2006 POST-CONSTRUCTION MONITORING AND PROJECT COMPLETION REPORT HOLLY STREET LANDFILL

Prepared for

City of Bellingham
Public Works Department
210 Lottie Street
Bellingham, Washington 98225

For submittal to

Washington State Department of Ecology

Prepared by

Anchor Environmental, L.L.C.
1423Third Avenue, Suite 300
Seattle, Washington 98101

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1 INTRODUCTION

The Holly Street Landfill Consent Decree, executed by the Washington Department of Ecology (Ecology), the City of Bellingham (City), and other Defendants, includes requirements for compliance monitoring in 2006, 2010, and 2015 (as necessary). The monitoring data will be used by Ecology to confirm that cleanup actions described in final design documents approved by Ecology in April 2004 (Anchor and Aspect 2004), and constructed by the City over the period from August 2004 to March 2005, have achieved Site cleanup standards. The post-construction monitoring data are also used to develop appropriate adaptive management/contingency response plans (as necessary) to ensure the continued effectiveness of the cleanup remedy. This report presents the results of the first stage of post-construction compliance monitoring performed in 2006, and outlines planned adaptive management response actions.

1.1 Background

The Holly Street Landfill Site is a 13-acre historic municipal solid waste landfill located in the City's Old Town district. Beginning in approximately 1937 and continuing as late as 1959, municipal solid waste was placed on both sides of Whatcom Creek, with the landfill divided into a northern unit and a southern unit. Both the northern landfill unit on the northwest bank of Whatcom Creek, and the southern landfill unit encompassing Maritime Heritage Park and the southeast bank of the creek, are listed and ranked by Ecology as contaminated sites subject to the investigation and cleanup requirements of the Washington State Model Toxics Control Act (MTCA). Since these areas are essentially one Site bisected by Whatcom Creek, Ecology combined the areas into a single Site known as the Holly Street Landfill.

The City currently owns 8.3 acres of the 13-acre landfill Site, including all landfill properties located along the Whatcom Creek shoreline. Various private property owners own land around the upland/inland perimeter of the landfill.

A Remedial Investigation/Feasibility Study (RI/FS) was prepared by Anchor and Aspect (2003) to characterize the nature and extent of contamination at the Holly Street Landfill Site. Soil, sediment, surface water, and groundwater conditions were characterized during the RI/FS. As set forth in Ecology's Cleanup Action Plan (CAP) for the Site (included as Exhibit A to the Consent Decree), based on the findings of the RI/FS, controls were needed

at the Site to continue to prevent future human and environmental exposure to buried (subsurface) refuse and associated soil contaminants. Moreover, although contaminants were not detected in Site groundwater at levels of potential concern, metals such as copper and zinc in the landfill refuse could potentially be mobilized by tidal processes in the shoreline landfill zone. During the conduct of the RI/FS, these processes were found to result in seepage to Whatcom Creek along a localized reach of the northern landfill unit shoreline, posing a potential risk to sensitive aquatic species in this area.

The RI/FS and CAP developed and evaluated remedial alternatives for the Site. As set forth in the Consent Decree, the selected cleanup alternative for the Site included a cap constructed along the northern landfill area and localized upland areas, institutional controls, and monitoring of localized surface water seeps. Based on a consideration of geochemical processes controlling copper and zinc mobility at the Site, the identified shoreline capping system was designed to restrict tidal mixing and associated oxygen transfer into nearshore refuse deposits of the northwest landfill lobe. Such a cap system is expected to be effective in controlling the release of copper and zinc into Whatcom Creek.

Consistent with the requirements of the CAP and Consent Decree, the cleanup option implemented by the City combined habitat restoration, public access, and land use elements into a single integrated cleanup and source control remedy. The integrated plan included:

- Excavating wedges of shoreline solid waste within and adjacent to the "B" Street right-of-way, and along limited oversteepened/bulkhead areas of the Maritime Heritage Park shoreline, and disposing the excavated material off-Site
- Backfilling the excavation areas with a clean cap material graded to relatively flat slopes, concurrently providing slope stabilization and restoring historically lost aquatic habitat in this important estuary
- Enhancing the existing soil cap in portions of the Maritime Heritage Center to be consistent with other landfill areas already capped to ensure that humans and the environment are protected from buried solid waste
- Incorporating public access into the overall project design to address existing community open space goals and planning objectives

The habitat restoration component of the integrated action included conversion of approximately 0.3 acres of uplands to aquatic habitat via excavation of refuse and subsequent capping, thus restoring critical estuarine riparian buffer, marsh, and mudflat banks that existed historically in this area of Bellingham Bay. This action also provided a park-like setting allowing citizens trail access along this stretch of Whatcom Creek to the Maritime Heritage Center. Incorporating public access design with cleanup and habitat restoration helped meet community open space goals and planning objectives, leveraged additional community support and funding, and provided an opportunity to educate the public about critical estuarine environments. Future plans are consistent with maintaining long-term habitat restoration and public access benefits at the Site.

