



DRAFT  
YEAR 5 INTERIM MONITORING REPORT—  
TERMINAL 4 PHASE I REMOVAL ACTION  
PORT OF PORTLAND, PORTLAND, OREGON

**Prepared for**

Port of Portland  
Portland, Oregon

**Prepared by**

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Portland, Oregon 97204

**January 2014**

DRAFT

YEAR 5 INTERIM MONITORING REPORT—  
TERMINAL 4 PHASE I REMOVAL ACTION  
PORT OF PORTLAND, PORTLAND, OREGON

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**January 2014**

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## TABLE OF CONTENTS

|          |  |           |
|----------|--|-----------|
| <b>1</b> | <b>INTRODUCTION .....</b>  | <b>1</b>  |
| 1.1      | General Scope of Interim Monitoring.....   | 1         |
| 1.2      | Schedule of Year 5 Interim Monitoring Events .....                                     | 2         |
| <b>2</b> | <b>MONITORING RESULTS SUMMARY FOR THE HEAD OF SLIP 3 CAP AREA.....</b>                 | <b>3</b>  |
| 2.1      | Armor Layer Stability .....  | 3         |
| 2.1.1    | Visual Survey .....  | 3         |
| 2.1.2    | Pinch-pile Wall Survey.....  | 3         |
| 2.2      | Presence of Sheen.....   | 3         |
| <b>3</b> | <b>MONITORING RESULTS SUMMARY FOR THE WHEELER BAY SHORELINE<br/>STABILIZATION.....</b> | <b>5</b>  |
| 3.1      | Slope Stability .....  | 5         |
| 3.2      | Armor Layer Stability .....  | 7         |
| 3.3      | Condition of Habitat Layer.....  | 7         |
| 3.4      | Establishment of Vegetation.....   | 9         |
| 3.4.1    | Willow Planting Establishment.....   | 9         |
| 3.4.2    | Grass Planting Establishment .....   | 11        |
| <b>4</b> | <b>CONCLUSIONS AND NEXT STEPS.....</b>   | <b>13</b> |
| 4.1      | Head of Slip 3 Cap .....   | 13        |
| 4.2      | Wheeler Bay .....  | 13        |
| 4.2.1    | Condition of Habitat Layer .....   | 14        |
| 4.3      | Reporting.....   | 14        |
| <b>5</b> | <b>REFERENCES .....</b>  | <b>15</b> |

### List of Tables

|         |   |    |
|---------|---|----|
| Table 1 | Willow Coverage Point Intercept Transect Results..... | 10 |
|---------|---|----|

**List of Figures**

- Figure 1 Interim Survey Locations
- Figure 2 Wheeler Bay Year 5 Habitat Conditions
- Figure 3 Wheeler Bay Year 5 Slope Stability Transect Locations

**List of Appendices**

- Appendix A Wheeler Bay and Head of Slip 3 Cap Year 5 Visual Slope and Armor Survey Monitoring Report

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## LIST OF ACRONYMS AND ABBREVIATIONS

|                          |   |
|--------------------------|---|
| ±                        | plus or minus                                 |
| Anchor                   | Anchor Environmental, L.L.C.                  |
| Anchor QEA               | Anchor QEA, LLC                               |
| DEQ                      | Oregon Department of Environmental Quality    |
| H:V                      | horizontal to vertical ratio                  |
| IMRP                     | Interim Monitoring and Reporting Plan         |
| LNAPL                    | light nonaqueous phase liquid                 |
| LWD                      | large woody debris                            |
| NGVD29                   | National Geodetic Vertical Datum of 1929      |
| NMFS                     | National Marine Fisheries Service             |
| PIT                      | Point Intercept Transect                      |
| Port                     | Port of Portland                              |
| Repair Memo              | Wheeler Bay 2011 Repair Memorandum            |
| USEPA                    | U.S. Environmental Protection Agency          |
| WB                       | Wheeler Bay                                   |
| Year 2 Monitoring Report | <i>Final Year 2 Interim Monitoring Report</i> |
| Year 3 Monitoring Report | <i>Final Year 3 Interim Monitoring Report</i> |
| Year 4 Monitoring Report | <i>Final Year 4 Interim Monitoring Report</i> |

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## 1 INTRODUCTION

This document provides a summary of the fifth-year monitoring results for the head of Slip 3 cap and Wheeler Bay (WB) shoreline stabilization. Interim monitoring survey locations are depicted in Figure 1. Monitoring was conducted in accordance with the requirements of the *Interim Monitoring and Reporting Plan* (IMRP; see *Appendix C to the Final Design Analysis Report*; Anchor 2008) and the *Final Year 4 Interim Monitoring Report* (Year 4 Monitoring Report; Anchor QEA 2013). A description of the observed site conditions and relevant data summaries are provided in this report.

Section 3.3 of this report also provides a summary of the condition of the habitat layer material placed on top of the armor rock layer in WB. The habitat layer material monitoring is not part of the monitoring requirements but was performed as part of the WB monitoring activities as a pilot project to determine whether or not the site-specific conditions are conducive to maintaining a sand/gravel habitat layer over the armor layer. If monitoring demonstrates that a habitat layer can be maintained in the long term, this habitat layer may be considered by the National Marine Fisheries Service (NMFS) and the U.S. Environmental Protection Agency (USEPA) when determining the appropriate mitigation project for the WB shoreline stabilization work that has been completed (NMFS 2008).

### 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.

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

- Armor layer stability
- Absence of sheen

WB stabilization monitoring of the entire slope (between 0 and 700 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
- Condition of the habitat layer

Note that the shoreline stabilization area extends to 820 feet; however, the area between 700 and 820 feet from the mouth of the bay is too steep for biostabilization and is composed entirely of riprap. Due to the presence of riprap and the lack of biostabilization materials, this area was not included in the monitoring survey. However, visual observations of the riprap slope were made to confirm the material has remained where placed.

## **1.2 Schedule of Year 5 Interim Monitoring Events**

The following list summarizes the monitoring events conducted during Year 5:

- The head of Slip 3 sheen observations were conducted on June 4 and September 12, 2013.
- The head of Slip 3 cap visual armor and slope stability survey was conducted on October 24, 2013.
- The assessment of willow and grass planting coverage at WB was performed on June 4, 2013.
- Semi-annual monitoring of the vegetation and slope stability of the entire shoreline (from 0 to 700 feet from the mouth of the bay) was performed on June 4 (following a high water event) and October 24, 2013.
- The habitat layer material of the shoreline slope (between 340 and 700 feet from the mouth of the bay) was assessed at WB on June 4, 2013.

---

## **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 presented in the *Wheeler Bay and Head of Slip 3 Cap Year 5 Visual Slope and Armor Survey Monitoring Report* (see 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 October 24, 2013. The water level during the site visit was approximately +4.33 feet National Geodetic Vertical Datum of 1929 (NGVD29). A description of monitoring activities and monitoring results are given in the following subsections.

On October 24, 2013, three transects were re-established on 40-foot spacing perpendicular to the shoreline in the same locations as the Years 1 through Year 4 slope observations. Monitoring staff walked from the upslope edge of the stabilization area to the water. Notes and photographs were taken to document visual slope stability along each transect (see Appendix A: Attachments A-5 [field data sheets] and A-6 [photographs]). In summary, no areas of instability were observed.

#### **2.1.2 Pinch-pile Wall Survey**

Monitoring of the pinch-pile wall was conducted from 2008 to 2012. During this time, none of the survey points collected moved greater than the accuracy of the survey method ( $\pm 0.6$  inch); therefore, further monitoring of the pinch-pile wall was not required, as described in the Year 4 Monitoring Report (Anchor QEA 2013).

### **2.2 Presence of Sheen**

Surveys for the visual presence of sheen were performed at the end of high water season (June 4, 2013) and during the low water season (September 12, 2013). The water level was approximately +7.74 feet NGVD29 during the June 4, 2013 survey and approximately +3.78 feet NGVD29 during the September 12, 2013 survey. Monitoring staff walked along

20-foot transects parallel to the shoreline to observe the presence of sheen. No sheen was observed (see Appendix A: Attachments A-7 and A-8).

In addition, although not a requirement of the IMRP, surveys for the visual presence of sheen 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 sheen was observed between the completion of the Terminal 4 Phase I Removal Action work through Year 4 of the interim monitoring time period (Ash Creek—NewFields 2008, 2009; Ash Creek 2009a, 2009b, 2009c, 2009d, 2010a, 2010b, 2010c, 2011a, 2011b, 2012a, 2012b). In addition, no sheen was observed during the Year 5 interim monitoring time period, which will be documented in a report in early 2014 by Apex Companies, LLC.

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### **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 4 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 middle and lower elevations. Woody debris continues to accumulate in the bay in and around the placed large woody debris, adding complexity to the system.

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 presented in the *Wheeler Bay and Head of Slip 3 Cap Year 5 Visual Slope and Armor Survey Monitoring Report* (see Appendix A).

#### **3.1 Slope Stability**

Semi-annual monitoring of the entire stabilized WB slope between 0 and 700 feet from the mouth of the bay was performed on June 4, 2013, following the high water season and during the regularly scheduled time (per the IMRP) on October 24, 2013, to confirm that the slope is functioning as designed. Note that the shoreline stabilization area extends to 820 feet; however, the area between 700 and 820 feet from the mouth of the bay is too steep for biostabilization and is composed entirely of riprap. Due to the presence of riprap and the lack of biostabilization materials, this area was not included in the monitoring survey. However, visual observations of the riprap slope confirm that the material has remained where placed.

A total of five slope observation transects were established perpendicular to the shoreline at approximately 0, 150, 300, 450, and 600 feet from the mouth of the bay, as depicted in Figure 3. Transects were established with a field measuring tape, and monitoring staff walked from the upslope edge of the grass planting area down to the water. Notes and photographs were taken to document slope stability at each transect (see Appendix A: Attachments A-1 [field data sheets] and A-2 [photographs]). 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 2011a). Additional 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 semi-annual basis during Year 5 to monitor their condition, as well as the 4-inch sloughing of the surficial layer along the bottom of the grass planting area. Results of Year 5 monitoring events indicate that the scarp areas did not change from last year. 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+60 during the Year 4 first quarter monitoring event of the repaired area. During Year 5, this erosional area remained unchanged from the scarp documented in the Repair Memo.
- A 1-foot scarp was observed in the willow planting area between Stations 03+40 and 06+70 during the Year 4 second, third, and fourth quarter monitoring events. During Year 5, this erosional area remained unchanged from the scarp documented in the Repair Memo.

Surplus, on-site habitat material was placed above the large woody debris (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 Year 4 second quarter monitoring event. Year 5 monitoring activities indicate no significant change in the scarp areas. 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.

At the time of the Year 4 first quarter monitoring event, 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 following a heavy rain 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 in Year 5, and the area showed improvement during Year 5 monitoring events due to increased grass coverage and growth.

During the October 24, 2013 observation, it was noted that at Station 04+50, a 20-foot swath of the grass planting area had approximately 50 percent live grass coverage with the remainder of coverage consisting of dead grass. The areas of dead grass did not appear to affect the stability of the slope.

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 NGVD29, and the grass planting area is between elevations +20 to +30 feet NGVD29).

### **3.2 Armor Layer Stability**

Transects were established perpendicular to the shoreline at 150-foot centers, as described in Section 3.1 and depicted in Figure 3. Monitoring staff walked along the transects looking for evidence of erosion within the armor layer. Notes and photographs were taken of the armor layer at each transect (see Appendix A: Attachments A-1 [field data sheets] and A-2 [photographs]). 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 NGVD29 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 5 years to determine if the habitat layer is eroding or accreting.

