Weyerhaeuser Company
Tacoma Export Facility

Operation Maintenance & Monitoring Plan

Wood Debris Monitoring Results

Prepared for

Weyerhaeuser Company
33663 Weyerhaeuser Way South
Federal Way, Washington 98003

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AGENCY REVIEW DRAFT

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10 YEARS 1996-2006

Table of Contents

List of Figures

List of Appendices

INTRODUCTION

In April of 2009 the Weyerhaeuser Company (Weyerhaeuser) performed wood debris monitoring in the head of the Hylebos Waterway, located in Commencement Bay, Washington (Figure 1), in order to fulfill requirements outlined in the 1997 Agreed Order (AO) for the Hylebos Wood Debris Site (HWDS; Ecology 1997) and accompanying Operations, Maintenance, and Monitoring Plan (OMMP; Shenk & Associates et al. 2000). The AO and OMMP were established as part of a Model Toxics Control Act (MTCA) cleanup of the Hylebos Waterway (Ecology 2001).

Under the AO and OMMP, Weyerhaeuser is required to monitor the areas of the HWDS where in-water log handling has occurred at Weyerhaeuser's Tacoma Export Facility (TEF) since the completion of the large-scale HWDS wood debris removal project in 2002 (Figure 2). In the spring of 2009, Weyerhaeuser moved its log export operations from the Port of Tacoma to the Port of Olympia, closed the TEF, and ceased wood handling operations in Commencement Bay. This report follows up on Weyerhaeuser's completion of all wood-handling operations at the former TEF. The following sections summarize the monitoring approach, procedures, and results of wood debris monitoring performed in 2009 under the AO and OMMP.

COMPLIANCE STANDARDS

The AO and OMMP specify that Weyerhaeuser must monitor for wood debris and re-engage in wood debris removal if there is more than 1 foot of wood present over 75 percent of the log ramp area. In addition, if there is an excess of 1 continuous acre of wood debris coverage greater than 75 percent, including the log ramp area, the ship loading area, or a combination of both, Weyerhaeuser must re-engage in wood debris removal where excesses occur, including areas with more than 50 percent wood coverage, if possible.

MONITORING AREAS

Monitoring took place adjacent to the TEF where Weyerhaeuser performed in-water log handling operations since 2002. In-water activities did not extend beyond a specific area within the HWDS, which is presented in Figure 2 and includes the following:

- **Area A**: The log ramp area.
- **Area B**: The log pen, where log wrangling and short-term storage occurred, which overlaps and occupies the area immediately adjacent to the log ramp area.
- **Area C**: The ship loading area.

Additionally, as part of the Hylebos Wood Debris Group (HWDG), Weyerhaeuser is required to participate with other parties that contributed wood debris to the HWDS in the monitoring of Area D (where no log storage or handling has taken place) and the Net Environmental Benefits Analysis (NEBA) Area, both of which are depicted in Figure 2. The NEBA and monitoring in Area D will be addressed together in a cooperative effort by the HWDG in either 2009 or 2010, as determined through negotiations between the HWDG and the Washington State Department

of Ecology (Ecology). Please refer to the discussion under "Recommendations for the NEBA and Area D" below for more details.

MONITORING APPROACH AND PROCEDURES

Photo Point Monitoring

The OMMP specifies that Weyerhaeuser is to monitor Areas B and C for surficial wood debris coverage. The monitoring procedures used in Areas B and C included the following:

- A diver-deployed camera to take digital photographs of the sediment surface at 45 monitoring locations across both areas (Appendix A).
    - Divers took plan view photographs of the sediment surface using a ¼-meter square quadrat as a point of reference for camera-to-sediment distance.
- The percent surficial wood coverage was measured on each photograph using a grid system.
    - The digital photographs were overlaid with a five by five grid, bounded by the ¼-meter square quadrat, to provide a wood debris coverage score, or "Wood Score" (Appendix B).
    - The Wood Score was calculated by dividing the number of grid squares containing wood by the total number of squares in the ¼-meter square quadrat and multiplying the result by 100, so that a score of 50 indicates that half, or 50 percent of the ¼-meter square quadrat was covered by wood.
    - Each photo point was then assigned a Wood Score, as follows:
        - Low = Wood Score of 0 to 25
        - Moderate = Wood Score of 25 to 75
        - High = Wood Score of 75 to 100
- Photo point monitoring locations were plotted on a map using a Geographic Information System (GIS) program and areas with a high wood score were delineated and measured in GIS to assess whether they exceeded the 1 contiguous acre criterion in the OMMP.

Wood Depth Monitoring

Weyerhaeuser monitored Area A in accordance with the OMMP to determine wood debris depth in the log ramp area. Monitoring procedures used in Area A included the following:

- Wood debris depth measurements at the eight monitoring locations, completed by a diver.
    - The diver used a metal rod marked at 1-inch intervals to penetrate through any surficial wood to identify the wood-sediment interface.

  - The diver documented the depth of wood at each monitoring location, in addition to measuring surficial wood debris coverage and identifying the sediment type (Appendix C).
- Wood depth monitoring locations were plotted on a map using GIS and assessed for exceedances of the "1 foot over 75 percent of the log ramp area" criterion in the OMMP.

Video Monitoring

Weyerhaeuser also performed an underwater video survey along four transects and in a crisscrossed pattern established over Areas A, B, and C. The video survey supplemented the photo and probe monitoring, and was not used as a primary monitoring tool at the HWDS.

The video records were reviewed and surficial wood coverage was visually classified into four categories based on the amount of coverage per the amount of surface visible during 1 second of video footage:

- No wood coverage = 0 percent cover
- Low wood coverage = 1 to 25 percent cover
- Moderate wood coverage = 25 to 75 percent cover
- High wood coverage = greater than 75 percent cover

The wood debris estimates were added to the electronic data files along with the time and coordinates recorded during the video monitoring. The time and location data were logged approximately once per second or approximately every 3 linear feet of transect. The wood debris coverage was then mapped in GIS to display the locations where surficial wood coverage was observed.