The Consent Decree included a list of specific deliverables required to document compliance during construction of the cleanup action. All such deliverables have been submitted to Ecology. Record drawing information was incorporated into a single "as-built" plan sheet, including the final topography of the creek banks provided by the contractor in those areas where excavation and/or fill work was performed. This finished slope topography was combined with earlier pre-construction bathymetric surveys for areas of Whatcom Creek that were beyond the limits of construction, to provide a single post-construction topographic surface (see Figure 1). The as-built locations of field changes, such as revised locations of woody debris and new storm sewer features near the bridge, were also added to the record drawing map.

LEGEND

CONTOUR IN FEET (MLLW)

WP-3 ◑ WELL POINT LOCATION AND NUMBER

BIO WP-2 ▲ BENTHIC AND EPIBENTHIC INVERTEBRATE SAMPLING LOCATION

0 20 40
Scale in Feet

NOTE: SLOPE TOPOGRAPHY IS FROM "AS-BUILT" CONTOURS PROVIDED BY CONTRACTOR DATED JUNE 13, 2005.

199.93'

FISH HATCHERY

CYCLONE FENCE (TYP.)

BANCROFT ST. R.O.W.

FIRE HYD. PK. NAIL
N: 6602172.9865
E: 1272170.0970
El. = 21.16

FIRE HYD. PK. NAIL
N: 6602172.9865
E: 1272170.0970
El. = 18.09

ASTOR ST. R.O.W.

4" DIA. DRAIN CONNECTION

"B" ST. R.O.W.

BENCHES

LARGE WOODY DEBRIS BARRIER

FORMER COLONY DOCK PILES

WP-3

BIO WP-3

ANCHORED LARGE WOODY DEBRIS STRUCTURE

WHATCOM CREEK

ROCK SLOPE PROTECTION

WP-2

BIO WP-2

WP-4

ROCK SLOPE PROTECTION

ROCK SLOPE PROTECTION

CONC. BRIDGE W/ ASP. OVERLAY

SIZE/MATL UNKNOWN

TOE OF TRAIL

LOG RAILS LINE SIDE OF TRAIL

ASPHALT TRAIL

POLE AND PANELS

MONITORING WELL (PROTECT)

WOOD FENCE

GRAVEL

RAILROAD TIE RETAINING WALL (TYP.)

LAWN

MARITIME HERITAGE PARK

CB

MONITORING WELL (PROTECT)

ASPHALT

WALKWAY

Nov 01, 2006 11:49am cdavidson K:\Jobs\990062-Holly Street\990062204 HOL-990062204-75 (EXHIBIT).dwg FIG 1

ANCHOR ENVIRONMENTAL, L.L.C.

Figure 1
Sampling Locations
Holly Street Landfill/Whatcom Creek Estuary Restoration

1.2 Overview of Sampling and Analysis Activities

As discussed above, detailed requirements for compliance monitoring and adaptive management/contingency responses for the Site are provided in *Exhibit E* of the Consent Decree, which describes and explains environmental monitoring activities and the rationale used to develop these activities for the Site. The objective of compliance monitoring activities is to confirm that cleanup standards have been achieved and to confirm the long-term effectiveness of cleanup actions at the Site.

Exhibit E of the Consent Decree contains discussions on duration and frequency of monitoring; the triggers for contingency response action along the shoreline; and the rationale for terminating monitoring. Three types of compliance monitoring are described in *Exhibit E*:

- **Protection Monitoring** to confirm that human health and the environment are adequately protected during the construction period of the cleanup action
- **Performance Monitoring** to confirm that the cleanup action has attained cleanup standards and other performance standards
- **Confirmation Monitoring** to confirm the long-term effectiveness of the cleanup action once performance standards have been attained.

Protection monitoring elements of *Exhibit E* were completed in March 2005, coinciding with the completion of remedial construction. Specific performance and confirmation monitoring activities were performed in 2006; the results of these monitoring activities are presented in this report. They included:

- Detailed bathymetric surveys of the shoreline action area
- Collection of well point seepage samples from the shoreline action area
- Collection of representative samples of epibenthic and benthic infauna from the shoreline action area
- Observation of fisheries utilization within the shoreline action area
- Documentation of data collection and contingency/adaptive management activities (as necessary).

The Ecology-approved Sampling and Analysis Plan (SAP) Addendum No. 3 describes the supplemental investigation tasks required to complete performance and confirmation

monitoring at the Site (Anchor 2006). No substantive deviations to the approved SAP occurred during the 2006 monitoring.

2 BATHYMETRIC SURVEYS

As discussed above, record drawing information was combined with earlier pre-construction bathymetric surveys to produce a single "as-built" plan sheet of post-construction Site conditions in June 2005 (Figure 1). Bathymetric surveys of the project area were again performed in May 2006 by Pacific Surveying and Engineering to provide a synoptic post-construction survey of the in-water remedial action area. Data quality objectives for the bathymetric surveys were equivalent to those used during remedial design (Anchor 2006).