Consistent with the Year 2 Monitoring Report (Anchor QEA 2011b) and the Year 3 Monitoring Report (Anchor QEA 2012), a quantitative assessment of the habitat layer was conducted on June 4, 2013, between Stations 03+40 and 06+70 at approximate elevations between +10 and +15 feet NGVD29. The coverage and thickness of the habitat material present along the existing shoreline was quantitatively evaluated in the following manner:

- Six transects were established 50 feet apart and perpendicular to the shoreline starting at Station 03+75 and ending at Station 06+75.
- A quadrat (3 feet by 3 feet) was placed at the top, middle, and bottom of the perpendicular transects from approximately +15 to +10 feet NGVD29. Substrate type was recorded as a percent of total 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 NGVD29 at Stations 2+80 to 3+40 and between elevations +10 and +15 feet NGVD29 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 A-1 of Appendix A, and photographs from each transect location are shown in Attachment A-4 to Appendix A. As expected, the areas protected by the piles underneath Berth 410 (between Station 03+75 and 06+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 middle and lower elevations. Habitat material and other types of non-armor rock material (i.e., placed material from upslope, depositional sand, or LWD) covered approximately 96 percent of the slope where habitat material was placed over armor rock. Armor rock was observed on the surface in approximately 4 percent of the overall area. The total thickness of material above riprap averaged 9 inches with an average of 7 inches consisting of habitat material. Year 5 coverage and thickness of the habitat material is consistent with Year 2, Year 3, and Year 4 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. The Year 5 vegetation assessment was conducted on June 4, 2013.

Based on the vegetation assessment performed, willow planting and grass planting establishment meets Year 5 goals, including the areas replanted as part of the 2011 repairs. No evidence of excessive vegetation destruction by geese or other animals was observed. There was evidence of beaver activity in the form of a few chewed tree limbs and limited areas of matted-down grass; however, none of these areas had significant impact on vegetation or slope stability. Additionally, thistle, blackberry, and other noxious weeds were controlled in June and July 2013. Limited thistle was noted during the semi-annual vegetation monitoring events. Notes and photographs from the site visits are provided in Attachments A-1 [field data sheets] and A-2 [photographs] to Appendix A.

#### **3.4.1 Willow Planting Establishment**

Coverage goals for the willow planting area between elevations 15 to 20 feet NGVD29 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 5 coverage:

- Transects were completed every 100 feet along the stabilization area planted with willow.
- A rag tape was laid along the slope from elevation +20 feet to +15 feet NGVD29.
- 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.
- If a survey point fell outside the willow planting boundary, coverage was not assessed.

Results of the PIT procedure are provided in Table 1. A statistical average of the percent coverage was determined for the entire shoreline (between 0 to 700 feet from the mouth of the bay, not including areas covered by armor as part of the repairs). Year 5 coverage averaged 91 percent, which is a slight increase over Year 4 results (88 percent).

Based on the results of the PIT procedure, the willow planting establishment for the entire planted area exceeds Year 5 coverage goals by 10 percent.

**Table 1**  
**Willow Coverage Point Intercept Transect Results**

| Station | Rag Tape (feet) | Willow Coverage (Yes or No) |
|---------|-----------------|-----------------------------|
| 00+00   | 2               | Yes                         |
|         | 4               | Yes                         |
|         | 6               | Yes                         |
|         | 8               | Yes                         |
|         | 10              | No                          |
|         | 12              | N/A                         |
|         | 14              | N/A                         |
| 01+00   | 2               | Yes                         |
|         | 4               | Yes                         |
|         | 6               | Yes                         |
|         | 8               | Yes                         |
|         | 10              | Yes                         |
|         | 12              | Yes                         |
|         | 14              | Yes                         |
| 02+00   | 2               | Yes                         |
|         | 4               | Yes                         |
|         | 6               | Yes                         |
|         | 8               | Yes                         |
|         | 10              | Yes                         |
|         | 12              | Yes                         |
|         | 14              | N/A                         |
| 03+00   | 2               | Yes                         |
|         | 4               | Yes                         |
|         | 6               | N/A                         |
|         | 8               | N/A                         |
|         | 10              | N/A                         |
|         | 12              | N/A                         |
|         | 14              | N/A                         |

| Station                                | Rag Tape (feet) | Willow Coverage (Yes or No) |
|--|-----------------|-----------------------------|
| 04+00                                  | 2               | Yes                         |
|  | 4               | Yes                         |
|  | 6               | Yes                         |
|  | 8               | Yes                         |
|  | 10              | No                          |
|  | 12              | No                          |
|  | 14              | N/A                         |
| 05+00                                  | 2               | Yes                         |
|  | 4               | Yes                         |
|  | 6               | Yes                         |
|  | 8               | Yes                         |
|  | 10              | Yes                         |
|  | 12              | Yes                         |
|  | 14              | Yes                         |
| 06+00                                  | 2               | Yes                         |
|  | 4               | Yes                         |
|  | 6               | Yes                         |
|  | 8               | Yes                         |
|  | 10              | Yes                         |
|  | 12              | Yes                         |
|  | 14              | N/A                         |
| 06+75                                  | 2               | Yes                         |
|  | 4               | Yes                         |
|  | 6               | Yes                         |
|  | 8               | Yes                         |
|  | 10              | No                          |
|  | 12              | N/A                         |
|  | 14              | N/A                         |
| 0 to 300 Feet Mean Willow Coverage =   |                 | 95%                         |
| 400 to 665 Feet Mean Willow Coverage = |                 | 88%                         |
| 0 to 665 Feet Mean Willow Coverage =   |                 | 91%                         |

Note:

N/A = Survey point outside the willow planting boundary—no coverage assessment.

### 3.4.2 Grass Planting Establishment

Grass planting coverage goals between elevations +20 to +30 feet NGVD29 are as follows:

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

Year 5 grass coverage was determined based on a visual assessment of the entire elevation +20 to +30 feet NGVD29. Results of the visual assessment indicate near 100 percent coverage for the entire grass planted area. Based on the monitoring performed, the entire grass planted area exceeds Year 5 goals by nearly 20 percent.

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## 4 CONCLUSIONS AND NEXT STEPS

The IMRP states that annual monitoring will occur until the Phase II Removal Action occurs. However, the IMRP also states that the Phase II Removal Action was expected to occur in 2010 and 2011. Because Phase II is not likely to occur in the next year and monitoring results in Year 5 indicate stable slopes and no sheen at the head of Slip 3, stable slopes in Wheeler Bay, and the achievement and exceedance of Year 5 grass and willow planting coverage goals, the Port proposes to reduce the monitoring frequency to every other year. If USEPA agrees with this frequency, the next set of monitoring events would occur in 2015.

### 4.1 Head of Slip 3 Cap

No instability, sloughing, or sheen was observed; therefore, monitoring activities will continue as described in the IMRP. Specifically, during the next scheduled monitoring year, surveys for the visual presence of sheen will be completed at two different water level conditions. Observations will be conducted when the water level is approximately +5 feet NGVD29 and when the water level is approximately +10 feet NGVD29. 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.

### 4.2 Wheeler Bay

No significant instability or sloughing was observed during Year 5 monitoring activities. In addition, willow and grass planting areas exceed Year 5 coverage goals. Because there were no significant areas of instability or sloughing throughout the length of the stabilized shoreline and coverage goals were achieved, the same monitoring activities that occurred in Year 5 will occur during the next proposed scheduled monitoring year of 2015 as follows:

- Assessment of willow and grass planting coverage of the entire shoreline during the growing season.
- Semi-annual monitoring of the vegetation and slope stability of the entire shoreline once following a high water event and once in October/November.

- Assessment of the habitat layer material (between 340 and 700 feet from the mouth of the bay) once during the year.

#### **4.2.1 Condition of Habitat Layer**

No new habitat material was placed with the intent of covering armor rock in the repaired areas 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 reused to cover all 2008 Phase I armor rock between elevations +10 and +13 feet NGVD29. Results of Year 5 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 4 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 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**

Reports during monitoring years will be submitted to USEPA in January (January 15) rather than December, per USEPA's approval of the Port's request to modify the schedule via email on February 20, 2013. Interim monitoring 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.

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## 5 REFERENCES

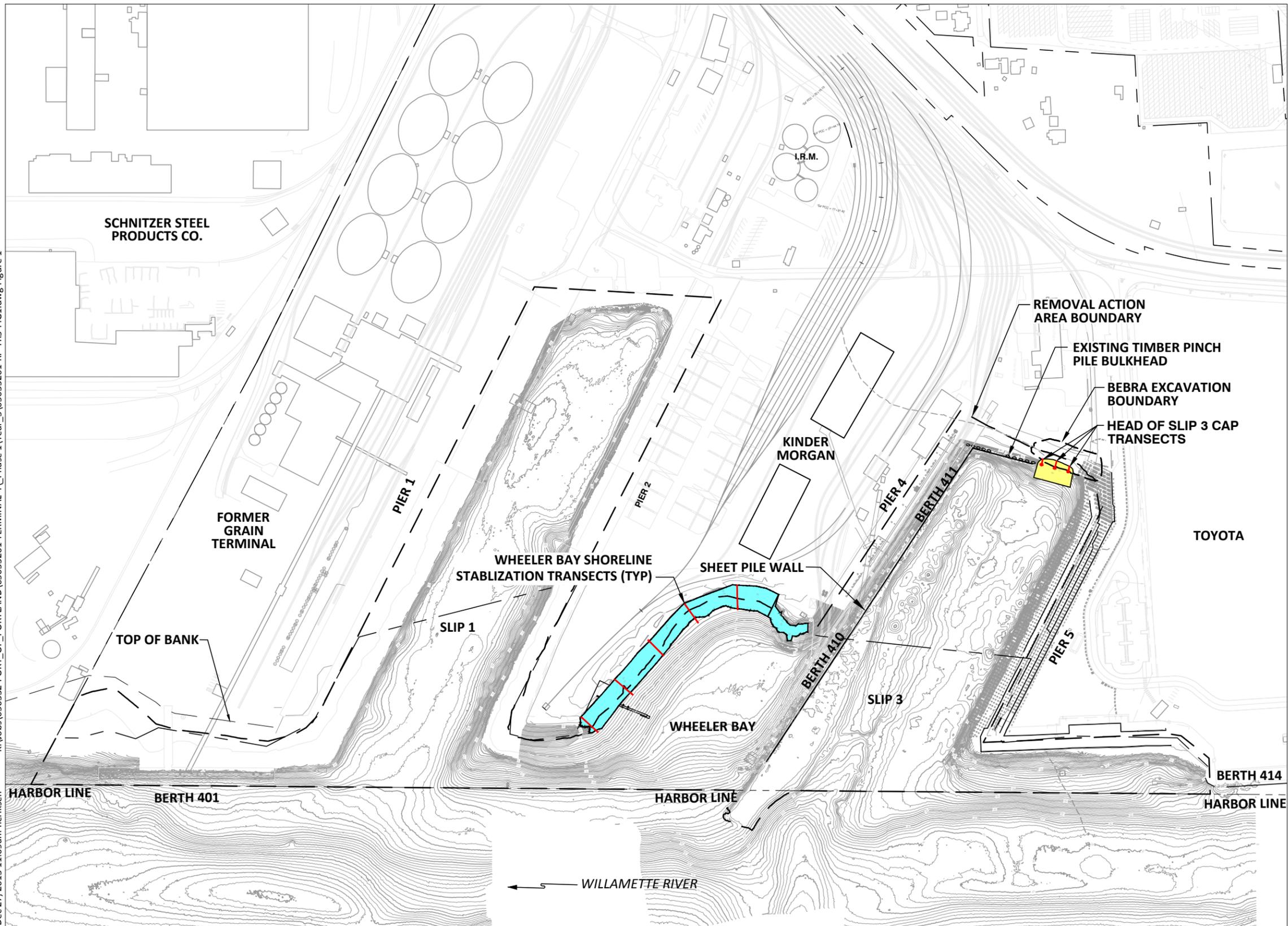
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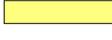
# FIGURES

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K:\Jobs\050332-PORT\_OF\_PORTLAND\05033201\_TERMINAL\_4\_Phase 1\Year\_5\05033201-RP-YR5-FIG1.dwg Figure 1  
Dec 27, 2013 11:09am heriksen



