Appendix D: Proposed Enhancements to Shoreline Conditions within the Log Pond

Whatcom Waterway Site
Bellingham, Washington

Prepared by:

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RETEC Project Number: PORTB-18876

Prepared for:

The Port of Bellingham
1801 Roeder Avenue
Bellingham, Washington 98225

October 10, 2006

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Table of Contents

List of Tables

List of Figures

1 Introduction

This appendix summarizes proposed enhancements to the shoreline within the area of the Whatcom Waterway site known as the Log Pond. A sediment cap was placed within the Log Pond by Georgia Pacific West, Inc. (GP) in 2000 as an Interim Remedial Action consistent with a Department of Ecology Agreed Order (00TCPNR-1418). The project was also authorized under Clean Water Act Permit No. 2002-2-00424 administered by the US Army Corps of Engineers (Corps). The sediment cap included containment measures to remediate sediment impacts while also enhancing and restoring inter-tidal and shallow sub-tidal aquatic habitat.

In 2005, the Port of Bellingham (Port) assumed responsibility from GP for work carried out in the Log Pond under this Agreed Order. Consistent with the requirements of the Agreed Order, The RETEC Group, Inc. (RETEC) performed Year 5 monitoring of the cap as designated by the Operations, Maintenance, and Monitoring Plan (OMMP, Anchor, 2001a). The OMMP includes provisions for compliance monitoring at years 1, 2, 5, and 10 after construction. Implementation of the OMMP is required under Corps permit No. 2000-2-00424. The findings of Year-5 Long Pond monitoring were summarized in Appendix I of Volume 1 of the Draft Supplemental Remedial Investigation & Feasibility Study (RI Report, RETEC, 2006).

This appendix describes proposed shoreline stability enhancements that will be implemented as part of the final Whatcom Waterway site cleanup. The purpose of the shoreline enhancements is to reduce the potential for shoreline erosion of the shoreline and of the cap edges, and to ensure long-term integrity of the cap edges.

2 Summary of Year 5 Monitoring Results

The Log Pond Interim Action included provisions for compliance monitoring at years 1, 2, 5 and 10 after construction. The monitoring procedures are defined in the OMMP and in the Army Corps of Engineers permit (Permit No. 2000-2-00424) for the project.

Year 5 monitoring was performed by RETEC as part of the Whatcom Waterway RI/FS and to satisfy the Year 5 monitoring requirements of the OMMP. A complete summary of the Year 5 monitoring event is included as Appendix I of the RI Report.

Most Log Pond monitoring conditions were consistent with cap design criteria. However, some shoreline erosion was noted in two areas, and limited cap recontamination was noted in one area of the Log Pond. The following portions of Section 2 provide brief review of the findings of Year-5 monitoring as they relate to the extent of shoreline erosion and the distribution of contamination in surface sediments. Refer to Appendix I of the RI Report for a complete discussion of the Year-5 monitoring event.

2.1 Surface Sediment Quality

Surface sediment sampling was initially conducted at six locations, consistent with the OMMP. Samples were collected from the top 12 centimeters of single grabs at six (6) locations within the Log Pond, as shown in Figure 1 (SS-40, SS-75, SS-76, SS-301, SS-WP-1, and SS-WP-2).

All phenolics, benzoic acid, and benzyl alcohol were either not detected or were below SQS criteria in all samples, which is consistent with Year 1 and Year 2 monitoring results. Total organic carbon (TOC) and total solids results were also consistent with the ranges of historic data from Years 1 and 2 (Table 4-2, Appendix I of RI Report).

With the exception of station SS-WP-1, mercury concentrations at the Year-5 monitoring locations were at or below Sediment Quality Standards (SQS) criteria. Samples at stations SS-301, SS-40, SS-75, and SS-WP-2 did not exceed the chemical SQS for mercury (0.41 mg/kg). Mercury concentrations at station SS-76 exceeded the chemical SQS, but passed confirmatory bioassays, indicating that sediments in this area continue to comply with the SQS. However, sediment mercury concentrations at SS-WP-1 exceeded the chemical SQS and also the site-specific bioaccumulation screening level (BSL; 1.2 mg/kg).

Additional surface sediment sampling was performed to supplement the Year-5 Log Pond monitoring data. This sampling included supplemental locations

in the vicinity of SS-WP-1 where elevated mercury levels were observed. Sampling was also performed along the Central Log Pond shoreline where some erosion was observed (refer to Section 2.2 below). Figure 5 summarizes the results of this supplemental sediment testing.

As shown in Figure 5, no mercury exceedances of the SQS (0.41 mg/kg) were noted in any of the stations along the Central Log Pond shoreline (stations SS-E1 through SS-E4). This area is subjected to the highest wave energies and has exhibited cap edge erosion. However, the cap thickness to date remains sufficient to have maintained containment over the sediments capped in this area.

In the Southern and Western areas of the Log Pond, elevated mercury concentrations were detected at four locations adjacent to station SS-WP-1 (the sample from Year-5 monitoring that contained elevated mercury levels). These samples included SS-W1, SS-W2, SS-W4 and SS-W6. One of these locations (SS-W4) was located outside of the area initially capped as part of the Log Pond Interim Action. The remaining samples were located within the designed cap limits.

Results from supplemental testing indicate that the surface detections of mercury at SS-WP-1 were caused by the resuspension of impacted sediments in the extreme southwestern corner of the Log Pond (the area represented by station SS-W4). The current distribution of mercury exceedances is very limited in extent. No evidence of similar edge effects were noted in the Central shoreline area, though limited erosion that has been observed in that area.

2.2 Bathymetric Monitoring

Year 5 bathymetric monitoring was performed on October 12, 2005 by Blue Water Engineering using equivalent methods and transects used during previous surveys. Figure 1 includes bathymetric contours measured during Year 5 monitoring.

Changes in cap bathymetry since initial construction were estimated by comparing 2001 post-construction bathymetry to current (October 2005) contours. As shown on Figure 3, no significant changes in cap thickness were noted in most areas of the cap. However, localized erosional areas were noted at the shoreline edges of the cap along the Central shoreline and in the Southern and Western Log Pond areas.

As shown in Figure 4, the majority of the cap remains thicker than 3 feet (as conservatively estimated using the 2.5 foot nominal cap thickness contour). Thin cap areas are limited to the designed thin-layer cap areas and to the limited erosional areas noted above.