Areas of relative net erosion or accretion were identified by comparing the 2006 bathymetric survey data with two different baseline conditions:

1. Comparisons of May 2006 data with the June 2005 composite "as-built" survey to identify recent changes in bathymetry (Figure 2)
2. Comparisons of May 2006 data with anticipated post-project bathymetric conditions set forth in the Ecology-approved remedial design to identify deviations from project expectations (Anchor and Aspect 2004; Figure 3)

The bathymetric survey comparisons reveal that, while relatively minor (3 to 9-inch) erosion of the sediment bed surface occurred over parts of the Site within the first year following construction, indicative of post-project sediment redistribution (Figure 2), the May 2006 survey nevertheless confirmed that the current cap extent, elevation, and thickness exceeded the minimum capping thickness specified in the CAP (Figure 3). Within the accuracy of the survey data, no contiguous areas of the cap were identified that did not comply with the minimum capping thickness set forth in the Consent Decree. The survey data comparisons depicted are consistent with relatively minor post-project sloughing of sediment deposits located immediately offshore of the cap. Thus, the 2006 bathymetric survey data confirm the successful placement and integrity of the cap constructed at the Holly Street Landfill Site, consistent with the requirements of the Consent Decree. Section 5 of this report describes the City's planned placement of supplemental shore protection materials to further ensure cap stability.

LEGEND

CONTOUR IN FEET

MHHW

ISOPACH THICKNESS

- GREATER THAN 15"
- 9" TO 15"
- 3" TO 9"
- -3" TO 3"
- -3 TO -9"
- -9" TO -15"
- DEEPER THAN -15"

NOTE:
SLOPE TOPOGRAPHY IS FROM SURVEY PERFORMED BY PSE ON MAY 25, 2006.

0 20 40
Scale in Feet

CONCRETE PLAZA AND WALKWAY

CONCRETE PLAZA AND WALKWAY

ELEVATED BOARDWALK

CHAIN LINK FENCE

4" DIA. DRAIN CONNECTION

LARGE WOODY DEBRIS BARRIER

ANCHORED LARGE WOODY DEBRIS STRUCTURE

BENCHES

ROCK SLOPE PROTECTION

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ASTOR ST. R.O.W.

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FISH HATCHERY

FORMER COLONY DOCK PILES

WHATCOM CREEK

MARITIME HERITAGE PARK

MONITORING WELL (PROTECT)

MONITORING WELL (PROTECT)

WOOD FENCE

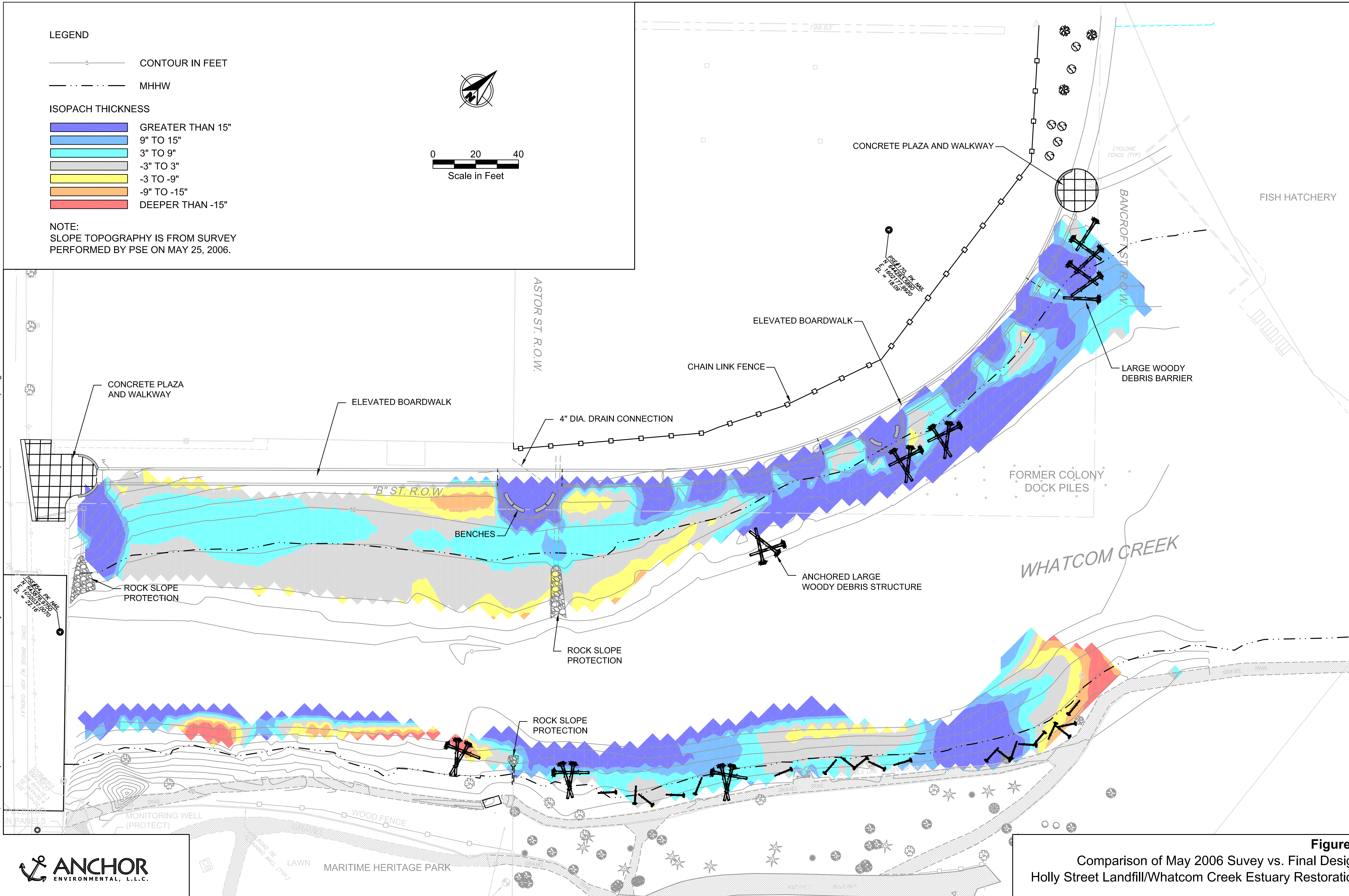
LAWN

CYCLONE FENCE (TYP.)

