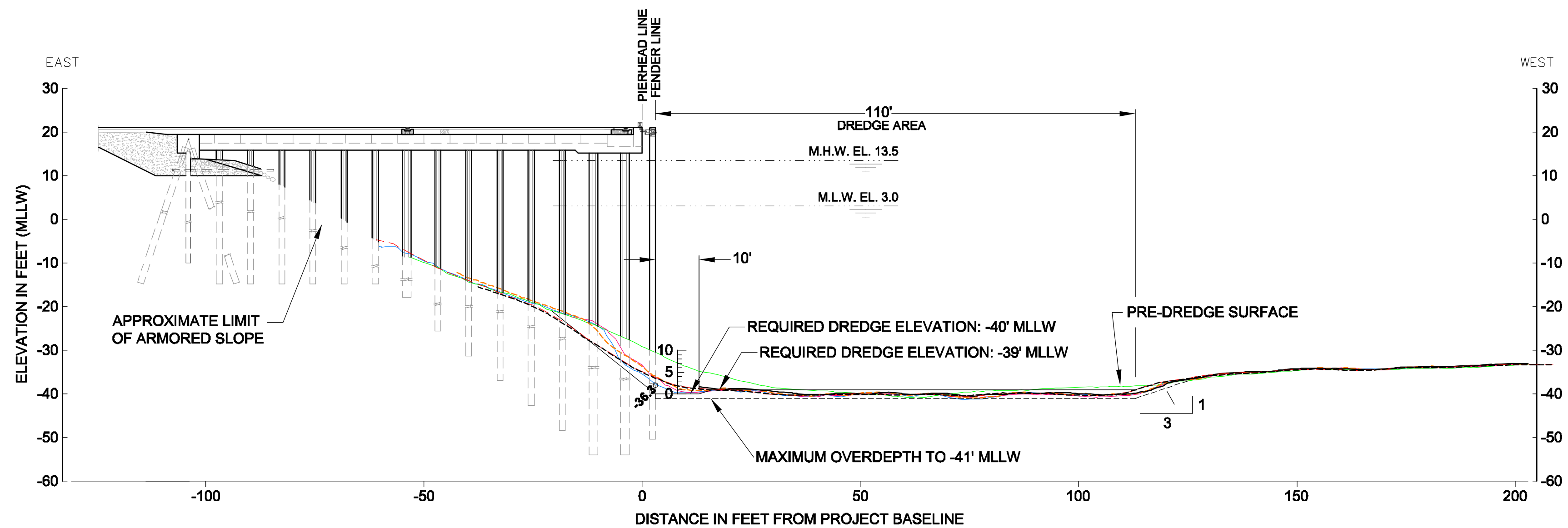
1. Pre-dredge survey provided by David Evans and Associates, Inc., dated March 27, 2008.
2. Post construction survey provided by eTrac, dated March 9, 2009.
3. 3-month conditions survey provided by eTrac, dated June 24, 2009.
4. 9-month conditions survey provided by eTrac, dated December 10, 2009.
5. 15-month conditions survey provided by eTrac, dated July 13, 2010 in berthing areas and October 4, 2010 in underpier area.
6. 21-month conditions survey provided by eTrac, dated December 14, 2010.

0 40
Scale in Feet

K:\Jobs\080166-Port of Olympia\080166-01-T2\08016601-RP-041.dwg FIG 4
Feb 14, 2011 11:33am dholmer