2.3 Wave Energies and Sediment Stability

A coastal engineering evaluation was performed to quantify the forces (i.e., wave energies) acting on shoreline areas of the Log Pond. The evaluations supplement previous evaluations conducted by Anchor Environmental as part of the Engineering Design report (Anchor, 2000). Appendix I of the RI contains the complete results of this study, including narrative and calculation data.

Wave energies within the Log Pond vary with location, wind speed/direction and water depth. Based on available wind data and the calculations the largest waves in the bay originate from the southwest. However, these waves cannot directly enter the Log Pond. Rather, they may enter the log pond only through diffraction (i.e., bending around the Port terminal). This diffraction process typically reduces the wave height by about half, and reduces potential erosive effects of these waves to a level consistent with wind-driven waves from the west (see below).

Given the geometry of the log pond, the greatest wave energies are caused by wind-generated waves from the west. Both typical and extreme storm waves from the west are fetch and depth limited. The wave parameters for western wind-generated waves are relevant to shoreline stability calculations along the central and eastern portions of the Log Pond shoreline which are not shielded by the Port terminal from waves out of the west.

Portions of the log pond in the southern corner and western bulkheaded shoreline are shielded from direct wave action from the West. Along these sections of shoreline wave energies are lower. Waves affecting these shorelines include reflected and diffracted waves originating from the west/southwest, vessel wakes originating in the Whatcom Waterway, and waves driven by northerly winds.

As described in Appendix I of the RI Report, the more sheltered southern and western portions of the Log Pond are likely exposed to waves from storms and vessel wakes in the range of 0.4 ft (33 percentile) to 0.8 feet (1 percentile). The Central and Eastern sections of the Log Pond shoreline are likely exposed to waves from storms in the range of 1.4 feet (low tide 33-percentile) to 2.5 feet (high tide 1 percentile). Sediment particle sizes that will be stable under these anticipated conditions were defined in Appendix I of the RI Report.

3 Proposed Shoreline Enhancements

As described in Section 2 above, the shoreline edges of the Log Pond cap are exposed to wave energies that are capable of redistributing cap sediments and adjacent beach sediments. Enhancements to the Log Pond shoreline are appropriate in order to limit cap redistribution and ensure the long-term integrity of the sediment cap. This section describes the design objectives, provides a description of the proposed design concept, and summarized preliminary cost for the design.

3.1 Objectives and Design Criteria

In considering potential enhancement to the shoreline edges of the Log Pond, the design option was developed based on the ability to meet five objectives. These objectives included the following:

- Stabilize shoreline sediments in order to maximize the long-term stability of the cap.
- Use a conservative design approach that minimizes potential future needs for maintenance and/or repair under anticipated conditions.
- Provide for containment of sediments present in the southern corner of the Log Pond (in areas both within and adjacent to the Interim Action cap footprint).
- Consider potential habitat benefits impacts and future project permitting requirements in the selection of material type and placement options.
- Ensure that any actions are compatible with future land uses and with existing institutional controls applicable to the Log Pond.

3.2 Description of Design Concept

Figure 6 illustrates the proposed design concept. This concept includes the Southwestern, Central, and Eastern areas of the shoreline to enhance the stability of these areas and minimize the potential for future erosion and erosion-induced recontamination.

- **Addition of Stone Groins**: Stone groins are to be placed at the eastern and western edges of the Log Pond, and in the Central shoreline section. These groins will anchor the shoreline and reduce the potential for lateral migration of cap sediments. The groins function by limiting the potential mobility of sediments that become resuspended by wave

energies. In conjunction with the placement of additional shoreline materials, the groins will mimic natural processes. This enhances the stability of the final shoreline, within the geographic constraints of the Log Pond, and reduces the extent of armoring and the sediment particle size ranges required in the final cap. The western groin will also directly limit some wind-driven waves from the west and will reduce the extent of stone armoring required along the shoreline. The proposed groins will be constructed of armor stone with a d_{50} of approximately 10 inches. Under the proposed design concept, the tops of the groins will be approximately 8 feet above MLLW, with crest widths of 6 feet and side-slopes of between 1.5H:1V and 2H:1V.

- **Gravel Placement along Southern & Western Shorelines:** A gravel mixture will be placed on the shorelines of the southern and western Log Pond areas. The final design may include a bedding layer of sand. However, the upper 2 feet of materials in the western shoreline area (Type 1 material as shown on Figure 6) will consist of fine to coarse gravel, with a d_{50} of 20 to 50 mm (1-2 inches). The upper 2 feet of materials in the beach section between the Central and Southern shorelines of the Log Pond (Type 2 material as shown on Figure 6) may need to consist of a coarse gravel, with a d_{50} of at least 2 inches, and containing a mixture from fine gravel to cobbles. However, the final material choice will be based on design calculations. The shoreline geometry established under this concept will assist in restricting material movement and may allow for a finer material to be used.

- **Stone Placement along Central Shoreline:** In the highest energy areas of the Central and Eastern shorelines, additional stone and coarse gravels will be placed in the inter-tidal zone as necessary to minimize the potential for continued erosion of these areas. The approximate placement areas are identified as “Type 3 materials” in Figure 6. Some Type 1 or Type 2 gravel materials may also be placed to the east of the Type 3 materials, depending on the final project design and stability analysis.

- **Grading of Shoreline Materials:** The additional shoreline materials will be graded to create minimum cap thicknesses of 3 feet, and stable slopes of 10:1 or flatter. The top edges of the slopes will extend a sufficient distance to connect with bulkheads or armored features to ensure containment of any sediments or soils that are currently exposed and that could potentially erode under wave action. This will ensure protection against potential future cap recontamination.

- **Potential Mitigation Activities**: Most of the contemplated changes in shoreline grade and substrate are neutral with respect to habitat quality for juvenile salmonids and other aquatic organisms. However, if required as part of project permitting, several types of mitigation actions could be included as part of the project. These include the removal of

creosoted pilings or over-water structures and optimizing grades in deeper sub-tidal portions of the Log Pond (e.g., areas currently below about -4 or -5 feet MLLW).