K:\Jobs\990062-Holly Street\99006204-HOL-99006204-78 (SRVY COMPARISON).dwg Plan
Oct 30, 2006 4:51pm dholmer

ANCHOR ENVIRONMENTAL, L.L.C.

Figure 2
Comparison of June 2005 vs. May 2006 Surveys
Holly Street Landfill/Whatcom Creek Estuary Restoration



LEGEND
CONTOUR IN FEET
MHHW
ISOPACH THICKNESS
GREATER THAN 15"
9" TO 15"
3" TO 9"
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0
20
40
Scale in Feet
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MONITORING WELL (PROTECT)
WOOD FENCE
LAWN
MARITIME HERITAGE PARK
MONITORING WELL (PROTECT)

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Figure 3
Comparison of May 2006 Suvey vs. Final Design
Holly Street Landfill/Whatcom Creek Estuary Restoration

3 WELL POINT SAMPLING

Water quality performance monitoring was performed at the Site in May 2006 to verify compliance of seepage discharges with MTCA surface water cleanup levels based on State Surface Water Quality Standards (Chapter 173-201A WAC). Primary seepage pathways to the Whatcom Creek shoreline were previously identified and sampled during both the RI/FS and supplemental remedial design evaluation using temporary well points. As stated in *Exhibit E* of the Consent Decree, post-construction monitoring focused on two prior well point locations (WP-2 and WP-3; see Figure 1), completed within the intertidal landfill cap seepage pathway.

Following completion of construction, a localized deposit of solid waste was identified offshore and below the design project limits, possibly consistent with historical plunge-pool deepening from past stormwater outfall discharges into this area, and resultant redistribution of solid waste. This deposit, which was not identified in either the RI/FS or remedial design documents, contains low permeability ash materials, interspersed with solid waste objects such as glass. The localized extent and limited permeability of these materials suggest that there is a low potential for water quality impacts in this area. To confirm this condition and inform appropriate contingency response actions, an additional seep monitoring location (WP-4) was positioned within this area of the Site (see Figure 1).

Well points at WP-2, WP-3, and WP-4 were installed and sampled in May 2006 during low tide conditions. Prior to sampling, more than three pore volumes were removed from the well points. All samples designated for dissolved metals analysis were filtered in the field through a 0.45-micron membrane in-line filter prior to nitric acid preservation. Well point samples were submitted to ARI (an Ecology-approved analytical laboratory) for analysis of dissolved metals (arsenic, cadmium, copper, lead, and zinc), salinity, and total suspended solids. Data quality objectives for the well point samples were equivalent to those used during the RI/FS and remedial design. Water quality data collected from the well points are summarized in Table 1.

Table 1
Holly Street Landfill Wellpoint Monitoring Data: May 10, 2006 Sampling

Analyte	Cleanup Level	WP-2	WP-3	WP-4
Conventionals (units):				
Temperature (deg C)	-	17.2	16.4	16.2
pH	-	6.1	6.2	7.0
Dissolved Oxygen (mg/L)		5.5	5.1	8.0
Salinity (ppt)	-	4.0	4.3	9.5
Total Suspended Solids (mg/L)	-	57	116	19
Dissolved Metals in µg/L				
Arsenic	36	**2.6**	**3.0**	**6.1**
Cadmium	9.3	0.2 U	0.2 U	0.5 U
Copper	3.1	**1.7**	**2.4**	**4.7**
Lead	8.1	1 U	1 U	1 U
Zinc	81	**9**	**10**	**13**

Notes:
U denotes that the analyte was undetected at the indicated reporting limit.
Highlighted value denotes exceedance of the chronic (4-day-avg) surface water cleanup level.
mg/L = milligrams per liter
ppt = parts per thousand
µg/L = micrograms per liter

Metal concentrations measured in well points WP-2 and WP-3 were below surface water cleanup levels during the May 2006 sampling (Table 1), and confirm the protectiveness of the cap constructed at the Site. However, dissolved copper concentrations in well point WP-4 (4.7 µg/L), while well below pre-construction levels measured in this area (Anchor and Aspect 2003 and 2004), nevertheless marginally exceeded the cleanup level of 3.1 µg/L based on chronic (4-day average) exposure. Water sampled in WP-4 was relatively saline and oxygenated. Elevated dissolved copper concentrations measured at this localized solid waste location are consistent with copper mobilized by tidal processes in this former plunge-pool zone. Consistent with the conceptual model of geochemical processes controlling copper mobility at the Site, a supplemental shore protection/cap system could be constructed in the WP-4 area to further restrict tidal mixing and associated oxygen transfer into localized refuse deposits in this area. Such a system is expected to be effective in controlling the release of copper into Whatcom Creek and is discussed further in Section 5.