RESULTS

Surficial Wood Debris Monitoring

Area B was monitored using seven photo points and eight probe points as shown in Figure 3 and the following chart, which depicts the Area B monitoring locations relative to each other, the shore, and channel line.

Channel Line								
43 0				42 0		41 0		
		34 4		F 0		G 0		H 0
27 0				C 100	26 100	D 30	E 4	
		19 72			A 20		B 5	
Shore								

The colored cells correspond to the colors used in Figure 3 and depict the monitoring locations, relative in position to one another as well as the shore and channel (not to scale). Numbers represent photo point monitoring locations and the letters represent wood debris depth monitoring locations (probe points), which were also scored by divers for wood coverage. The values below each shaded cell represent the wood debris coverage score for that location.

Area B is approximately 2.5 acres in size and wood debris was detected in 8 out of 15 monitoring locations, with an average coverage of 42 percent across all locations where wood was detected. Due to an error in global positioning system (GPS) logging, Points 34 and 43 had to be relocated on the GIS map, because the coordinates for those locations recorded on the primary GPS unit corresponded to locations that were not used during monitoring. During monitoring, a secondary GPS system and map were used to track monitoring locations and Points 34 and 43 were moved to reflect the locations recorded on the secondary system. The primary and secondary GPS systems recorded the same monitoring locations for all of the other 43 locations. The wood debris coverage score distributions indicate that Area B has only moderate surficial wood coverage limited to the area within 90 feet of the dock in front of the shore, and is punctuated by one location with high surficial wood coverage. Based on the spatial analysis conducted through GIS, there is no possibility that a contiguous acre of high wood coverage exists in Area B (Figure 3).

Area C was monitored using 38 photo points as shown in Figure 3 and the following chart, which depicts the Area C monitoring locations relative to each other, the shore, and channel line.

Channel Line																		
40.5			40			39			38			37			36			35
0			0			0			0			0			0			0
33.5		33			32			31				30		29			28	
0		0			0			0				0		0			0	
			25			24			23			22			21			20
			0			100			40			0			0			0
	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
	0	52	4	32	24	48	32	32	48	100	4	20	32	56	100	0	0	24
Shore																		

The colored cells correspond to the colors used in Figure 3 and depict the monitoring locations by their number, relative in position to one another as well as the shore and channel (not to scale). The values below each shaded cell represent the wood debris coverage score for that location.

Area C is approximately 7 acres in size and wood debris was detected in 17 out of 38 photo points, with an average coverage of 44 percent across all locations where wood was detected. The wood debris coverage score distributions indicate that Area C has only moderate surficial wood coverage, which is limited to the area within 90 feet of shore, and is punctuated in three separate locations with high surficial wood coverage. Based on the spatial analysis conducted through GIS, there is no possibility that a contiguous acre of high wood coverage exists in Area C (Figure 4) or a combination of Areas B and C.

Wood Debris Depth Monitoring

Wood debris depth was monitored in Area A at eight locations as shown in Figure 3. Wood debris was detected in five out of eight monitoring points in area, with an average depth of less than 1 inch across all locations where wood was detected. The wood debris depth score

distributions indicate that Area A has only a light covering of surficial wood, which is limited to the area within 90 feet of the shore.

Video Transects

As depicted in Figure 4 the area in front of the former TEF generally has only low to moderate wood debris coverage. Areas with the highest surficial wood debris coverage are found in the former log handling areas and, generally, no surficial wood debris is observed beyond the channel line.

DISCUSSION

Compliance Evaluation

Weyerhaeuser is in compliance with the criteria in the OMMP for surficial wood debris coverage and depth as evidenced by the results of plan view photographs in Areas B and C and wood debris depth monitoring in Area A. The video survey confirms that Weyerhaeuser is in compliance with OMMP criteria and that Weyerhaeuser does not need to engage in further wood debris cleanup activities to in order to meet requirements under the AO or OMMP for the HWDS.

Current Nature and Extent of Wood Debris at the Former TEF

Pockets of residual wood debris remain under historical wood handling locations at the former TEF, shoreward of the channel line. Along the entire length of the facility, five isolated locations were found to have high surficial wood debris coverage. Those five locations are small and broken up by areas with zero, low, and moderate wood debris coverage. Of the locations with high wood coverage, the area in front of the former log ramp has the most wood. In that area, hand probe monitoring showed that the wood was less than 1-inch deep. Beyond the channel line, the sediment surface is almost completely free of wood.

Recommendations for Additional Monitoring

Because Weyerhaeuser has decommissioned the TEF, and this monitoring effort follows up on all Weyerhaeuser in-water log handling activities in the area, no further monitoring of the TEF is recommended.

Recommendations for the NEBA and Area D

According to the OMMP and Compliance Monitoring Plan (CMP; FSI et al. 2000) for the HWDS, the NEBA and monitoring of Area D are to occur after the HWDG and Ecology come to an agreement on a timeline and approach for each of those efforts. The timing of the NEBA is supposed to coincide with benthic infaunal recolonization in the areas dredged as part of the large-scale wood debris removal effort at the HWDS in 2002 and 2006 (FSI et al. 2000). The presumption is that 3 years is adequate for benthic infaunal succession to occur and therefore the NEBA can occur as early as 2009. A final determination of readiness for the NEBA will be

made after Ecology and the HWDG agree on appropriate reference areas to compare against the area in which the NEBA will occur and a preliminary analysis has been completed to determine that benthic infaunal succession has reached an appropriate point for the implementation of the NEBA.

It is recommended that Area D be monitored after Manke completes wood debris monitoring along its property and can convene with the rest of the HWDG and Ecology to determine methods and a timeline for that work.

REFERENCES

Floyd & Snider Inc. (FSI), Pentec Environmental, Inc., Evans-Hamilton Inc. 2000. *Compliance Monitoring Plan for the Hylebos Waterway Wood Debris Program.* Prepared for the Hylebos Waterway Wood Debris Group. Seattle, WA.

