YEAR 4 INTERIM MONITORING REPORT— TERMINAL 4 PHASE I REMOVAL ACTION PORT OF PORTLAND, PORTLAND, OREGON

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Prepared for

Port of Portland

Portland, Oregon

Prepared by

Anchor QEA, LLC

421 SW Sixth Avenue, Suite 750

Portland, Oregon 97204

December 2012

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Port of Portland

7200 Northeast Airport Way

Portland, Oregon 97218

Prepared by

Anchor QEA, LLC

421 Southwest Sixth Avenue, Suite 750

Portland, Oregon 97204

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TABLE OF CONTENTS

1 INTRODUCTION 1
1.1 General Scope of Interim Monitoring 1
1.2 Schedule of Year 4 Interim Monitoring Events 2
2 MONITORING RESULTS SUMMARY FOR THE HEAD OF SLIP 3 CAP AREA 3
2.1 Armor Layer Stability 3
2.1.1 Visual Survey 3
2.1.2 Pinch-pile Wall Survey 3
2.2 Presence of Sheens 6
3 MONITORING RESULTS SUMMARY FOR THE WHEELER BAY SHORELINE STABILIZATION 7
3.1 Slope Stability 7
3.2 Armor Layer Stability 9
3.3 Condition of Habitat Layer 9
3.4 Establishment of Vegetation 10
3.4.1 Willow Planting Establishment 11
3.4.2 Grass Planting Establishment 14
4 CONCLUSIONS AND NEXT STEPS 15
4.1 Head of Slip 3 Cap 15
4.2 Wheeler Bay 15
4.2.1 Condition of Habitat Layer 16
4.3 Reporting 16
5 REFERENCES 17

List of Tables

Table 1 Head of Slip 3 Cap Pinch-pile Wall Survey Results 5
Table 2 Willow Coverage Point Intercept Transect Results 13

List of Figures

Figure 1 Interim Survey Locations
Figure 2 Wheeler Bay Year 4 Habitat Conditions
Figure 3 Wheeler Bay Year 4 Slope Stability Transect Locations

List of Appendices

Appendix A Wheeler Bay and Head of Slip 3 Cap Year 4 Visual Slope and Armor Survey Monitoring Report

LIST OF ACRONYMS AND ABBREVIATIONS

±	plus or minus
Anchor	Anchor Environmental, L.L.C.
Anchor QEA	Anchor QEA, LLC
DAR	Design Analysis Report
DEQ	Oregon Department of Environmental Quality
H:V	horizontal to vertical
IMRP	*Interim Monitoring and Reporting Plan*
LNAPL	light nonaqueous phase liquid
LWD	large woody debris
NGVD	National Geodetic Vertical Datum
NMFS	National Marine Fisheries Service
PIT	Point Intercept Transect
Port	Port of Portland
Repair Memo	Wheeler Bay 2011 Repair Memorandum
WB	Wheeler Bay
Year 3 Monitoring Report	*Final Year 3 Interim Monitoring Report*

1 INTRODUCTION

This document provides a summary of the fourth year monitoring results for the head of Slip 3 cap and Wheeler Bay (WB) shoreline stabilization. Interim monitoring survey locations are depicted on Figure 1. Monitoring was conducted in accordance with the requirements of the *Interim Monitoring and Reporting Plan* (IMRP; see Appendix C of the Design Analysis Report [DAR]; Anchor 2008) and the *Final Year 3 Interim Monitoring Report* (Year 3 Monitoring Report; Anchor QEA 2012a). A description of the observed site conditions and relevant data summaries are provided in this report.

This document (see Section 3) also provides a summary of monitoring results for the repaired shoreline (between 0 and 340 feet from the mouth of the bay) and remaining shoreline (between 340 and 700 feet from the mouth of the bay) at WB. The monitoring requirements for the repaired shoreline were described in the 2010 *Wheeler Bay Shoreline Stabilization Slope Repair Final Closure Report* (Anchor QEA 2011a) and the *Final 2011 Wheeler Bay Shoreline Stabilization Slope Repair Closure Report* (Anchor QEA 2012b). Although not required by the IMRP, this document also summarizes monitoring results for the existing habitat layer (between 340 and 700 feet from the mouth of the bay) as described in the Year 3 Monitoring Report (Anchor QEA 2012a).

1.1 General Scope of Interim Monitoring

The IMRP provides the monitoring and reporting requirements between the completion of the Terminal 4 Phase I Removal Action work and the beginning of the Phase II Removal Action work. Additional monitoring requirements of the stabilized shoreline at WB were provided in the Year 3 Monitoring Report (Anchor QEA 2012a).

The head of Slip 3 cap integrity monitoring was performed to confirm the following:

- Armor layer stability
- Absence of sheens

WB stabilization monitoring of the repaired slope (between 0 and 340 feet from the mouth of the bay) was performed to confirm the following:

- Slope stability
- Armor layer stability
- Establishment of vegetation
- Stability and presence of woody debris as designed

WB stabilization monitoring of the remaining slope (between 340 and 700 feet from the mouth of the bay) was performed to confirm the items above and also the condition of the habitat layer.

1.2 Schedule of Year 4 Interim Monitoring Events

The following list summarizes the monitoring events conducted during Year 4:

- The head of Slip 3 sheen observations were conducted on May 10 and August 23, 2012.
- Slip 3 cap visual armor and slope stability surveys were conducted on November 13, 2012.
- A survey of the pinch-pile wall was performed on November 14, 2012.
- The Year 4 vegetation assessment at WB was performed on November 13, 2012.
- The habitat layer material of the shoreline slope (between 340 and 700 feet from the mouth of the bay) was also observed at WB on November 13, 2012.
- Quarterly monitoring of the vegetation and slope stability of the repaired shoreline (from 0 to 340 feet from the mouth of the bay) was performed on February 17, May 10, August 23, and November 13, 2012.
- Quarterly monitoring of the vegetation and slope stability of the remaining shoreline (from 340 to 700 feet from the mouth of the bay) was performed on May 10, August 23, and November 13, 2012.

2 MONITORING RESULTS SUMMARY FOR THE HEAD OF SLIP 3 CAP AREA

A summary description of the observed site conditions and relevant data summaries related to the head of Slip 3 cap area are provided in this section. Additional details are provided in the *Wheeler Bay and Head of Slip 3 Cap Year 4 Visual Slope and Armor Survey Monitoring Report*, provided as Appendix A.

2.1 Armor Layer Stability

2.1.1 Visual Survey

A visual assessment of the head of Slip 3 cap area slope and armor condition was performed on November 13, 2012. The water level during the site visit was approximately +5.9 feet National Geodetic Vertical Datum (NGVD). A description of monitoring activities that were performed and monitoring results are given in the following subsections.

On November 13, 2012, three transects were re-established on 40-foot spacing perpendicular to the shoreline in the same locations as the Years 1 through 3 slope observations. Monitoring staff walked from the upslope edge of the stabilization area to the water. Notes and photographs (provided as Attachments A-5 and A-6 to Appendix A, respectively) were taken to document visual slope stability along each transect. In summary, no areas of instability were noted.

2.1.2 Pinch-pile Wall Survey

A survey of the pinch-pile wall was completed to assess the stability of the armor layer and in-water portion of the cap in front of the pinch-pile wall. On October 16, 2008 (immediately after completion of construction), a surveyor's spike was inserted in the top of the pinch-pile wall at 40-foot spacing (three monitoring points), and a baseline survey was performed. Two successive surveys were conducted on June 16 and September 16, 2009, and were compared to the baseline survey as part of the Year 1 monitoring activities. On November 11, 2010, a survey of the pinch-pile wall was conducted as part of Year 2 monitoring activities. On September 22, 2011, a survey of the pinch-pile wall was conducted as part of Year 3 monitoring activities. On November 14, 2012, the most recent survey of the pinch-pile wall was conducted as part of Year 4 monitoring activities. The Port of Portland

(Port) in-house survey crew completed the pinch-pile wall surveys. The accuracy of the survey method used is plus or minus (±) 0.6 inch. Results of the surveys are provided in Table 1. The following recorded measurements indicate that the wall is stable and that the observed measurements are likely within the accuracy of the survey method:

- Over the first 8 months, all three points moved approximately 0.4 inch or less in a north-northwest direction (parallel to the wall—the wall runs in a north-northwest/south-southwest alignment), which is within the accuracy of the survey method.
- During the next 3-month measurement, all three points moved approximately 0.4 inch in a southeast direction (roughly perpendicular to the wall alignment), which is also within the accuracy of the survey method.
- During the second year measurement, all three points moved by approximately 0.3 inch in a northerly direction, which is within the accuracy of the survey method.
- During the third year measurement, all three points were surveyed to be 0.6 inch or less east of the original surveyed location, which is within the accuracy of the survey method.
- During the fourth year measurement, all three points were surveyed to be 0.3 inch or less east of the original survey location. Again, this is within the accuracy of the survey method.
- The total observed movement throughout the 4-year period is less than 0.6 inch for all three points, which is also within the accuracy of the survey method.

The IMRP specified response actions in the event of movement greater than 1 inch. No significant movement greater than 1 inch compared to baseline was observed.

Table 1
Head of Slip 3 Cap Pinch-pile Wall Survey Results

Point Number	Coordinate and Elevation	Survey Data						Distance Moved									
								Delta (feet)					Delta (inches)				
		10/16/2008	6/16/2009	9/16/2009	11/11/2010	9/22/2011	11/14/2012	10/16/08 to 6/16/09	10/16/08 to 9/16/09	10/16/08 to 11/11/10	10/16/08 to 09/22/11	10/16/08 to 11/14/12	10/16/08 to 6/16/09	10/16/08 to 9/16/09	10/16/08 to 11/11/10	10/16/08 to 09/22/11	10/16/08 to 11/14/12
3000.00	Northing	66964.66	66964.67	66964.67	66964.68	66964.67	66964.66	-0.01	0.01	-0.02	-0.01	0.00	0.40	0.32	0.24	0.59	0.14
	Easting	71313.60	71313.60	71313.58	71313.58	71313.58	71313.59	0.00	0.03	0.00	0.02	0.01					
	Elevation	7.74	7.71	7.75	7.74	7.78	7.74	0.03	-0.01	0.01	-0.04	0.00					
3001.00	Northing	67000.51	67000.53	67000.52	67000.54	67000.51	67000.52	-0.02	0.01	-0.02	0.00	-0.01	0.27	0.29	0.31	0.25	0.17
	Easting	71307.63	71307.62	71307.61	71307.62	71307.61	71307.62	-0.01	0.02	0.01	0.02	0.01					
	Elevation	8.38	8.37	8.38	8.38	8.37	8.38	0.01	0.00	0.00	0.01	0.00					
3002.00	Northing	67030.30	67030.32	67030.30	67030.32	67030.30	67030.30	-0.02	0.00	-0.02	0.00	0.00	0.32	0.34	0.31	0.38	0.29
	Easting	71302.60	71302.59	71302.57	71302.58	71302.57	71302.57	0.01	0.03	0.02	0.03	0.02					
	Elevation	7.99	7.98	7.99	8.00	7.98	7.99	0.01	0.00	-0.01	0.01	0.00					

Note:
Horizontal Datum: Port of Portland Local Projection (International Feet), Vertical Datum: NGVD 1929 (Feet).

2.2 Presence of Sheens

Surveys for the visual presence of sheens were performed at the end of high water season (May 10, 2012) and during the low water season (August 23, 2012). The water level was approximately +12.9 feet NGVD during the May 10, 2012, survey and approximately +5.9 feet NGVD during the August 23, 2012, survey. Monitoring staff walked along 20-foot transects parallel to the shoreline to observe the presence of sheens. No sheens were observed, as documented in Attachments A-7 and A-8 to Appendix A.

In addition, although not a requirement of the IMRP, surveys for the visual presence of sheens were performed during each light nonaqueous phase liquid (LNAPL) monitoring event completed as part of the required remedial action for the Terminal 4 Slip 3 Upland Facility defined in the Record of Decision (DEQ 2003) and the Explanation of Significant Difference (DEQ 2004). No sheens were observed between the completion of the Terminal 4 Phase I Removal Action work through Year 4 of the interim monitoring time period, as documented in Ash Creek—NewFields 2008 and 2009 and Ash Creek 2009a, 2009b, 2009c, 2009d, 2010a, 2010b, 2010c, 2011a, 2011b, 2012a and 2012b.

3 MONITORING RESULTS SUMMARY FOR THE WHEELER BAY SHORELINE STABILIZATION

Overall, the WB shoreline is developing as expected into high quality habitat (see Figure 2). The willows have grown to a height of 2 to 3 meters and seem to be stabilizing the shoreline. The habitat material has remained over the placed riprap outside of the repaired area, and sand is depositing on top of the habitat material, especially at the lower elevations. Woody debris continues to accumulate in the bay in and around the placed large woody debris (LWD) adding complexity.