4 BIOLOGICAL SAMPLING AND ANALYSIS

The overall habitat monitoring objective for the Site is to determine if productive biological communities are being established in the area. This objective was addressed by documenting re-colonization of epibenthic and benthic macroinvertebrates in the area (relative to pre-construction baseline conditions), and documenting general utilization of the Site area by juvenile salmonids. An overview of the macroinvertebrate and juvenile salmonid sampling procedures is provided in *Exhibit E* of the Consent Decree. Habitat monitoring stations are identified as BIO WP-2 and BIO WP-3 on Figure 1.

Epibenthic and benthic macroinvertebrate sampling was conducted in July 2006. Triplicate epibenthic and benthic macroinvertebrate samples were collected at each of two locations in the Holly Street Landfill Site area (denoted BIO WP-2 and BIO WP-3 on Figure 1). Species lists and enumeration results were provided for each sample. B&B Consulting (Dr. Brian Bingham) oversaw all epibenthic and benthic macroinvertebrate sampling and enumeration.

To ensure that data collected in 2006 would be comparable to those collected in the baseline year, collection methods were matched as closely as possible (Bingham 2002). An epibenthic suction pump (Simenstad et al. 1991) was used to collect three replicate samples of the epibenthos at each station. The pump covered a 0.033 square meter (m^2) area of the bottom and enclosed a volume of 7.1 liters (L). To ensure that all invertebrates were removed from the pump, three volumes of water (21.3 L) were flushed through the system. The pump had 0.130-millimeter (-mm) screened ports that retained the macroinvertebrates but allowed water to pass through and flush the system. The collected material was then washed through a 0.253-mm mesh sieve and preserved the sample in 10 percent buffered formalin. The samples were later transferred to 70 percent ethanol. In the laboratory, all invertebrates were picked from the samples, sorted, and identified to the lowest possible taxonomic level.

Also in July 2006, three 0.023 m^2 petite ponar grab samples (PSEP 1997) were collected from BIO WP-2 and BIO WP-3. The collection method differed slightly from the baseline year. In the baseline year, accumulated rocks, glass, plastic, and other debris prevented collection of typical ponar grab samples (Bingham 2002), requiring sampling of the Site at low tide and collection of equivalent benthic sediment volumes with a shovel. During the 2006 sampling, the benthic habitat was much sandier and cleaner, allowing collection of ponar samples from a small boat at

high tide. The collected samples were washed through a 0.5-mm brass sieve and fixed with 10 percent buffered formalin. The samples were later transferred to 70 percent ethanol, sorted, and identified to the lowest possible taxonomic group.

Juvenile salmonid utilization of the restored habitat at the Holly Street Landfill Site was monitored by conducting shoreline-based observations. A trained Anchor biologist used binoculars and polarized glasses to observe fish distributions in the project area. Observations were made on two sampling days (May 11 and May 30, 2006) during the spring juvenile salmonid outmigration period. On both sampling days, sampling was conducted during two 15-minute periods to provide fish observation data during different portions of the tidal cycle (e.g., flood, ebb, slack). Observations were made from five sampling locations along the north and south banks of the estuary from the Whatcom Creek Fish Hatchery (also known as the Maritime Heritage Park Fish Hatchery) to the Holly Street Bridge.

4.1 Epibenthic Results

Epibenthic samples were composed largely of oligochaetes and harpacticoid copepods (Table 2). There were, however, many other species present in smaller numbers. Substantially more species were reported in 2006 than during baseline year (31 species vs. 21 species). Many of the new species were mollusks (which were completely absent in the baseline year samples).

Table 2
2006 Epibenthic Organism Enumeration (BIO WP-2 and BIO WP-3)

	Station					
	WP-2			WP-3		
	1	2	3	1	2	3
Annelida						
Neanthes limnicola	1					
Owenia fusiformis		3				
Polydora sp.	1					
Unidentified oligochaete	39	24	51	12	16	39
Mollusca						
Acmaea sp.				1		
Modiolus modiolus			1		2	1
Rochefortia tumida			2			
Transenella tantilla			3		1	1
Littorine egg case	1	3	3	28	1	6
Unidentified gastropod egg case		2	2	1	1	
Unidentified veliger	1	1	4			
Arthropoda						
Corophium spinicorne		2	1		23	31
Cumella vulgaris		1				
Eogammarus sp.				15	1	
Harpacticus sp.	72	48	39	43	34	66
Leptochelia savignyi					1	
Nannopsis palustris	57	43	40	9	11	31
Nippoleucon hinumensis			5			
Orthopsyllis illgi			1	1		
Tisbe sp.					1	
Unidentified ostracod 1	3	1	4			1
Unidentified ostracod 2			3	1		
Unidentified ostracod 3				1		1
Unidentified ostracod 4	21	29	13	5	3	4
Unidentified copepod nauplius		1	1			
Unidentified calanoid copepod	4	2	5	3	1	2
Unidentified brachyuran zoea	1			1		
Unidentified chironomid			1			
Unidentified Elimidae						1
Miscellaneous						
Unidentified nematodes	8	3		8	3	12
Elphidium excavatum (Foraminifera)	4	1	1			

4.2 Benthic Results

As in the baseline year, benthic samples were dominated by large numbers of the nereid polychaete *Neanthes limnicola* (Table 3). These polychaetes accounted for most of the biomass in the benthic samples. In the baseline year, insects were found in most of the epibenthic and benthic samples. These were nearly absent from the 2006 samples.