Shenk & Associates, Floyd & Snider Inc., and Pentec Environmental, Inc. 2000. *Hylebos Waterway Wood Debris Program: Operation Maintenance & Monitoring Plan*. Prepared for the Hylebos Waterway Wood Debris Group. Seattle, Washington.

Washington State Department of Ecology (Ecology). 1997. Agreed Order with the Hylebos Wood Debris Group. Olympia, Washington.

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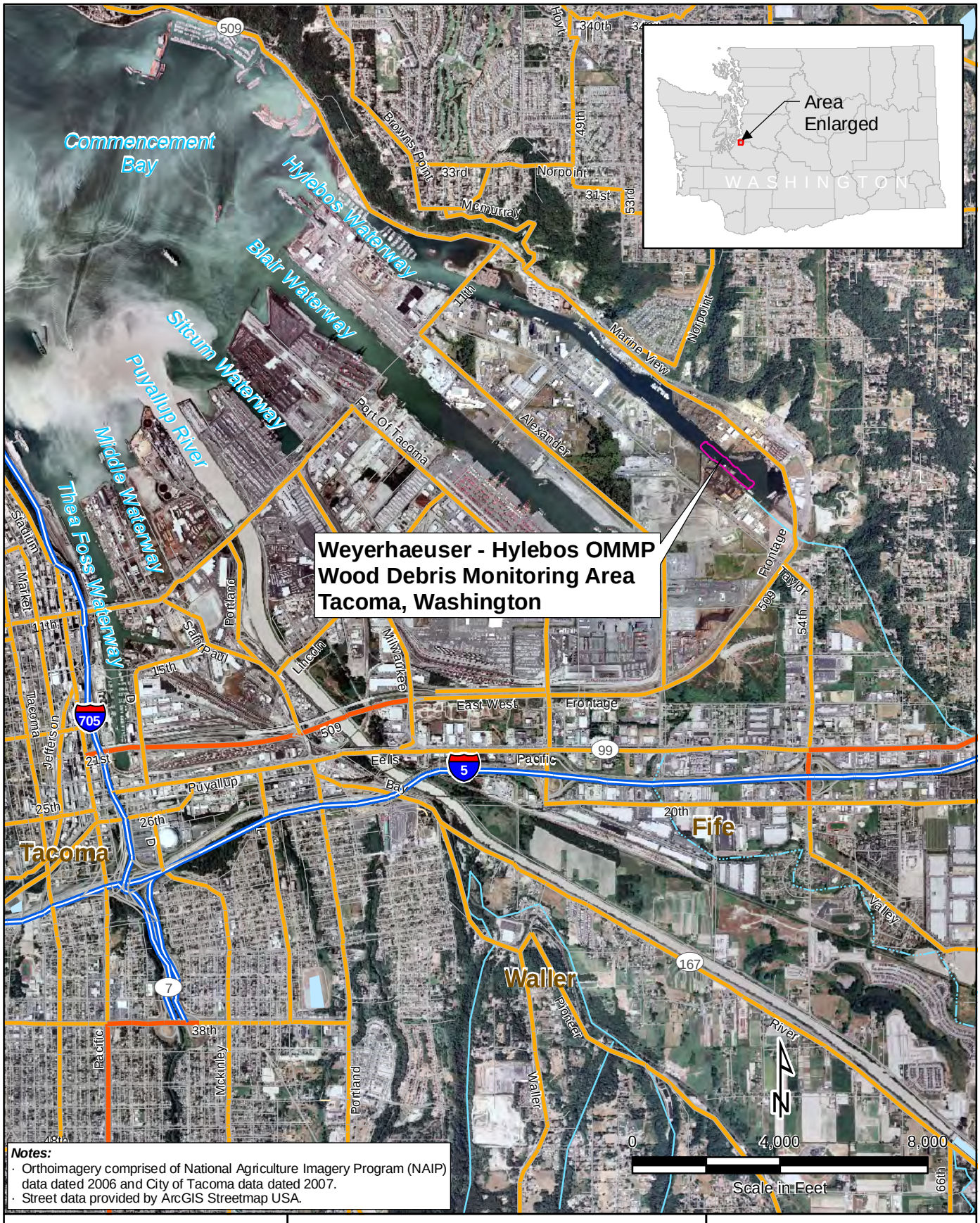
Operation Maintenance and Monitoring Plan

