2.0 Construction Activities

2.1. TIMELINE

The contractor began mobilizing their equipment to the site on November 13, 2003, and started dredging on November 14, 2003, at about 2:00 a.m. Dredging was conducted from November 14, 2003, to January 20, 2004. The contractor stopped dredging from December 20, 2003, through January 7, 2004, so they could perform dredging work at Blair Waterway in Tacoma, Washington, for a different client. Capping was conducted from January 23 to February 29, 2004 and on March 11, 2004. The contractor demobilized from the site on March 11, 2004.

Dredging was performed first in Area B due to the higher concentrations of PCBs in this area, and was generally complete on December 3, 2003. Confirmational surveys revealed some high spots remaining in Area B, which were dredged on December 13, 16, and 18, 2003, and January 11 and 20, 2004. Dredging in Area A commenced on December 3, 2003, and was completed on January 20, 2004, including any remaining high spots. Capping started in Area B on January 23, 2004 with placement of base capping sands, which were subsequently also placed in Area A. Placement of all armoring materials (including riprap, quarry spalls, and sandy-gravel [habitat mix]) was completed by February 29, 2004, and one adjustment occurred in March 2004. Confirmational surveys were conducted on March 3. The surveys showed that the surface elevations were too high in the 50-foot-wide part of Area B that extends into the navigation channel. On March 11, the contractor lowered the surface elevation in the 50-foot-wide part of Area B to be within the allowable 30-foot navigation channel depth. A final confirmation survey was conducted for King County on March 11, 2004.

2.2. CONTRACTOR SELECTION

The Request for Bids to construct the Duwamish/Diagonal CSO/SD Sediment Remediation Project was advertised in the Seattle Daily Journal of Commerce, Seattle Times, and the Chinese Post. A pre-bid conference was held on August 5, 2003, in the eighth floor conference room of the Exchange Building at 821 Second Avenue in Seattle. Sealed bids were required to be submitted to King County at the eighth floor Contracts Counter of the Exchange Building by 2:30 p.m. on August 12, 2003.

Three bids were received and were opened on August 21, 2003. The lowest responsive bid was submitted by Miller Contracting Inc. (Miller) of Bellingham, Washington, for $2,972,750 for upland disposal and $3,152,750 for disposal at Blair Slip 1. The engineer's estimate for this project was $2,756,612.75 and $3,006,163.75, respectively. The contractor also included J.E. McAmis Industries of Chico, California, as a subcontractor responsible for the dredging portion of the project, to conform with maritime regulations that require dredging vessels to be from the United States. Miller

was selected as the prime contractor and Notice to Proceed was issued on October 6, 2003.

A separate contract was advertised on August 1, 2003, for the disposal portion of the project. Sealed bids were required to be submitted to King County's Procurement and Contract Services Section Mailstop EXC-F1-0871 by 2:00 p.m. on August 12, 2003. Rabanco Regional Disposal Company (Rabanco) of Seattle, Washington, had the only responsive bid. Rabanco had a separate agreement with Wilder Construction Company of Everett, Washington, to operate an offloading facility at the Port of Seattle's Terminal 25. Sediment delivered to that facility would be offloaded from the barge, placed in lined railroad cars, and transported to Rabanco's Roosevelt Landfill in Klickitat County, Washington. The contract was awarded to Rabanco on September 10, 2003, as the alternate disposal option. Notice to proceed was issued on November 10, 2003, after the County dropped Blair Slip 1 as the preferred disposal option.

2.3. GENERAL CONSTRUCTION PROCEDURES

The contractor was required to dredge the southern portion of the site (Area B) first due to higher concentrations of PCBs located in this part of the site. Upon completion of the dredging in Area B, the contractor could dredge Area A. This allowed for residuals that may have been released during the Area B dredging and which settled downstream in Area A to be removed during that dredging operation. When all dredging was complete the contractor was allowed to begin capping operations. The cap consisted of several different layers. A base cap layer primarily composed of sand was placed first to contain all remaining sediment contamination. This was followed by an erosion control layer of gravel, quarry spall, or riprap, depending on the velocities anticipated from propeller wash, current, and waves at different locations. Finally, a layer of "habitat mix" (a rounded sand and gravel blend) was placed on exposed quarry spall or riprap surfaces. The placement of the base cap in Area B was required prior to placing base cap in Area A; however, the contractor was allowed to place various armor layers prior to the placement of all the base caps.