Table 3
2006 Benthic Organism Enumeration (BIO WP-2 and BIO WP-3)

	Station					
	WP-2			WP-3		
	1	2	3	1	2	3
Annelida						
Eteone spetsbergensis			3	2	5	
Hobsonia florida	5	6	10			
Neanthes limnicola	69	71	117	16	32	40
Unidentified maldanid	10	2	2	3	1	4
Unidentified spionid	16	7	4	4	2	2
Unidentified oligochaete	112	84	107	115	19	25
Mollusca						
Macoma inquinata		1				
Arthropoda						
Balanus sp.				1		
Corophium spinicorne	1				1	1
Nannopsis palustris	10	2	1	57	3	
Nippoleucon hinumensis					1	
Pancolus californiensis	2			3	1	2
Unidentified calanoid copepod				1		
Miscellaneous						
Unidentified Nematodes						3

4.3 Juvenile Salmonid Monitoring Results

On May 11, 2006, an estimated 20 to 25 juvenile salmonids measuring approximately 30 to 60 mm in total length were observed on the north bank adjacent to the Holly Street Bridge. On May 30, 2006, approximately 30 to 40 juvenile salmonids measuring 60 to 90 mm in total length were observed at the bend in the bulkhead along the Whatcom Creek hatchery on the north side of the creek. In addition, a total of five juvenile salmonids were observed during the two time periods on May 30 near the some of the juvenile habitat restoration features that were part of the design, including anchored woody debris.

Fish observations are summarized in Table 4 and the location of these observations are shown on Figure 4. The fish observations documented that juvenile salmonids were utilizing the Whatcom Creek estuary in the project area.

Table 4
Summary of Fish Observations

Observation	May 11, 2006		May 30, 2006	
	Morning	**Afternoon**	**Morning**	**Afternoon**
Tide Stage	**Ebb tide, +2 feet MLLW**	**High slack tide, +7 feet MLLW**	**Ebb tide, +4.5 feet MLLW**	**Flood tide, +3 feet MLLW**
Time	**0815 to 0830**	**1810 to 1825**	**0915 to 0930**	**1730 to 1745**
Weather	**Overcast, light rain**	**Overcast, no rain**	**Sunny, light clouds**	**Sunny with hazy clouds**
A	20 to 25 juvenile salmonids between 30 and 60 mm total length; congregated near bridge	None	None	Two sculpin between 30 and 60 mm total length
B	None	None	Three juvenile salmonids between 30 and 60 mm total length; feeding near habitat logs	Two juvenile salmonids between 60 and 90 mm total length
C	None	None	None	30 to 40 juvenile salmonids between 60 and 90 mm total length; five rainbow trout between 100 and 150 mm total length; rainbows appeared to be actively feeding on juvenile salmonids
D	Approximately 100 shiner perch between 100 and 150 mm total length; feeding at confluence of creek and estuary	None	None	None
E	none	None	None	None