Wood Debris Monitoring Results

Figures

AGENCY REVIEW DRAFT



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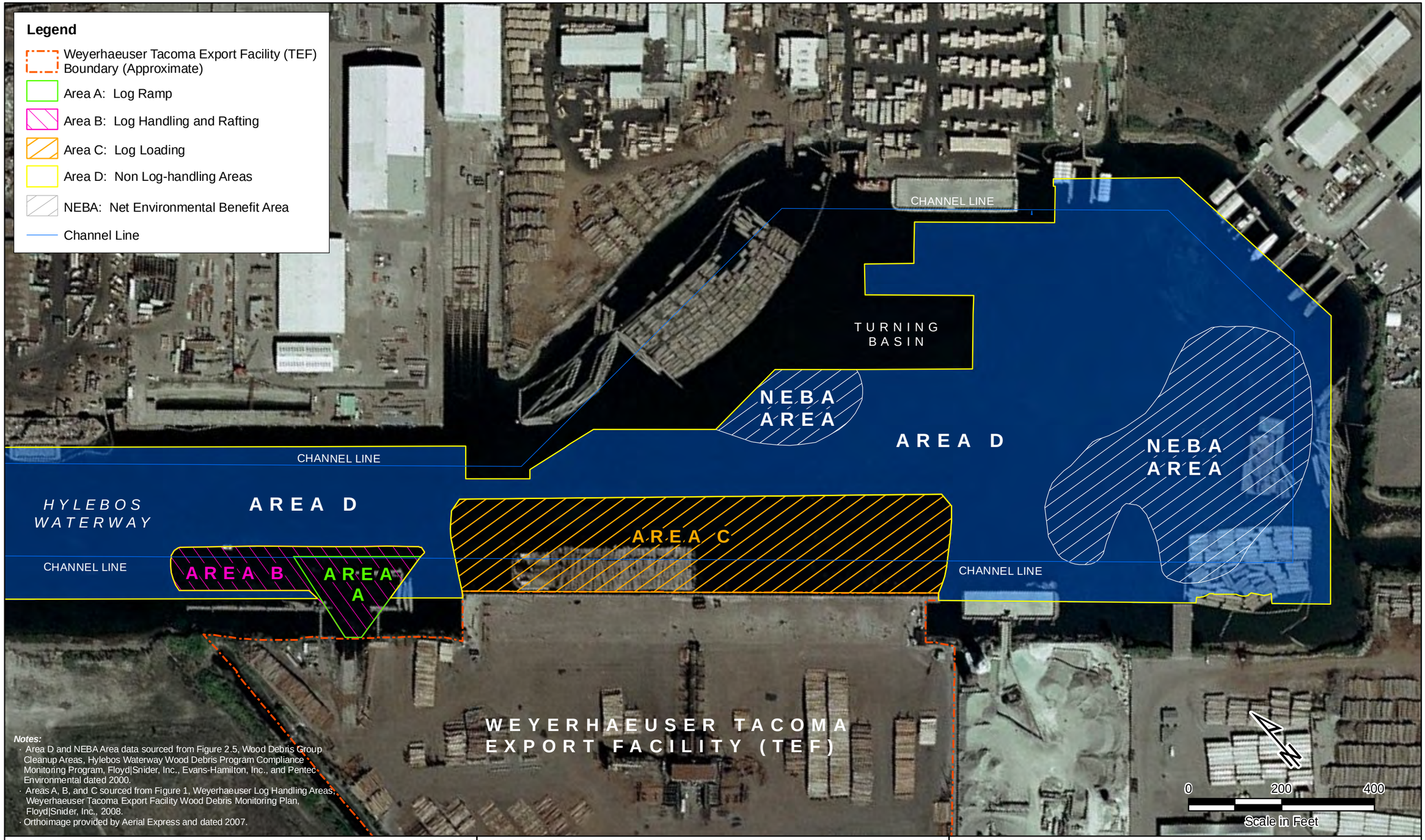
OMMP Wood Debris Monitoring Results
Weyerhaeuser Hylebos TEF
Hylebos Waterway
Tacoma, Washington

Figure 1
Vicinity Map of the
Hylebos Waterway

File: F:\projects\Weyer Hylebos OMMP\GIS\MXD\Figure 1 (Site Vicinity Map).mxd
6/23/2009



Notes:

- Area D and NEBA Area data sourced from Figure 2.5, Wood Debris Group Cleanup Areas, Hylebos Waterway Wood Debris Program Compliance Monitoring Program, Floyd|Snider, Inc., Evans-Hamilton, Inc., and Pentec Environmental dated 2000.
- Areas A, B, and C sourced from Figure 1, Weyerhaeuser Log Handling Areas, Weyerhaeuser Tacoma Export Facility Wood Debris Monitoring Plan, Floyd|Snider, Inc., 2008.
- Orthoimage provided by Aerial Express and dated 2007.

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OMMP Wood Debris Monitoring Results
Weyerhaeuser Hylebos TEF
Hylebos Waterway
Tacoma, Washington

Figure 2
Weyerhaeuser Tacoma Export Facility Wood Debris Monitoring Plan Areas A, B, & C, Hylebos Wood Debris Site Area D, and Net Environmental Benefit Analysis Areas (NEBAs)

File: F:\projects\Weyer Hylebos OMMP\GIS\MXD\Figure 2 (Locations of Multiple Areas).mxd
6/23/2009

Legend

% Wood Debris Coverage Observed in Photo Point Locations	*% Wood Debris Coverage Observed in Hand Probe Locations*	
0 - 25	0 - 20	
25 - 75	25 - 75	
75 - 100	75 - 100	

0.53 Acres — Worst-Case Scenario Areas where 75% or Greater Wood Debris Coverage Exists

27 — Photo Point Location and Designation

D<1 in. — Hand Probe Location and Designation with Recorded Wood Debris Depth

Approximate Extent of Monitoring Area

Turning Basin

Hylebos Waterway

CHANNEL LINE

CHANNEL LINE

0.18 Acres

0.1Acres

0.06 Acres

0.04 Acres

Notes:

1. Due to mis-logged GPS data, photo points 34 and 43 were manually relocated using an aerial photo reference image to better reflect their locations based on field notes and observations.

- Locations of photo points and hand probes were collected during 2009 wood debris survey performed by Floyd|Snider, Inc., and Research Support Services.
- Wood debris depths for hand probe locations are less than 1 inch.
- Orthoimage provided by Aerial Express and dated 2007.

0 150 300

Scale in Feet

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OMMP Wood Debris Monitoring Results
Weyerhaeuser Hylebos TEF
Hylebos Waterway
Tacoma, Washington