A summary description of the observed site conditions and relevant data summaries related to the WB shoreline stabilization are provided in this section. Additional details are provided in the *Wheeler Bay and Head of Slip 3 Cap Year 4 Visual Slope and Armor Survey Monitoring Report*, provided as Appendix A.

3.1 Slope Stability

Quarterly monitoring of the repaired slope (between 0 and 340 feet from the mouth of the bay) was performed on February 17, May 10, August 23, and November 13, 2012, to confirm that the repair is functioning as designed. After the first quarterly monitoring event of the repaired slope, quarterly monitoring was expanded to include the entire stabilized WB slope. Three transects were established perpendicular to shore within the repaired area at approximately 0, 150, and 300 feet from the mouth of the bay. Additional transects were established at 450 and 600 feet from the mouth of the bay to monitor the entire stabilized slope. The transects are depicted on Figure 3. Transects were marked with flags, and monitoring staff walked from the upslope edge of the grass planting down to the water. Notes and photographs (provided as Attachments A-1 and A-2 to Appendix A, respectively) were taken to document slope stability at each transect. Photographs were taken in groups of three: one in the grass planting area, one in the willow planting area, and one in the armored bank or habitat material area on each transect.

A repair of the Wheeler Bay shoreline was completed in 2011 to address erosional areas where exposed demarcation fabric was observed and reported in June and July, 2011, and further reported in the Wheeler Bay 2011 Repair Memorandum dated September 9, 2011

(Repair Memo; Anchor QEA 2011b). In addition, three minor erosional areas with no exposed demarcation fabric were also documented in the Repair Memo. These areas were not addressed in the 2011 repair due to the minor erosion observed and no exposed demarcation fabric. These minor erosional areas were evaluated on a quarterly basis during Year 4 to monitor their condition. Results of the quarterly monitoring indicate that two of the minor scarp areas were unchanged from 2011 and one was no longer present. Photographs of the scarps are provided in Attachment A-3 to Appendix A and described as follows:

- A 1-foot scarp was observed in the willow planting area between Stations 00+00 and 01+75 during the first quarter monitoring event of the repaired area. This erosional area was unchanged from the scarp documented in the Repair Memo.
- Additionally, a 1-foot scarp was observed in the willow planting area between Stations 03+40 and 06+70 during the second, third, and fourth quarter monitoring events. This erosional area was unchanged from the scarp documented in the Repair Memo.
- Finally, the 0.5-foot scarp between Stations 2+00 and 2+25 documented in the Repair Memo was not observed during Year 4 monitoring activities.

Surplus, on-site habitat material was placed above the LWD between stations 03+40 and 03+90 during the 2011 repair. A 1-foot scarp in the surplus habitat material was observed at Stations 03+50 and 03+90 during the second quarter monitoring event. Photographs of the scarps are provided in Attachment A-3 to Appendix A.

No orange demarcation layer material was exposed by any of the scarps, and the scarps did not appear to impact slope stability.

After heavy rain, the surficial layer of grass in the grass planting area between Stations 01+70 and 02+90 was observed to have sloughed downslope approximately 4 inches at the time of the first quarter monitoring event. This area encompasses the former material transfer zone between Stations 02+35 and 02+70 used to transfer materials downslope as part of the 2011 repair. No additional sloughing was observed during any subsequent monitoring events. The sloughing did not appear to impact slope stability.

No instability or other areas of erosion or sloughing were observed in the willow or grass planting areas (the willow planting area is between elevations +15 to +20 feet NGVD, and the grass planting area is between elevations +20 to +30 feet NGVD).

3.2 Armor Layer Stability

Transects were established perpendicular to the shoreline at 150-foot centers, as described in Section 3.1 and as depicted on Figure 3. Monitoring staff walked along the transects looking for evidence of erosion within the armor layer. Notes and photographs (provided as Attachments A-1 and A-2 to Appendix A, respectively) were taken of the armor layer at each transect. The armor layer showed no signs of instability, sloughing, or erosion. All woody debris installed as part of the original design and repair activities was in place, stable, and in good condition.

3.3 Condition of Habitat Layer

A sand and gravel habitat material mixture was placed over the armor layer on a 3 horizontal to 1 vertical (3H:1V) slope from approximate elevations +10 to +15 feet NGVD during the Terminal 4 Phase I Removal Action construction in 2008 (see Figure 3). The habitat layer serves no function of armoring. The intent of the habitat material is to allow it to naturally accrete or erode and provide normative ecological functions. Pursuant to the Biological Opinion (NMFS 2008), the Port has monitored the habitat material layer over the past 4 years to determine if the habitat layer is eroding or accreting.

Consistent with the Year 2 Monitoring Report (Anchor QEA 2011c), a quantitative assessment of the habitat layer was conducted on November 13, 2012, using the same methods used during the second and third year of WB monitoring. A quantitative estimate of the coverage and thickness of the habitat material present in the existing shoreline between Stations 3+40 and 6+70 and approximate elevations +10 and +15 feet NGVD was made in the following manner:

- A 670-foot transect was established at approximately elevation +15 feet NGVD from the mouth of the bay to the end of the willow planting area.
- Six perpendicular transects on 50-foot centers extended over the armor rock-placed area from approximate elevations +15 to +10 feet NGVD.

- A quadrat (3 feet by 3 feet) was placed at the top, middle, and bottom of the perpendicular transects. Substrate type was recorded as a percent of area within the quadrat.
- Habitat material thickness up to 12 inches was determined for a single quadrat in each perpendicular transect, alternating between top, middle, and bottom quadrats.

The existing 2008 Phase I armor rock between elevations +10 and +13 feet NGVD at Stations 2+80 to 3+40 and between elevations +10 and +15 feet NGVD at Stations 3+40 to 7+00 is currently covered by habitat material. Results of the habitat material layer quantification are summarized in the following subsections and in Table 1 of Appendix A, and photographs from each transect location are shown in Attachment A-4 of Appendix A. As expected, the areas protected by the piles underneath Berth 410 (between Station 3+75 and 6+25) continue to be shielded from erosive forces. Sand and LWD continue to be deposited on top of the habitat layer material, especially at the lower elevations. Habitat material and other types of non-armor rock material (i.e., placed material from upslope, depositional sand, or LWD) covered 99 percent of the slope where habitat material was placed over armor rock. Armor rock was observed on the surface in only 1 percent of the overall area. Average total thickness of material above riprap was greater than 10 inches with greater than 7 inches of habitat material. Year 4 coverage and thickness of the habitat material is consistent with Year 2 and Year 3 results.

3.4 Establishment of Vegetation

According to the IMRP, the vegetation coverage will be documented in Years 2, 3, and 5 to confirm that the target cover percentages are being achieved. Although not required by the IMRP, a vegetation assessment was conducted in Year 4 during a site visit on November 13, 2012.

Based on the vegetation assessment performed, willow planting and grass planting establishment is anticipated to meet Year 5 goals, including in the areas newly planted as part of the repairs. As such, the newly planted areas are not expected to impact the overall coverage goals for Year 5. No evidence of excessive vegetation destruction by geese or other animals was observed. Additionally, thistle, blackberry, and other noxious weeds were

controlled in February, May, June, and September 2012. Limited thistle and blackberry was noted during the quarterly vegetation monitoring events.

Additionally, quarterly visual vegetation monitoring was performed on the repaired areas between 0 and 340 feet from the mouth of the bay and expanded to include the entire stabilized WB slope after the first quarter monitoring event. No significant mortality or grazing was observed in the willow or grass planted area. Notes and photographs from the site visits are provided in Attachments A-1 and A-2 to Appendix A.

3.4.1 Willow Planting Establishment

Coverage goals for the willow planting area between elevations 15 to 20 feet NGVD are as follows:

- 50 percent coverage by Year 3
- 80 percent coverage by Year 5

In accordance with the IMRP, the following Point Intercept Transect (PIT) procedure was used to determine Year 4 coverage:

- Transects were completed every 100 feet along the stabilization area planted.
- A rag tape was laid along the slope from elevation 15 feet to elevation 20 feet NGVD.
- A survey occurred every 2 feet along the tape. If vegetation occurred within a vertical line up from the survey point, this survey point was considered to have vegetative cover.

Results of the PIT procedure are provided in Table 2 and summarized subsequently. A statistical average of the percent coverage was determined for the repaired shoreline (between 0 to 340 feet from the mouth of the bay, not including areas covered by armor as part of the repairs) and the remaining area of the shoreline. Average Year 4 coverage results for both the repaired and remaining areas increased over Year 3 coverage results. The average coverage for the planted area disturbed by the WB repair construction from 0 to 340 feet from the mouth of the bay increased to 85 percent in Year 4 from 74 percent in Year 3. The average coverage for the remaining area from 340 to 700 feet from the mouth of the bay

increased to 92 percent in Year 4 from 88 percent in Year 3. The average Year 4 coverage for the entire planting area from 0 to 700 feet from the mouth of the bay was 88 percent.

Based on the results of the PIT procedure, the willow planting establishment for the entire planted area, including the areas impacted during the repair work, is anticipated to meet Year 5 coverage goals.

Table 2
Willow Coverage Point Intercept Transect Results

Station	Rag Tape	Willow Coverage (Y/N)
00+00	2	N
	4	Y
	6	Y
	8	Y
	10	Y
	12	Y
	14	Y
01+00	2	Y
	4	Y
	6	Y
	8	Y
	10	Y
	12	Y
	14	N
02+00	2	Y
	4	Y
	6	Y
	8	Y
	10	Y
03+00	2	Y
	4	Y
	6	Y
	8	Y
	10	Y
	12	N
	14	N
04+00	2	Y
	4	Y
	6	Y
	8	Y
	10	Y
	12	Y
	14	Y
05+00	2	Y
	4	Y
	6	Y
	8	Y
	10	Y
	12	Y
	14	Y
06+00	2	Y
	4	Y
	6	Y
	8	Y
	10	Y
	12	Y
	14	Y
06+65	2	Y
	4	Y
	6	Y
	8	N
	10	N
MEAN 0-300		0.85
MEAN 400-665		0.92
MEAN 0-695		0.88

3.4.2 Grass Planting Establishment

Grass planting coverage goals between elevations 20 to 30 feet NGVD are as follows:

- 80 percent coverage in Year 3
- 80 percent coverage in Year 5

Although not required by the IMRP, Year 4 grass coverage was determined based on a visual assessment of the entire elevation 20 to 30 feet NGVD. As part of the 2011 repair work, a portion of the site was used to transfer materials downslope (material transfer zone) and was subsequently hydroseeded between 235 and 270 feet from the mouth of the bay. Results of the visual assessment indicate more than 95 percent coverage for the entire grass planted area, including the material transfer zone between 235 and 270 feet from the mouth of the bay. Based on the monitoring performed, the entire grass planted area, including the new grass planted area completed during the 2011 repair work, is anticipated to meet Year 5 goals.

4 CONCLUSIONS AND NEXT STEPS

4.1 Head of Slip 3 Cap

No instability, sloughing, or sheens were observed; therefore, no further monitoring action beyond what is required in the IMRP is recommended for the head of Slip 3 cap at this time.

Surveys for the visual presence of sheens will be completed at two different water level conditions. Observations will be conducted when the water level is approximately +5 feet NGVD and when the water level is approximately +10 feet NGVD. Depending on the water level, one of these surveys may be conducted concurrently with the visual survey of the slope upland of the pinch-pile wall in October. Otherwise, the two surveys will be conducted when the water level is at the specified elevations prior to November, as required in the IMRP.

The IMRP specified response actions in the event of pinch-pile wall movement greater than 1 inch. After 4 years of monitoring of the pinch-pile wall, none of the survey points have moved greater than the accuracy of the survey method (± 0.6 inch). These data indicate the pinch-pile wall, the armor layer, and in-water portion of the cap in front of the pinch-pile wall are stable and will remain stable in the future. Therefore, the Port recommends that no further monitoring of the pinch-pile wall be performed.

4.2 Wheeler Bay

No significant instability or sloughing was observed during Year 4 monitoring activities. In addition, willow and grass planting areas, including the areas hydroseeded during the 2011 repair work, currently meet Year 5 goals. Because there were no significant areas of instability or sloughing throughout the length of the stabilized shoreline, the Port recommends reducing the monitoring frequency to twice a year—once after a high water event and once during the regularly scheduled time in October or November per the IMRP—to confirm that the stabilized shoreline is functioning as designed.

Monitoring will consist of a visual survey of the slope for sloughing, stability, and erosion. A visual survey of the armor layers will also be completed to determine if excessive erosion is occurring.

The proposed monitoring frequency is expected to be adequate to identify any large-scale issues that could impact the stabilized slope (e.g., sloughing or erosion due to a high water event). The monitoring events will be conducted in approximately July and October. The first monitoring event will be timed to occur after a high water event.

Based on Year 4 assessment of the willow and grass planting areas, grass and willow plantings are expected to meet Year 5 coverage goals. Therefore, no monitoring is suggested in addition to the monitoring already required by the IMRP (see Appendix C of the DAR; Anchor 2008).