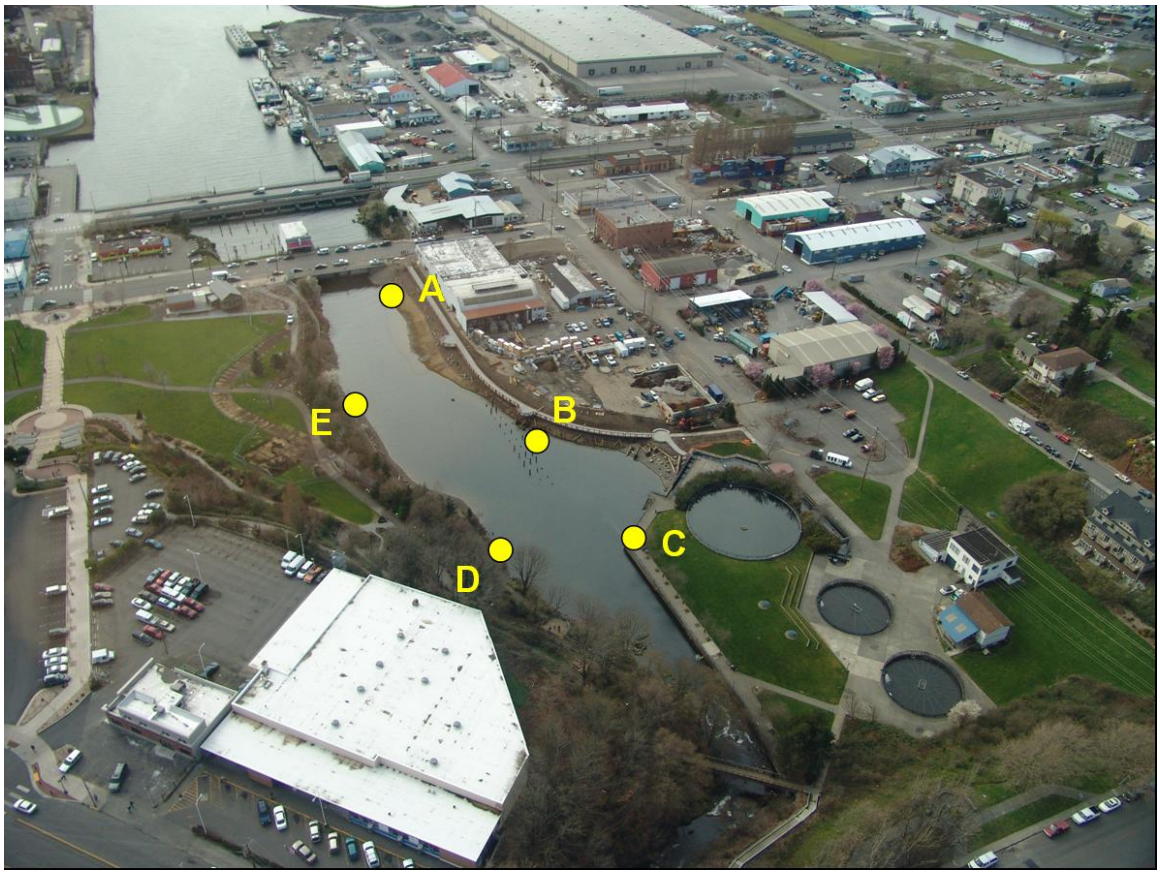

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Figure 4
Fish Observation Sites
Holly Street Landfill/Whatcom Creek Estuary

5 ADAPTIVE MANAGEMENT AND CONTINGENCY RESPONSE

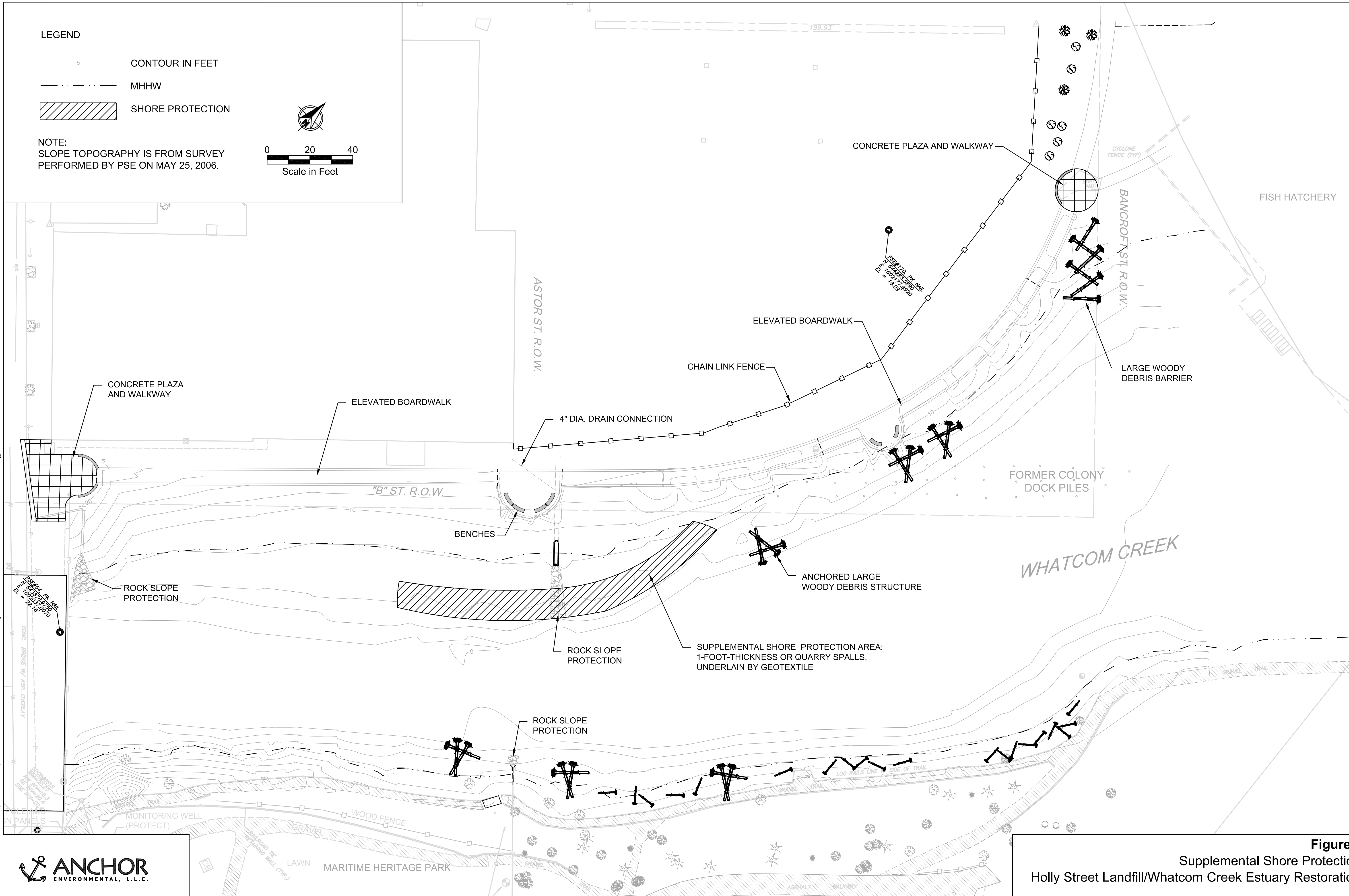
As discussed in Section 2, the 2006 post-construction bathymetric monitoring confirmed that the current cap's horizontal extent, elevation range, and thickness exceed the minimum requirements specified in the CAP. Moreover, epibenthic, benthic, and fisheries utilization data summarized in Section 4 indicate that productive biological communities have now become established in the project area. However, as summarized in Section 3, outside and below the specified capping limits, a localized deposit of solid waste has been identified at the Site offshore of the existing 15-inch stormwater outfall, potentially the result of historical plunge-pool deepening caused by past stormwater discharges to this area of the Site (near Station WP-4 depicted on Figure 1). The localized extent and limited permeability of the exposed solid waste materials suggest that there is a low potential for water quality impacts in this area.