**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

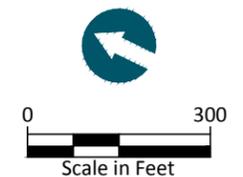


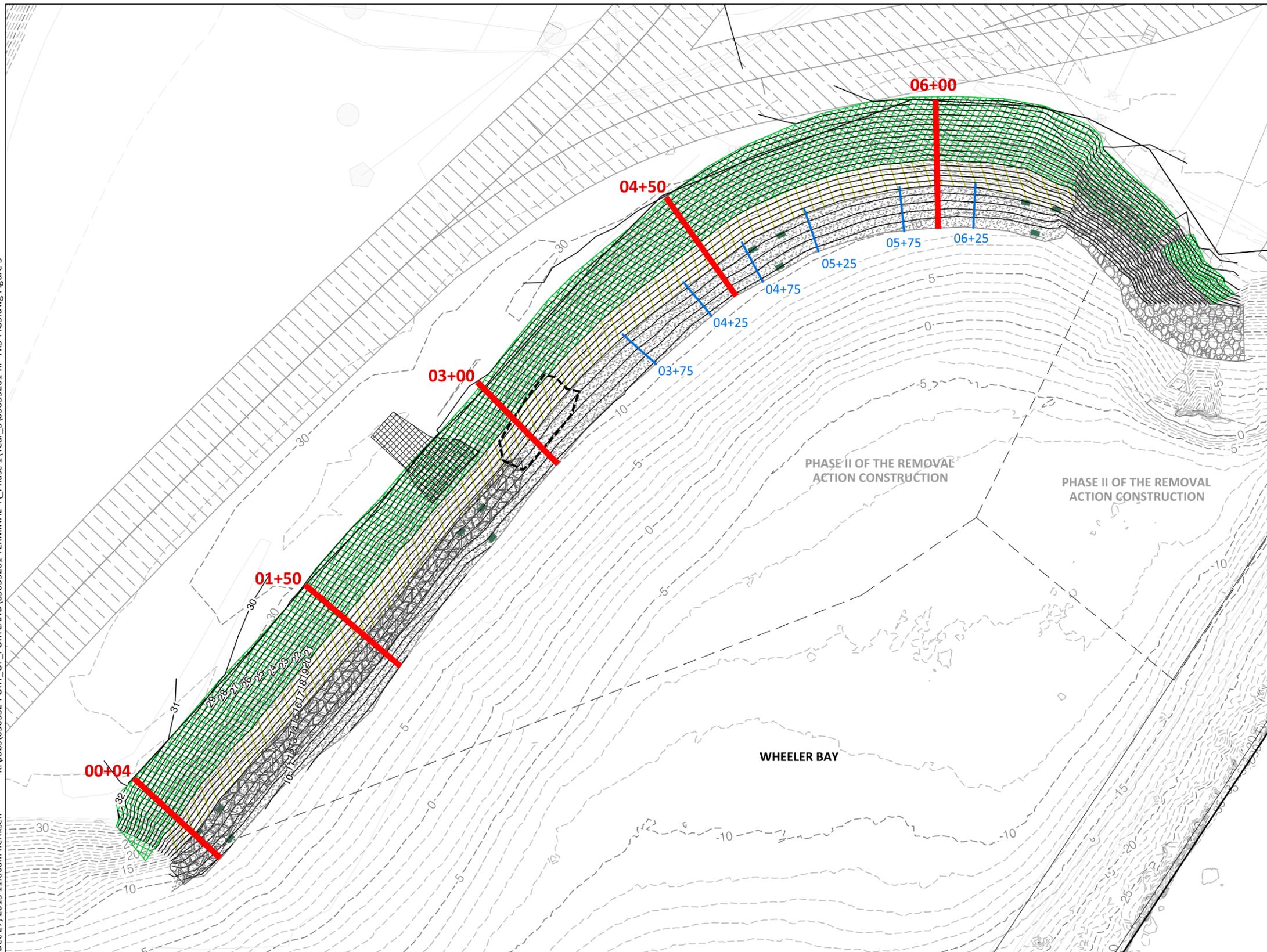


Photo Date: 6/4/2013



Photo Date: 10/24/2013

K:\Jobs\050332-PORT\_OF\_PORTLAND\05033201\_TERMINAL\_4\_Phase 1\Year\_5\05033201-RP-YR5-FIG3.dwg Figure 3  
Dec 27, 2013 11:06am heriksen



**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)
- 2008 RE-CONSTRUCTION CONTOURS
- 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

APPENDIX A  
WHEELER BAY AND HEAD OF SLIP 3 CAP  
YEAR 5 VISUAL SLOPE AND ARMOR  
SURVEY MONITORING REPORT

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## MEMORANDUM

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**To:** John Verduin, Anchor QEA  
**From:** Julie Fox, Anchor QEA  
**Cc:** Elizabeth Appy, Anchor QEA  
**Re:** Wheeler Bay and Head of Slip 3 Cap Year 5 Visual Slope and Armor Survey Monitoring Report, Terminal 4 Removal Action, Port of Portland

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### YEAR 5 SLOPE AND ARMOR OBSERVATIONS

In accordance with the requirements of the *Interim Monitoring and Reporting Plan* (IMRP; *Appendix C to the Final Design Analysis Report*; Anchor 2008) and the *Final Year 4 Interim Monitoring Report* (Year 4 Monitoring Report; Anchor QEA 2013), semi-annual visual assessments of the Wheeler Bay (WB) slope and armor condition were performed on June 4 and October 24, 2013. The water level during these two site visits was approximately +7.74 and +4.33 feet National Geodetic Vertical Datum of 1929 (NGVD29), respectively. Observations for the presence of sheen were conducted at the head of Slip 3 on June 4 and September 12, 2013. The water level during these two site visits was +7.74 and +3.78 feet NGVD29, respectively.

A description of all Year 5 monitoring activities performed and results is given as follows.

#### 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

Semi-annual monitoring of the entire stabilized slope between 0 and 700 feet from the mouth of the bay was performed on June 4, 2013, following the high water season and on October 24, 2013, to confirm that the shoreline is functioning as designed.

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A total of five slope observation transects were established perpendicular to the shoreline every 150-feet starting approximately from the mouth of the bay (see Figure A-1). 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. 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. Field data sheets and photographs from the site visit are provided in the attachments to this memorandum (see Attachments A-1 [field data sheets] and A-2 [photographs]).

In addition, a quantitative estimate of the coverage and thickness of the habitat material present in the existing shoreline between Stations 03+40 and 06+70 and between approximate elevations +10 and +15 feet NGVD29 was made in the following manner:

- Six transects were established 50 feet apart and perpendicular to the shoreline starting at Station 03+75 and ending at Station 06+75.
- A quadrat (3 feet by 3 feet) was placed at the top, middle, and bottom of the each perpendicular transect. Substrate type was recorded as a percent of total 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***

A number of erosion scarps were observed in the willow planting area. Photos of the scarps are compiled in Attachment A-3 and described below:

- A 1-foot scarp was observed in the willow planting area between Stations 00+00 and 01+60 during the Year 4 first quarter monitoring event. The Year 5 monitoring results indicate this scarp area was unchanged from monitoring activities conducted in the previous year.
  - A 1-foot scarp was observed in the willow planting area between Stations 03+40 and 06+70 during the Year 4 second, third, and fourth quarter monitoring events. The Year 5 monitoring results indicate this scarp area was unchanged from monitoring activities conducted in the previous year.
-

- A 1-foot scarp in the habitat material placed above the woody debris as part of the 2011 repair was observed at Stations 03+50 and 03+90 during the second quarter monitoring event. Year 5 monitoring activities indicate this scarp area was unchanged from monitoring activities conducted in the previous year.

No orange demarcation layer material was exposed by any of the scarps, and the scarps did not appear to impact slope stability. At the time of the Year 4 first quarter monitoring event, 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 following a heavy rain event. No additional sloughing was observed during the monitoring events in Year 5, and the area showed increased grass coverage and growth compared to last year.

During the October 24, 2013 observation, it was noted that at Station 04+50, a 20-foot swath of the grass planting area had approximately 50-percent live grass coverage with the remainder of coverage consisting of dead grass. The areas of dead grass did not appear to affect the stability of the slope. No other sloughing, instability, or other areas of erosion were observed in the willow or grass planting areas (elevations +15 to +25 feet NGVD29).

### *Armor Layer Stability*

The armor layer at WB showed no evidence of instability, sloughing, or erosion during the semiannual 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 visits. 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 as follows and in Table A-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 approximately 96 percent of the

---

slope where habitat material was placed over armor rock. Armor rock was observed on the surface in approximately 4 percent of the overall area. The total thickness of habitat material and other non-armor rock material above armor rock averaged 9 inches, with an average of 7 inches consisting of habitat material.

### **Head of Slip 3 Cap**

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

- Slope stability
- Absence of sheen

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 Years 1 through 4 locations. Transects were walked from the upslope edge of the stabilization area to the water on October 24, 2013. 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 sheen. Observations occurred during post-high water (June 4, 2013) and during low water conditions (September 12, 2013). The water level during the observation events was approximately +7.74 (post-high water) and +3.78 feet NGVD29 (low water). 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 rock material was stable and free of erosion and sloughing. No sheen was observed during either of the sheen observation events.

### **Conclusions**

#### ***Wheeler Bay***

No sloughing or instability of the slope or armor layer was observed. As expected, the condition of the habitat layer in areas protected by the piles underneath Berth 410 (between

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Station 03+75 and 06+25) continues to be shielded from erosive forces. Year 5 coverage and thickness of the habitat material is consistent with Years 2, 3, and 4 habitat material evaluation results.

### ***Head of Slip 3 Cap***

No instability, sloughing, or sheen was observed.

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

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# TABLE

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**Table A-1**  
**Year 5 Habitat Material Assessment Results**  
**June 4, 2013 Monitoring Event at Wheeler Bay**

| Perpendicular<br>Transect Location<br>(Distance in feet<br>from Mouth of Bay) | Quadrat Location:<br>Top (T), Middle<br>(M), or Bottom (B) | Surface Substrate (Percent of Sampled Quadrat Area) |                                   |                             |  |  |                         | Total<br>(percent) | Thickness <sup>b</sup> of Substrate<br>Above Armor Rock |                               |                                |
|---|--|---|-----------------------------------|-----------------------------|--|--|-------------------------|--------------------|---|-------------------------------|--------------------------------|
|   |  | Non-Armor Rock Material                             |                                   |                             |  |  | Armor Rock              |                    | Habitat<br>Mix<br>(inches)                              | Other<br>Material<br>(inches) | Total<br>Thickness<br>(inches) |
|   |  | Placed<br>Material<br>from<br>Upslope<br>(percent)  | Depositional<br>Sand<br>(percent) | Habitat<br>Mix<br>(percent) | Large<br>Woody<br>Debris <sup>a</sup><br>(percent) | Placed<br>Fines on<br>Coir Fabric<br>(percent) | Armor Rock<br>(percent) |                    |   |                               |                                |
| 375   | T  |   |                                   | 2.5                         | 97.5   |  |                         | 100.0              | 3   | 9                             | > 12                           |
| 375   | M  |   | 25                                | 25                          | 50   |  |                         | 100.0              |   |                               |                                |
| 375   | B  |   | 50                                | 50                          |  |  |                         | 100.0              |   |                               |                                |
| 425   | T  |   | 80                                |                             | 15   |  | 5                       | 100.0              |   |                               |                                |
| 425   | M  |   | 30                                | Trace                       | 70   |  |                         | 100.0              | 11  | 1                             | > 12                           |
| 425   | B  |   | 100                               | Trace                       |  |  |                         | 100.0              |   |                               |                                |
| 475   | T  |   | 40                                | Trace                       | 60   |  |                         | 100.0              |   |                               |                                |
| 475   | M  |   | 40                                | 30                          | 30   |  |                         | 100.0              |   |                               |                                |
| 475   | B  |   | 50                                |                             | 50   |  |                         | 100.0              | 11  | 1                             | > 12                           |
| 525   | T  | 15  | 5                                 |                             | 80   |  |                         | 100.0              | 7   |                               | 7                              |
| 525   | M  |   | 30                                | 30                          | 40   |  | Trace                   | 100.0              |   |                               |                                |
| 525   | B  |   | 20                                |                             | 80   |  |                         | 100.0              |   |                               |                                |
| 575   | T  | 5   | 5                                 |                             | 90   |  |                         | 100.0              |   |                               |                                |
| 575   | M  | 5   | 5                                 | 5                           | 85   |  |                         | 100.0              | 8   |                               | 8                              |
| 575   | B  |   | 30                                | 20                          | 50   |  |                         | 100.0              |   |                               |                                |
| 625   | T  | 25  | 25                                |                             | 50   |  |                         | 100.0              |   |                               |                                |
| 625   | M  |   | 15                                | 10                          | 25   |  | 50                      | 100.0              |   |                               |                                |
| 625   | B  |   | 20                                | 10                          | 60   |  | 10                      | 100.0              | 2   |                               | 2                              |
| MEAN_TOP  |  | 7.5   | 25.8                              | 0.4                         | 65.4   | 0.0  | 0.8                     |                    | 5   | 9                             | 10                             |
| MEAN_MIDDLE   |  | 0.8   | 24.2                              | 16.7                        | 50.0   | 0.0  | 8.3                     |                    | 10  | 1                             | 10                             |
| MEAN_BOTTOM   |  | 0.0   | 45.0                              | 13.3                        | 40.0   | 0.0  | 1.7                     |                    | 7   | 1                             | 7                              |
| MEAN_375-625  |  | 2.8   | 31.7                              | 10.1                        | 51.8   | 0.0  | 3.6                     |                    | 7   | 4                             | 9                              |