4.2.1 Condition of Habitat Layer

No new habitat material was placed with the intent of covering armor rock in the repaired area of the shoreline. Below the 2011 armor rock placement area (between 280 and 340 feet from the mouth of the bay), existing habitat rock was re-used to cover all 2008 Phase I armor rock between elevations +10 and +13 feet NGVD. Results of Year 4 monitoring efforts to quantify the amount of habitat material remaining between 340 and 700 feet from the mouth of the bay indicate little change compared to Year 3 conditions, and additional material was placed below the 2011 repair area between 280 and 340 feet from the mouth of the bay, as described previously. Continued annual evaluation of the condition of the habitat layer will be performed in this area on the same schedule as the other monitoring activities at WB. Evaluation of the habitat material in this area will be consistent with the method described in Section 3.3.

4.3 Reporting

Annual reports will be submitted to USEPA in December. Annual reports will consist of technical memoranda with color photographs of a reasonable size to interpret the conditions, a description of site conditions observed, data summaries, a statement of any deficiencies found, recommended corrective actions, and a schedule for implementing the corrective actions.

5 REFERENCES

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DEQ, 2004. Explanation of Significant Difference, Port of Portland Terminal 4 Slip 3 Upland Facility. Oregon Department of Environmental Quality. September 1, 2004.

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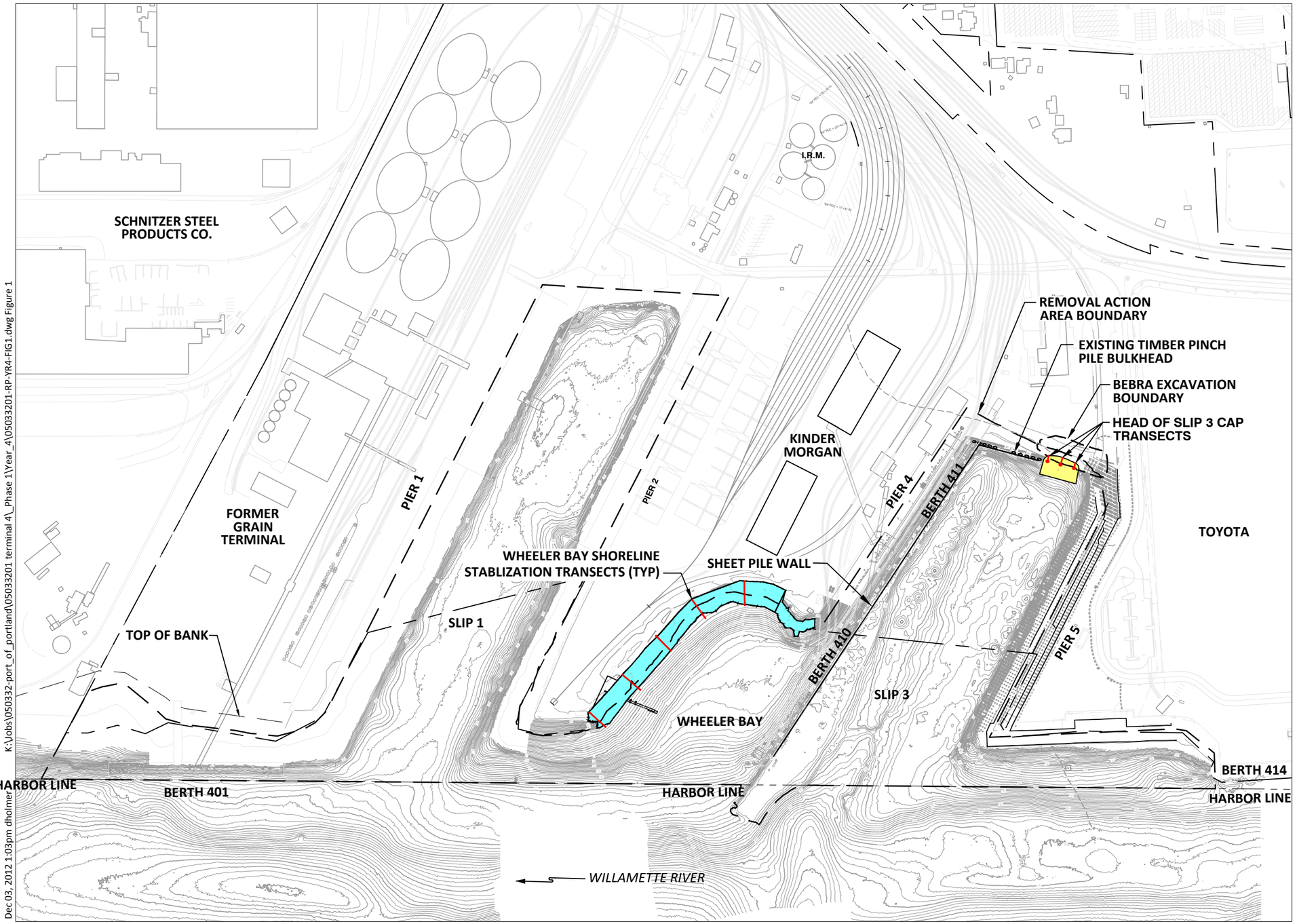
FIGURES



LEGEND:

- WHEELER BAY SHORELINE STABILIZATION
- HEAD OF SLIP 3 CAP
- DSL PROPERTY LINE
- TRANSECT
- SURVEYORS SPIKE

NOTES:

1. HORIZONTAL DATUM: PORT OF PORTLAND LOCAL PROJECTION (INTERNATIONAL FEET)
   VERTICAL DATUM: NGVD 29-47
   CONTOUR INTERVAL = 1FT
2. BATHYMETRIC SURVEY BY PORT OF PORTLAND DATED MAY, 2007

0 300
Scale in Feet

K:\Jobs\050332-port_of_portland\05033201 terminal 4_Phase 1\Year_4\05033201-RP-YR4-FIG1.dwg Figure 1

Dec 03, 2012 1:03pm dholmes

ANCHOR QEA

Figure 1
Interim Survey Locations
Year 4 Interim Monitoring Report - Terminal 4 Phase I Removal Action
Portland, Oregon

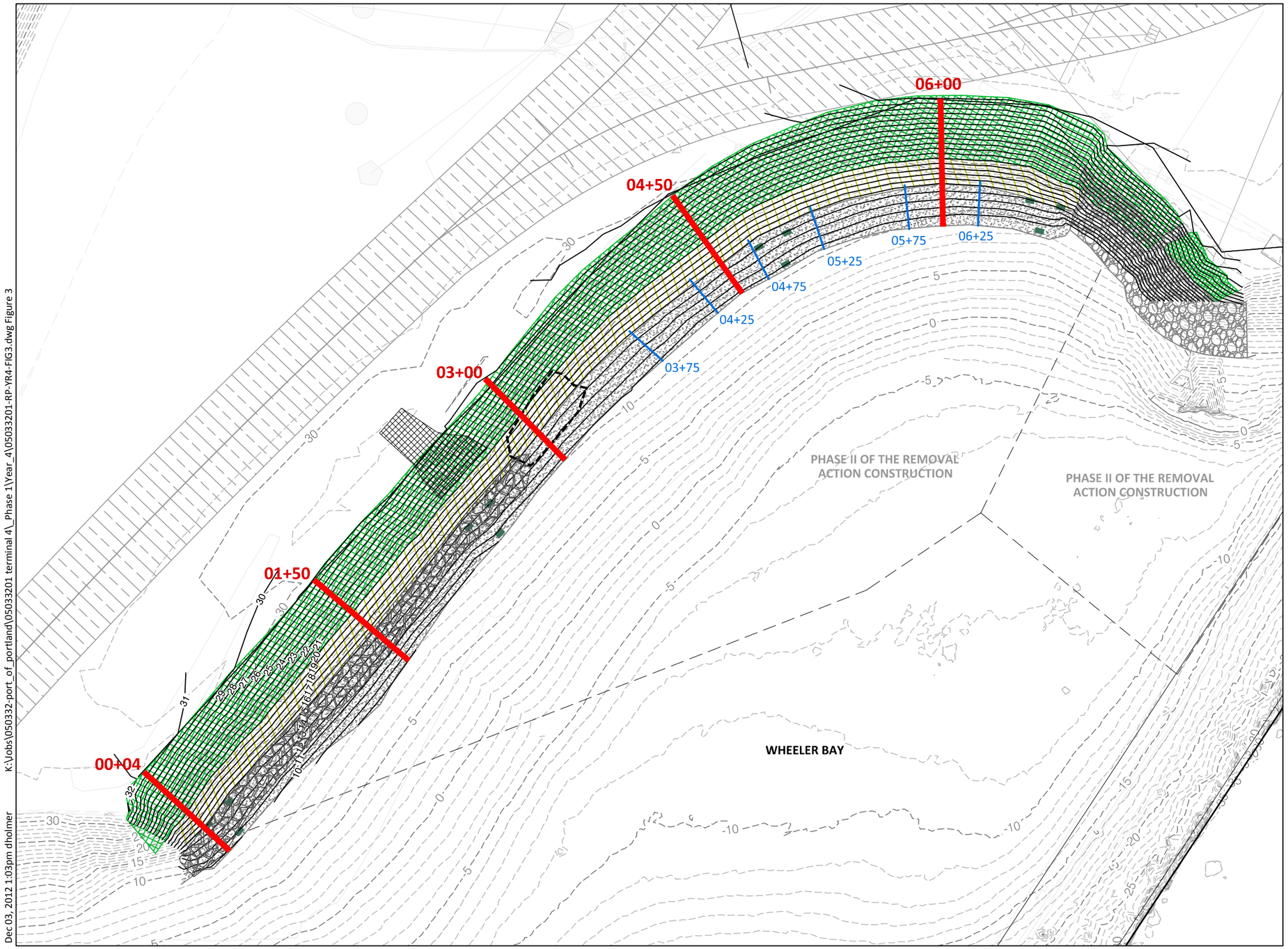
Photo Date: 8/23/2012

Photo Date: 5/10/2012

I:\Projects\Port of Portland\CONFIDENTIAL_T4\Interim_Monitoring+Reporting\Year 4 Report\Figures\Figure 2.docx

ANCHOR QEA

Figure 2
Wheeler Bay Year 4 Habitat Conditions
Year 4 Interim Monitoring Report – Terminal 4 Phase I Removal Action
Portland, Oregon



LEGEND:

- 2008 AS-BUILT HYDROSEED AND JUTE MAT
- 2010 AS-BUILT HYDROSEED
- 2008 AS-BUILT COIR FABRIC AND PLANTINGS WITH MULCH
- 2008 AS-BUILT HABITAT ROCK
- 2008 AS-BUILT ARMOR ROCK
- 2010 AS-BUILT ARMOR ROCK
- 2008 AS-BUILT ECOLOGY BLOCK LWD ANCHORS (BURIED MINIMUM 4 FEET BELOW FINISH GRADE)
- -25 2008 RE-CONSTRUCTION CONTOURS
- 29 2008 AS-BUILT CONTOUR
- 03+40 HABITAT LAYER TRANSECT
- 00+04 SLOPE STABILITY TRANSECT
- 2011 AS-BUILT ARMOR ROCK

NOTES:

1. HORIZONTAL DATUM: PORT OF PORTLAND LOCAL PROJECTION (INTERNATIONAL FEET)
   VERTICAL DATUM: NGVD 29-47
   CONTOUR INTERVAL = 1 FT
2. PRE-CONSTRUCTION BATHYMETRIC SURVEY BY PORT OF PORTLAND DATED NOVEMBER, 2007
3. PRE-CONSTRUCTION UPLAND SURVEY PROVIDED BY PORT OF PORTLAND DATED JANUARY 2008.
4. AS-BUILT UPLAND SURVEY BY MINISTER-GLASER DATED OCTOBER 13, 2008 AND PROVIDED BY ASH CREEK.