Figure 3
Wood Debris Coverage and Depth Monitoring Results

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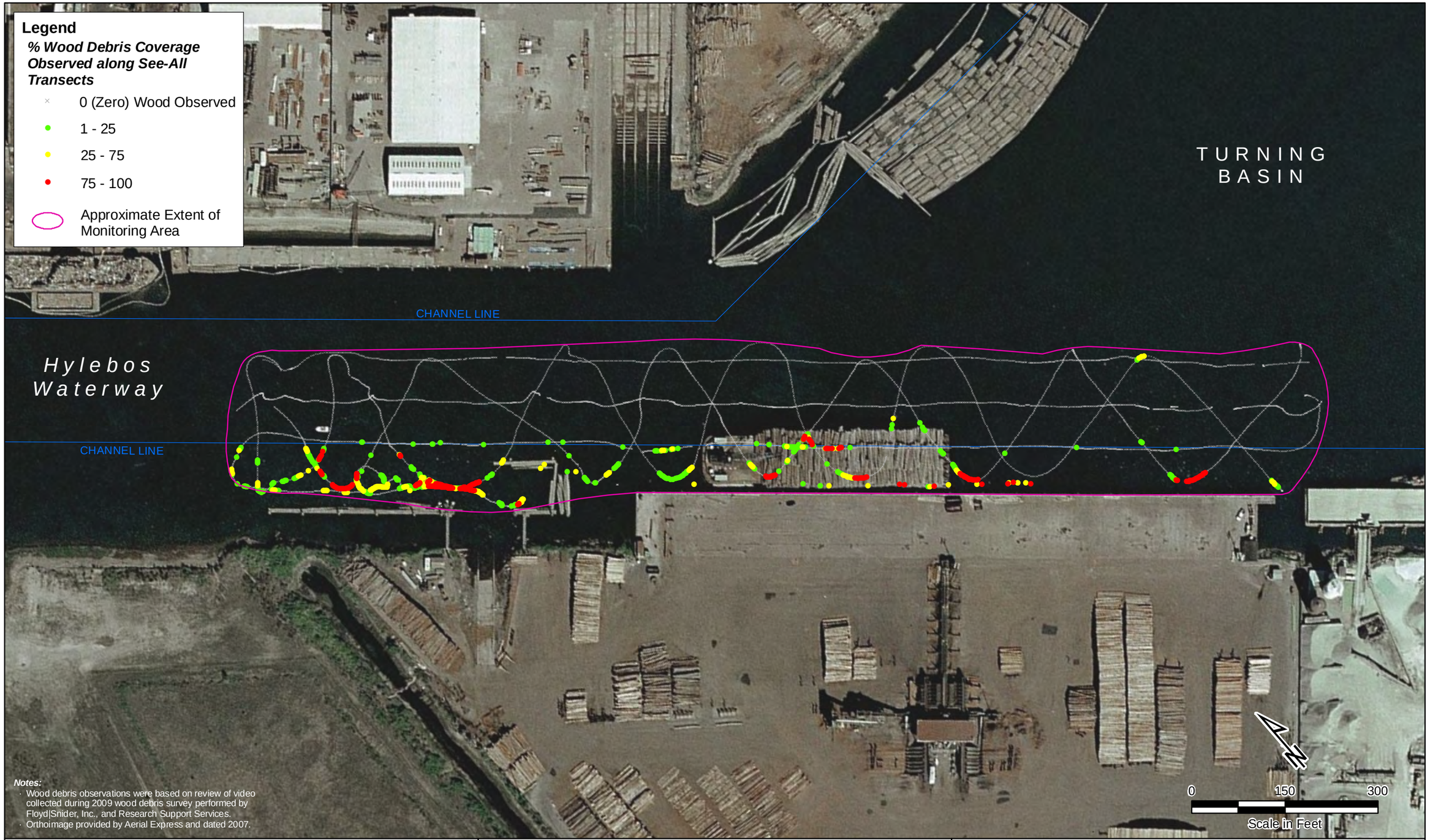

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OMMP Wood Debris Monitoring Results
Weyerhaeuser Hylebos TEF
Hylebos Waterway
Tacoma, Washington

Figure 4
Wood Debris Coverage based on 2009 Video Survey

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Operation Maintenance and Monitoring Plan