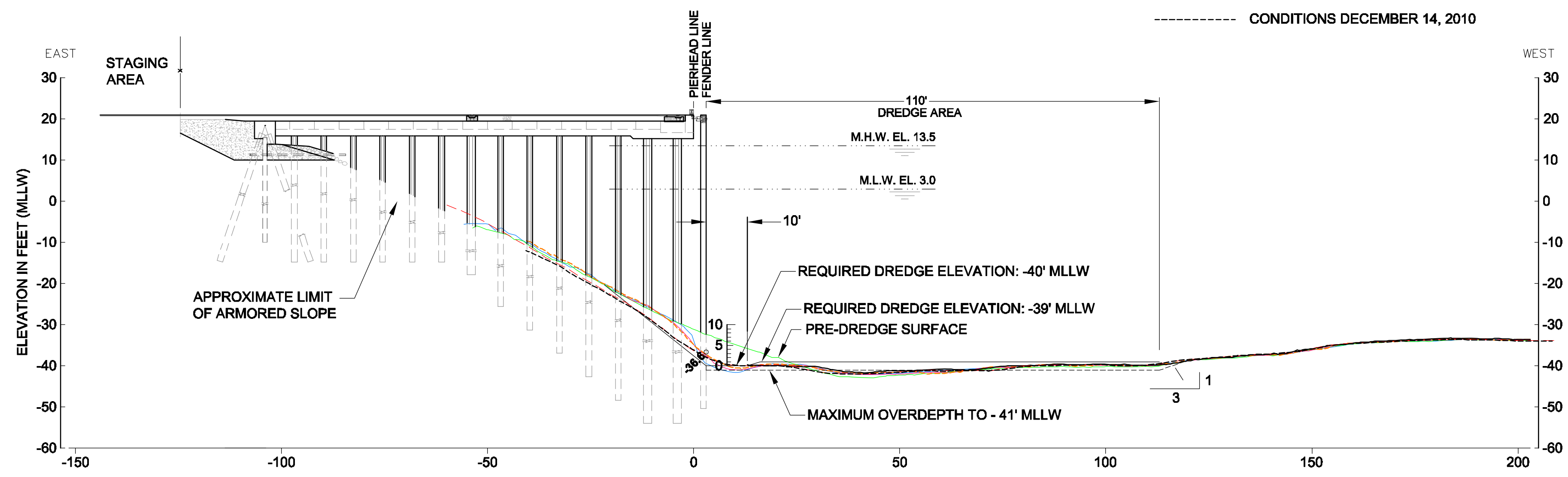
Figure 4
Cross Sections 8+90 and 9+70
Berths 2 and 3 Interim Cleanup Action Pilot Study
Port of Olympia

ANCHOR QEA



10+90 FIG 1 CROSS SECTION
SCALE: 1" = 40'

PRE-DREDGE MARCH 27, 2008
POST-COVER MARCH 9, 2009
CONDITIONS JUNE 24, 2009
CONDITIONS DECEMBER 10, 2009
CONDITIONS JULY 13, 2010
CONDITIONS OCTOBER 4, 2010
CONDITIONS DECEMBER 14, 2010



11+90 FIG 1 CROSS SECTION
SCALE: 1" = 40'

0 40
Scale in Feet

LEGEND:

-33.1 Leadline Elevation in Feet (December 12, 2010)

HORIZONTAL DATUM: Washington State Plane - South Zone (NAD 83(91)), U.S. Survey Feet.
VERTICAL DATUM: NOS Mean Lower Low Water (MLLW).
SURVEYS:

1. Pre-dredge survey provided by David Evans and Associates, Inc., dated March 27, 2008.
2. Post construction survey provided by eTrac, dated March 9, 2009.
3. 3-month conditions survey provided by eTrac, dated June 24, 2009.
4. 9-month conditions survey provided by eTrac, dated December 10, 2009.
5. 15-month conditions survey provided by eTrac, dated July 13, 2010 in berthing areas and October 4, 2010 in underpier area.
6. 21-month conditions survey provided by eTrac, dated December 14, 2010.

K:\Jobs\080166-Port of Olympia\080166-01-T2\08016601-RP-041.dwg FIG 5
Feb 14, 2011 11:35am dholmer