0 60
Scale in Feet

K:\Jobs\050332-port_of_portland\05033201 terminal 4_Phase 1\Year- 4\05033201-RP-YR4-FIG3.dwg Figure 3
Dec 03, 2012 1:03pm dholmer

ANCHOR QEA

Figure 3
Wheeler Bay Year 4 Slope Stability Transect Locations
Year 4 Interim Monitoring Report - Terminal 4 Phase I Removal Action
Port of Portland

APPENDIX A
WHEELER BAY AND HEAD OF SLIP 3 CAP YEAR 4 VISUAL SLOPE AND ARMOR SURVEY MONITORING REPORT

ANCHOR QEA

421 SW Sixth Avenue, Suite 750
Portland, Oregon 97204
Phone 503.688.5057
www.anchorqea.com

MEMORANDUM

To:	John Verduin, P.E.; Anchor QEA	**Date:**	November 30, 2012
From:	Gabe Nagler; Anchor QEA	**Project:**	050332-01
Cc:	Elizabeth Appy and Ben Hung; Anchor QEA		
Re:	Wheeler Bay and Head of Slip 3 Cap Year 4 Visual Slope and Armor Survey Monitoring Report, Terminal 4 Removal Action, Port of Portland		

YEAR 4 SLOPE AND ARMOR OBSERVATIONS

In accordance with the requirements of the *Interim Monitoring and Reporting Plan* (IMRP; Design Analysis Report [DAR] Appendix C; Anchor 2008) and Year 3 Monitoring Report (Anchor QEA 2012), a quarterly visual assessment of the Wheeler Bay (WB) slope and armor condition was performed on May 10, August 23 and November 13, 2012. The water level during the site visits was approximately +13.0, +5.9 and +5.9 feet (ft) National Geodetic Vertical Datum (NGVD), respectively. Prior to receiving Environmental Protection Agency (EPA) comments on the Year 3 Monitoring Report, first quarter slope stability observations of the repaired area (from 0 to 340 feet from the mouth of the bay) were performed on February 17, 2012. The water level during the site visit was +7.0 ft NGVD. Additionally, a visual assessment of the Slip 3 slope and armor condition was performed on November 13, 2012. The water level during the site visit was +5.9 ft NGVD. Finally, observations for the presence of sheen were conducted at the head of Slip 3 on May 10 and August 23, 2012. The water level during these two site visits was +12.9 and +5.9 ft NGVD, respectively.

A description of all Year 4 monitoring activities performed and results is given below.

Wheeler Bay

Monitoring of WB was performed to confirm the following:

- Slope stability
- Armor layer stability
- Stability/presence of woody debris as designed
- Condition of the habitat layer

Quarterly monitoring of the repaired slope (between 0 and 340 feet from the mouth of the bay) was performed on February 17, May 10, August 23, and November 13, 2012, to confirm that the repair is functioning as designed.

After the first quarterly monitoring event of the repaired slope, quarterly monitoring was expanded to include the entire stabilized WB slope. A total of five slope observation transects were established perpendicular to the shoreline at 150-foot centers. Transects were walked from the upslope edge of the grass planting down to the water. Notes and photographs were taken of slope stability at each transect. Approximate transect locations are shown in Figure A-1. Notes and photographs were taken of slope stability at each transect. Photographs were taken in groups of three; one in the grass planting area, one in the willow planting area, and one in the armored bank or habitat material area on each transect. Data sheets and photographs from the site visit are provided in the attachments to this memorandum (Attachments A-1 and A-2, respectively).

A repair of the Wheeler Bay shoreline was completed in 2011 to address significant erosion scarps and exposed demarcation fabric observed in June and July, 2011 and reported in the Wheeler Bay 2011 Repair memorandum dated September 9, 2011 (Repair Memo; Anchor QEA 2011). Three minor scarps identified in the Repair Memo were not addressed by the 2011 repair. These minor scarps were evaluated on a quarterly basis during Year 4 to monitor their condition.

In addition, a quantitative estimate of the coverage and thickness of the habitat material present in the existing shoreline between Stations 3+40 and 6+70 and approximate elevations +10 and +15 feet NGVD was made in the following manner:

- A 670-foot transect was established at approximately elevation +15 feet NGVD from the mouth of the bay to the end of the willow planting area.
- Six perpendicular transects on 50-feet centers extended over the armor rock-placed area from approximate elevations +15 to +10 feet NGVD.
- A quadrat (3 feet by 3 feet) was placed at the top, middle, and bottom of the perpendicular transects. Substrate type was recorded as a percent of area within the quadrat.
- Habitat material thickness up to 12 inches was determined for a single quadrat in each perpendicular transect, alternating between top, middle, and bottom quadrats.

Results

Slope stability: Results of the quarterly monitoring indicate that two of the minor scarp areas identified in the Repair Memo were unchanged from 2011 and one was no longer present. Photographs of the scarps are provided in Attachment A-3 to Appendix A and described as follows:

- A 1-foot scarp was observed in the willow planting area between Stations 00+00 and 01+75 during the first quarter monitoring event of the repaired area. This scarp was unchanged from the scarp documented in the Repair Memo.
- Additionally, a 1-foot scarp was observed in the willow planting area between Stations 03+40 and 06+70 during the second, third, and fourth quarter monitoring events. This scarp was unchanged from the scarp documented in the Repair Memo.
- Finally, the 0.5-foot scarp between Stations 2+00 and 2+25 documented in the Repair Memo was not observed during Year 4 monitoring activities.

Surplus, on-site habitat material was placed above the woody debris between stations 03+40 and 03+90 during the 2011 repair. A 1-foot scarp in the surplus habitat material was observed at Stations 03+50 and 03+90 during the second quarter monitoring event. Photographs of the scarps are provided in Attachment A-3 to Appendix A.

No orange demarcation layer material was exposed by any of the scarps and the scarps did not appear to impact slope stability.

After heavy rain, the surficial layer of grass in the grass planting area between Stations 01+70 and 02+90 was observed to have sloughed downslope approximately 4 inches during the first quarter monitoring event (Attachment 3). This area encompasses the former material transfer zone between Stations 02+35 and 02+70 used to transfer materials downslope as part of the 2011 repair. No additional sloughing was observed during any subsequent monitoring events. The sloughing did not appear to impact slope stability.

No sloughing, instability, or other areas of erosion were observed in the willow or grass planting areas (elevations +15 to +25 feet NGVD).

Armor layer stability: The armor layer at WB showed no signs of instability, sloughing, or erosion during any of the quarterly site visits.

Stability/presence of woody debris as designed: All woody debris installed as part of the construction design was in place, stable, and in good condition at the time of the visit. In addition to the installed large wood debris, a significant amount of drift wood was also present.

Condition of habitat layer: Results of the habitat material layer quantification are summarized below and in Table 1, and photographs from each transect location are shown in Attachment A-4. Habitat material and other types of non-armor rock material (i.e., placed material from upslope, depositional sand, or large woody debris) covered 99 percent of the slope where habitat material was placed over armor rock. Armor rock was observed on the surface in only 1 percent of the overall area. Average total thickness of material above armor rock was greater than 10 inches, with greater than 7 inches of habitat material.

Table 1
Habitat Material Assessment Results

		Surface Substrate (Percent of Quadrat Area)							Thickness of Substrate Above Armor Rock		
		Non-armor rock Material					Armor Rock				
Perpendicular Transect Location (ft from Mouth of Bay)	Quadrat Location (Top, Middle, Bottom)	Placed Material from Upslope (%)	Depositional Sand (%)	Habitat Mix (%)	Log (%)	Coir Fabric w/ Placed Fines on Top (%)	Armor Rock (%)	Total (%)	Habitat Mix (Inches)	Other Material (Inches)	Total Thickness (Inches)
375	T			30	70			100			
375	M				100			100			
375	B		50	50	0.05			100.05	11	0.5	11.5
425	T				20	80		100	0	> 12	> 12
425	M		65	10	25			100			
425	B		75	0.5	25			100.5			
475	T	80		20				100			
475	M		45	10	45			100	> 12	0	> 12
475	B		35	0.5	65			100.5			
525	T		50	0.5	50			100.5			
525	M		25	25	50			100			
525	B		25	5	70			100	> 12	0	> 12
575	T	15		85				100			
575	M	10	15	15	60			100			
575	B		55	5	40			100			
625	T	30		70				100			
625	M		25	5	50		20	100	0	2	2
625	B		60	5	35			100			
MEAN_TOP		21	8	34	23	13	0				
MEAN_MIDDLE		2	29	11	55	0	3		0	0	0
MEAN_BOTTOM		0	50	11	39	0	0		0	0	0
MEAN_375-625		7.5	29.2	18.7	39.2	4.4	1.1		7	3	10

Notes:

a = Where woody debris was observed, substrate type was recorded as Log if woody debris was greater than 3 inches in diameter.

b = Thickness of habitat mix only measured up to 12 inches in depth.

Head of Slip 3 Cap

Monitoring of the head of Slip 3 cap was performed to confirm the following:

- Slope stability
- Absence of sheens

Transects were established on 40-foot spacing perpendicular to the shoreline to confirm slope stability. A total of three transects were re-established based on the Year 1, 2, and 3 locations. Transects were walked from the upslope edge of the stabilization area to the water on November 13, 2012. Notes and photographs were taken of slope stability at each transect. Data sheets and photographs are provided in Attachments A-5 and A-6, respectively.

In addition, the water along the cap was observed for the presence of sheens. Observations occurred during post-high water (May 10, 2012) and post-low water conditions (August 23, 2012). Water levels during the observation events were approximately +12.9 and +5.9 feet NGVD, respectively. Notes and photographs were taken during observation events. Data sheets and photographs are provided in Attachments A-7 and A-8, respectively.

Results

No areas of instability were observed along any portion of the stabilized slope. Armor rocks were stable and free of erosion and sloughing. No sheens were observed during either of the sheen observation events.

Conclusions

Wheeler Bay

No sloughing or instability of the slope or armor layer was observed. No further slope monitoring action beyond what is required by the IMRP is recommended for the WB shoreline at this time.

As expected, the condition of the habitat layer in areas protected by the piles underneath Berth 410 (between Station 3+75 and 6+25) continues to be shielded from erosive forces. Year 4 coverage and thickness of the habitat material is consistent with Years 2 and 3 habitat material evaluation results.

Head of Slip 3 Cap

No instability, sloughing, or sheens were observed; therefore, no further monitoring action beyond what is required in the IMRP is recommended for the head of Slip 3 cap at this time.

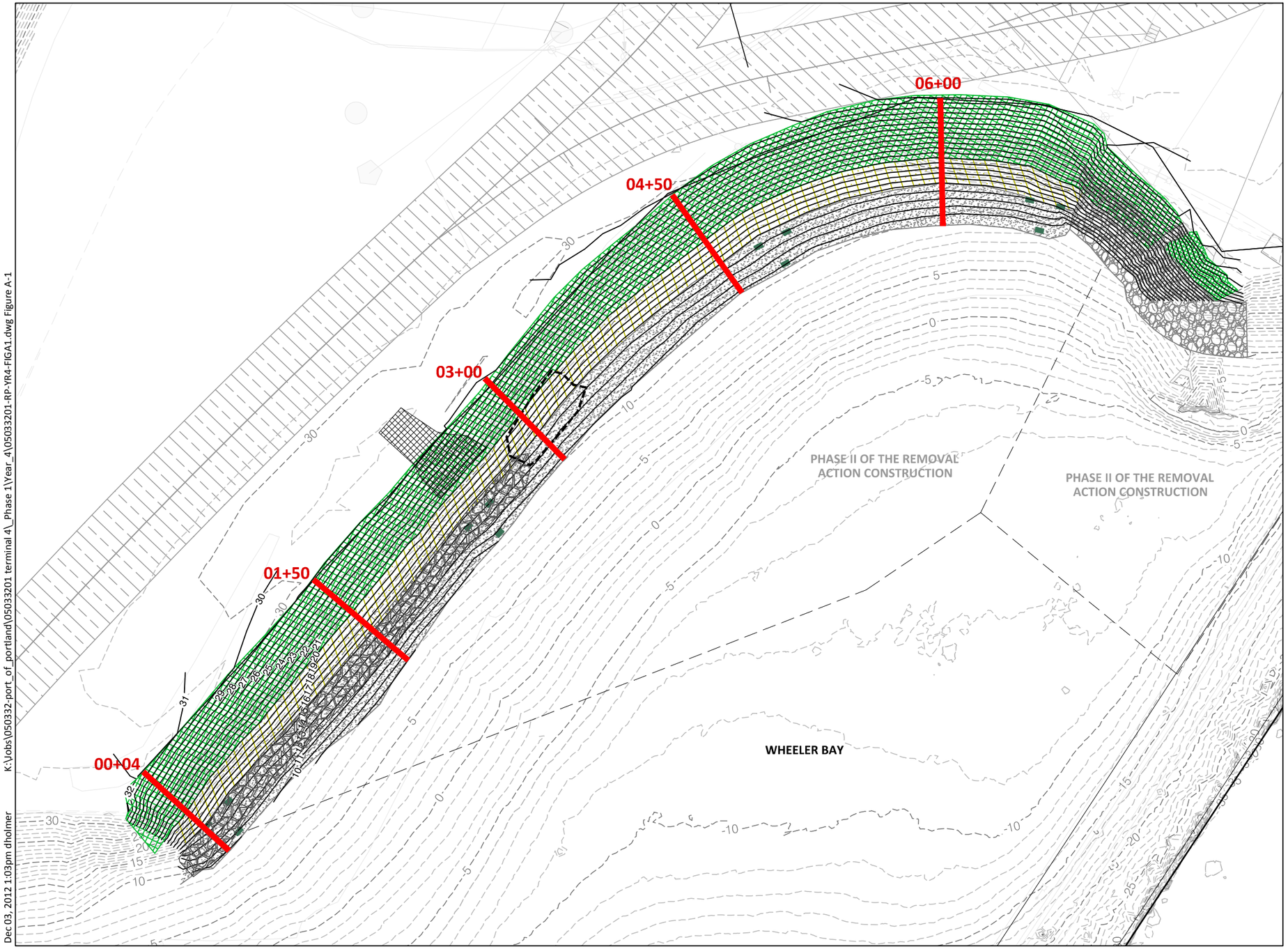
REFERENCES

Anchor (Anchor Environmental, L.L.C.), 2008. *Interim Monitoring and Reporting Plan (IMRP). Appendix C to the Final Design Analysis Report: Terminal 4 Phase I Removal Action*. Prepared for the Port of Portland. June.