Wood Debris Monitoring Results

Appendix A
Photographs from Photo Point Monitoring

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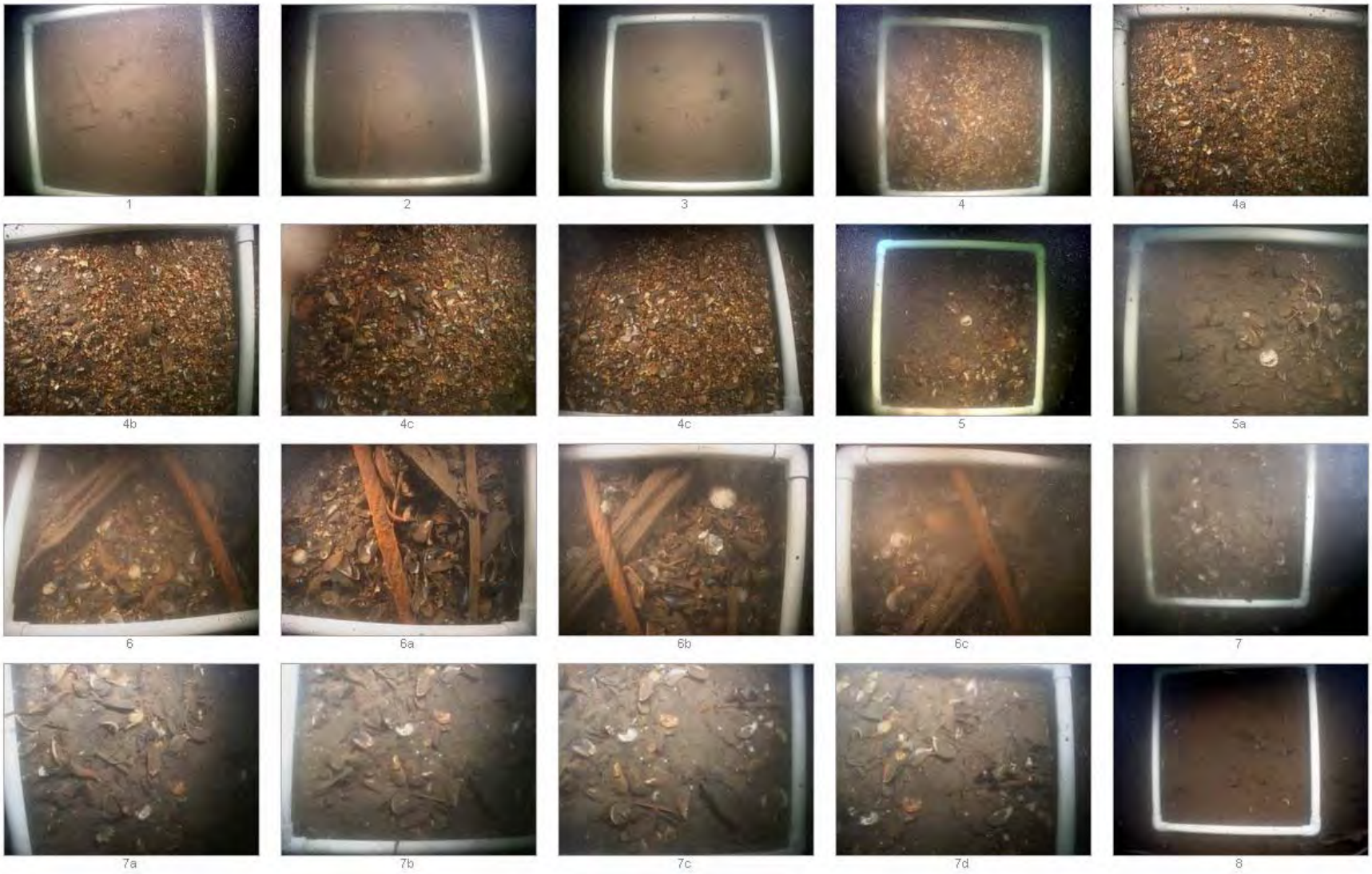
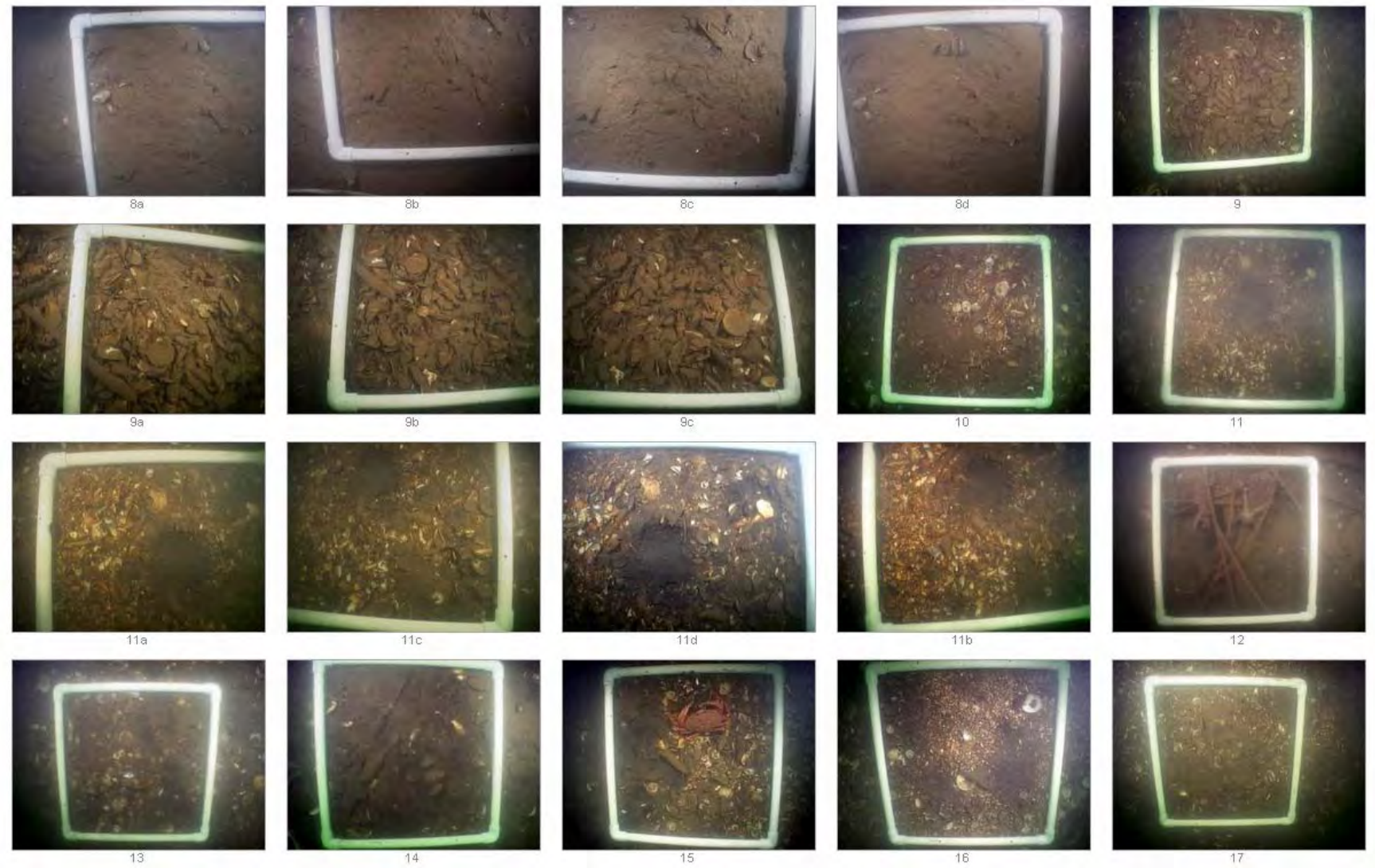
Photographs from Photo Point Monitoring