Notes:

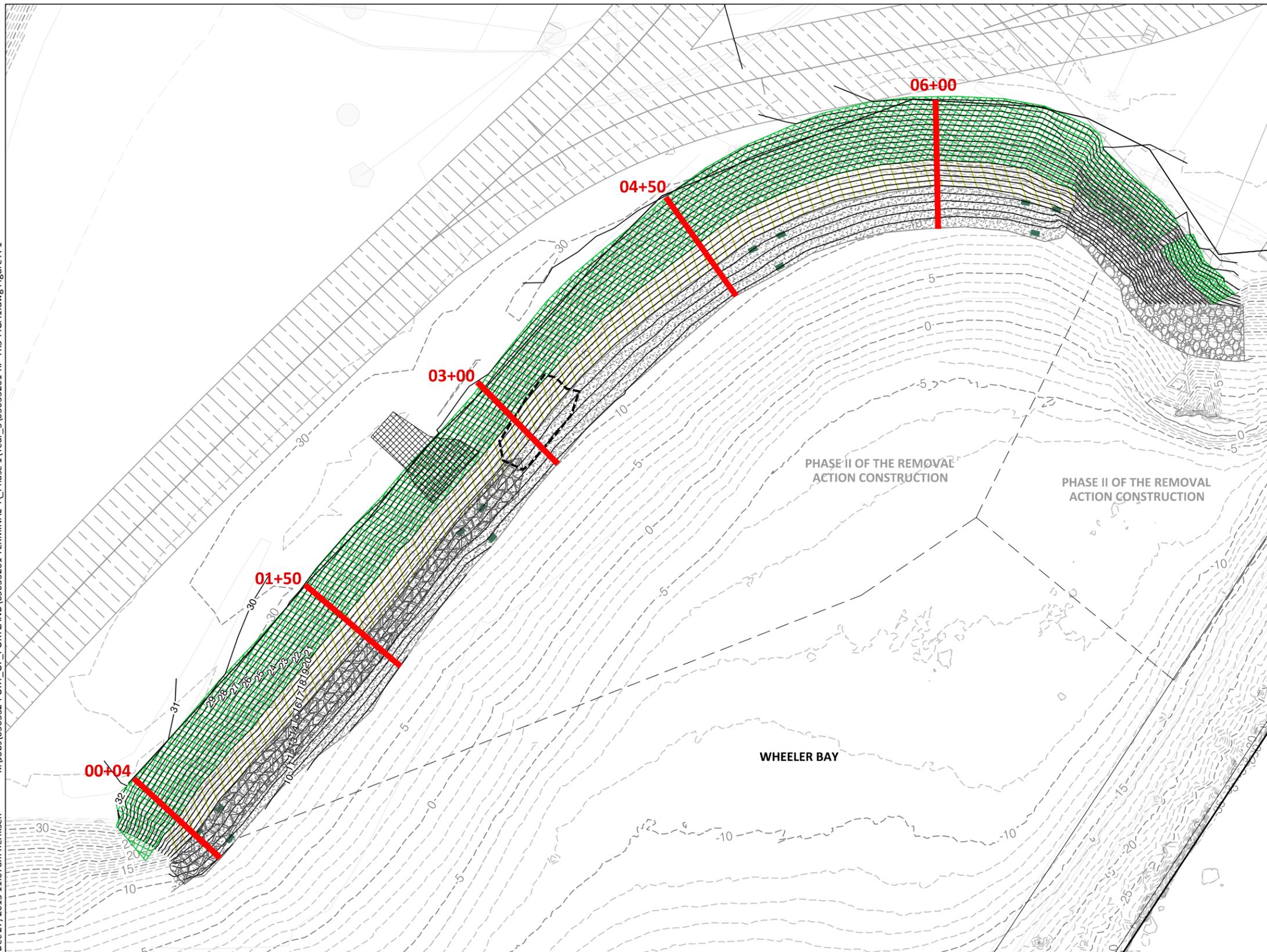
a = Woody debris is considered large if greater than 3 inches in diameter.

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

FIGURE

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K:\Jobs\050332-PORT\_OF\_PORTLAND\05033201\_TERMINAL\_4\_Phase 1\Year\_5\05033201-RP-YR5-FIGA1.dwg Figure A-1  
Dec 27, 2013 11:07am heriksen

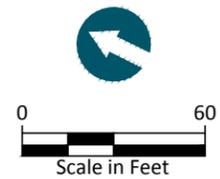


**LEGEND:**

-  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
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-  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)  
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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.



ATTACHMENT A-1  
WHEELER BAY MONITORING DATA  
SHEETS

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# Year 5 Habitat Material Assessment

6/4/13  
Pg 1 of 1

Low-High Water Sampling Period

|                |              | Surface Substrate (percent of quadrat area) |                       |                                    |                          |  |                          | Thickness of substrate above rip rap |                         |                          |      |  |    |    |
|----------------|--------------|---|-----------------------|------------------------------------|--------------------------|--|--------------------------|--------------------------------------|-------------------------|--------------------------|------|--|----|----|
|                |              | Non-riprap Material                         |                       |                                    |                          | Rip rap                                |                          |                                      |                         |                          |      |  |    |    |
| Location       | Quadrant     | Placed material from upslope (%)            | Depositional Sand (%) | Habitat Mix (%)<br><i>= gravel</i> | Log (%)                  | Coir fabric w/ placed fines on top (%) | Rip rap (%)              | Habitat Mix (inches)                 | Other Material (inches) | Total Thickness (inches) |      |  |    |    |
| <del>325</del> | <del>T</del> |   |                       |                                    |                          |  |                          |                                      |                         |                          |      |  |    |    |
| <del>325</del> | <del>M</del> | <i>No Habitat Material @ 325</i>            |                       |                                    |                          |  |                          |                                      |                         |                          |      |  |    |    |
| <del>325</del> | <del>B</del> |   |                       |                                    |                          |  |                          |                                      |                         |                          |      |  |    |    |
| 351            | T            |   |                       |                                    |                          |  |                          |                                      |                         | 2.5                      | 97.5 |  | 3" | 9" |
| 352            | M            |   | 25                    | 25                                 | 50                       |  | 4" JF                    | 4" JF                                | >12" JF                 |                          |      |  |    |    |
| 353            | B            |   | 50                    | 50                                 |                          |  |                          |                                      |                         |                          |      |  |    |    |
| 354            | T            |   | 80                    |                                    | 15                       |  | 5                        |                                      |                         |                          |      |  |    |    |
| 355            | M            |   | 30                    | Trace                              | 70                       |  |                          | 11"                                  | 1"                      | >12"                     |      |  |    |    |
| 356-357        | B            |   | 100                   | T                                  |                          |  |                          |                                      |                         | 356 + 357                |      |  |    |    |
| 358            | T            |   | 40                    | T                                  | 60                       |  |                          |                                      |                         |                          |      |  |    |    |
| 359            | M            |   | 40                    | 30                                 | 30                       |  |                          |                                      |                         |                          |      |  |    |    |
| 360            | B            |   | 50                    |                                    | 50                       |  |                          | 11"                                  | 1"                      | >12"                     |      |  |    |    |
| 365            | T            | 15  | 5                     |                                    | 80                       |  |                          | 7"                                   | -                       | 7"                       |      |  |    |    |
| 366            | M            |   | 30                    | 30                                 | 40                       |  | T                        | 7" (EP)                              |                         | 7" (EP) 366 (EP)         |      |  |    |    |
| 367            | B            |   | 20                    |                                    | 80                       |  |                          |                                      |                         |                          |      |  |    |    |
| 368            | T            | 5   | 5                     |                                    | 90                       |  |                          |                                      |                         |                          |      |  |    |    |
| 369            | M            | 5   | 5                     | 5                                  | 90 <sup>(EP)</sup><br>85 |  |                          | 8"                                   | -                       | 8"                       |      |  |    |    |
| 370            | B            |   | 30                    | 20                                 | 50                       |  |                          |                                      |                         |                          |      |  |    |    |
| 371            | T            | 25  | 25                    |                                    | 50                       |  |                          |                                      |                         |                          |      |  |    |    |
| 372            | M            |   | 15                    | 10                                 | 25                       |  | 10 <sup>(EP)</sup><br>50 |                                      |                         |                          |      |  |    |    |
| 373            | B            |   | 20                    | 10                                 | 60                       |  | 10                       | 2"                                   | -                       | 2" *                     |      |  |    |    |

excavate bottom right.

log = >3" diameter

Project Name: T-4, Wheeler Bay

Project No: 050332-01

*Year 5 Post-High Water Monitoring Event*

Observation Crew: Gabe Nagler, Elizabeth Appy, Julie Foy

Weather: Sunny, 75°F light wind

Photo Point ID: 1G Time: 11:47am

Station # 0+00 SE

|               |            |    |
|---------------|------------|----|
| Photo Bearing | 140        | -- |
| Photo ID #    | <u>309</u> | -- |

Photo Point ID: 1W Time: 11:56am

Station # 0+00 SE

|               |            |    |
|---------------|------------|----|
| Photo Bearing | 140        | -- |
| Photo ID #    | <u>316</u> | -- |

Photo Point ID: 1R Time: 11:57am

Station # 0+00 SE

|               |            |    |
|---------------|------------|----|
| Photo Bearing | 140        | -- |
| Photo ID #    | <u>317</u> | -- |

Photo Point ID: 2G Time: 11:49am

Station # 1+50 NW SE

|               |            |            |
|---------------|------------|------------|
| Photo Bearing | 320        | 140        |
| Photo ID #    | <u>310</u> | <u>311</u> |

Photo Point ID: 2W Time: 11:52am

Station # 1+50 NW SE

|               |            |            |
|---------------|------------|------------|
| Photo Bearing | 320        | 140        |
| Photo ID #    | <u>313</u> | <u>312</u> |

Photo Point ID: 2R Time: 11:53am

Station # 1+50 NW SE

|               |            |            |
|---------------|------------|------------|
| Photo Bearing | 320        | 140        |
| Photo ID #    | <u>315</u> | <u>314</u> |

0+91 Beaver evidence  
pix # 318

11:58 am

Project Name: T-4, Wheeler Bay

Project No: 050332-01

Photo Point ID: 3G

Time: 11:59 am

Station # 3+00

|               |     |     |
|---------------|-----|-----|
| Photo Bearing | 320 | 140 |
| Photo ID #    | 319 | 320 |

Photo Point ID: 3W

Time: 12:00 pm

Station # 3+00

|               |     |     |
|---------------|-----|-----|
| Photo Bearing | 320 | 140 |
| Photo ID #    | 321 | 322 |

Photo Point ID: 3R

Time: 12:00 pm

Station # 3+00

|               |     |     |
|---------------|-----|-----|
| Photo Bearing | 320 | 140 |
| Photo ID #    | 323 | 324 |

Photo Point ID: 4G

Time: 12:02 pm

Station # 4+50

|               |     |     |
|---------------|-----|-----|
| Photo Bearing | 320 | 140 |
| Photo ID #    | 325 | 326 |

Photo Point ID: 4W

Time: 12:04

Station # 4+50

|               |     |     |
|---------------|-----|-----|
| Photo Bearing | 320 | 140 |
| Photo ID #    | 327 | 328 |

Photo Point ID: 4R

Time: 12:06

Station # 4+50

|               |     |     |
|---------------|-----|-----|
| Photo Bearing | 320 | 140 |
| Photo ID #    | 329 | 330 |

Photo Point ID: 5G

Time: 12:06 pm

Station # 6+00

|               |     |     |
|---------------|-----|-----|
| Photo Bearing | 320 | 140 |
| Photo ID #    | 331 | 332 |

Photo Point ID: 5W

Time: 12:07 pm

Station # 6+00

|               |     |     |
|---------------|-----|-----|
| Photo Bearing | 320 | 140 |
| Photo ID #    | 333 | 334 |

Photo Point ID: 5R

Time: 12:08 pm

Station # 6+00

|               |     |     |
|---------------|-----|-----|
| Photo Bearing | 320 | 140 |
| Photo ID #    | 335 | 336 |

Armor stone movement? NO

Instability? NO

Sloughing? NO

Approx. Willow Height: 2-3m

Approx. Grass Height: 6-24" 100% coverage.