King County provided construction management and water quality monitoring services.

2.4. DREDGING OPERATIONS

2.4.1 Equipment

The contractor mobilized a derrick (*Crystal Gale*), tugs *(MV Norton Bay* and *MV Loren M)*, split hull barges *(Sand Island and Swan Island)*, and a hydrographic survey vessel to the site. The *Crystal Gale* is 142 feet long by 58 feet wide with a 12-foot draft. It is equipped with an American 12-210 crawler crane with a 10-cy clamshell bucket. The derrick is equipped with a differential global positioning system (DGPS) with an antenna on the tip of the boom over the bucket. WinOps® software was used to allow the operator to know where the horizontal position of the bucket was relative to the dredge plan at any given time. The vertical position of the dredge bucket was determined by 1-

foot markings on the cable and an electronic tide gauge that updated every 5 minutes. Two upstream and two downstream anchors were placed outside the dredge area, and winches on the corners of the dredge barge were used to change position upstream and downstream. The small tug (*MV Loren M)* periodically moved anchors inshore and offshore so the dredge barge could move inshore or offshore. Occasionally, the dredge had to be moved inshore to allow river traffic to pass.

Dredged sediment was placed in the two split hull barges (1,700 cy capacity each) and taken to the offloading facility for offloading, transport, and disposal. Water overflow pipes on the split hull barges were covered with three layers of filter fabric, which allowed some dewatering at the dredge site and no overflow at the offloading site. Some excess water was pumped from barges to holding tanks either on the barge or at the offloading facility.

Upland support equipment and facilities at the dredge site included a construction trailer and sanitary facilities. The contractor did not store any equipment on site. Personnel transferred on and off the derrick and tugs either at an offsite location, by boarding from the shore, or at the "E"-shaped pier located inshore of Area B. The King County inspector was set up in the construction trailer and continuously monitored dredging from the trailer or from the "E"-shaped pier.

King County personnel monitored water quality during dredging activities and collected confirmational sediment samples following completion of the dredging (see Section 3.0). Turbidity exceedances were observed periodically during the dredging operations and are discussed further in Section 3.1.1. Several actions were taken in an attempt to reduce turbidity, including slowing the rate of dredging, slowing the rate of movement through the water, not overfilling the bucket, and using a different bucket. An 18-cy rock bucket without digging teeth was used on November 25, 2003 to try to reduce turbidity exceedances. However, this 18-cy bucket resulted in higher than acceptable turbidity values because the top section of the bucket was open and its mouth did not seal well when closed; thus allowing sediment to escape. Consequently, the 10-cy digging bucket was used for the duration of the dredging.

While dredging near the outfalls on December 9, 2003, at approximately 10:00 a.m., an oil sheen was observed on the water surface by the contractor. It is believed to have been a pocket of oil that had been deposited from a past discharge and was disturbed by the dredging. Upon observation, the contractor halted dredging activities and deployed an oil absorbent boom. The contractor notified King County, the U.S. Coast Guard (Reference 707-574) and Ecology (Reference 03-3096). The U.S. Coast Guard stated that it was acceptable to resume dredging in the area with caution. King County instructed the contractor to move to another portion of the site and continue dredging there and to only partially fill the barge so that water levels in the barge would stay below the overflow drain pipes, and thus contain all oily water within the barge. When the contractor returned to this area no further sheens were observed.

The 10 cy digging bucket was effective for sediment conditions and debris present at the site, and required enforcement of BMPs to minimize turbidity and loss of material. The limitations identified for the other dredging equipment considered during the Alternatives Evaluation process are included in the *Cleanup Study Report* (EBDRP 2001) and are still valid. An environmental bucket was considered and rejected due to its inability to dig in firm sediments. Previous studies by the Port of Seattle showed that environmental buckets were ineffective in sediment hardness of greater than three blow counts. Most sediment along side slopes exceeded this number. Hydraulic dredging equipment was rejected as infeasible for the following reasons:

- There was no nearby location of sufficient size that was suitable to deal with the large amounts of water and sediment mix that would be generated.
- Large debris was expected to be encountered which could clog the dredge, resulting in high turbidity releases when the dredge was shut down to clear the pipeline. At least 39 logs were removed plus other debris, including barge tow cables.
- There would have been a very high cost of time and money for mobilization and set up of hydraulic dredging for a relatively small quantity of sediments to be removed, and hydraulic dredging could cause the project to take more than one winter dredging season to finish both dredging and capping.