Photographs from Photo Point Monitoring



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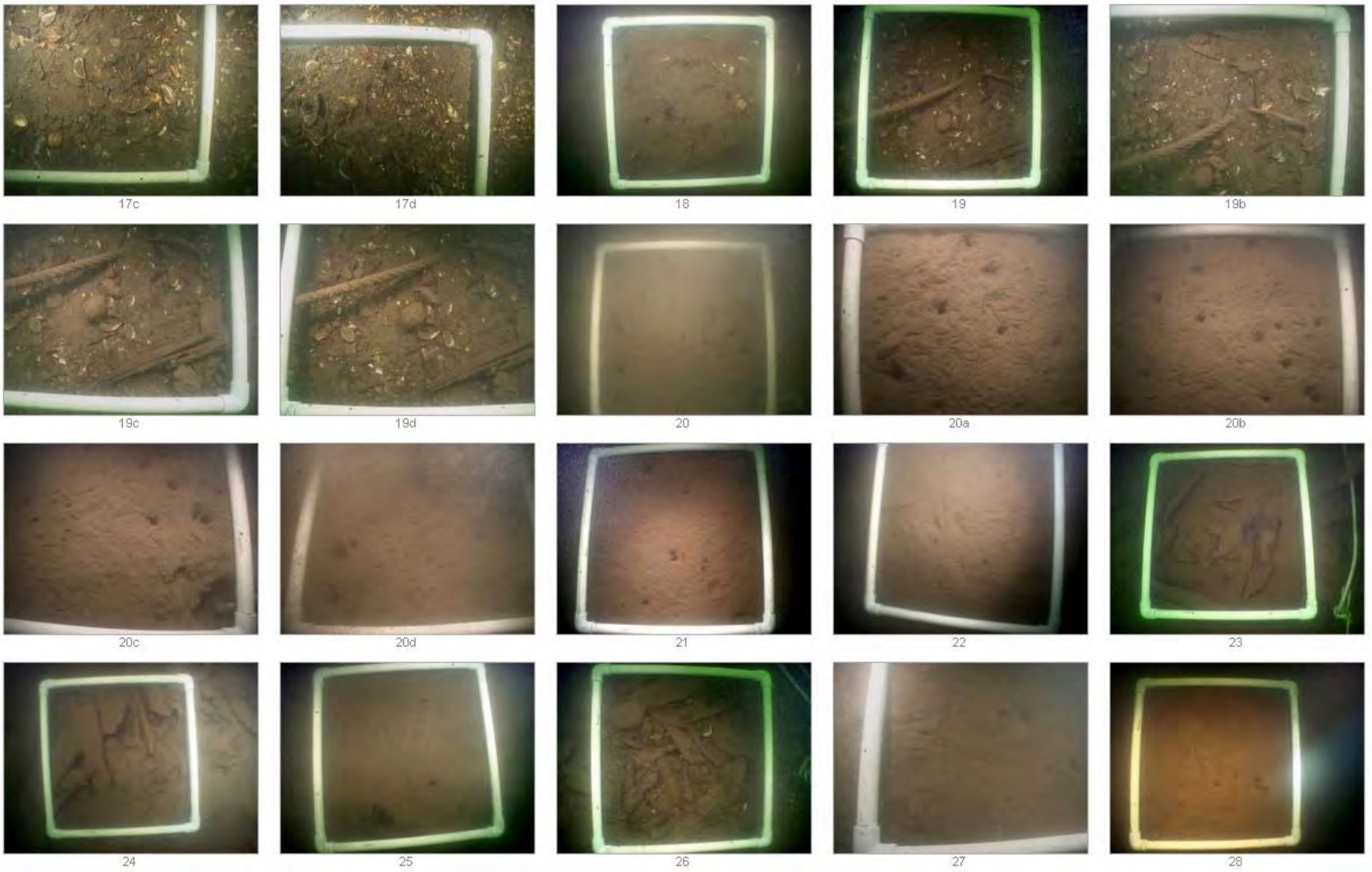

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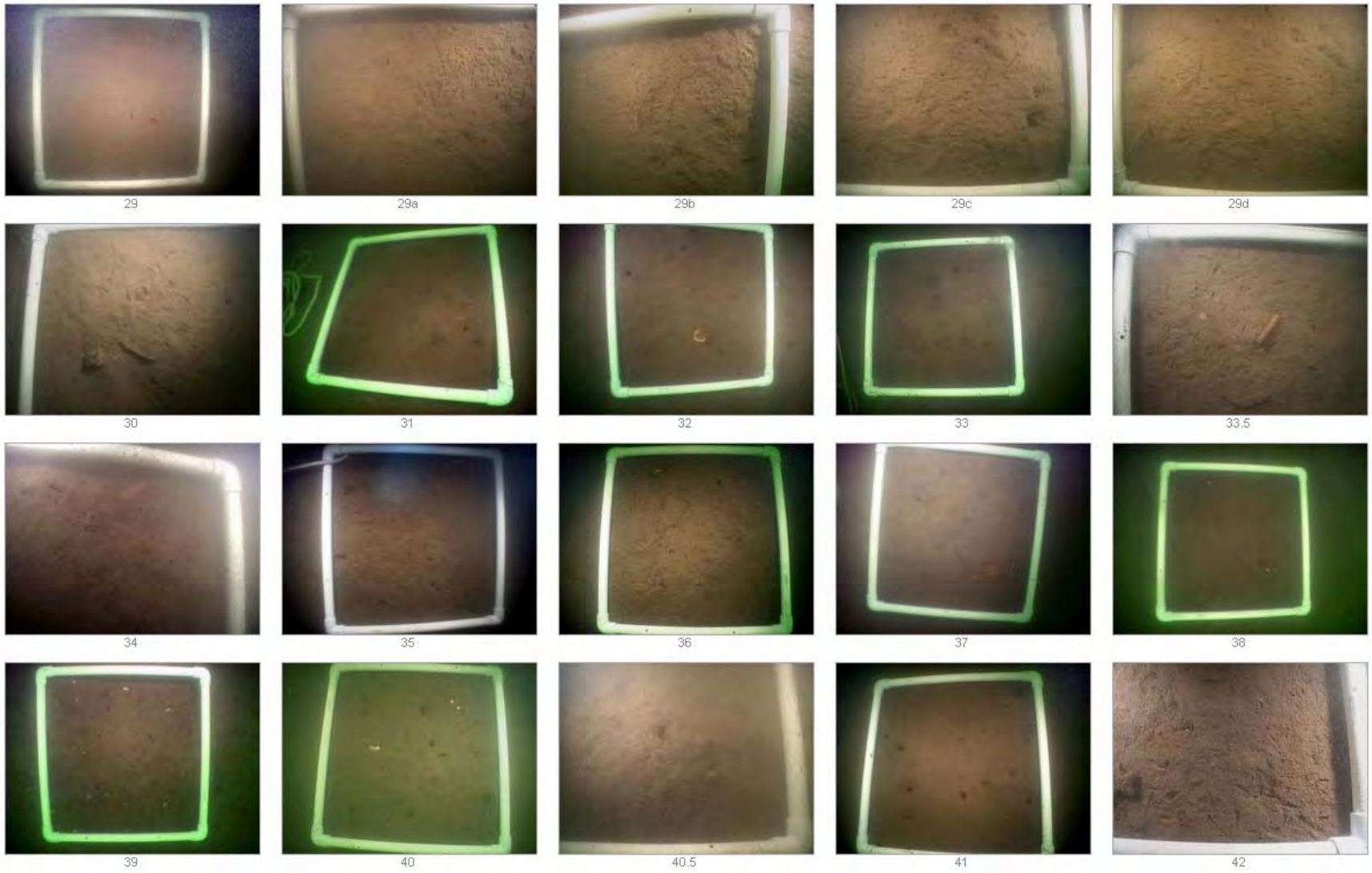