Goose Grazing? N/A

Invasive Species?

Canadian Thistle

*scars unchanged or improved from previous year*

Other notes:

Rip rap area @ back of bay

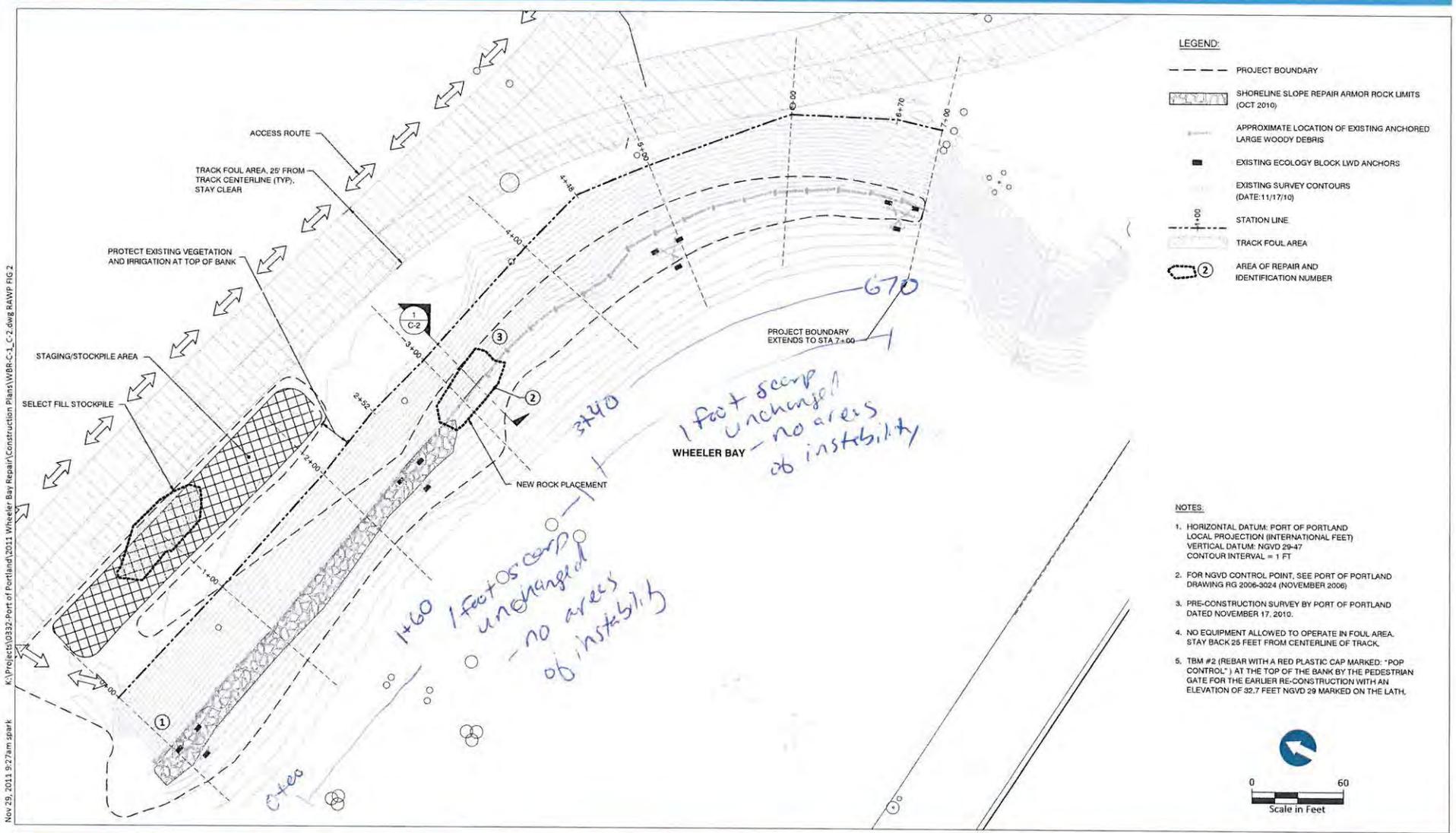
PIX # 337

time 12:09 pm

*Evidence of beaver activity but not having any significant impact on vegetation.*

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

# Year 5 Post-High Water monitoring Event



Nov 29, 2011 9:27am .pwpk  
 K:\Projects\0333-Port of Portland\2011 Wheeler Bay Repair\Construction Plans\WBPR-C-1\_C-2.dwg RANP FIG 2



Date: 6/4/2013

Recorded By: Julie Fox



Project Name: T-4, Wheeler Bay

Project No: 050332-01

Year 5 Slope obs @ WB

Observation Crew: Julie Fox, Doug Laffoon

Weather: Sunny, light wind

Photo Point ID: 1G

Time: 1:24

Station # 00+04

100% grass coverage

|               |     |    |
|---------------|-----|----|
| Photo Bearing | 140 | -- |
| Photo ID #    | 1   | -- |

Photo Point ID: 1W

Time: 1:25

Station # 00+04

no sloughing or evidence of

|               |     |    |
|---------------|-----|----|
| Photo Bearing | 140 | -- |
| Photo ID #    | 2   | -- |

(1ft scarp unchanged from last year) unstable slope

Photo Point ID: 1R

Time: 1:27

Station # 00+04

no sloughing or erosion

|               |     |    |
|---------------|-----|----|
| Photo Bearing | 140 | -- |
| Photo ID #    | 3   | -- |

Photo Point ID: 2G

Time: 1:29

Station # 01+50

100% grass coverage

|               |     |     |
|---------------|-----|-----|
| Photo Bearing | 320 | 140 |
| Photo ID #    | 4   | 5   |

Photo Point ID: 2W

Time: 1:29

Station # 01+50

no sloughing or erosion

|               |     |     |
|---------------|-----|-----|
| Photo Bearing | 320 | 140 |
| Photo ID #    | 6   | 7   |

(1ft scarp unchanged from last year)

Photo Point ID: 2R

Time: 1:30

Station # 01+50

no sloughing or erosion

|               |     |     |
|---------------|-----|-----|
| Photo Bearing | 320 | 140 |
| Photo ID #    | 8   | 9   |

Deck has moved upslope slightly

Project Name: T-4, Wheeler Bay

Project No: 050332-01

Year 5 Slope obs @ WB

|  |                     |   |     |            |           |           |  |  |
|--|---------------------|---|-----|------------|-----------|-----------|--|--|
| Photo Point ID: <u>3G</u>  | Time: <u>1:35pm</u> |   |     |            |           |           |  |  |
| Station # <u>03+00</u>   |                     | <u>100% grass coverage</u>  |     |            |           |           |  |  |
| <table border="1" style="width: 100%;"><tr><td>Photo Bearing</td><td>320</td><td>140</td></tr><tr><td>Photo ID #</td><td><u>10</u></td><td><u>11</u></td></tr></table> | Photo Bearing       | 320   | 140 | Photo ID # | <u>10</u> | <u>11</u> |  |  |
| Photo Bearing  | 320                 | 140   |     |            |           |           |  |  |
| Photo ID #   | <u>10</u>           | <u>11</u>   |     |            |           |           |  |  |
| Photo Point ID: <u>3W</u>  | Time: <u>1:35pm</u> |   |     |            |           |           |  |  |
| Station # <u>03+00</u>   |                     | <u>no sloughing or erosion</u>  |     |            |           |           |  |  |
| <table border="1" style="width: 100%;"><tr><td>Photo Bearing</td><td>320</td><td>140</td></tr><tr><td>Photo ID #</td><td><u>12</u></td><td><u>13</u></td></tr></table> | Photo Bearing       | 320   | 140 | Photo ID # | <u>12</u> | <u>13</u> |  |  |
| Photo Bearing  | 320                 | 140   |     |            |           |           |  |  |
| Photo ID #   | <u>12</u>           | <u>13</u>   |     |            |           |           |  |  |
| Photo Point ID: <u>3R</u>  | Time: <u>1:36</u>   |   |     |            |           |           |  |  |
| Station # <u>03+00</u>   |                     | <u>no sloughing or erosion</u>  |     |            |           |           |  |  |
| <table border="1" style="width: 100%;"><tr><td>Photo Bearing</td><td>320</td><td>140</td></tr><tr><td>Photo ID #</td><td><u>14</u></td><td><u>15</u></td></tr></table> | Photo Bearing       | 320   | 140 | Photo ID # | <u>14</u> | <u>15</u> |  |  |
| Photo Bearing  | 320                 | 140   |     |            |           |           |  |  |
| Photo ID #   | <u>14</u>           | <u>15</u>   |     |            |           |           |  |  |
| Photo Point ID: <u>4G</u>  | Time: <u>1:38</u>   |   |     |            |           |           |  |  |
| Station # <u>04+50</u>   |                     | <u>100% grass coverage except 20' swath centered over transect pt - only 50% coverage. - other 50% dead grass</u> |     |            |           |           |  |  |
| <table border="1" style="width: 100%;"><tr><td>Photo Bearing</td><td>320</td><td>140</td></tr><tr><td>Photo ID #</td><td><u>16</u></td><td><u>17</u></td></tr></table> | Photo Bearing       | 320   | 140 | Photo ID # | <u>16</u> | <u>17</u> |  |  |
| Photo Bearing  | 320                 | 140   |     |            |           |           |  |  |
| Photo ID #   | <u>16</u>           | <u>17</u>   |     |            |           |           |  |  |
| Photo Point ID: <u>4W</u>  | Time: <u>1:39</u>   |   |     |            |           |           |  |  |
| Station # <u>04+50</u>   |                     | <u>no sloughing or erosion</u>  |     |            |           |           |  |  |
| <table border="1" style="width: 100%;"><tr><td>Photo Bearing</td><td>320</td><td>140</td></tr><tr><td>Photo ID #</td><td><u>18</u></td><td><u>19</u></td></tr></table> | Photo Bearing       | 320   | 140 | Photo ID # | <u>18</u> | <u>19</u> |  |  |
| Photo Bearing  | 320                 | 140   |     |            |           |           |  |  |
| Photo ID #   | <u>18</u>           | <u>19</u>   |     |            |           |           |  |  |
| <u>(IF+scarp in willows unchanged)</u>   |                     |   |     |            |           |           |  |  |
| Photo Point ID: <u>4R</u>  | Time: <u>1:40</u>   |   |     |            |           |           |  |  |
| Station # <u>04+50</u>   |                     | <u>no sloughing or erosion</u>  |     |            |           |           |  |  |
| <table border="1" style="width: 100%;"><tr><td>Photo Bearing</td><td>320</td><td>140</td></tr><tr><td>Photo ID #</td><td><u>20</u></td><td><u>21</u></td></tr></table> | Photo Bearing       | 320   | 140 | Photo ID # | <u>20</u> | <u>21</u> |  |  |
| Photo Bearing  | 320                 | 140   |     |            |           |           |  |  |
| Photo ID #   | <u>20</u>           | <u>21</u>   |     |            |           |           |  |  |

Photo Point ID: 5G

Time: 1:42

Station # 06+00

|               |     |     |
|---------------|-----|-----|
| Photo Bearing | 320 | 140 |
| Photo ID #    | 22  | 23  |

100% grass coverage

Photo Point ID: 5W

Time: 1:43

Station # 06+00

|                 |     |     |
|-----------------|-----|-----|
| Photo Bearing # | 320 | 140 |
| Photo ID #      | 24  | 25  |

2ft scarp in willows unchanged from last monitoring event.