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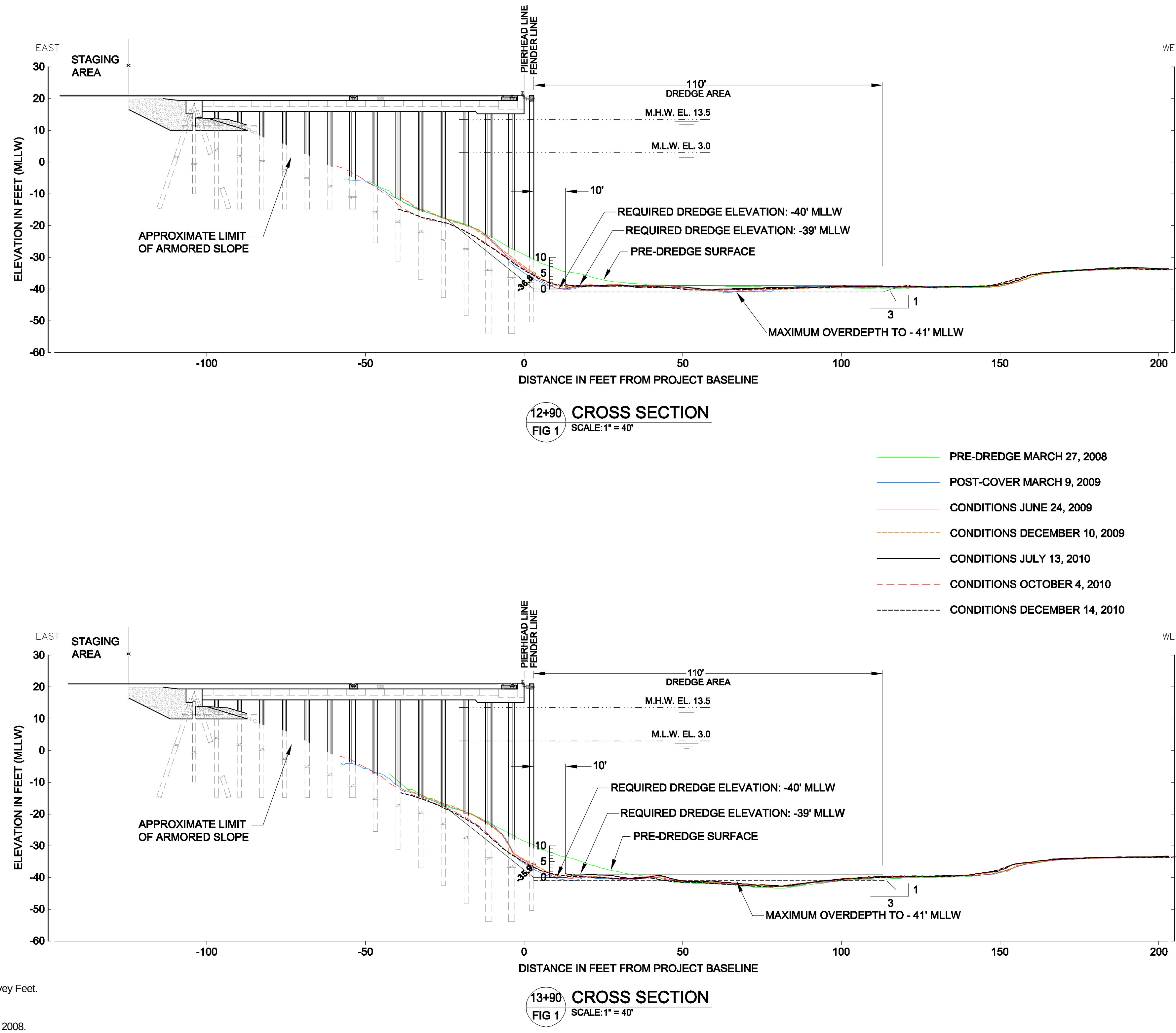
Figure 5
Cross Sections 10+90 and 11+90
Berths 2 and 3 Interim Cleanup Action Pilot Study
Port of Olympia



LEGEND:

33.1 Leadline Elevation in Feet (December 12, 2010)

HORIZONTAL DATUM: Washington State Plane - South Zone (NAD 83(91)), U.S. Survey Feet.
VERTICAL DATUM: NOS Mean Lower Low Water (MLLW).
SURVEYS:

1. Pre-dredge survey provided by David Evans and Associates, Inc., dated March 27, 2008.
2. Post construction survey provided by eTrac, dated March 9, 2009.
3. 3-month conditions survey provided by eTrac, dated June 24, 2009.
4. 9-month conditions survey provided by eTrac, dated December 10, 2009.
5. 15-month conditions survey provided by eTrac, dated July 13, 2010 in berthing areas and October 4, 2010 in underpier area.
6. 21-month conditions survey provided by eTrac, dated December 14, 2010.