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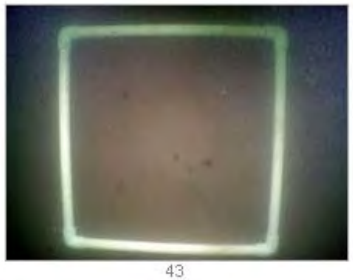

43

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Tacoma Export Facility

Operation Maintenance and Monitoring Plan

Wood Debris Monitoring Results

Appendix B
Surficial Wood Debris Monitoring Results

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Photo Point Monitoring Results

Location	Wood Score	Easting	Northing
1	24	548157.7271	5234513.227
2	0	548144.4249	5234526.409
3	0	548131.219	5234538.925
4	100	548118.0231	5234551.143
5	56	548104.1574	5234562.939
6	32	548089.7418	5234574.454
7	20	548076.6767	5234587.356
8	4	548062.6738	5234599.301
9	100	548049.1405	5234611.191
10	48	548035.4272	5234623.815
11	32	548021.8284	5234635.396
12	32	548007.7823	5234647.096
13	48	547994.2088	5234659.297
14	24	547980.9114	5234671.975
15	32	547966.4264	5234683.713
16	4	547952.984	5234695.623
17	52	547939.0342	5234707.611
18	0	547925.2969	5234719.527
19	72	547826.0093	5234805.22
20	0	548170.8303	5234529.989
21	0	548129.3611	5234565.421
22	0	548083.7448	5234606.643
23	40	548047.3793	5234638.863
24	100	548006.4949	5234674.22
25	0	547964.6992	5234710.978
26	100	547864.8008	5234799.132
27	0	547799.2329	5234856.912
28	0	548172.2487	5234546.222
29	0	548131.7395	5234583.638

Photo Point Monitoring Results

Location	Wood Score	Easting	Northing
30	0	548092.6512	5234620.361
31	0	548051.245	5234659.349
32	0	548012.057	5234695.427
33	0	547970.995	5234733.158
33.5	0	547944.955	5234757.327
34	4	547785.2642	5234840.496
35	0	548190.018	5234558.575
36	0	548150.1327	5234595.548
37	0	548108.7867	5234632.656
38	0	548070.1459	5234671.159
39	0	548028.3135	5234707.726
40	0	547949.7447	5234783.299
40.5	0	547988.6999	5234745.033
41	0	547921.839	5234808.087
42	0	547897.2163	5234832.018
43	0	547813.3505	5234872.695
A	20	547851.82	5234769.46
B	5	547866.25	5234756.86
C	100	547851.72	5234794.15
D	30	547870.29	5234778.11
E	4	547889.74	5234761.89
F	0	547852.51	5234817.41
G	0	547879.21	5234792.06
H	0	547909.64	5234769.22

Weyerhaeuser Hylebos
Tacoma Export Facility

Operation Maintenance and Monitoring Plan

Wood Debris Monitoring Results

Appendix C
Wood Debris Depth Monitoring Data

AGENCY REVIEW DRAFT

Wood Debris Depth Monitoring Data

Pt	Easting	Northing	Water Depth	Probe Depth	Description
A	547851.82	5234769.46	22 ft @ 12:24 pm	12 in. silt over clay. < 1in. wood.	20% surface wood debris. No subsurface wood debris.
B	547866.25	5234756.86	20 ft @ 12:25 pm	19 in. silt over clay. < 1in. wood.	5% surface wood debris. No subsurface wood debris. Silt over clay.
C	547851.72	5234794.15	36 ft @ 12:32 pm	7 in. silt over clay < 1in. wood.	100% wood debris cover composed of light bark & wood debris, with slightly sandy silt. No subsurface wood debris.
D	547870.29	5234778.11	36 ft @ 12:30 pm	17 in. silt over clay < 1in. wood.	30% wood debris cover. Surface sed. fine and sandy silt. Layer of wood debris over clay in places, mostly silt.
E	547889.74	5234761.89	35 ft @ 12:27 pm	8 in. of silt over sand. 18 in. to clay. < 1in. wood.	Less than 5% surface wood debris. Silt with sandy layer below. Clay below that.
F	547852.51	5234817.41	39 ft @ 01:38 pm	6 in. silt over sand. 16 in. to clay.	No surface wood debris. Sandy silt bottom.
G	547879.21	5234792.06	39 ft @ 01:33 pm	8 in. stiff silt over clay	No surface wood debris. Stiff silt bottom.
H	547909.64	5234769.22	40 ft @ 01:31 pm	2 in. sandy silt over clay.	No surface wood debris. Sandy silt bottom.