3.3 Estimated Costs

Table 1 summarizes the estimated costs to complete the shoreline enhancements described in this section and presented above. The costs are presented in 2006 dollars, without correction for inflation. The table shows costs for both a design concept with all new material and considers recycling material for the ASB deconstruction. These cost include conservative estimates of the amount of material needed, final design may indicate less material is needed or alternative quantities based on the final dimensions.

Costs shown in Table 1 include direct construction costs, including material purchase and placement, as well as costs for design, permitting, construction monitoring, sales tax and reporting. Two rounds of post-construction bathymetric testing are assumed in addition to the regularly-scheduled Year 10 Log Pond monitoring scheduled for 2010. Costs for the Year-10 monitoring event are not shown in Table 1, because those costs are estimated elsewhere as part of the Whatcom Waterway RI/FS cost estimates.

The total probable costs for the design concept without reuse of ASB material are approximately $732,000. The total probable costs for the design concept with reuse of ASB material is approximately $520,000. The majority (approximately 95%) of project costs are associated with the capital phase of the work (design, permitting and construction). A construction contingency of 30 percent is recommended prior to final design and permitting, as shown in Table 1.

3.4 Implementation

Shoreline enhancements of the type described in this memorandum would be most cost-effectively designed and permitted as part of the Whatcom Waterway final remedial action. Final project details and costs would be developed as part of project design and permitting.

4 Summary and Conclusions

Based on the information presented in this appendix, RETEC offers the following conclusions regarding the current conditions within the Log Pond:

- **Monitoring Data Show that the Log Pond Cap is Successful:** Data from subsurface sediment testing, well point testing, and tissue monitoring show continued success of the Log Pond cap at containing capped sediments.
- **Limited Edge Effects were Identified in Shoreline Areas:** Most cap areas have been shown to be stable since construction. However, some limited areas of erosion have been observed in shoreline edges of the cap. In the southwestern corner of the Log Pond, elevated mercury levels were noted along the edges of the cap.
- **Edge Effects Can be Addressed with Shoreline Enhancements**: The edge effects observed in the Log Pond shoreline areas can be corrected by enhancing shoreline conditions. A design concept for such shoreline enhancements was developed. The concept provides for long-term shoreline stability, and that would do so in a manner compatible with habitat and land use considerations applicable to the project area. A cost estimate for the shoreline enhancements was developed and is attached as Table 1.
- **Shoreline Actions Can Be Performed During the Whatcom Waterway Cleanup**: The shoreline upgrades can be designed and permitted as part of the Whatcom Waterway site cleanup. The final design option should be selected after further technical evaluations during Environmental Design.

5 References

Anchor, 2000. Final Engineering Design Report Interim Remedial Action Log Pond Cleanup/Habitat Restoration; Whatcom Waterway Site, Bellingham, Washington. Prepared for Georgia Pacific West Inc, Bellingham, Washington. Prepared by Anchor Environmental, L.L.C.. July 31, 2000.

Anchor, 2001a. Operation Maintenance and Monitoring Plan; Interim Remedial Action Log Pond Cleanup/Habitat Restoration Project. Prepared for Georgia Pacific West Inc, Bellingham, Washington. Prepared by Anchor Environmental, L.L.C., Seattle, Washington. 2001.

Anchor, 2001b. Year 1 Monitoring Report – Interim Remedial Action Log Pond Cleanup/Habitat Restoration Project. Prepared for Georgia Pacific West Inc, Bellingham, Washington. Prepared by Anchor Environmental, L.L.C., Seattle, Washington. December 2001.

RETEC, 2006. Draft Supplemental Remedial Investigation & Feasibility Study, Volume 1: RI Report. The RETEC Group Inc., August 4, 2006.

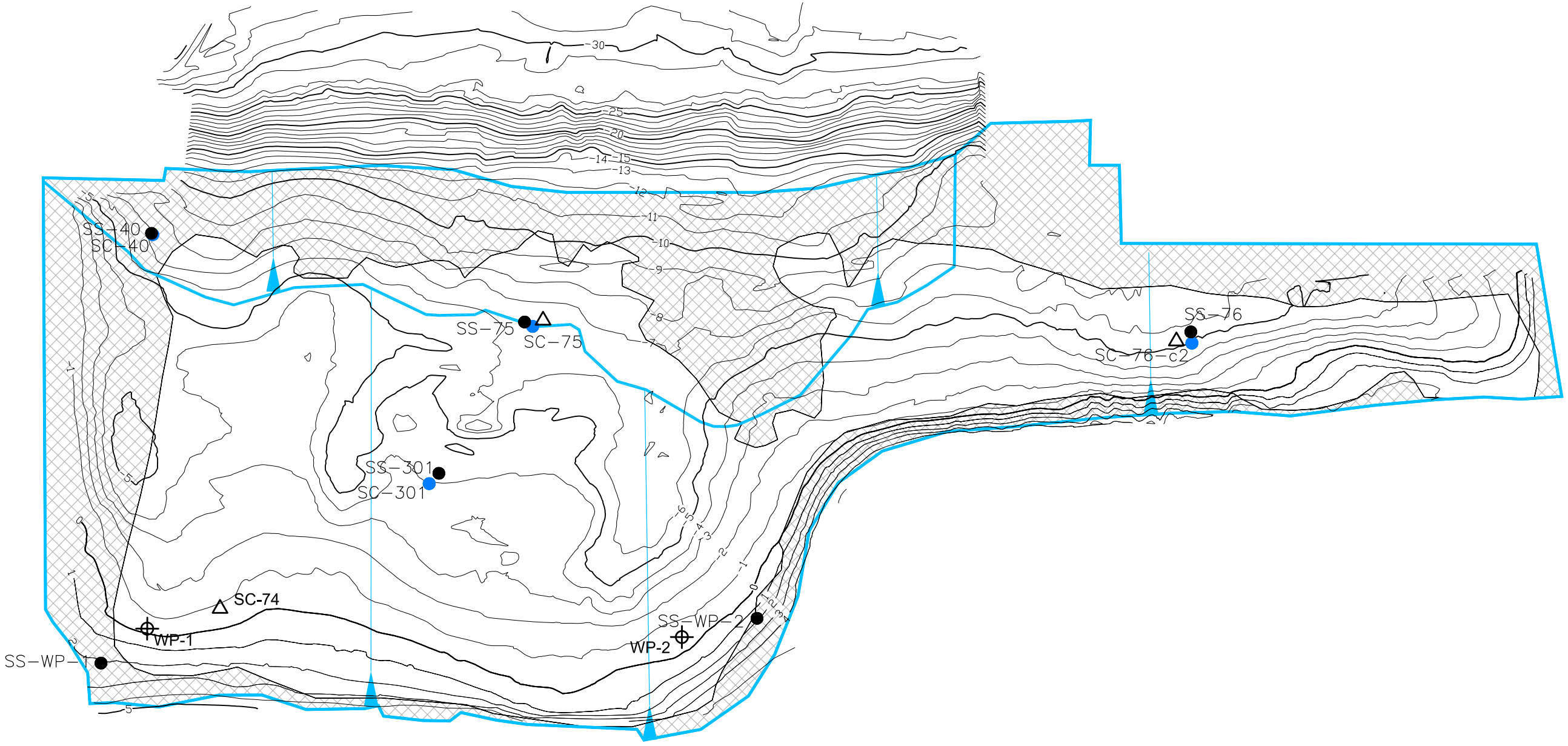
U.S. Army Corps of Engineers. *Shore Protection Manual*. Two Volumes, Coastal Engineering Research Center, Waterways Experiment Station, Vicksburg, MS, 1984.