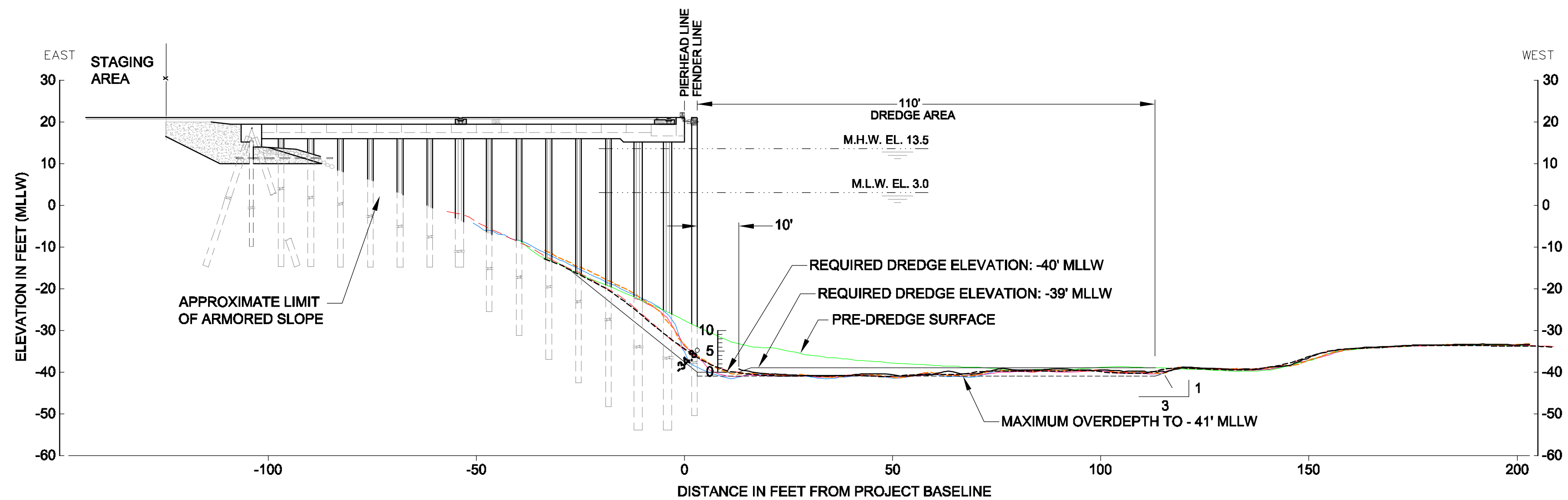
0 40
Scale in Feet

K:\Jobs\080166-Port of Olympia\080166-01-T2\08016601-RP-041.dwg FIG 6

Feb 14, 2011 11:36am dholmer

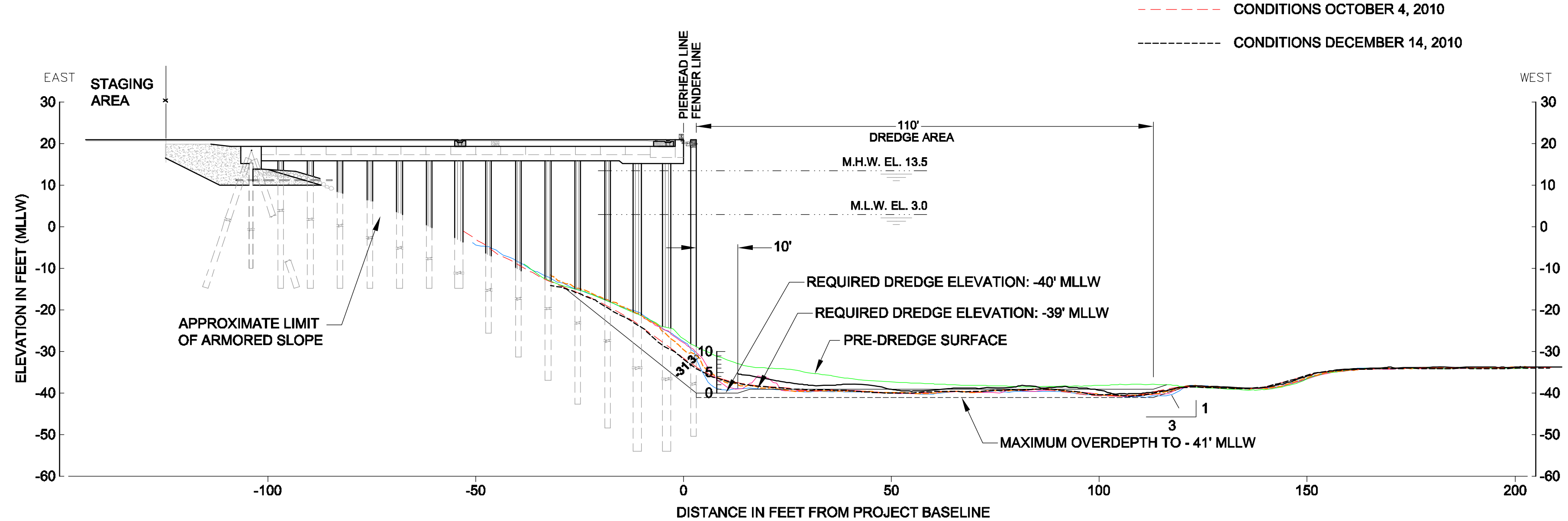
Figure 6
Cross Sections 12+90 and 13+90
Berths 2 and 3 Interim Cleanup Action Pilot Study
Port of Olympia

ANCHOR QEA



14+90 FIG 1 **CROSS SECTION**
SCALE: 1" = 40'

- PRE-DREDGE MARCH 27, 2008
- POST-COVER MARCH 9, 2009
- CONDITIONS JUNE 24, 2009
- CONDITIONS DECEMBER 10, 2009
- CONDITIONS JULY 13, 2010
- CONDITIONS OCTOBER 4, 2010
- CONDITIONS DECEMBER 14, 2010



15+40 FIG 1 **CROSS SECTION**
SCALE: 1" = 40'

0 40
Scale in Feet

LEGEND:

33.1 Leadline Elevation in Feet (December 12, 2010)

HORIZONTAL DATUM: Washington State Plane - South Zone (NAD 83(91)), U.S. Survey Feet.
VERTICAL DATUM: NOS Mean Lower Low Water (MLLW).
SURVEYS:
1. Pre-dredge survey provided by David Evans and Associates, Inc., dated March 27, 2008.
2. Post construction survey provided by eTrac, dated March 9, 2009.
3. 3-month conditions survey provided by eTrac, dated June 24, 2009.
4. 9-month conditions survey provided by eTrac, dated December 10, 2009.
5. 15-month conditions survey provided by eTrac, dated July 13, 2010 in berthing areas and October 4, 2010 in underpier area.
6. 21-month conditions survey provided by eTrac, dated December 14, 2010.

K:\Jobs\080166-Port of Olympia\080166-01-T2\08016601-RP-041.dwg FIG 7
Feb 14, 2011 11:36am dholmer