Photo Point ID: 5R

Time: 1:44

Station # 06+00

|               |     |     |
|---------------|-----|-----|
| Photo Bearing | 320 | 140 |
| Photo ID #    | 26  | 27  |

no sloughing or erosion

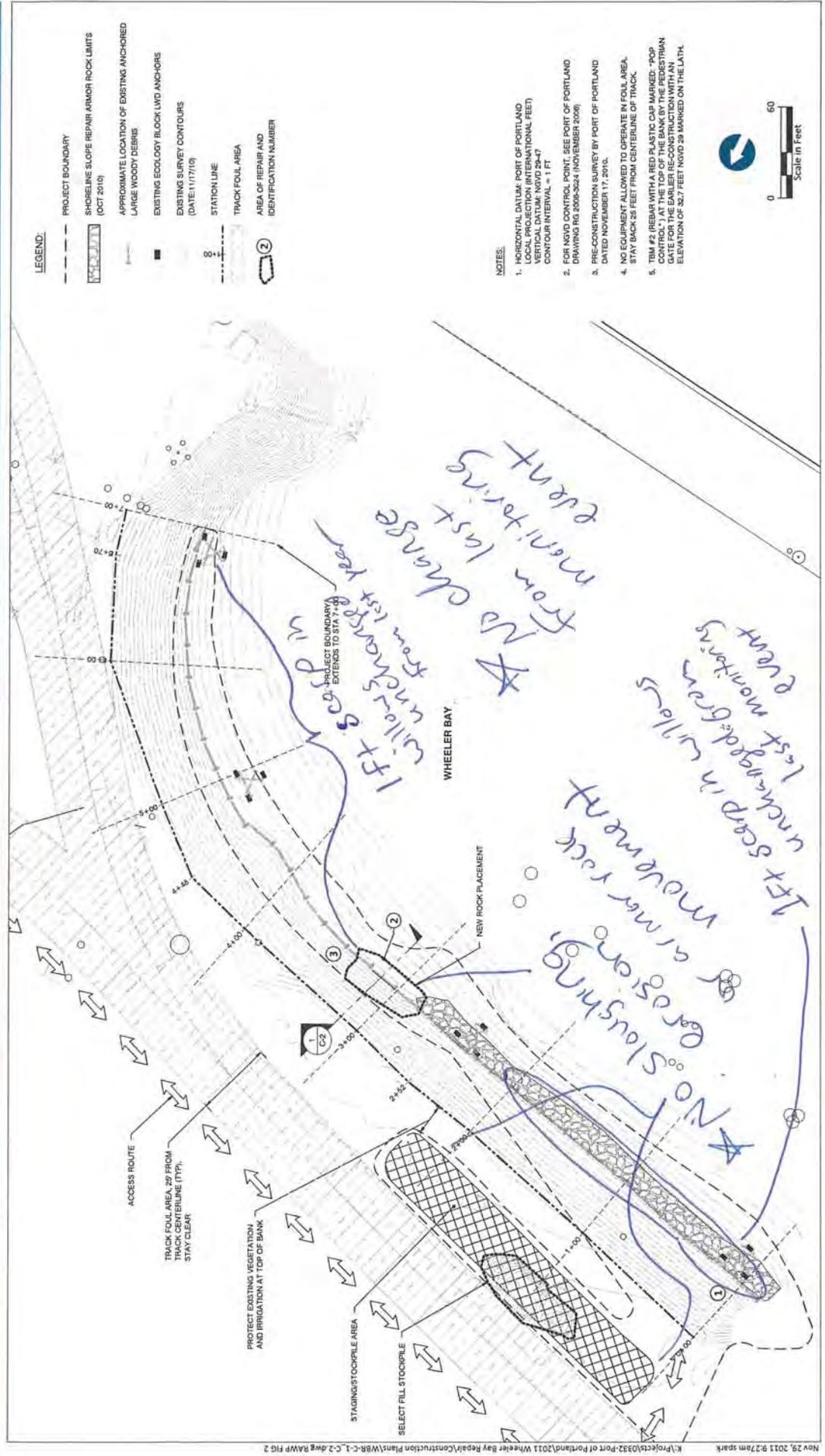
Armor stone movement? NO  
 Instability? NO  
 Sloughing? NO  
 Approx. Willow Height: -6-12ft  
 Approx. Grass Height: -26"  
 Goose Grazing? -NO  
 Invasive Species? NO

Other notes:

A number of beaver trails or evidence there of (matted down grass)  
 ↓ & trails in sand along beach. Willow plantings untraced by beaver along slope. Only trails along top of slope show minimal evidence of beaver.

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

Year 5 Slope observation @ Wheeler Bay



Recorded By: Julie Fox

Date: 10/21/13



Year 5 Willow Planting P.I.T. 6/4/13

| Station | Rag Tape      | Coverage?    |              |
|---------|---------------|--------------|--------------|
|         |               | Y            | N            |
| 00+00   | 2             | Y            | N            |
|         | 4             | Y            | N            |
|         | 6             | Y            | N            |
|         | 8             | Y            | N            |
|         | 10            | Y            | N            |
|         | <del>12</del> | <del>Y</del> | <del>N</del> |
|         | <del>14</del> | <del>Y</del> | <del>N</del> |
| 01+00   | 2             | Y            | N            |
|         | 4             | Y            | N            |
|         | 6             | Y            | N            |
|         | 8             | Y            | N            |
|         | 10            | Y            | N            |
|         | 12            | Y            | N            |
|         | 14            | Y            | N            |
| 02+00   | 2             | Y            | N            |
|         | 4             | Y            | N            |
|         | 6             | Y            | N            |
|         | 8             | Y            | N            |
|         | 10            | Y            | N            |
|         | 12            | Y            | N            |
|         | <del>14</del> | <del>Y</del> | <del>N</del> |
| 03+00   | 2             | Y            | N            |
|         | 4             | Y            | N            |
|         | <del>6</del>  | <del>Y</del> | <del>N</del> |
|         | <del>8</del>  | <del>Y</del> | <del>N</del> |
|         | <del>10</del> | <del>Y</del> | <del>N</del> |
|         | <del>12</del> | <del>Y</del> | <del>N</del> |
|         | <del>14</del> | <del>Y</del> | <del>N</del> |

no willow plantings below 10

no willow plantings at 14 (below 12)

no willow plantings below 6

| Station              | Rag Tape      | Coverage?    |              |
|----------------------|---------------|--------------|--------------|
| 04+00                | 2             | Y            | N            |
|                      | 4             | Y            | N            |
|                      | 6             | Y            | N            |
|                      | 8             | Y            | N            |
| 05+00                | 2             | Y            | N            |
|                      | 4             | Y            | N            |
|                      | 6             | Y            | N            |
|                      | 8             | Y            | N            |
|                      | 10            | Y            | N            |
|                      | 12            | Y            | N            |
|                      | 14            | Y            | N            |
| 06+00                | 2             | Y            | N            |
|                      | 4             | Y            | N            |
|                      | 6             | Y            | N            |
|                      | 8             | Y            | N            |
|                      | 10            | Y            | N            |
|                      | 12            | Y            | N            |
|                      | <del>14</del> | <del>Y</del> | <del>N</del> |
| SF<br>06+95<br>06+75 | 2             | Y            | N            |
|                      | 4             | Y            | N            |
|                      | 6             | Y            | N            |
|                      | 8             | Y            | N            |
|                      | 10            | Y            | N            |
|                      | <del>12</del> | <del>Y</del> | <del>N</del> |
|                      | <del>14</del> | <del>Y</del> | <del>N</del> |

10 (N) 12 (N) 14 outside willow boundary.

- outside willow planting area

} outside willow planting area

ATTACHMENT A-2  
WHEELER BAY MONITORING  
PHOTOGRAPHS

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



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



Transect 01+50 at 140 Degrees (Grass, Willow, Armor Rock)



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



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



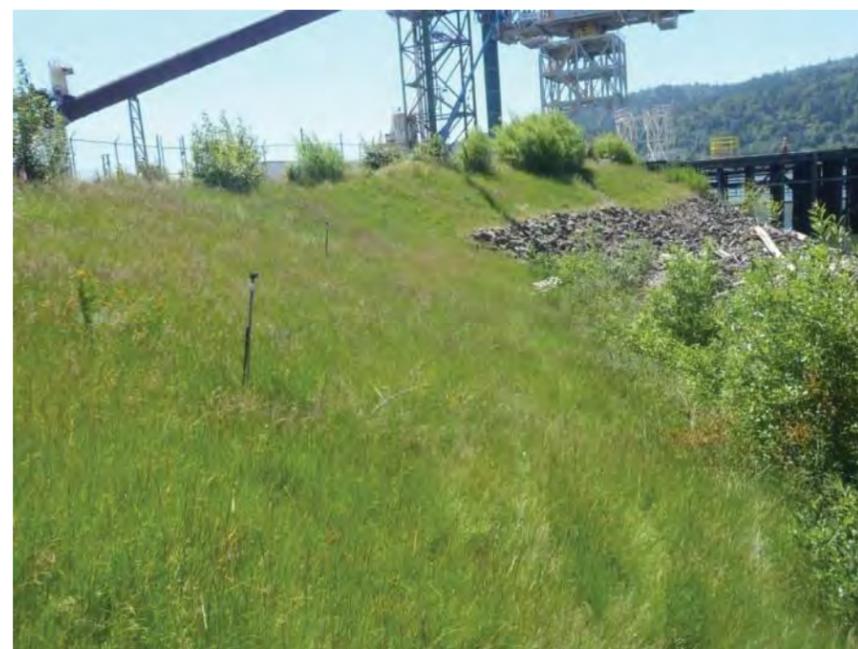
Transect 04+50 at 320 degrees (Grass, Willow, Armor Rock)



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



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



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



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



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



Transect 01+50 at 140 Degrees (Grass, Willow, Armor Rock)



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



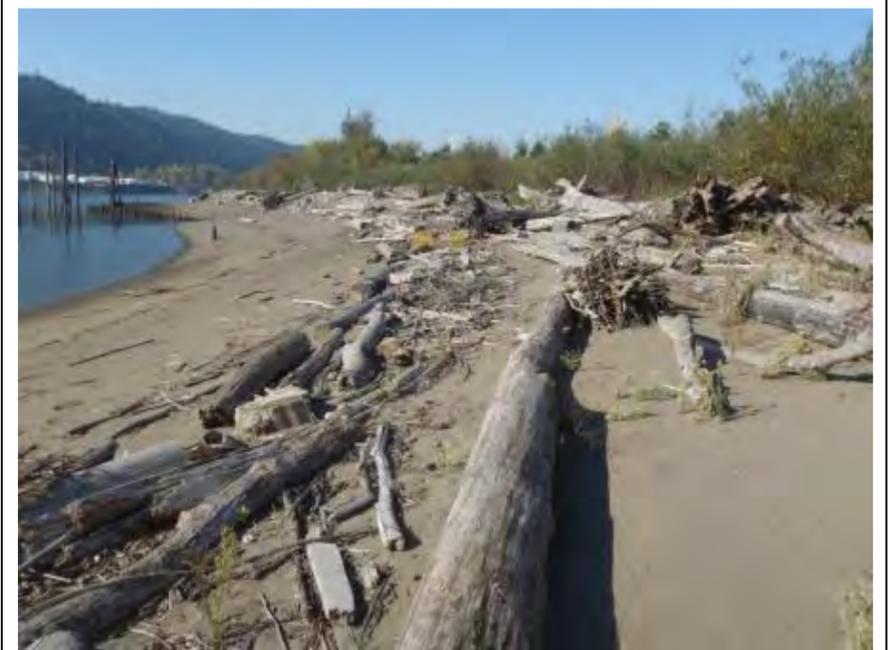
Transect 03+00 at 140 Degrees (Grass, Willow, Armor Rock)