Table 1.
Whatcom Waterway Remediation -- Log Pond Shoreline Enhancements
Estimated Costs

REMEDIAL COST ELEMENTS	COSTS ASSUMING ASB MATERIAL REUSE				COSTS ASSUMING NO ASB MATERIAL REUSE			
	Quantity	Units	Unit Cost	**Probable Costs**	Quantity	Units	Unit Cost	**Probable Costs**
REMEDIAL CONSTRUCTION COSTS								
Mobilization, Demobilization, Non-Scheduled Contract	10	%	$ 329,889	$ 32,989	10	%	$ 475,387	$ 47,539
Demolition								
Removal of pilings, debris	1	total est.	$ 15,000	$ 15,000	1	total est.	$ 15,000	$ 15,000
Beach Stabilization & Enhancement								
Western Groin (Armor Stone)								
Material Placement	2,400	cyd	$ 7	$ 16,800	2,400	cyd	$ 7	$ 16,800
Material Purchase & Delivery	3,600	ton	$ -	$ -	3,600	ton	$ 23	$ 82,800
Eastern Groin (Armor Stone)								
Material Placement	533	cyd	$ 7	$ 3,731	533	cyd	$ 7	$ 3,731
Material Purchase & Delivery	800	ton	$ -	$ -	800	ton	$ 23	$ 18,389
Central Groin (Armor Stone)								
Material Placement	770	cyd	$ 7	$ 5,390	770	cyd	$ 7	$ 5,390
Material Purchase & Delivery	1,155	ton	$ 3	$ 3,465	1,155	ton	$ 23	$ 26,565
Type 1 Material (Fine Gravel Mix)								
Material Placement	5,247	cyd	$ 7	$ 36,729	5,247	cyd	$ 7	$ 36,729
Material Purchase & Delivery	7,871	ton	$ 18	$ 141,669	7,871	ton	$ 18	$ 141,669
Type 2 Material (Coarse Gravel Mix)								
Material Placement	2,911	cyd	$ 7	$ 20,377	2,911	cyd	$ 7	$ 20,377
Material Purchase & Delivery	4,367	ton	$ 18	$ 78,597	4,367	ton	$ 18	$ 78,597
Type 3 Material (Stone)								
Material Placement	707	cyd	$ 7	$ 4,949	707	cyd	$ 7	$ 4,949
Material Purchase & Delivery	1,061	ton	$ 3	$ 3,182	1,061	ton	$ 23	$ 24,392
	CONSTRUCTION SUBTOTAL			**$ 362,877**	**CONSTRUCTION SUBTOTAL**			**$ 522,926**
ENGINEERING & REGULATORY				**$ 157,209**				**$ 208,905**
Design, Permitting (12%)	12%	of Construction Costs		$ 43,545	12%	of Construction Costs		$ 62,751
Construction Management & Monitoring (7%)	12%	of Construction Costs		$ 43,545	12%	of Construction Costs		$ 62,751
Additional Bathymetric Monitoring Events	2	total est.	$ 20,000	$ 40,000	2	total est.	$ 20,000	$ 40,000
WSST (8.3%)	8.3%	of Construction Costs		$ 30,119	8.3%	of Construction Costs		$ 43,403
TOTAL EXCLUDING CONTINGENCY				**$ 520,087**				**$ 731,831**
CONTINGENCY (30%)				$ 156,026				$ 219,549
TOTAL INCLUDING CONTINGENCY				**$ 676,113**				**$ 951,380**

Notes:

Costs for design and permitting assume that the work is completed as part of the design & permitting of the Whatcom Waterway site final remedial action.



LEGEND

- PHASE I AND II CAP LIMITS FROM ENGINEERING DESIGN REPORT (ANCHOR 2000)
- THIN LAYER CAPPING AREA (0.5' TO 3') FROM ENGINEERING DESIGN REPORT (ANCHOR 2000)
- OCTOBER 2005 BATHYMETRY (MLLW)
- SS-76 GRAB SAMPLE LOCATION
- SC-76 CORE LOCATION
- SC-76 CRAB TISSUE COLLECTION LOCATION
- WP-1 WELL POINT LOCATION