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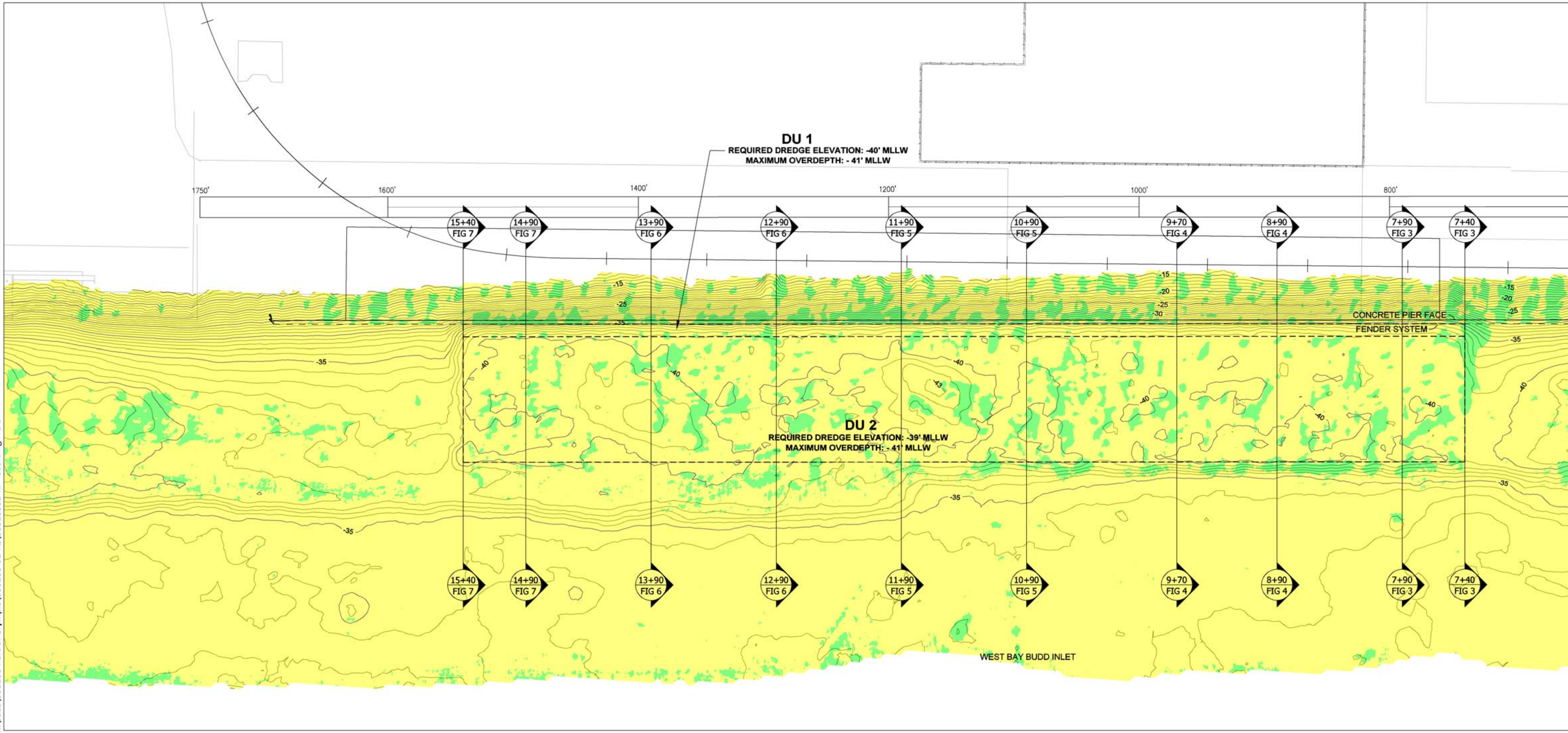
Figure 7
Cross Sections 14+90 and 15+40
Berths 2 and 3 Interim Cleanup Action Pilot Study
Port of Olympia



K:\Jobs\080166-Port of Olympia\080166-01-T2\08016601-RP-039.dwg FIG 8

Feb 18, 2011 8:38am dholmer

Horizontal Datum: Washington State Plane - South Zone (NAD 83(91)), U.S. Survey Feet.

Vertical Datum: NOS Mean Lower Low Water (MLLW).

Survey: Bathymetric surveys provided by Etrac dated July 11, 2010 (except underpier from October 4, 2010) and December 14, 2010.

Notes: Contour interval is 1 foot.

Isopach Showing Diference in Feet Between Surveys Conducted in July (underpier from October) and December 2010:

Range Beg.	Range End	
< -2.00	-1.50	Current Condition is Deeper than Previous
-1.50	-1.00	
-1.00	-0.50	
-0.50	0.00	
0.00	0.50	Current Condition is Shallower than Previous
0.50	1.00	
1.00	1.50	
1.50	> 2.00	

LEGEND:

- Fender Line
- Pierhead Line
- Contours
- Rail Line
- Dredge Area

0 80
Scale in Feet

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Figure 8
Comparison of July and December 2010 Bathymetric Surveys
Berths 2 and 3 Interim Cleanup Action Pilot Study
Port of Olympia

ATTACHMENTS A AND B (on CD)