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



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



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



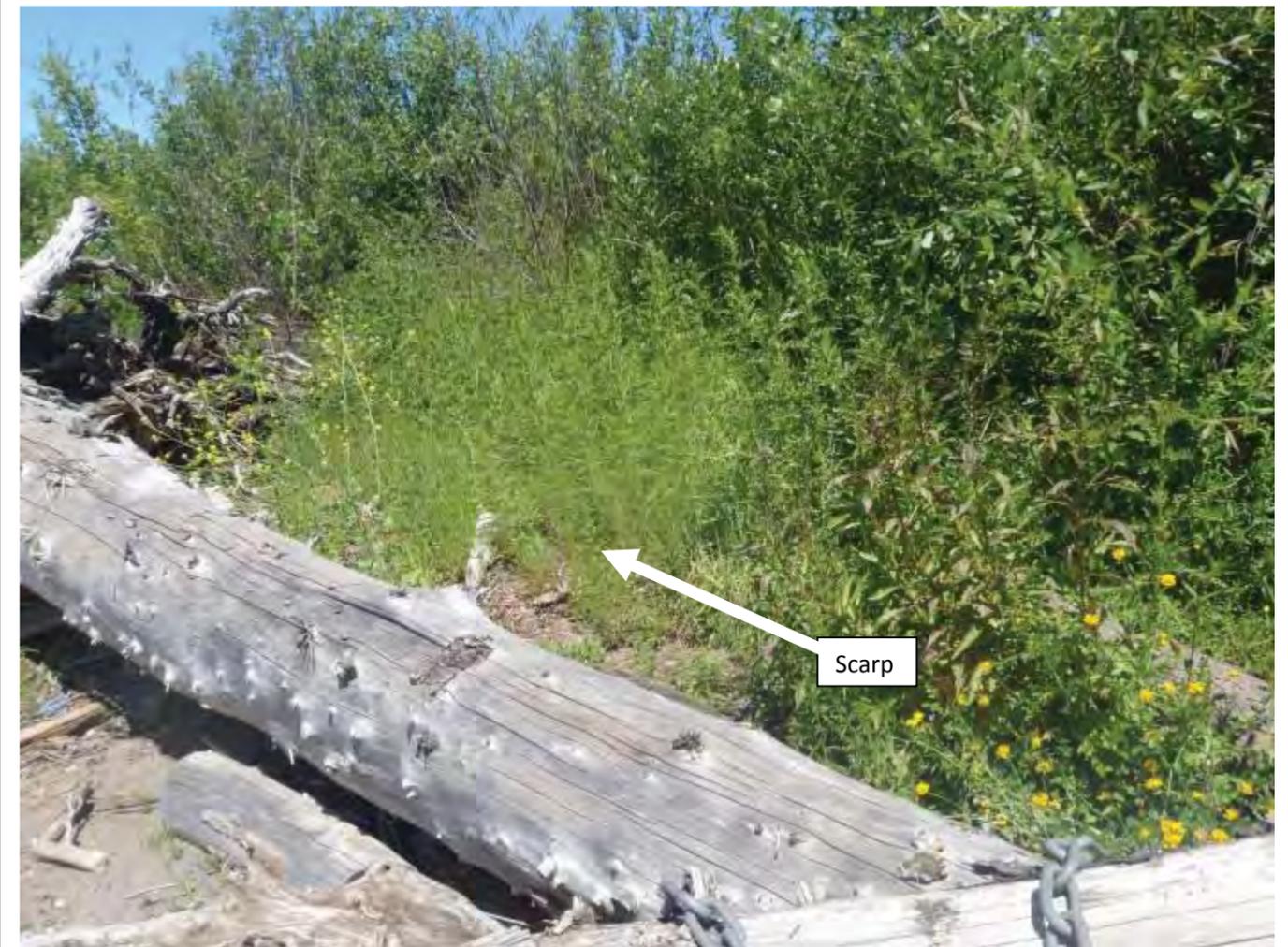
Transect 06+00 at 140 degrees (Grass, Willow, Armor Rock)

ATTACHMENT A-3  
WHEELER BAY SLOPE STABILITY  
PHOTOGRAPHS

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1-foot scarp in the willow planting area between Stations 00+00 and 01+60 (Photo Date: 6/4/2013).



1-foot scarp in the willow planting area between Stations 3+40 and 6+70. (Photo Dates: 6/4/2013)



1-foot scarp in the habitat material placed above the woody debris at Station 03+50 as part of the 2011 Repair (Photo Date: 6/4/2013).



1-foot scarp in the habitat material placed above the woody debris at Station 03+90 as part of the 2011 Repair (Photo Date: 6/4/2013).



Improvement in 4-inch sloughing of surficial layer along bottom of grass planting area between Stations 01+70 and 02+90 (Photo Date: 6/4/2013).

ATTACHMENT A-4  
WHEELER BAY HABITAT MATERIAL  
ASSESSMENT PHOTOGRAPHS

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Transect 03+75 (Top)



Transect 03+75 (Middle)



Transect 03+75 (Bottom)



Transect 04+25 (Top)



Transect 04+25 (Middle)



Transect 04+25 (Bottom)



Transect 04+75 (Top)



Transect 04+75 (Middle)



Transect 04+75 (Bottom)



Transect 05+25 (Top)



Transect 05+25 (Middle)



Transect 05+25 (Bottom)



Transect 05+75 (Top)



Transect 05+75 (Middle)



Transect 05+75 (Bottom)



Transect 06+25 (Top)



Transect 06+25 (Middle)



Transect 06+25 (Bottom)

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

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**ANCHOR Slope Observation Data Sheet**  
QEA

Project Name: \_\_\_\_\_ Project No: 050332-01

Year 5 Slope Obs @ Head of Slip 3

Observation Crew: Doug Laffoon, Julie Fox

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

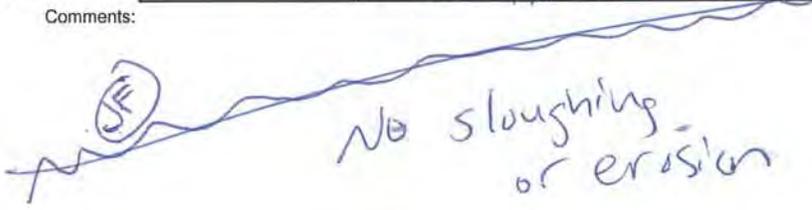
Weather: Sunny light wind

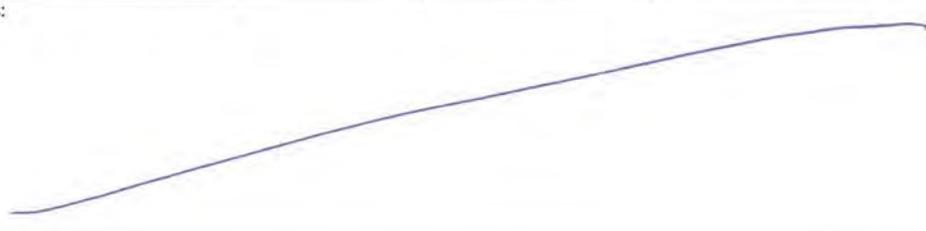
|  |             |              |               |    |
|--|-------------|--------------|---------------|----|
| <b>Transect 1</b>                        | #32 Upslope |              | Downslope #33 |    |
|  | N:          | E: ON TARGET | N:            | E: |
| Comments:<br>No slaughting<br>or erosion |             |              |               |    |

|  |             |              |               |    |
|--|-------------|--------------|---------------|----|
| <b>Transect 2</b>                        | #34 Upslope |              | Downslope #35 |    |
|  | N:          | E: ON TARGET | N:            | E: |
| Comments:<br>No slaughting<br>or erosion |             |              |               |    |

Pole @ 29'

|  |             |              |               |    |
|--|-------------|--------------|---------------|----|
| <b>Transect 3</b>                        | #36 Upslope |              | Downslope #37 |    |
|  | N:          | E: ON TARGET | N:            | E: |
| Comments:<br>NO slaughting or<br>erosion |             |              |               |    |

|  |             |              |               |    |
|--|-------------|--------------|---------------|----|
| <b>Transect 4</b>  | #38 Upslope |              | Downslope #39 |    |
|  | N:          | E: ON TARGET | N:            | E: |
| Comments:<br><br>No slaughting<br>or erosion |             |              |               |    |

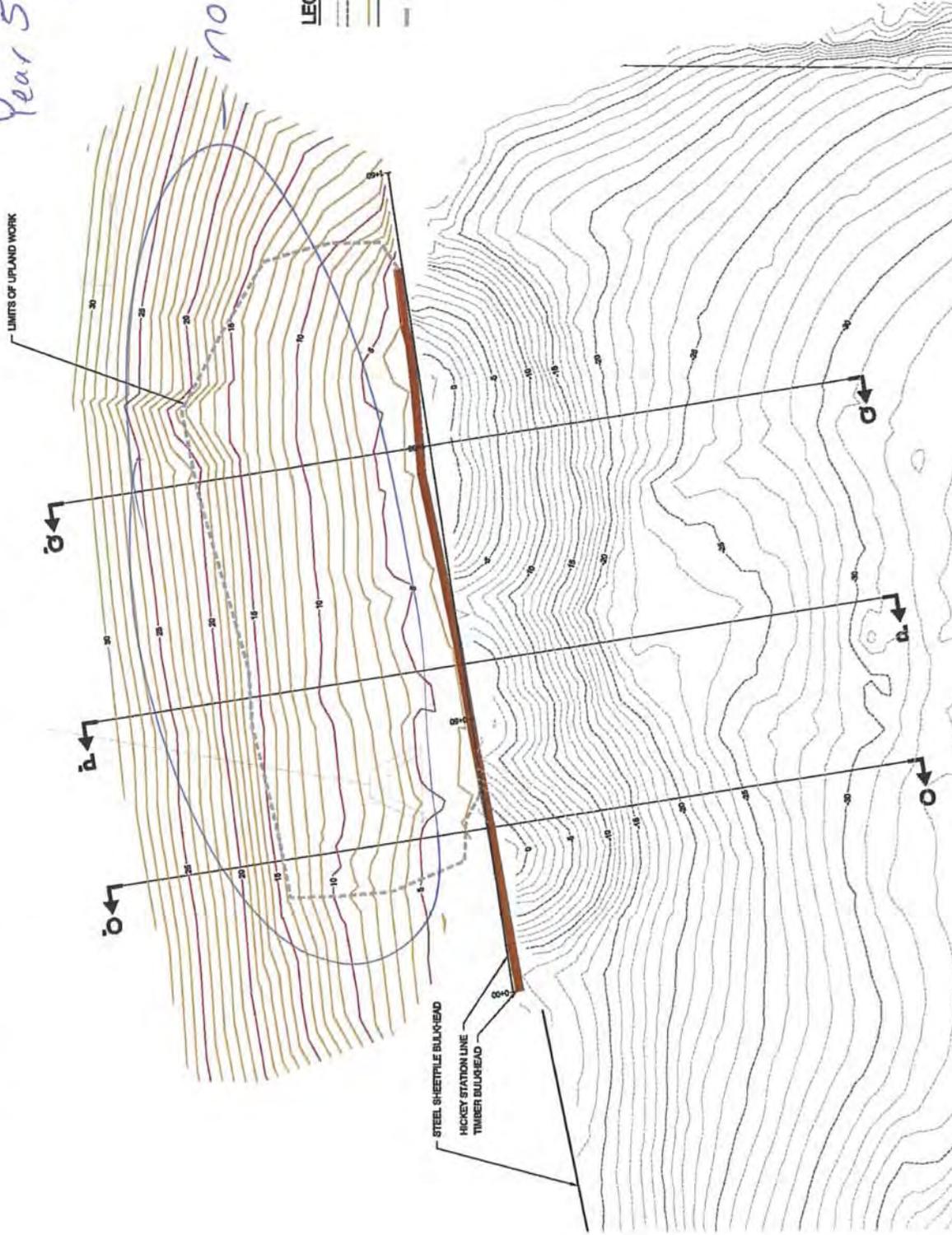
|   |         |    |           |    |
|---|---------|----|-----------|----|
| <b>Transect 5</b>   | Upslope |    | Downslope |    |
|   | N:      | E: | N:        | E: |
| Comments:<br> |         |    |           |    |