N

40 0 80

SCALE IN FEET

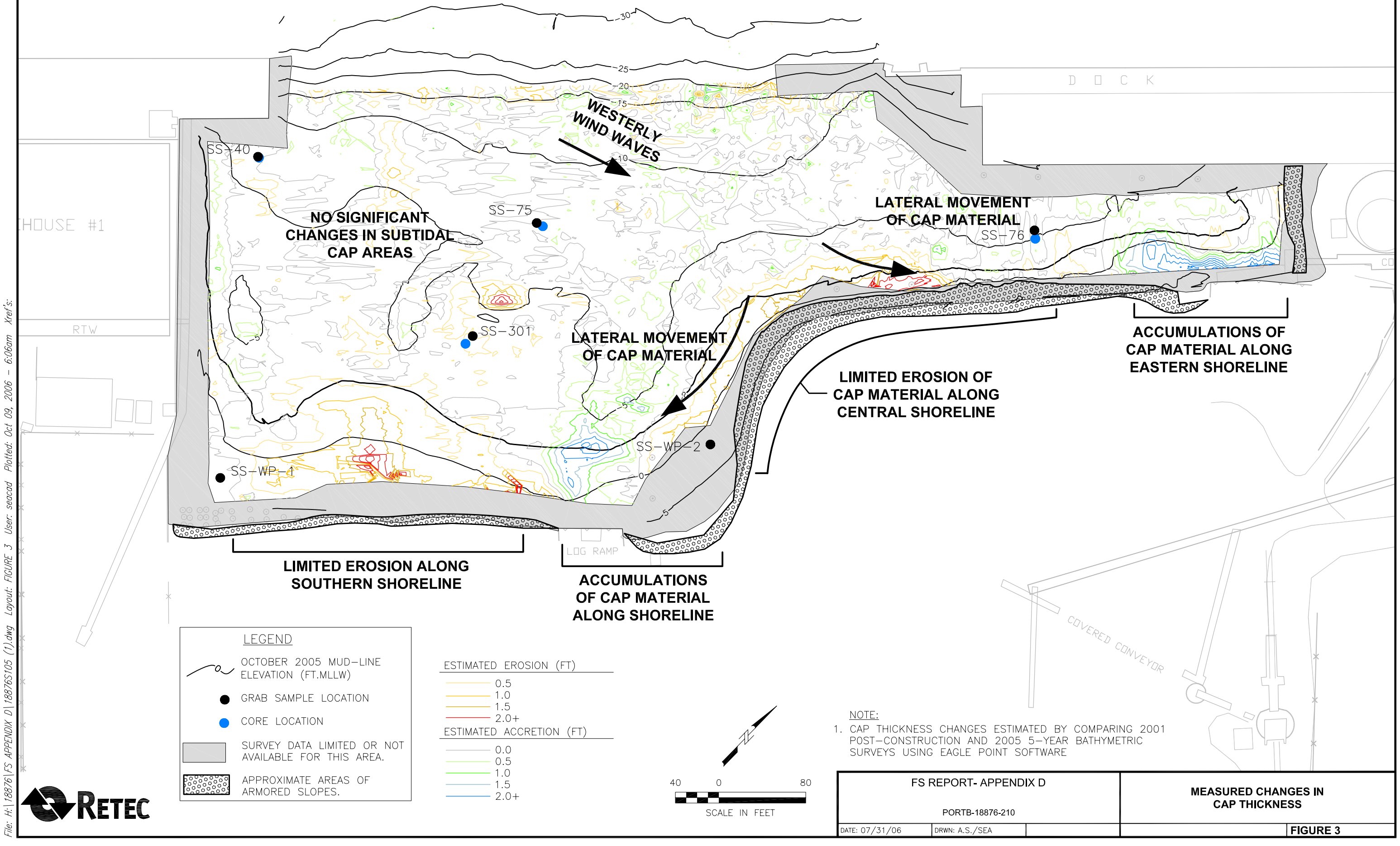
NOTES:

1. BATHYMETRY SHOWN FROM OCTOBER 12, 2005 SURVEY. PERFORMED BY BLUE WATER ENGINEERING. (FT. MLLW)

RETEC

FS REPORT- APPENDIX D PORTB-18876-210				SAMPLING LOCATIONS AND BATHYMETRY
DATE: 07/31/06	DRWN: A.S./SEA			FIGURE 1

File: H:\18876\FS APPENDIX D\188765102 (1).dwg Layout: FIGURE 1 User: seacad Plotted: Oct 09, 2006 - 6:01am Xref's:



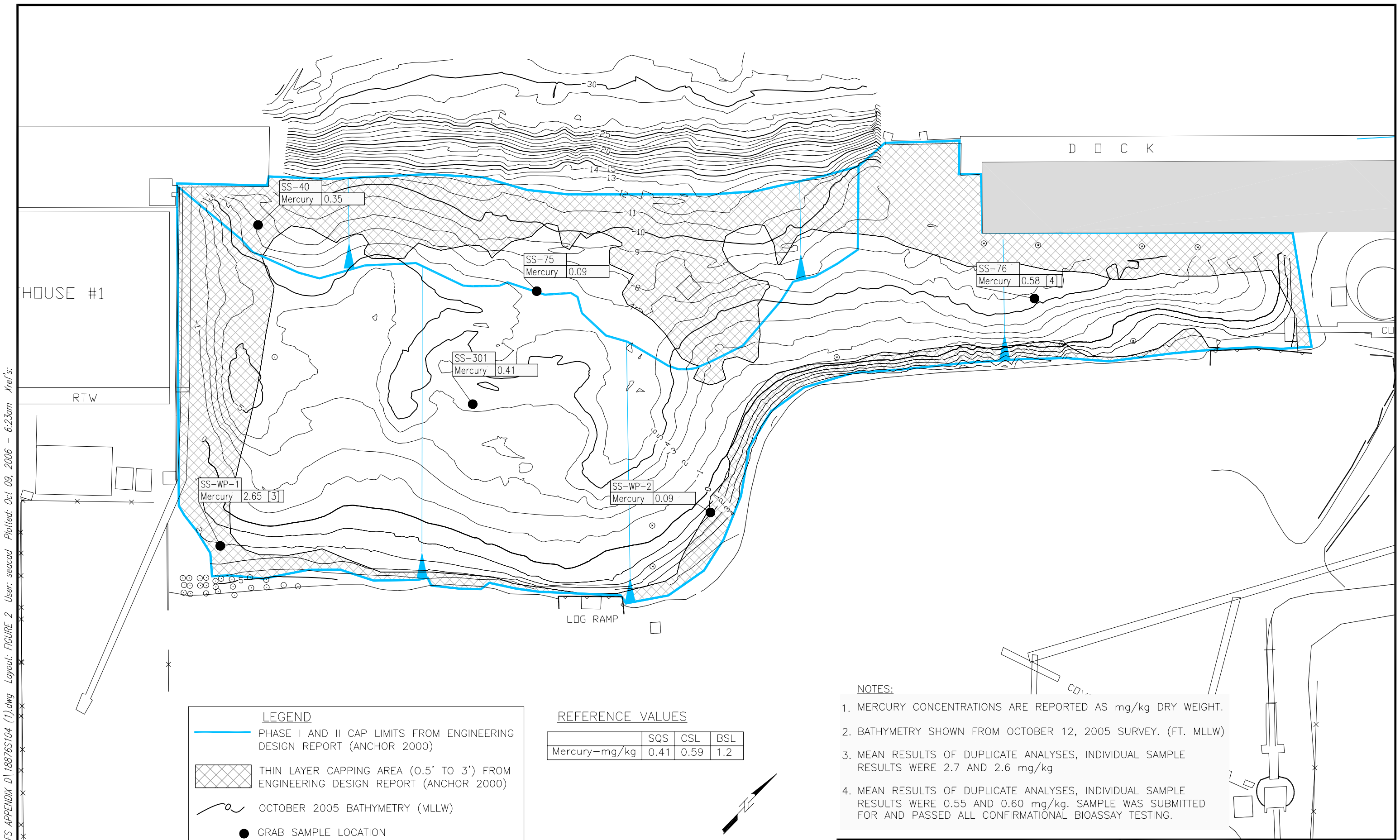
NOTE:

1. CAP THICKNESS CHANGES ESTIMATED BY COMPARING 2001 POST-CONSTRUCTION AND 2005 5-YEAR BATHYMETRIC SURVEYS USING EAGLE POINT SOFTWARE

RETEC

FS REPORT- APPENDIX D PORTB-18876-210			MEASURED CHANGES IN CAP THICKNESS
DATE: 07/31/06	DRWN: A.S./SEA		FIGURE 3

File: H:\18876\FS APPENDIX D\18876S105 (1).dwg Layout: FIGURE 3 User: seacad Plotted: Oct 09, 2006 - 6:06am Xref's:



LEGEND

- PHASE I AND II CAP LIMITS FROM ENGINEERING DESIGN REPORT (ANCHOR 2000)
- THIN LAYER CAPPING AREA (0.5' TO 3') FROM ENGINEERING DESIGN REPORT (ANCHOR 2000)
- OCTOBER 2005 BATHYMETRY (MLLW)
- GRAB SAMPLE LOCATION

REFERENCE VALUES

	SQS	CSL	BSL
Mercury–mg/kg	0.41	0.59	1.2

40 0 80

SCALE IN FEET

NOTES:

1. MERCURY CONCENTRATIONS ARE REPORTED AS mg/kg DRY WEIGHT.
2. BATHYMETRY SHOWN FROM OCTOBER 12, 2005 SURVEY. (FT. MLLW)
3. MEAN RESULTS OF DUPLICATE ANALYSES, INDIVIDUAL SAMPLE RESULTS WERE 2.7 AND 2.6 mg/kg
4. MEAN RESULTS OF DUPLICATE ANALYSES, INDIVIDUAL SAMPLE RESULTS WERE 0.55 AND 0.60 mg/kg. SAMPLE WAS SUBMITTED FOR AND PASSED ALL CONFIRMATIONAL BIOASSAY TESTING.

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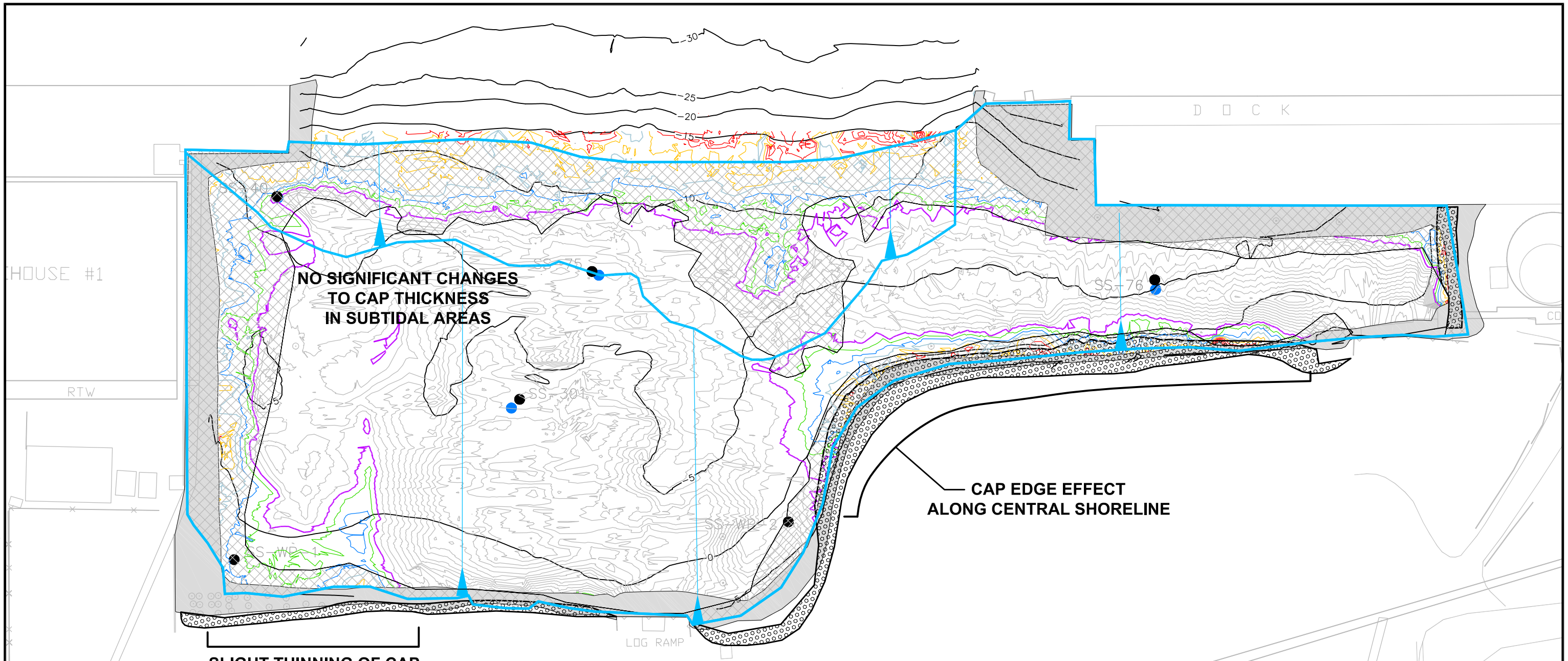
FS REPORT- APPENDIX D