Anchor QEA (Anchor QEA, LLC), 2011. *Re: Wheeler Bay 2011 Repair.* Memorandum addressed to Kelly Madalinski, Port of Portland. September.

Anchor QEA, 2012. *Final Year 3 Interim Monitoring Report, Terminal 4 Phase I Removal Action*. Prepared for the Port of Portland. May.

FIGURE



LEGEND:

- 2008 AS-BUILT HYDROSEED AND JUTE MAT
- 2010 AS-BUILT HYDROSEED
- 2008 AS-BUILT COIR FABRIC AND PLANTINGS WITH MULCH
- 2008 AS-BUILT HABITAT ROCK
- 2008 AS-BUILT ARMOR ROCK
- 2010 AS-BUILT ARMOR ROCK
- 2008 AS-BUILT ECOLOGY BLOCK LWD ANCHORS (BURIED MINIMUM 4 FEET BELOW FINISH GRADE)
- -25 2008 RE-CONSTRUCTION CONTOURS
- 29 2008 AS-BUILT CONTOUR
- 00+04 SLOPE STABILITY TRANSECT
- 2011 AS-BUILT ARMOR ROCK

NOTES:

1. HORIZONTAL DATUM: PORT OF PORTLAND LOCAL PROJECTION (INTERNATIONAL FEET)
   VERTICAL DATUM: NGVD 29-47
   CONTOUR INTERVAL = 1 FT
2. PRE-CONSTRUCTION BATHYMETRIC SURVEY BY PORT OF PORTLAND DATED NOVEMBER, 2007
3. PRE-CONSTRUCTION UPLAND SURVEY PROVIDED BY PORT OF PORTLAND DATED JANUARY 2008.
4. AS-BUILT UPLAND SURVEY BY MINISTER-GLASER DATED OCTOBER 13, 2008 AND PROVIDED BY ASH CREEK.

0 60
Scale in Feet

K:\Jobs\050332-port_of_portland\05033201 terminal 4_Phase 1\Year- 4\05033201-RP-YR4-FIGA1.dwg Figure A-1

Dec 03, 2012 1:03pm dholmer

ANCHOR QEA

Figure A-1
Wheeler Bay Year 4 Slope Stability Transect Locations
Appendix A, Year 4 Interim Monitoring Report - Terminal 4 Phase I Removal Action
Port of Portland

ATTACHMENT A-1
WHEELER BAY MONITORING DATA SHEETS

Observation Date: 2/17/12

ANCHOR QEA · **Observation Data Sheet**

Project Name: T-4, Wheeler Bay **Project No:** 050332-01

Observation Crew: G. Nagler

Weather: Overcast, raining, 45°F

Photo Point ID: 1G Time: 1500

Station # 00+04

Photo Bearing	140	--
Photo ID #	019	--

no ~~erosion~~ sloughing/instability

Photo Point ID: 1W Time: 1501

Station # 0+04

Photo Bearing	140	--
Photo ID #	020	--

minor 1' scarp @ willow - riprap interface

Photo Point ID: 1R Time: 1502

Station # 0+04

Photo Bearing	140	--
Photo ID #	021	--

no ~~sloughing~~/instability

Photo Point ID: 2G Time: 1505

Station # 1+70

see pics 033+034

Photo Bearing	320	140
Photo ID #	022	

no ~~sloughing~~/instability

minor sloughing of grass between 1+70 and 2+90

Photo Point ID: 2W Time: 1506

Station # 1+70

Photo Bearing	320	140
Photo ID #	023	

no sloughing/instability

Photo Point ID: 2R Time: 1507

Station # 1+70

Photo Bearing	320	140
Photo ID #	024	

no sloughing/instability

ANCHOR QEA · **Observation Data Sheet**

Project Name: T-4, Wheeler Bay **Project No:** 050332-01

Photo Point ID: 3G Time: 1510

Station # 03+40

Photo Bearing	320	–
Photo ID #	025	–

no sloughing / instability

Photo Point ID: 3W Time: 1511

Station # 03+40

Photo Bearing	320	–
Photo ID #	026	–

no sloughing / instability

Photo Point ID: 3R Time: 1512

Station # 03+40

Photo Bearing	320	–
Photo ID #	027	–

no sloughing / instability

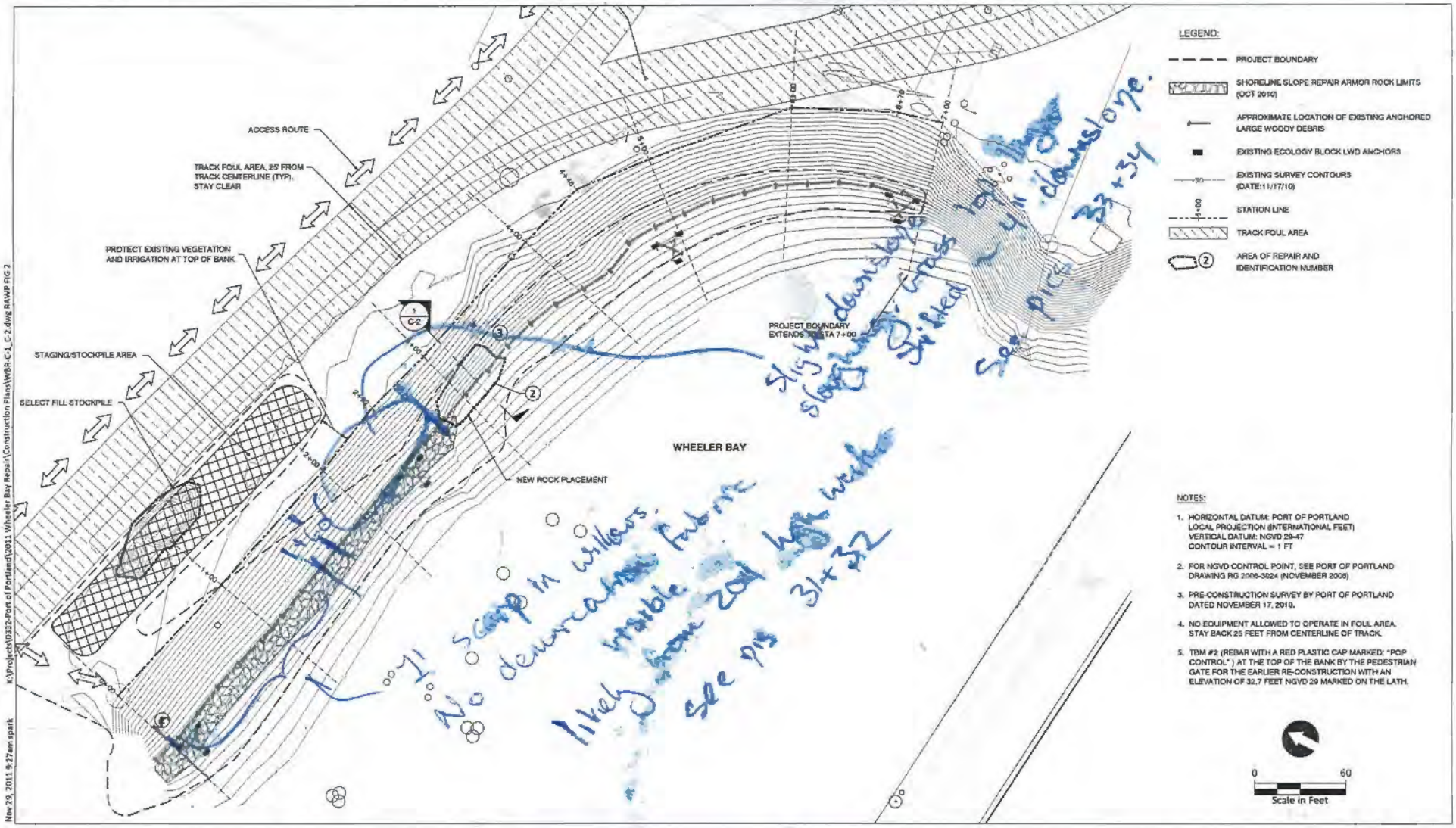
Comments (flooding, erosion, vandalism, plant mortality?):
Armor stone movement? no
Instability? no
Sloughing? yes - sta 1+70 - 2+90. - grass area
Approx. Willow Height: 9 - 12'
Approx. Grass Height: 5 - 10 cm
Goose Grazing? some goose droppings
Invasive Species? minimal

Other notes:

see map for scarp areas. all minor. likely from 2011 high water.

Acronyms: G = grass area, W = willow area, R = rock/riprap area

2/15/12



ANCHOR QEA

Date: 2/17/12

Recorded By: G. Nagler

Slope Observation Data Sheet
As-Built Plan View

Observation Date: 5/10/2012

ANCHOR QEA · **Observation Data Sheet**

Project Name: T-4, Wheeler Bay **Project No:** 050332-01

Observation Crew: D. Laffoon G. Nugler

Weather: Sunny

Photo Point ID: 1G Time: 1500

Station # 00+04

Photo Bearing	140	--
Photo ID #	31	--

Photo Point ID: 1W Time: 1505

Station # 00+04

Photo Bearing	140	--
Photo ID #	32	--

Photo Point ID: 1R Time: 1510

Station # 00+04

Photo Bearing	140	--
Photo ID #	33	--

Photo Point ID: 2G Time: 1512

Station # 01+50

Photo Bearing	320	140
Photo ID #	34	35

Photo Point ID: 2W Time: 1513

Station # 01+50

Photo Bearing	320	140
Photo ID #	39	40

Photo Point ID: 2R Time: 154

Station # 01+50

Photo Bearing	320	140
Photo ID #	41	42

ANCHOR QEA · **Observation Data Sheet**

5/10/12

Project Name: T-4, Wheeler Bay **Project No:** 050332-01

Photo Point ID: 3G Time: 1517

Station # 03+00

Photo Bearing	320	140
Photo ID #	43	44

Photo Point ID: 3W Time: 1518

Station # 03+00

Photo Bearing	320	140
Photo ID #	45	46

Photo Point ID: 3R Time: 1519

Station # 03+00

Photo Bearing	320	140
Photo ID #	47	48

@ 03+50 scarp in hab material above LWD. No orange fab. showing 49,50

Photo Point ID: 4G Time: 1525

Station # 04+50

Photo Bearing	320	140
Photo ID #	52	53

@ 3+90 1' scarp above LWD in ~~ha~~ hab material. No demarcation showing #51 (pic)