While dissolved copper concentrations measured in well point WP-4 (4.7 μg/L) were well below pre-construction levels measured in this area (Anchor and Aspect 2003, 2004), they nevertheless marginally exceeded the cleanup level of 3.1 μg/L based on chronic (4-day average) exposure (Table 1). Further monitoring and/or modeling could be performed to translate the single WP-4 sample result into a 4-day average concentration, consistent with the conceptual model of geochemical processes controlling copper mobility at the Site; but a more immediate action alternative would be to construct a supplemental cap system in the WP-4 area to further restrict tidal mixing and associated oxygen transfer into localized refuse deposits in this area. The supplemental shore protection/cap system would also provide for improved stability at the toe of the cap in this area (see Figure 3).

The City is currently designing a stormwater diversion that would redirect flow away from the 15-inch outfall line and instead into the larger stormwater system that serves this area (e.g., discharged into the C-Street outfall system). The stormwater diversion is currently scheduled to be implemented in fall 2006 or early winter 2007. Concurrent with the stormwater diversion action and closure of the 15-inch outfall discharge into the Whatcom Creek estuary, the City will place an additional 1-foot thickness of quarry spalls at an elevation ranging between approximately +5 and +7 feet MLLW, over a distance of roughly 80 feet upstream and downstream of the existing stormwater channel, as depicted in Figure 5. The quarry spalls will be underlain with a sheet of geotextile fabric to improve protectiveness, as it will prevent the underlying sediments from winnowing through voids in the spalls over time. A sand/gravel

"fish mix" as specified in the remedial action contract documents will be placed over the surface of the quarry spalls. Once incoming native sands and silts deposit in the area as a result of normal sedimentation, this supplemental action will provide further control of oxidation releases from soil to groundwater by limiting tidally induced exchange of oxidized surface waters into the landfill (lateral recharge), and will also further stabilize the toe of the cap in this area. The roughly 100 cubic yards of supplemental quarry spalls will be placed on or before February 15, 2007, and all construction activities will be performed consistent with the requirements of Corps Permit #2004-00096. The City will apply for an extension of the Corps Nationwide 38 permit to authorize this supplemental placement activity.

Following placement of the supplemental shore protection system, further bathymetric, well point, and biological monitoring will continue in 2010, consistent with the Consent Decree requirements.


LEGEND
CONTOUR IN FEET
MHHW
SHORE PROTECTION
NOTE:
SLOPE TOPOGRAPHY IS FROM SURVEY
PERFORMED BY PSE ON MAY 25, 2006.
0 20 40
Scale in Feet
CONCRETE PLAZA AND WALKWAY
FISH HATCHERY
BANCROFT ST. R.O.W.
ASTOR ST. R.O.W.
ELEVATED BOARDWALK
CHAIN LINK FENCE
LARGE WOODY
DEBRIS BARRIER
CONCRETE PLAZA
AND WALKWAY
ELEVATED BOARDWALK
4" DIA. DRAIN CONNECTION
FORMER COLONY
DOCK PILES
"B" ST. R.O.W.
BENCHES
WHATCOM CREEK
ANCHORED LARGE
WOODY DEBRIS STRUCTURE
ROCK SLOPE
PROTECTION
ROCK SLOPE
PROTECTION
SUPPLEMENTAL SHORE PROTECTION AREA:
1-FOOT-THICKNESS OR QUARRY SPALLS,
UNDERLAIN BY GEOTEXTILE
ROCK SLOPE
PROTECTION
MONITORING WELL
(PROTECT)
WOOD FENCE
GRAVEL
LAWN
MARITIME HERITAGE PARK
MONITORING WELL (PROTECT)
Nov 06, 2006 3:38pm cdavidson K:\Jobs\990062-Holly Street\99006204\HOL-99006204-80.dwg FIG 5

ANCHOR ENVIRONMENTAL, L.L.C.

Figure 5
Supplemental Shore Protection
Holly Street Landfill/Whatcom Creek Estuary Restoration

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