2.4.2 Sequencing

The dredge cut plan is shown in Figure 5. At about 2 a.m. on November 14, 2003, the contractor began dredging in Area B at the inshore part of the dredge area. Because most of the dredge area was on the side slope created when the navigation channel was dredged, the contractor worked from the shallower inshore area to the deeper offshore area to maintain slope stability. After completing the 50-foot-wide strip of Area B located within the navigation channel, dredging in Area B was substantially complete. Dredging began in Area A on December 3, 2003, and the same general procedures of working from the top of the slope to the bottom were used in Area A. The confirmatory surveys by King County's surveyor showed some high spots in Area B, so the contractor moved equipment back to the location and made the required changes. The contractor's surveys identified high spots in Area A, so equipment was moved to those locations and the required changes were performed. All dredging in Areas A and B was completed on January 20, 2004.

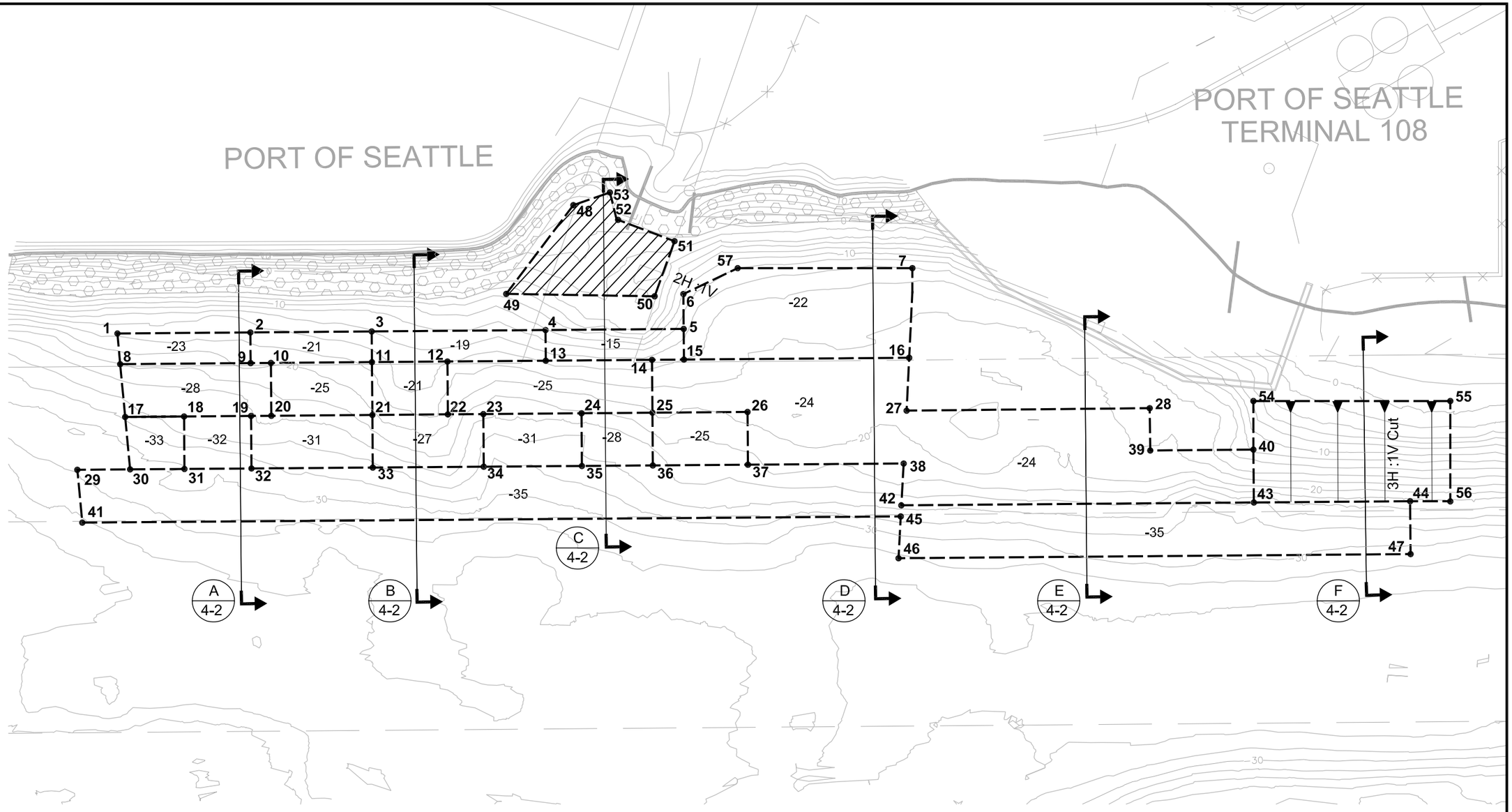
The contractor worked the first three days (November 14, 15, and 17) dredging two shifts per day. The shifts ran from 2 a.m. to 12 a.m. (first shift) and 12 a.m. to 10 p.m. (second shift) and produced about two barges of material per day. However, on November 18, the offloading facility stopped accepting barges for 2 days due to difficulty handling the sediment with high water content because it would not stack, which reduced their storage capacity. Rabanco resumed accepting barges on November 25, but limited the daily average to their contracted amount of 2,000 cy/day, which is about 1.3 barges per day. The dredging contractor switched to working one shift per day and delivered barges according to Rabanco's schedule. When dredging stopped from December 20 to January