Photo Point ID: 4W Time: 1526

Station # 04+50

Photo Bearing	320	140
Photo ID #	54	55

Photo Point ID: 4R Time: 1527

Station # 04+50

Photo Bearing	320	140
Photo ID #	56	57

5/10/12

Photo Point ID: 5G Time: _____

Station # 06+00

Photo Bearing	320	140
Photo ID #	58	59

1530

Photo Point ID: 5W Time: 1531

Station # 06+00

Photo Bearing	320	140
Photo ID #	60	61

Photo Point ID: 5R Time: 1532

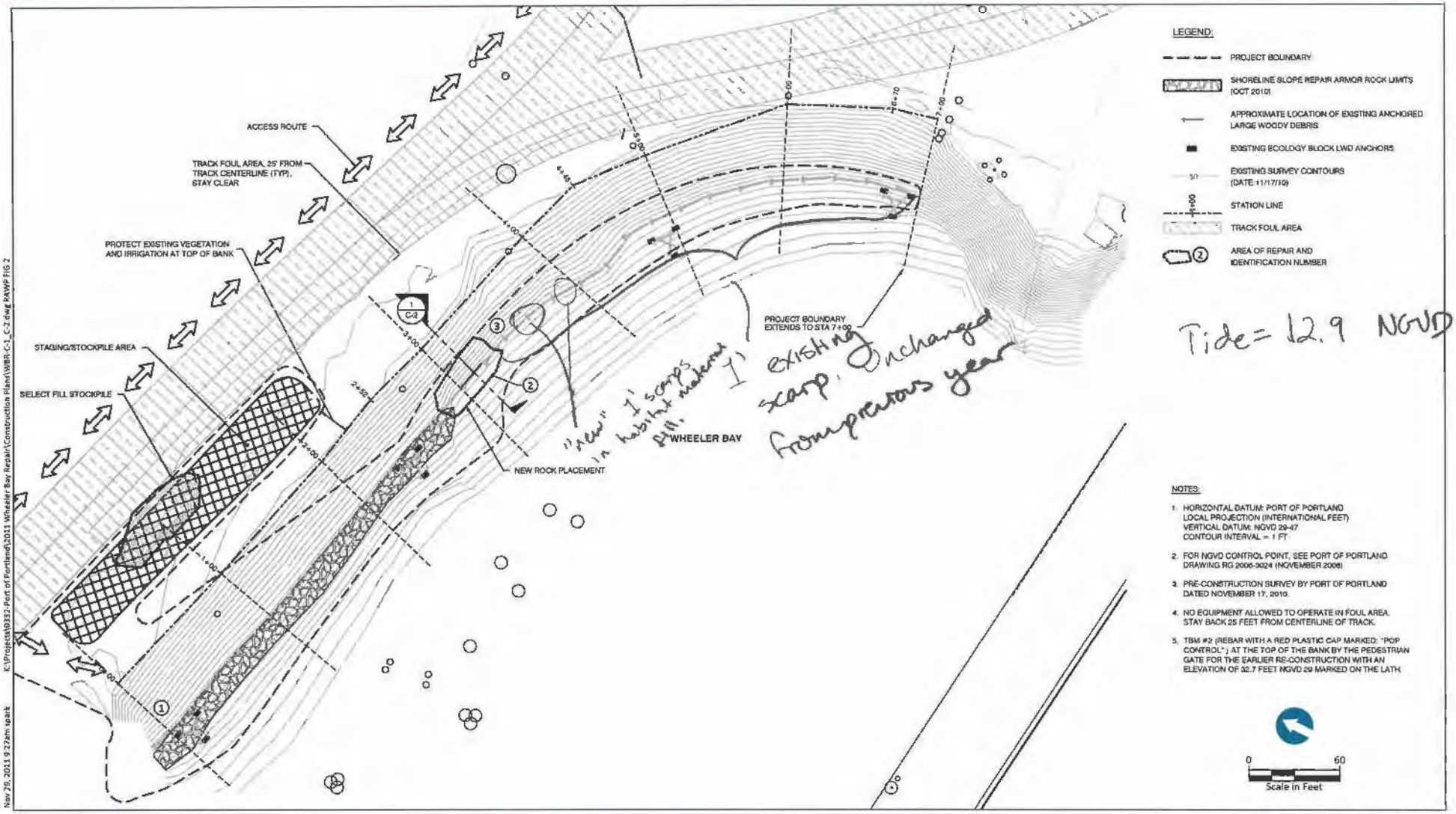
Station # 06+00

Photo Bearing	320	140
Photo ID #	62	63

Armor stone movement? No
Instability? ~~Some~~ scarp largely unchanged. Some new 1' scarp. No demarcation showing
Sloughing? ~~No~~
Approx. Willow Height: 1 - 2.5 meters
Approx. Grass Height: 10 - 20cm
Goose Grazing? No, some beaver activity in willows noted
Invasive Species? - recently weeded

Other notes: 1' scarp from 03+20 to 06+00. Unchanged.
No demarcation fabric showing

Acronyms: G = grass area, W = willow area, R = rock/riprap area



ANCHOR QEA

Date: 5/10/12

Recorded By: G. Nagler

Slope Observation Data Sheet
As-Built Plan View

Observation Date: 8/23/12

ANCHOR QEA · **Observation Data Sheet**

Project Name: T-4, Wheeler Bay **Project No:** 050332-01

Observation Crew: G. Nagler, D. Lufkin

Weather: Overcast, 75° F

Photo Point ID: 1G Time: 1344

Station # 00+04

Photo Bearing	140	--
Photo ID #	337	--

No signs of erosion

Photo Point ID: 1W Time: 1345

Station # 00+04

Photo Bearing	140	--
Photo ID #	338	--

No signs of erosion

Photo Point ID: 1R Time: ~~13~~ 1346

Station # 00+04

Photo Bearing	140	--
Photo ID #	339	--

No signs of erosion

Photo Point ID: 2G Time: 1349

Station # ~~00+04~~ 01+50

Photo Bearing	320	140
Photo ID #	340	341

No signs of erosion

Photo Point ID: 2W Time: 1350

Station # 01+50

Photo Bearing	320	140
Photo ID #	342	343

pic #0346 - 6" erosion scarp. in bark layer. Unchanged from Year 3. Surficial only

Photo Point ID: 2R Time: 1351

Station # 01+50

Photo Bearing	320	140
Photo ID #	343	344

No signs of erosion

Project Name: T-4, Wheeler Bay **Project No:** 050332-01

Photo Point ID: 3G Time: 1354

Station # 03+00

Photo Bearing	320	140
Photo ID #	347	348

no signs of erosion

Photo Point ID: 3W Time: 1355

Station # 03+00

Photo Bearing	320	140
Photo ID #	349	350

1' scarp of placed habitat metered from ~~no signs of erosion~~ 2011 repair, surficial only. @ 300' + 340' (359 + 360 pictures)

Photo Point ID: 3R Time: 1356

Station # 03+00

Photo Bearing	320	140
Photo ID #	351	352

no signs of erosion

Photo Point ID: 4G Time: 1359

Station # 04+50

Photo Bearing	320	140
Photo ID #	353	354

no signs of erosion

Photo Point ID: 4W Time: 1400

Station # 04+50

Photo Bearing	320	140
Photo ID #	355	356

6"-1' scarp, surficial same as Year 3

Photo Point ID: 4R Time: 1401

Station # 04+50

Photo Bearing	320	140
Photo ID #	357	358

no signs of erosion

Photo Point ID: 5G Time: 1404

Station # 06+00

Photo Bearing	320	140
Photo ID #	361	362

Photo Point ID: 5W Time: 1405

Station # 06+00

Photo Bearing	320	140
Photo ID #	363	364

Photo Point ID: 5R Time: 1406

Station # 06+00

Photo Bearing	320	140
Photo ID #	365	366

Armor stone movement? none
Instability? none
Sloughing? none
Approx. Willow Height: 3-4 meters
Approx. Grass Height: 10-15cm (heat over, dry)
Goose Grazing? none
Invasive Species? dandy lion, thistle

Other notes:

Some willows show signs of heat stress

Acronyms: G = grass area, W = willow area, R = rock/riprap area

5.34' @ 1406 (NGVD 29)

Slope Observation Data Sheet.
As-Built Plan View

ANCHOR QEA

Date: 8/23/12

Recorded By: G. Nagler

Observation Date: 11/13/12

ANCHOR QEA · **Observation Data Sheet**

Project Name: T-4, Wheeler Bay **Project No:** 050332-01 4th Q Monitoring Event

Observation Crew: G. Nagler, D. Lafleur

Weather: overcast,

Photo Point ID: 1G Time: 925

Station # 00+03

Photo Bearing	140	–
Photo ID #	004	–

No signs of slaughing or erosion

Photo Point ID: 1W Time: 0927

Station # 00+03

Photo Bearing	140	–
Photo ID #	005	–

No signs of slaughing or erosion except existing 1' scarp. Unchanged from prior year

Photo Point ID: 1R Time: 0929

Station # 00+03

Photo Bearing	140	–
Photo ID #	006	–

No signs of slaughing or erosion

Photo Point ID: 2G Time: 0930

Station # 01+50

Photo Bearing	320	140
Photo ID #	007	008

No signs of slaughing or erosion

Photo Point ID: 2W Time: 0931

Station # 01+50

Photo Bearing	320	140
Photo ID #	009	010

No signs of slaughing or erosion except existing 1' scarp unchanged from prior year.

Photo Point ID: 2R Time: 0932

Station # 01+50

Photo Bearing	320	140
Photo ID #	011	012

no signs of slaughing or erosion

ANCHOR QEA · **Observation Data Sheet**

Project Name: T-4, Wheeler Bay **Project No:** 050332-01

11/13/12 4th Q Monitoring Event

Photo Point ID: 3G Time: 0934

Station # 03+00

Photo Bearing	320	140
Photo ID #	014	015

no sloughing or erosion

Photo Point ID: 3W Time: 0935

Station # 03+00

Photo Bearing	320	140
Photo ID #	016	017

no sloughing or erosion

Photo Point ID: 3R Time: 0936

Station # 03+00

Photo Bearing	320	140
Photo ID #	018	019

no sloughing or erosion

Photo Point ID: 4G Time: 0937

Station # 04+50

Photo Bearing	320	140
Photo ID #	020	021

~1' scarp in willows (GN) unchanged from previous events no erosion or sloughing

Photo Point ID: 4W Time: 0938

Station # 04+50

Photo Bearing	320	140
Photo ID #	022	023

~1' scarp in willows unchanged from previous events

Photo Point ID: 4R Time: 0940

Station # 04+50

Photo Bearing	320	140
Photo ID #	024	025

~1' scarp in willows (GN) unchanged from previous events no erosion or sloughing.

11/13/12

4th Q Monitoring Event

Photo Point ID: 5G Time: 0940

Station # 06+00

Photo Bearing	320	140
Photo ID #	026	027

no erosion or sloughing

Photo Point ID: 5W Time: 0941

Station # 06+00

Photo Bearing	320	140
Photo ID #	028	029

~1' scarp in willows. Unchanged from previous event. No demarcation fabric showing

Photo Point ID: 5R Time: 0942

Station # 06+00

Photo Bearing	320	140
Photo ID #	030	031

no erosion or sloughing

Armor stone movement? none
Instability? none
Sloughing? none
Approx. Willow Height: 2-3m
Approx. Grass Height: 5-15cm
Goose Grazing? none
Invasive Species? few; dormant

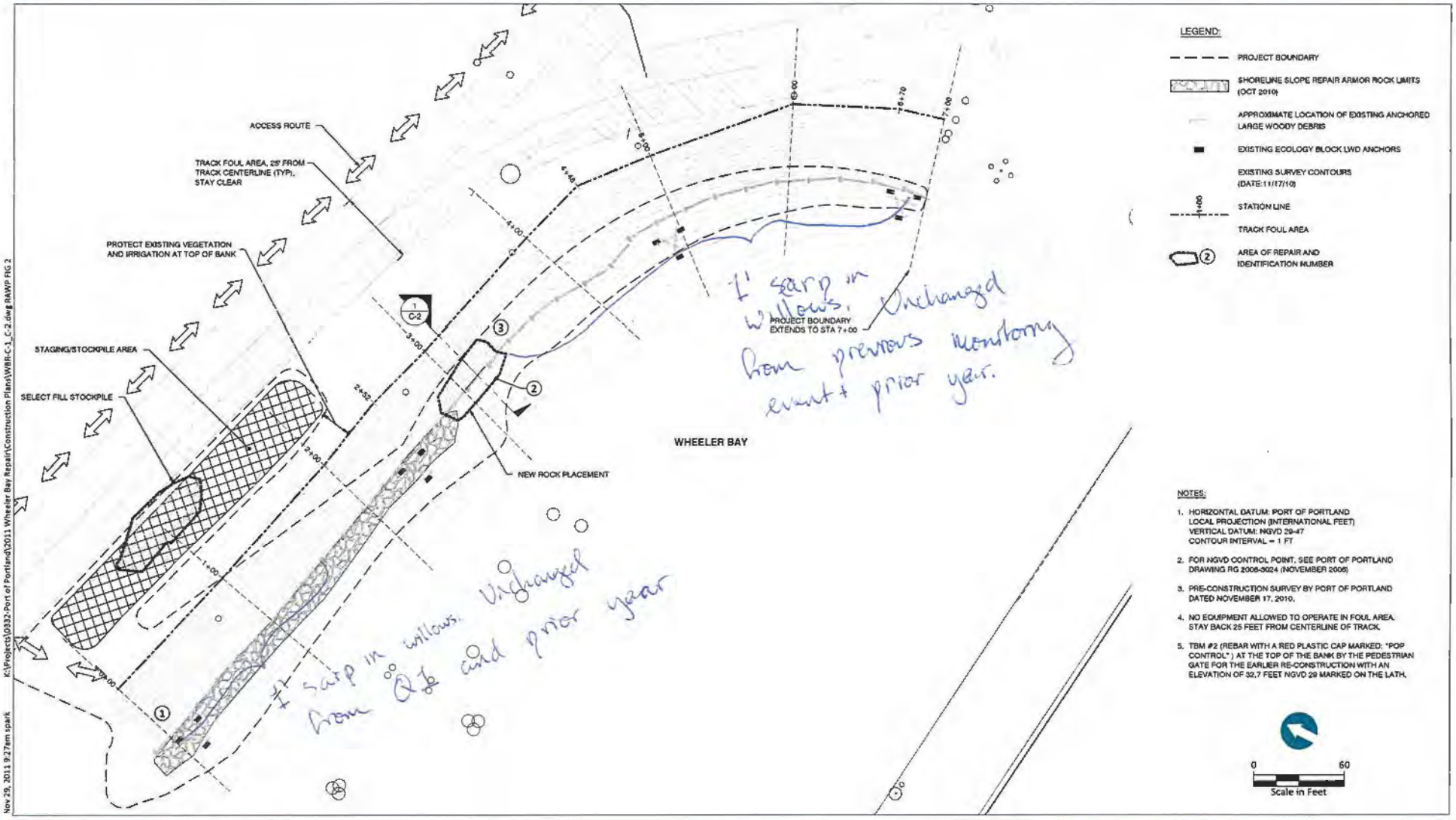
grass coverage > 95%. No bare spots visible

Other notes:

Beaver activity @ 2+00 pic 013.