# Head of Slip 3 Cap Transects Observation

Date 10/24/2013

*Year 5 Slope Observation  
at Head of Slip 3*

*no sloughing or  
erosion.*



As-built Head of Slip 3 Capping and Upland Plan View and Cross Section Locations  
Terminal 4, Portland, Oregon



Recorded by Julie Fox

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

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North Transect, looking up-slope



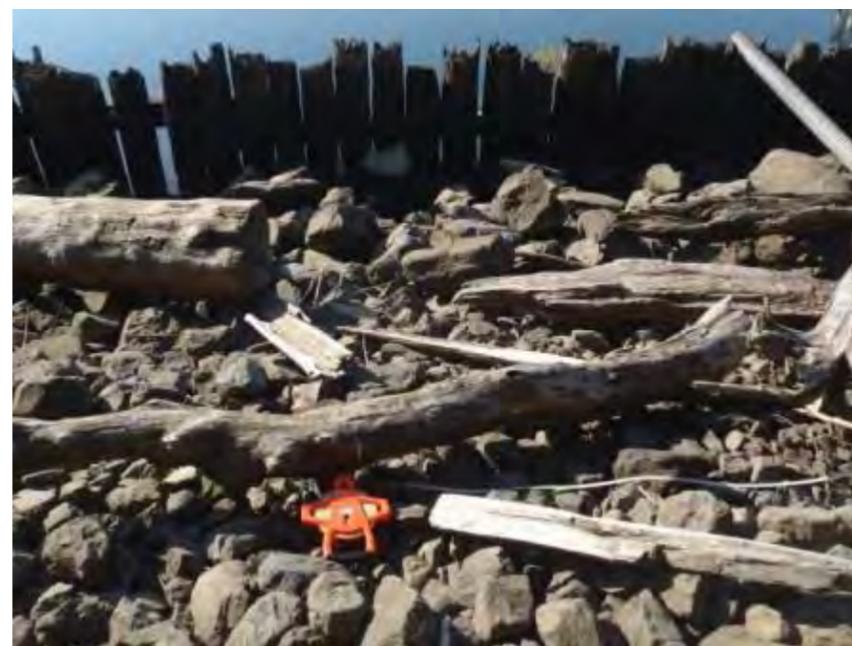
Middle Transect, looking up-slope



South Transect, looking up-slope



North Transect, looking down-slope



Middle Transect, looking down-slope



South Transect, looking down-slope

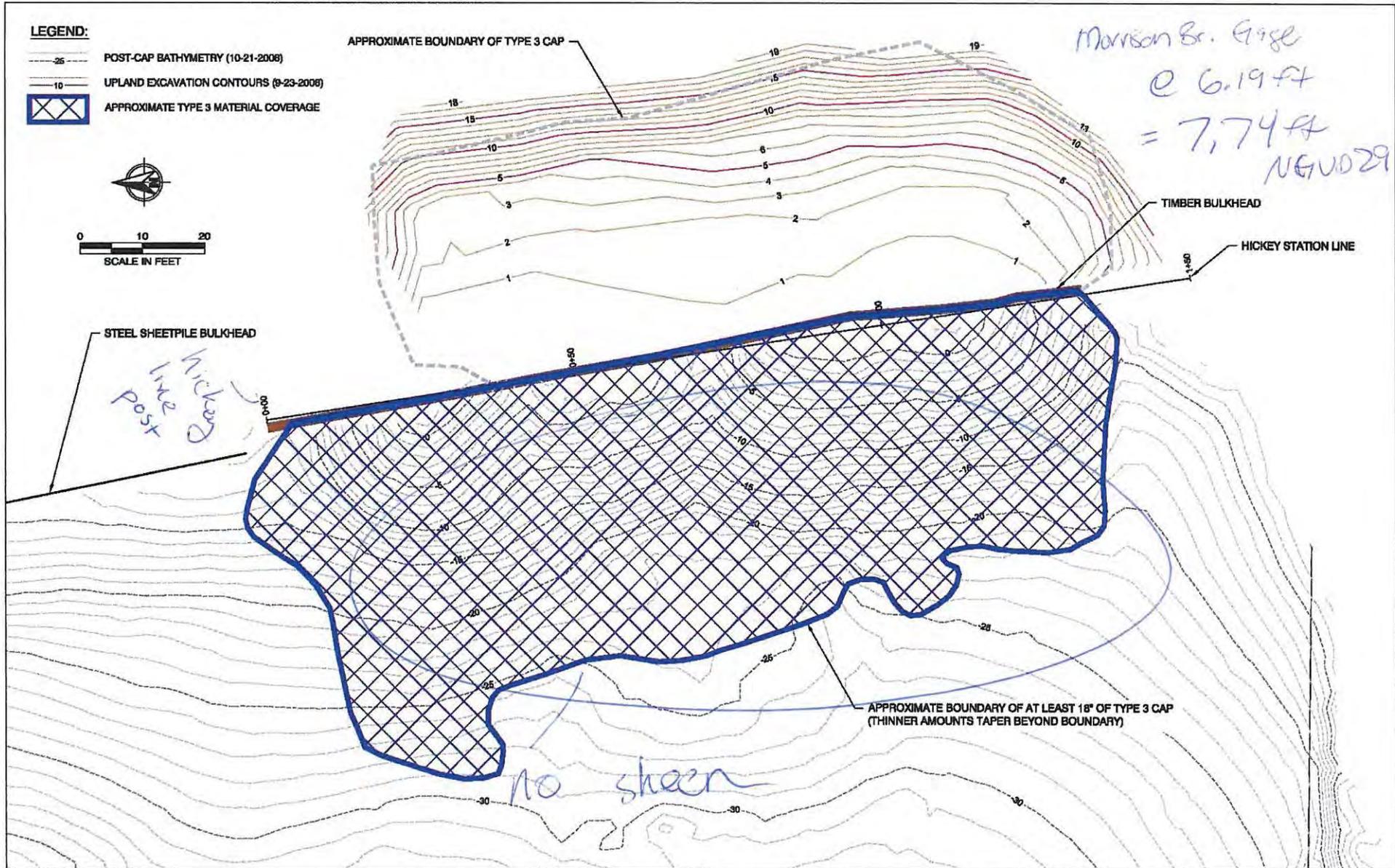
ATTACHMENT A-7  
HEAD OF SLIP 3 CAP MONITORING  
DATA SHEETS—SHEEN

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# Head of Slip 3 Cap Area Observation

Get elevation based on date/time

Date 15:15  
2/4/13



Extent of Type 3 Cap Placement and Extent of Upland Excavation -Head of Slip 3 Terminal 4, Portland, Oregon

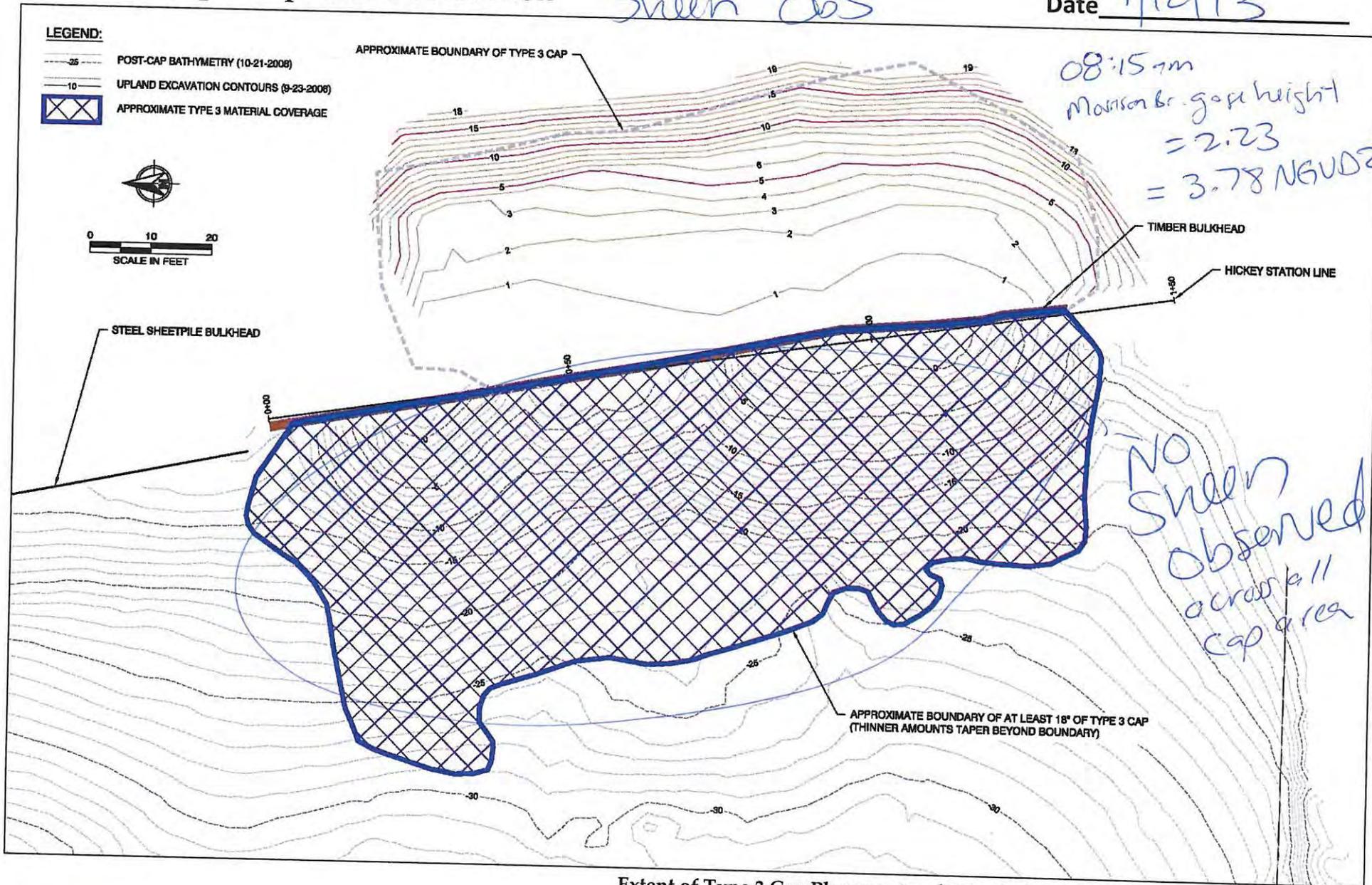


Recorded by Julie Fox, Gabe Nagler

# Head of Slip 3 Cap Area Observation

Low water  
Sheen obs

Date 9/12/13



Extent of Type 3 Cap Placement and Extent of Upland Excavation -Head of Slip 3 Terminal 4, Portland, Oregon



Recorded by [Signature]

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

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High Water Observation on 6/4/2013: No Sheen



Low Water Observation on 09/12/2013: No Sheen