PORTB-18876-210

SURFACE SEDIMENT MERCURY CONCENTRATIONS YEAR 5 MONITORING

DATE: 07/31/06 | DRWN: A.S./SEA | **FIGURE 2**

File: H:\18876\FS APPENDIX D\18876S104 (1).dwg Layout: FIGURE 2 User: seacad Plotted: Oct 09, 2006 - 6:23am Xref's:



LEGEND

- PHASE I AND II CAP LIMITS FROM ENGINEERING DESIGN REPORT (ANCHOR 2000)
- THIN LAYER CAPPING AREA (0.5' TO 3') FROM ENGINEERING DESIGN REPORT (ANCHOR 2000)
- OCTOBER 2005 MUD-LINE ELEVATION (FT.MLLW)
- GRAB SAMPLE LOCATION
- CORE LOCATION
- SURVEY DATA LIMITED OR NOT AVAILABLE FOR THIS AREA.
- APPROXIMATE AREAS OF ARMORED SLOPES.

NOMINAL CAP THICKNESS (FT)[1]

- 3.0+
- 2.5
- 2.0
- 1.5
- 1.0
- 0.5
- <0.0

N

40 0 80

SCALE IN FEET

NOTE:

1. CAP THICKNESS ESTIMATED BY COMPARING 2000 PRE-CONSTRUCTION AND 2005 5-YEAR BATHYMETRIC SURVEYS USING EAGLE POINT SOFTWARE. IN AREAS WITH 3 FEET OF APPLIED CAP THE ACTUAL CAP THICKNESS IS ESTIMATED TO BE 0.5 TO 0.8 FEET THICKER THAN THE NOMINAL THICKNESS DUE TO THE EFFECTS OF SEDIMENT CONSOLIDATION.

RETEC

FS REPORT- APPENDIX D PORTB-18876-210				CURRENT NOMINAL CAP THICKNESS
DATE: 07/31/06	DRWN: A.S./SEA			FIGURE 4

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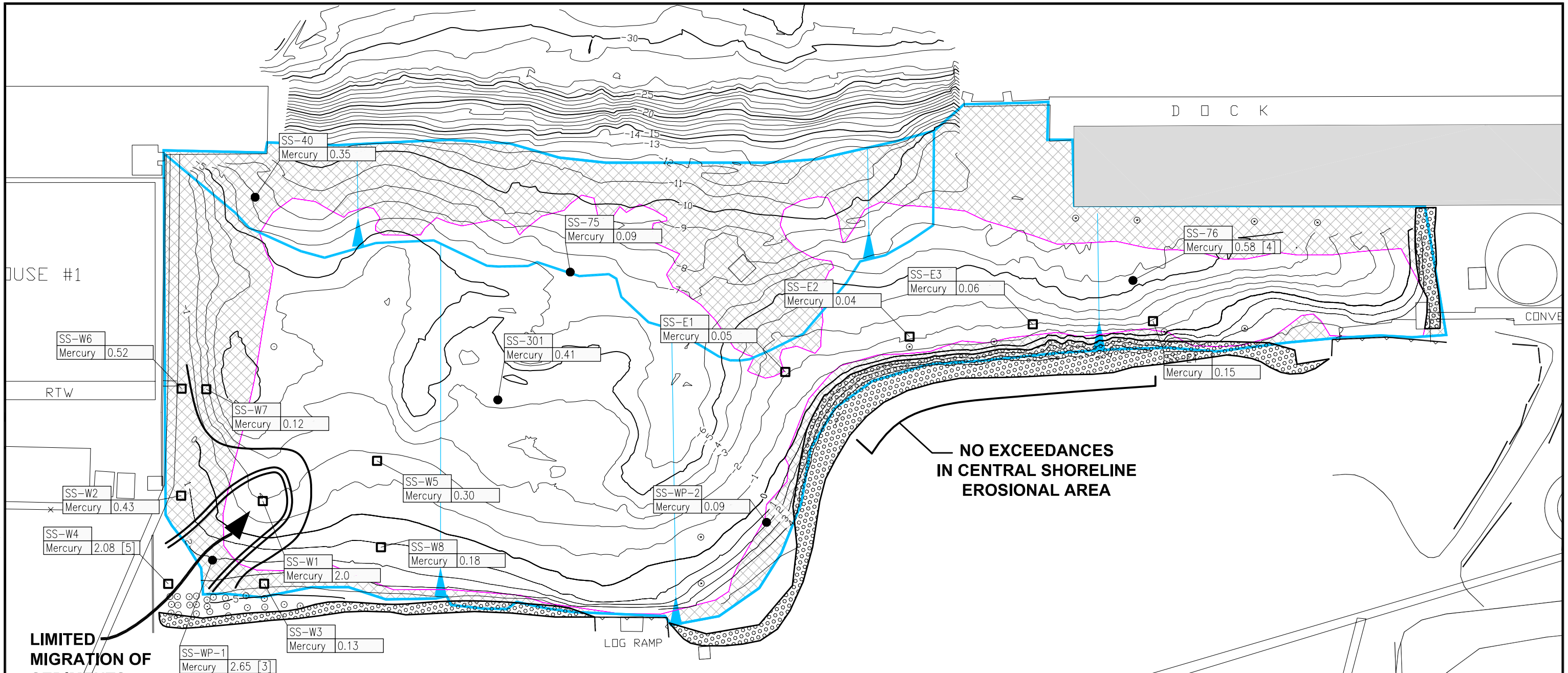

LEGEND

- APPROXIMATE AREAS OF ARMORED SLOPES
- PHASE I AND II CAP LIMITS FROM ENGINEERING DESIGN REPORT (ANCHOR 2000)
- THIN LAYER CAPPING AREA (0.5' TO 3') FROM ENGINEERING DESIGN REPORT (ANCHOR 2000)
- OCTOBER 2005 MUD-LINE ELEVATION (FT.MLLW)
- YEAR 5 SURFACE SAMPLE LOCATION
- SUPPLEMENTAL SAMPLING LOCATION