1' scarp ~~present~~ present between 00+00 - 01+60 and 3+40 - 6+70. Both areas unchanged from prior year. No demarcation fabric showing.

Acronyms: G = grass area, W = willow area, R = rock/riprap area



Slope Observation Data Sheet
As-Built Plan View

ANCHOR QEA

Date: 11/13/12

Recorded By: Jake Nagler

4th Quarter Observations

ATTACHMENT A-2
WHEELER BAY MONITORING PHOTOGRAPHS

Transect 00+04 @ 140 degrees (Grass, Willow, Armor Rock)

Transect 01+70 @ 320 degrees (Grass, Willow, Armor Rock)

Transect 01+70 @ 140 degrees (Grass, Willow, Armor Rock)

Transect 03+40@ 320 degrees (Grass, Willow, Armor Rock)

1 foot Scarp in Willow Planting Area between Sta. 00+00 and 01+60

Bottom of grass planting area Minor 4 inch sloughing of grass area between Sta. 01+70 and 02+90	Top of grass planting area Minor 4 inch sloughing of grass area between Sta. 01+70 and 02+90

Transect 00+04 @ 140 degrees (Grass, Willow, Armor Rock)

Transect 01+40 @ 320 degrees (Grass, Willow, Armor Rock)

Transect 01+40 @ 140 Degrees (Grass, Willow, Armor Rock)

Transect 03+00 @ 320 degrees (Grass, Willow, Armor Rock)

Transect 03+00 @ 140 Degrees (Grass, Willow, Armor Rock)

Transect 04+50 @ 320 degrees (Grass, Willow, Armor Rock)

Transect 04+50 @ 140 Degrees (Grass, Willow, Armor Rock)

Transect 06+00 @ 320 degrees (Grass, Willow, Armor Rock)

Transect 06+00 @ 140 Degrees (Grass, Willow, Armor Rock)

Transect 00+04 @ 140 degrees (Grass, Willow, Armor Rock)

Transect 01+50 @ 320 degrees (Grass, Willow, Armor Rock)

Transect 01+50 @ 150 Degrees (Grass, Willow, Armor Rock)

Transect 03+00 @ 320 degrees (Grass, Willow, Armor Rock)

Transect 03+00 @ 140 Degrees (Grass, Willow, Armor Rock)

Transect 04+50 @ 320 degrees (Grass, Willow, Armor Rock)

Transect 04+50 @ 140 Degrees (Grass, Willow, Armor Rock)

Transect 06+00 @ 320 degrees (Grass, Willow, Armor Rock)

Transect 06+00 @ 140 Degrees (Grass, Willow, Armor Rock)

Transect 00+04 @ 140 degrees (Grass, Willow, Armor Rock)

Transect 01+50 @ 320 degrees (Grass, Willow, Armor Rock)

Transect 01+50 @ 150 Degrees (Grass, Willow, Armor Rock)

Transect 03+00 @ 320 degrees (Grass, Willow, Armor Rock)

Transect 03+00 @ 140 Degrees (Grass, Willow, Armor Rock)

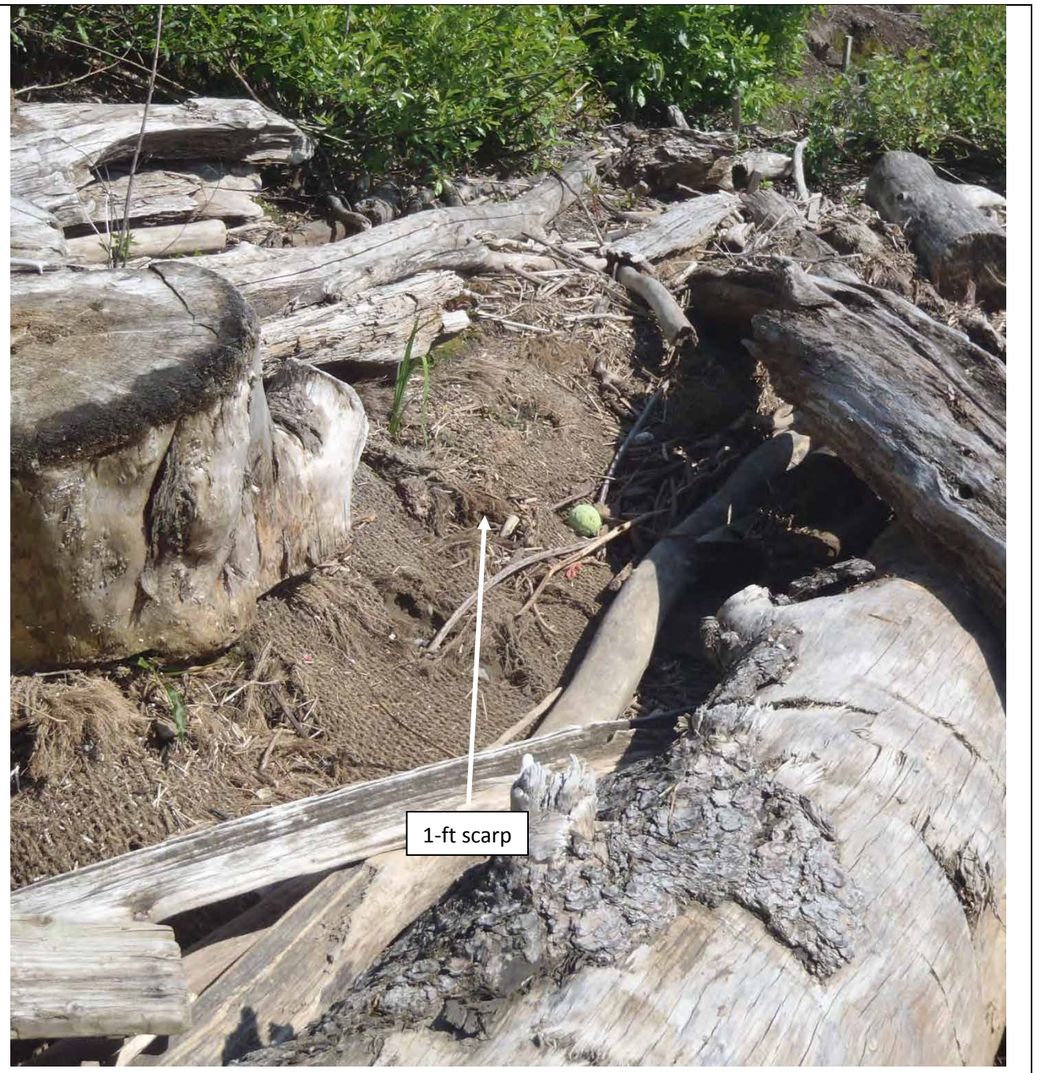
Transect 04+50 @ 320 degrees (Grass, Willow, Armor Rock)

Transect 04+50 @ 140 Degrees (Grass, Willow, Armor Rock)

Transect 06+00 @ 320 degrees (Grass, Willow, Armor Rock)

ATTACHMENT A-3
WHEELER BAY SLOPE STABILITY PHOTOGRAPHS

1 foot Scarp in Willow Planting Area between Sta. 00+00 and 01+60. (Photo: 1st Quarter Monitoring Event)



1 foot Scarp in Willow Planting Area between Sta. 3+40 and 6+70. (Photo: 2nd Quarter Monitoring Event)

1-foot Scarp in the Habitat Material Placed Above the Woody Debris as Part of the 2011 Repair. (Photo: 2nd Quarter Monitoring Event @ Sta. 3+50)	1-foot Scarp in the Habitat Material Placed Above the Woody Debris as Part of the 2011 Repair. (Photo: 2nd Quarter Monitoring Event @ Sta. 3+90)

Bottom of Grass Planting Area 4 inch Sloughing of Surficial Layer Between Sta. 01+70 and 02+90 (Photo: 1st Quarter Monitoring Event)	Bottom of Grass Planting Area 4 inch Sloughing of Surficial Layer Between Sta. 01+70 and 02+90 (Photo: 1st Quarter Monitoring Event)

ATTACHMENT A-4
WHEELER BAY HABITAT MATERIAL ASSESSMENT PHOTOGRAPHS

Transect 03+75 (T,M,B)

Transect 04+25 (T,M,B)

Transect 04+75 (T,M,B)

Transect 05+25 (T,M,B)

Transect 05+75 (T,M,B)

Transect 06+25 (T,M,B)

ATTACHMENT A-5
HEAD OF SLIP 3 CAP MONITORING DATA SHEETS—SLOPE STABILITY

Observation Date: 11/13/12

ANCHOR QEA **Slope Observation Data Sheet**

Project Name: Year 4 Slip 3 Slope **Project No:** 050332-01

Observation Crew: G. Nagler D. Laffoon

Datum (circle one): NAD 83 / WGS 84 / NAD 27 /Lat long

Weather: overcast

	Upslope 073		Downslope 074	
Transect 1	N:	E:	N:	E:

Comments: On target

no sloughing or erosion

	Upslope 075		Downslope 076	
Transect 2	N:	E: ON	N: TARGET	E:

Comments:

no sloughing or erosion

	Upslope 077		Downslope 078	
Transect 3	N:	E: ON TARGET	N:	E:

Comments:

no sloughing or erosion

	Upslope 079		Downslope 080	
Transect 4	N: O	E: N	N: ARGET	E:

Comments:

no sloughing or erosion

	Upslope		Downslope	
Transect 5	N:	E:	N:	E:

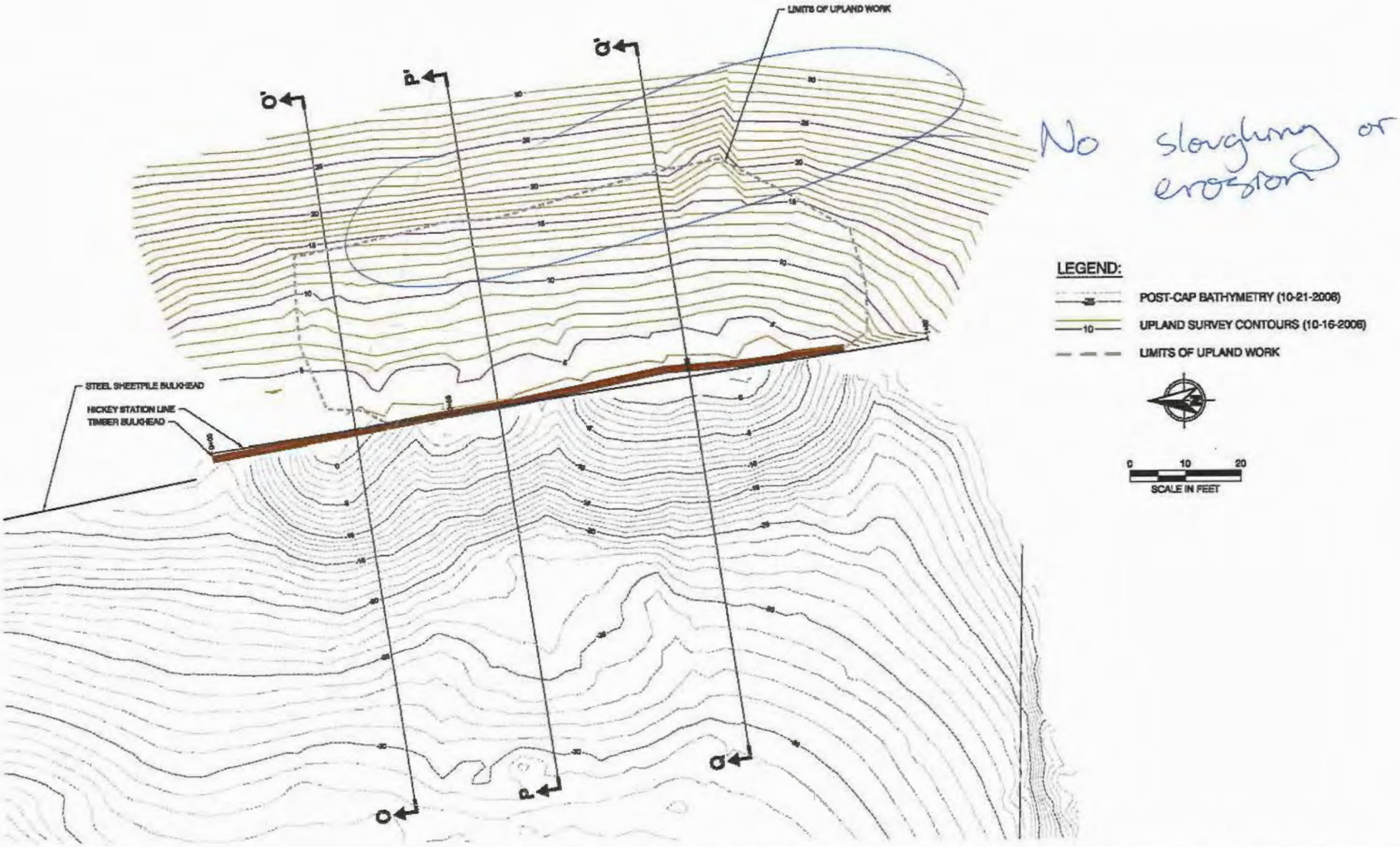
Comments:

Recorded by: G. Nagler + D. Laffoon

Year 4 Slip 3 Slope Observation

Head of Slip 3 Cap Transects Observation

Date 11/13/12



No sloughing or erosion

As-built Head of Slip 3 Capping and Upland Plan View and Cross Section Locations

Terminal 4, Portland, Oregon

ANCHOR QEA

Recorded by G. Nagler

ATTACHMENT A-6
HEAD OF SLIP 3 CAP MONITORING PHOTOGRAPHS—SLOPE STABILITY

North Transect, looking down-slope

North Transect, looking up-slope

Middle Transect, looking down-slope

Middle Transect, looking up-slope

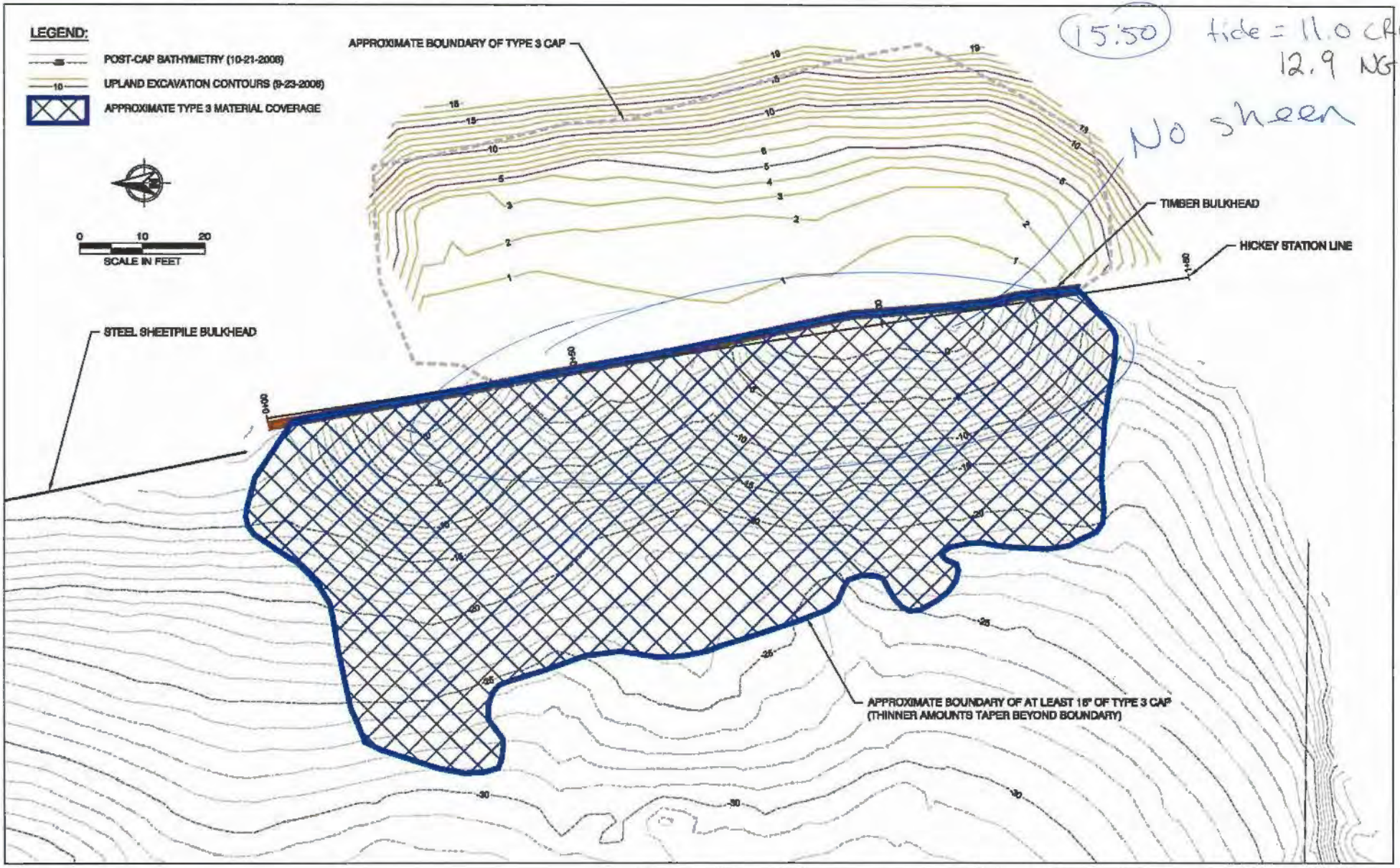
South Transect, looking down-slope

South Transect, looking up-slope

ATTACHMENT A-7
HEAD OF SLIP 3 CAP MONITORING DATA SHEETS – SHEEN

Head of Slip 3 Cap Area Observation

Date 5/10/12



Extent of Type 3 Cap Placement and Extent of Upland Excavation -Head of Slip 3

Terminal 4, Portland, Oregon

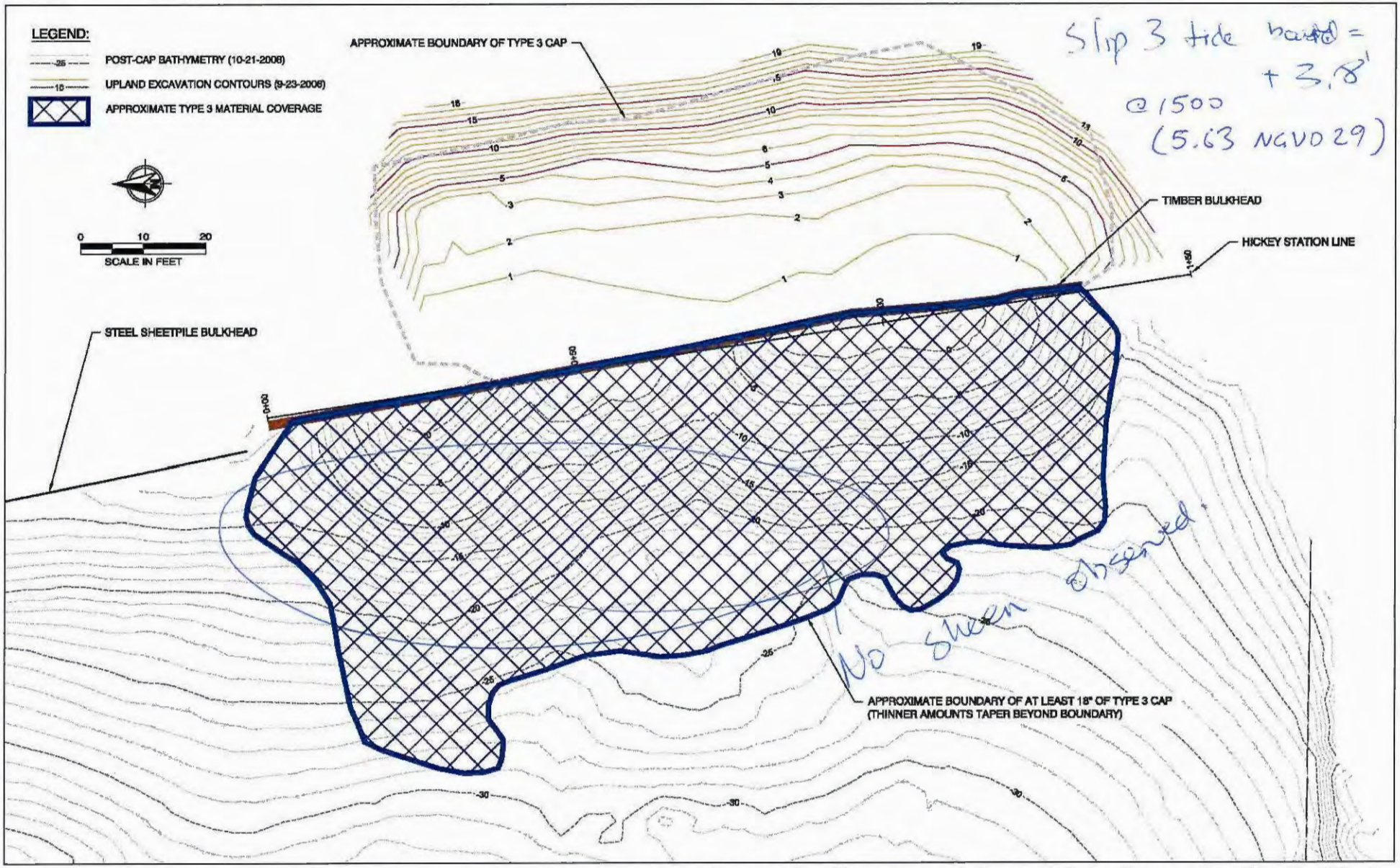
ANCHOR QEA

Recorded by G. Nagler + D. Lafleur

Year 4 low water sheen observation

Head of Slip 3 Cap Area Observation

Date 8/23/12



Extent of Type 3 Cap Placement and Extent of Upland Excavation -Head of Slip 3

Terminal 4, Portland, Oregon

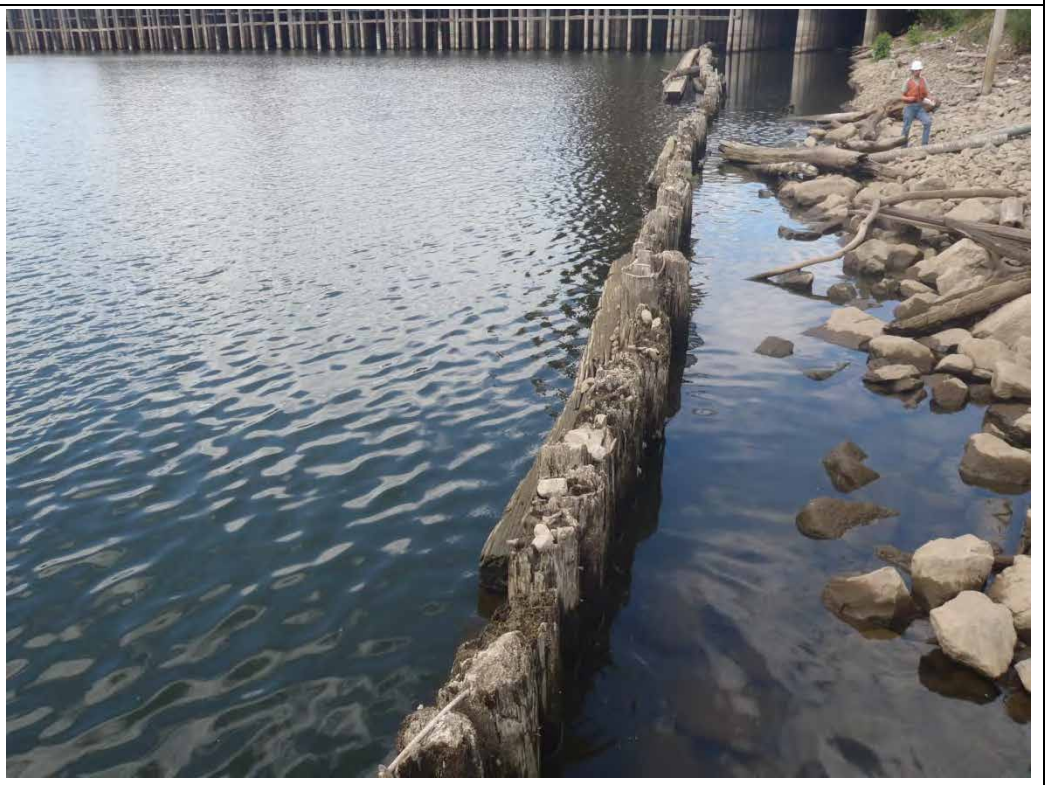
ANCHOR QEA

Pictures taken. #0367-0373

Recorded by G. Nagler

ATTACHMENT A-8
HEAD OF SLIP 3 CAP MONITORING PHOTOGRAPHS – SHEEN

High water observation 5/10/2012: No sheen



Low water observation 08/23/2012: No sheen