7, Rabanco was able to completely empty the site, which provided maximum storage capacity for both the King County project and the Port of Seattle's East Waterway project. Dredging resumed on January 8, and on January 9 King County approved Miller's request to work two compressed shifts. The first shift ran from 5 a.m. to 2 p.m. and the second shift ran from 2 p.m. to 9 p.m. Double compressed shifts were worked 10 of the 12 days it took to complete dredging by January 20, 2004.

Dredging occurred over 49 days and removed approximately 68,250 cy of material (including debris and over dredge). The average production rate of all material dredged and delivered for offloading was approximately 1,393 cy per day.

DREDGE COORDINATES

POINT	EASTING	NORTHING
1	1266907	209510
2	1266947	209390
3	1266984	209281
4	1267036	209125
5	1267077	209001
6	1267108	209012
7	1267198	208813
8	1266881	209498
9	1266920	209381
10	1266926	209363
11	1266956	209272
12	1266979	209204
13	1267008	209116
14	1267040	209021
15	1267050	208992
16	1267117	208790
17	1266835	209478
18	1266852	209425
19	1266872	209365
20	1266878	209347
21	1266909	209256
22	1266931	209189
23	1266942	209157
24	1266971	209069
25	1266993	209005
26	1267021	208920
27	1267069	208777
28	1267142	208559
29	1266773	209506
30	1266789	209458
31	1266805	209410
32	1266825	209350
33	1266861	209241
34	1266895	209141
35	1266924	209053
36	1266945	208989
37	1266974	208904
38	1267020	208764
39	1267104	208546
40	1267135	208453
41	1266727	209486
42	1266982	208754
43	1267088	208438
44	1267134	208297
45	1266972	208751
46	1266934	208741
47	1267087	208281
48	1267156	209137
49	1267056	209171
50	1267097	209037
51	1267153	209035
52	1267156	209092
53	1267178	209108
54	1267179	208468
55	1267236	208290
56	1267146	208261
57	1267148	208971



Legend:

- Remove Minimum of 4 Feet below Grade in this Area
- Cross Section Location (C / C-8)
- Approximate Extent of Visible Rock Bulkhead
- -10 Existing Bathymetry Elevation Contours in Feet (2-Foot Interval)
- -21 Dredge Coordinate
- Dredge Boundary
- Minimum Required Dredge Elevation (MLLW)

Notes:

1. Topography/Basemap provided by the Port of Seattle (1994). This data is to be used for visual reference only.
2. Bathymetric contours created by Anchor Environmental from BWE 2002 survey referenced to MLLW (NOS).
3. Horizontal Datum - Washington State Plane North Zone NAD 83
4. A side slope shall be cut on the inshore portion of the site that removes as much sediment as possible without undercutting or destablizing the rock bulkhead.

0 50 100
Scale in Feet

EcoChem Team

Duwamish/Diagonal Sediment Remediation Project

Dredge Cut Plan

Figure 5

Jul 18, 2005 11:24am cdavidson K:\Jobs\00008601-Duwamish\CLSR_RPRT_2005\00008601-02CR.dwg Fig 5

2.5. DISPOSAL ACTIVITIES

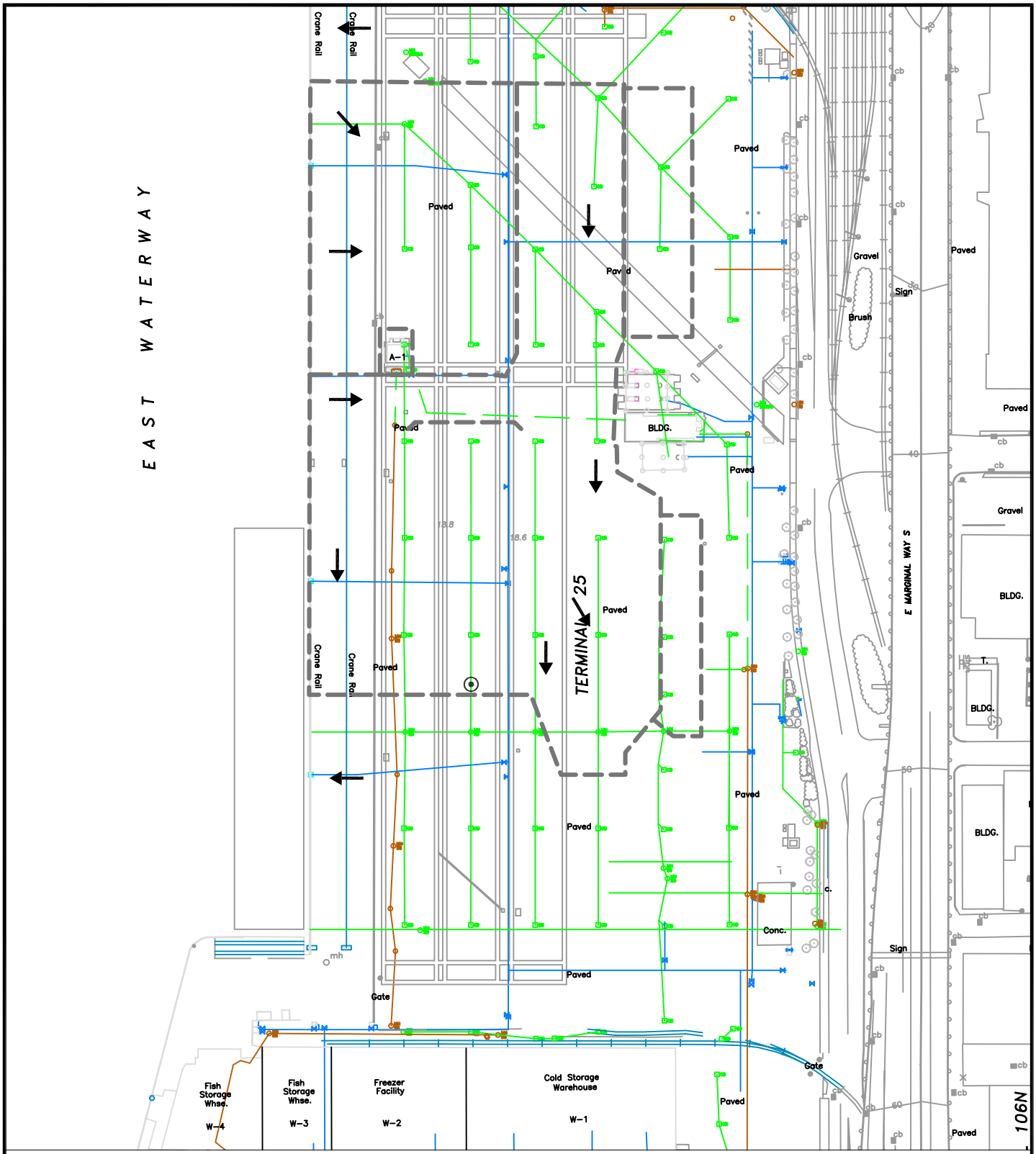
The offloading facility was the responsibility of Rabanco, the offloading contractor. By contract, the offloading contractor took ownership of the dredged sediment upon picking the sediment up with their off-loading bucket. Figure 6 shows the layout of the offloading facility. Once a barge was delivered to the offloading site, the offloading contractor was allowed 24 hours to offload the barge and return it to service for the dredging contractor. Dredged sediments were removed from each barge with a 5-cy clamshell bucket on a Bucyrus-Erie 88-B, Series 4 heavy duty crawler crane. Offloaded sediment was dropped onto the ground and then was transferred into staging areas or directly into lined 20-foot open-top shipping containers on railcars using front-end loaders. A steel-plate "batter board" that angles up from the pier deck and extends out past the barge's sediment containment system was provided. When material dripped from the clamshell bucket, it hit the board and ran down into the sediment offloading area or fell directly back into the barge. The batter board assembly was relocated whenever the crane was repositioned, in order to be beneath the arc of the bucket. During the last week of dredging, the facility started to offload and dispose of dredged sediments from the Port of Seattle's East Waterway dredging project.

Excess water was pumped out of each barge and into storage tanks for filtration treatment testing and proper disposal. Excess water was also collected from the stockpiled sediments along with rain water and stored in three 100,000 gallon tanks on site to allow filtration treatment, chemical testing, and proper disposal. Sampling is discussed further in Section 3.2.2. Ultimately, the water was discharged to the sanitary sewer at a manhole on the south side of the offloading site in compliance with the King Country Industrial Waste Authorization for discharge to the sewer. Approximately 2 million gallons of water was discharged from the tanks from the Duwamish/Diagonal project and from the one week overlap with the East Waterway project.

Railcars loaded with empty 20-foot open-top shipping containers were staged along the two loading tracks (Figure 6) for access by the front-end loaders. Two types of shipping containers were used. The first containers were 20-foot open-top ISO shipping containers, with dimensions of 20-feet long by 8-feet wide by 8-feet-6-inches high, and with side-hinged rear doors with manual latches. Prior to placement of the sediments in the containers, a 6 mil plastic liner was placed in the open top containers to prevent leakage and spillage out the top. Additional procedures to prevent spillage out the top were to limit the amount of sediment to about 34 tons, which resulted in adequate free board. The second type of container was a commercial 20-foot sealed-top container. A gasketed top was raised out of the way during loading and then secured on top after loading. Some loading was performed with a backhoe-type loader equipped with an articulating bucket.

Burlington Northern Santa Fe Railway Company (BNSF) then transported the loaded containers to Roosevelt, Washington, in Klickitat County for disposal at Roosevelt

Regional Landfill, a Resource Conversation and Recovery Act of 1976 (RCRA) Subtitle D landfill. Filled debris containers were shipped in a similar manner. No dewatering of dredged sediment was required because this landfill is conducting a moisture enhancement demonstration project approved by Ecology. A total of 91,555 tons of sediment were disposed of at Roosevelt Regional Landfill.



EcoChem Team	Duwamish/Diagonal Sediment Remediation Project	Figure 6
	Offloading/Rehandling Facility Layout at Terminal 25	

Jul 07, 2005 1:13pm cdavidson K:\Jobs\000086601-Duwamish\CLSR_RPRT_2005\000086601-78CR.dwg Fig 6

2.6. DECONTAMINATION

Upon completion of all the dredging operations, the clamshell bucket was rinsed off over a haul barge to remove sediments from the bucket. The haul barges were decontaminated by rinsing them with river water sprayed from fire hoses. This rinse water was collected inside of the barges and then pumped into the water tanks at the offloading facility for proper disposal.

2.7. CAPPING OPERATIONS

After all the dredging was complete and elevations were confirmed by the post-dredge survey, capping operations were allowed to begin. The capping plan showing armoring material is shown in Figure 7. Capping material was obtained from Canadian quarries and transported to the site by flat deck haul barges. Base cap and habitat mix materials were obtained from Lehigh Northwest – Producer's Pit in Victoria, British Columbia (BC) and the quarry spall and riprap were obtained from Pitt River Quarries in Coquitlam, BC.

The capping material was placed using a Hitachi 1800 excavator with a clamshell bucket. The contractor primarily worked two shifts during capping in an effort to complete the work by the end of February 2004. Base cap material was initially placed throughout Area B and approximately half of Area A. The logistics of ordering and obtaining the required quantities of the different capping materials from the two different quarries resulted in placement of materials at different locations in the site as the materials were available. For instance, base cap was placed throughout the area that would have quarry spall and riprap placed over it. While surveys of this portion of the base cap were conducted and reviewed, the contractor continued to place base cap in other portions of the site. If locations were discovered to have too little coverage, the contractor was required to place more material and then resurvey the area in question, prior to approval of a given layer in that portion of the site. Because it was unclear how much base cap material would be required for the whole site due to dispersion within the water column, only a portion of the base cap was initially ordered. This was followed by an order of quarry spall from the other quarry. Following the approval of a portion of the base cap layer's extent and thickness, the quarry spall was allowed to be placed in that portion. During the time that the surveys for the quarry spall were being reviewed, the contractor returned to placing base cap in other portions of the site. After low spots were corrected, the contractor placed habitat mix over the quarry spall and as a foundation layer under where the riprap would be placed. This procedure of placing cap materials, surveying, and reviewing continued until the entire site was capped.

Capping material placement occurred over 28.5 days with approximately 75,232 cy of material placed. The average production rate of all material placed was approximately 2,640 cy/day. The contractor encountered equipment problems. Initially, the WinOps system for determining horizontal positioning of the clamshell bucket relative to the dredge plan behaved sporadically. Anchor cables had to be replaced during capping

operations. The hydraulic cylinder operating the clamshell burned out and had to be replaced. A rock skip-type bucket was used temporarily and had to be installed, and uninstalled once the clamshell was back in operation. Equipment maintenance and material handling also hampered the production rate. On several occasions, the contractor was faced with the unavailability of capping material, oftentimes due to delays at U. S. Customs as the materials originated in BC. The production rate was also restrained by the time required to review and approve confirmatory surveys. Operational controls (cycle time) to limit the effects of resuspension also limited the production rate.

Base cap placement occurred over 18 16-hour days with approximately 53,162 cy placed. This is an average production rate, including equipment and material problems, of approximately 2,953 cy/day (185 cy/hour). Neglecting the equipment and material problems, the base cap material placement rate is estimated to be 3,157 cy/day (395 cy/hour).

Habitat mix placement occurred over 6 16-hour days with approximately 12,043 cy placed. This is an average production rate, including equipment and material problems, of approximately 2,007 cy/day (125 cy/hour). Neglecting the equipment and material problems, the base cap material placement rate is estimated to be 2,143 cy/day (268 cy/hour).

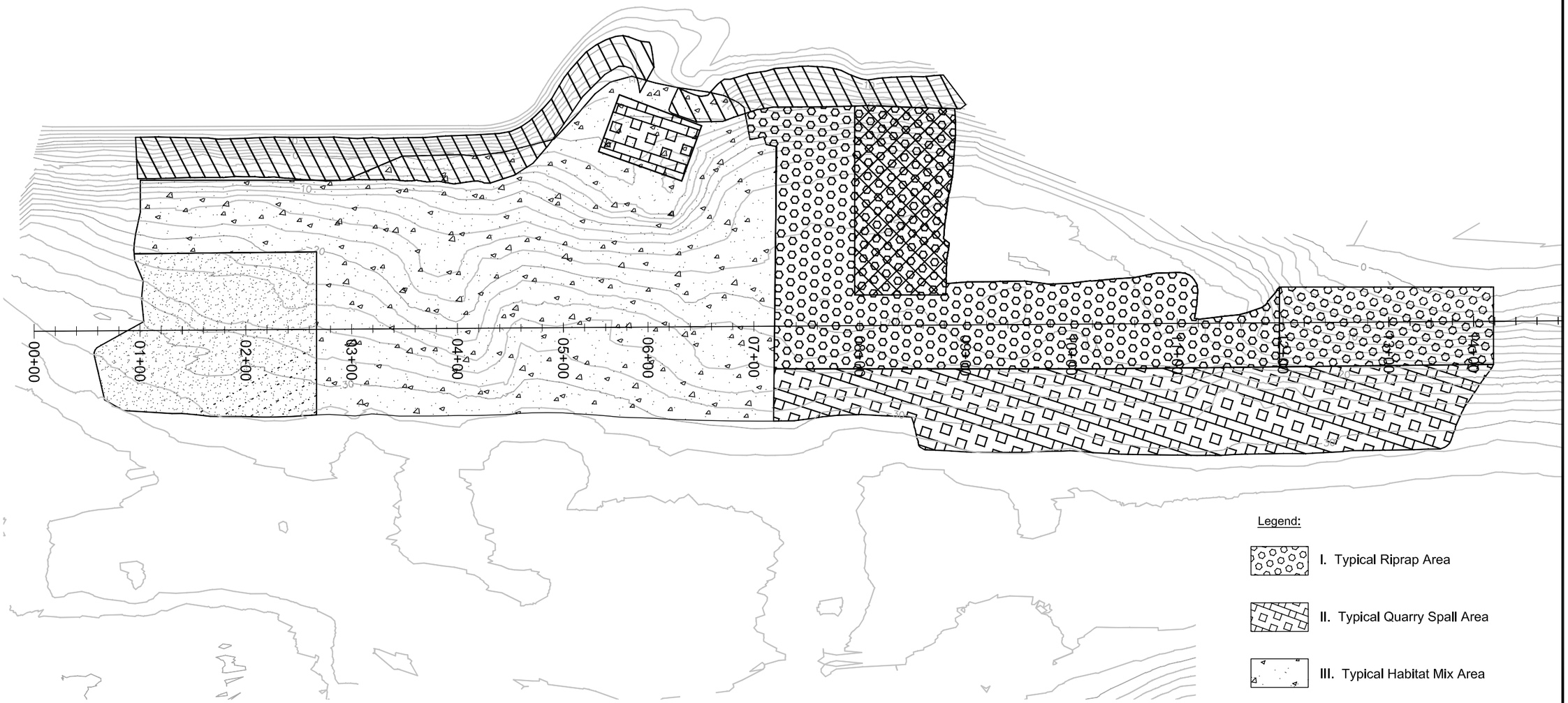
Quarry spall placement occurred over 2 16-hour days with approximately 3,686 cy placed. This is an average production rate, including equipment and material problems, of approximately 1,843 cy/day (115 cy/hour). Neglecting the equipment and material problems, the base cap material placement rate is estimated to be 2,071 cy/day (259 cy/hour).

Riprap placement occurred over 2.5 16-hour days with approximately 6,341 cy placed. This is an average production rate, including equipment and material problems, of approximately 2,536 cy/day (159 cy/hour). Neglecting the equipment and material problems, the base cap material placement rate is estimated to be 2,921 cy/day (365 cy/hour).

A construction survey taken during placement of the base cap material in Area A revealed that the original design, which mimicked the original slope of 7.5 horizontal to 1 vertical (7.5H:1V), would result in final elevations that would be significantly higher than the original grade in most locations. After consulting with the National Marine Fisheries Service (NMFS), the US Fish and Wildlife Service (USFWS), and the U.S. Army Corps of Engineers, the contractor was instructed to place less thickness of base cap material so as to approximate the original grade, which was the intent of the original design. Even with this change, a minimum thickness for base cap material of 2 to 3 feet was achieved. The original cap design projected that a minimum thickness of 2 to 3 feet of base cap material would be provided if Area A were filled with base cap material to a slope of 7.5H:1V. Because the contractor had detailed bottom surveys over small areas, they

could adjust the amount of fill to approximate the original bottom elevations without putting too much or too little base cap material on it.

The March 3 confirmational surveys performed upon completion of capping activities showed that in Area B the portion in the navigation channel had some elevations shallower than the authorized channel depth of -30 feet Mean Lower Low Water (MLLW). The contractor was instructed to remove this material and performed the changes on March 11, 2004. A permit extension was issued to work from March 1 to March 15, but the contractor used only one in-water work day in March 2004.



Legend:

- I. Typical Riprap Area
- II. Typical Quarry Spall Area
- III. Typical Habitat Mix Area
- IV. Typical Base Cap Area
- V. Habitat Mix over Existing Structural Rock Bulkhead
- VI. Light Loose Riprap, Special Note Gradation Requirements

— -10 — Existing Bathymetry Elevation Contours in Feet (2-Foot Interval)

0 50 100
Scale in Feet

Notes:
1. Topography/Basemap provided by the Port of Seattle (1994). This data is to be used for visual reference only.
2. Bathymetric contours created by Anchor Environmental from BWE 2002 survey referenced to MLLW (NOS).
3. Place 'Habitat Mix' over the existing riprap between elevations -5 feet MLLW and +12 feet MLLW.
4. Horizontal Datum - Washington State Plane North Zone NAD 83

EcoChem Team

Duwamish/Diagonal Sediment Remediation Project

Required Grain Sizes for Cap Erosion Layer

Figure 7

Jul 01, 2005 11:30am cdavidson K:\Jobs\00008601-Duwamish\CLSR_RPRT_2005\00008601-79CR.dwg Fig 7