REFERENCE VALUES

SMS	SQS	CSL	BSL
Mercury-mg/kg	0.41	0.59	1.2

40 0 80

SCALE IN FEET

NOTES:

1. MERCURY SEDIMENT CONCENTRATIONS ARE REPORTED AS mg/kg DRY WEIGHT.
2. BATHYMETRY SHOWN FROM OCTOBER 12, 2005 SURVEY. (FT. MLLW)
3. MEAN RESULTS OF DUPLICATE ANALYSES, INDIVIDUAL SAMPLE RESULTS WERE 2.7 AND 2.6 mg/kg.
4. MEAN RESULTS OF DUPLICATE ANALYSES, INDIVIDUAL SAMPLE RESULTS WERE 0.55 AND 0.60 mg/kg. SAMPLE WAS SUBMITTED FOR AND PASSED ALL CONFIRMATIONAL BIOASSAYS.
5. MEAN RESULTS OF DUPLICATE ANALYSES, INDIVIDUAL SAMPLE RESULTS WERE 2.7 AND 1.45 mg/kg.

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FS REPORT- APPENDIX D

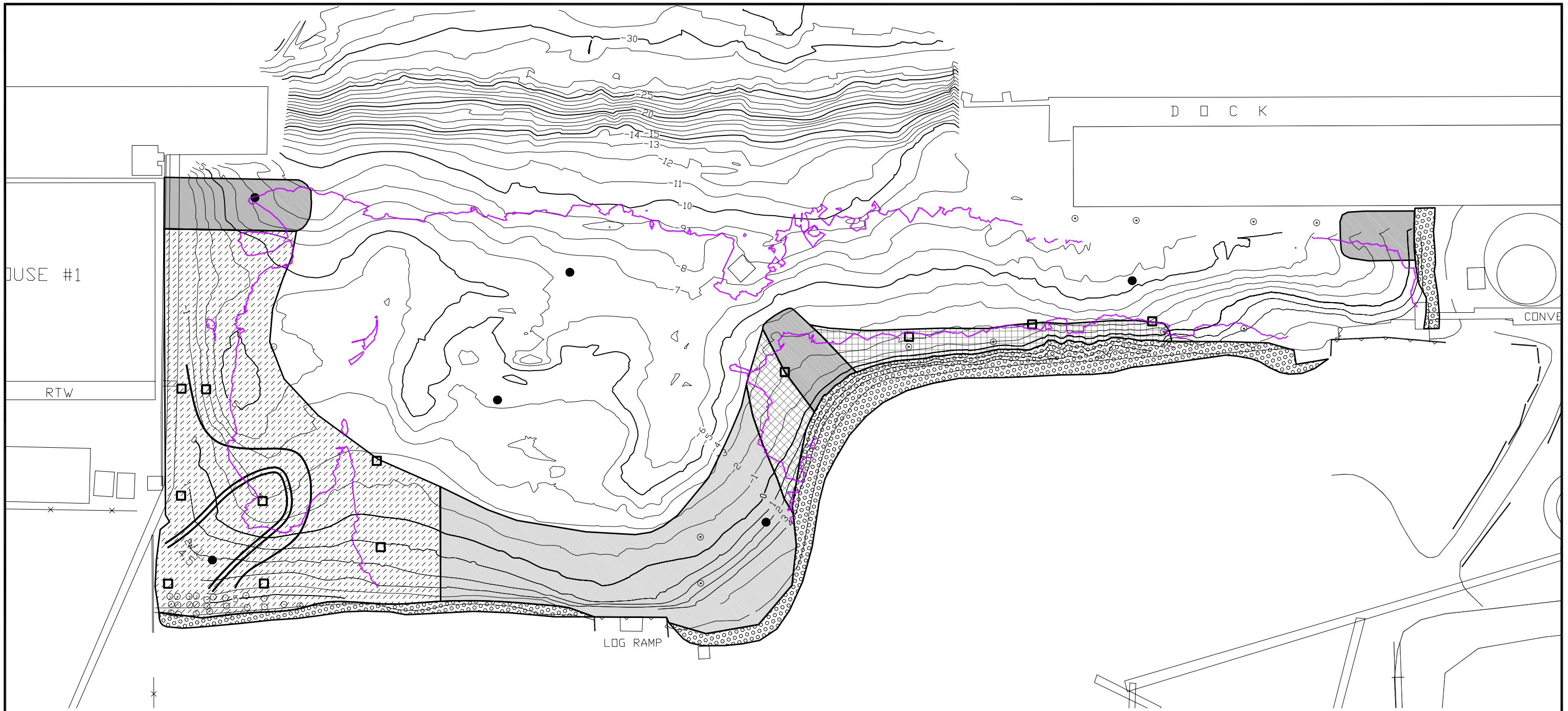
PORTB-18876-260

DATE: 07/31/06 | DRWN: A.S./SEA

RESULTS OF SUPPLEMENTAL SURFACE SEDIMENT TESTING

FIGURE 5

File: H:\18876\FS APPENDIX D\188765103 (1).dwg Layout: FIGURE_5 User: seacad Plotted: Oct 09, 2006 - 6:25am Xref's:



LEGEND

- CURRENT ESTIMATED LIMITS OF THICK CAP (3FT)*
- YEAR 5 SURFACE SAMPLE LOCATION
- SUPPLEMENTAL SAMPLING LOCATION

KEY

- TYPE 1 MATERIAL
- TYPE 2 MATERIAL
- TYPE 3 MATERIAL
- NEW GROIN
- EXISTING ARMORED SLOPE

40 0 80

SCALE IN FEET

NOTES:

1. BATHYMETRY SHOWN FROM OCTOBER 12, 2005 SURVEY. (FT. MLLW)

* BASED ON NOMINAL THICKNESS CONTOUR OF 2.5 FEET AS SHOWN IN FIGURE 4. THE NOMINAL THICKNESS DOES NOT ACCOUNT FOR CAP CONSOLIDATION.

RETEC

WHATCOM RI/FS - APPENDIX D PORTB-18876-260			**LOG POND SHORELINE ENHANCEMENTS**
DATE: 08/14/06	DRWN: E.M./SEA		**FIGURE 6**

File: H:\18876\FEASIBILITY STUDY\188765207.dwg Layout: FIGURE 6 User: seacad Plotted: Oct 09, 2006 - 6:32am Xref's: