DETAILED PROJECT DESCRIPTION

ATTACHMENT A OF THE JOINT PERMIT APPLICATION

ZIDELL WATERFRONT REMEDIATION PROJECT
3121 SW MOODY AVENUE
PORTLAND, OREGON

Prepared for

ZRZ REALTY COMPANY

December 14, 2009
Project No. 8014.01.19

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The material and data in this report were prepared under the supervision and direction of the undersigned.

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ACRONYMS AND ABBREVIATIONS

ACM	asbestos-containing material
BMP	best management practice
City	City of Portland
COE	U.S. Army Corps of Engineers
Consent Judgment	September 12, 2006, General Judgment on Stipulation and Consent, Case No. 0609-09344
COP	City of Portland Vertical Datum (Elevation 0.0 COP is Elevation -1.375 National Geodetic Vertical Datum of 1929)
DEQ	Oregon Department of Environmental Quality
DSL	Oregon Department of State Lands
FS	feasibility study
MFA	Maul Foster & Alongi, Inc.
ODOT	Oregon Department of Transportation
OHW	ordinary high water
ORS	Oregon Revised Statutes
RCM	reactive core mat
RI	remedial investigation
ROD	Record of Decision
site	tax lots 1S1E10AC-00200 and 1S1E10-00300 (formerly referred to as tax lots 1 and 42), the area directly under the Ross Island Bridge, the riverbank adjacent to these areas, and the in-water sediment cap area
SMP	soil management plan
TRM	turf reinforcement mat
Zidell	ZRZ Realty Company, Zidell Marine Corporation, and Tube Forgings of America, Inc.

1 INTRODUCTION

Maul Foster & Alongi, Inc. (MFA) has prepared this detailed project description on behalf of ZRZ Realty Company, Zidell Marine Corporation, and Tube Forgings of America, Inc. (collectively referred to in this report as Zidell) as a supplement to the Joint Permit Application (JPA) for the bank and sediment remediation proposed at the Zidell waterfront property located at 3121 SW Moody Avenue in Portland, Oregon.

1.1 Background

On April 14, 1995, Zidell entered into a Voluntary Agreement with the Oregon Department of Environmental Quality (DEQ) to conduct a remedial investigation (RI) and feasibility study (FS) at the site[1] (DEQ No. WMCVC-NWR-94-23; ECSI No. 689). The RI was completed in 2003 (MFA, 2003) and the FS was completed in 2004 (MFA, 2004b). The remedial action was selected by the DEQ in the Record of Decision (ROD) (DEQ, 2005), in accordance with Oregon Revised Statutes (ORS) 465.200 through 465.380 and Oregon Administrative Rules Chapter 340, Division 122, Section 0090. The remedy selected by the DEQ, as documented in the ROD (DEQ, 2005), is based on the final RI/FS reports and on DEQ modifications to the remedial action recommended in the FS report. The September 12, 2006, General Judgment on Stipulation and Consent, Case No. 0609-09344, between the State of Oregon and Zidell (Consent Judgment) requires that Zidell implement the proposed bank and sediment remediation described in this report by September 12, 2011.

1.2 Required Authorizations

Before initiating the proposed work, the following authorizations must be acquired and regulatory requirements must be met:

- Approval of Pre-Final and Final Design by the DEQ
- Clean Water Act Section 401 Water Quality Certification—DEQ
- Clean Water Act Section 404 permit; Section 10 Rivers and Harbors Act authorization—U.S. Army Corps of Engineers (COE)
- Demonstration of substantive compliance with Oregon Removal/Fill Law (ORS Chapter 196); access authorization, lease or acquisition of State lands—Oregon Department of State Lands (DSL)

[1] The RI, FS, and ROD encompass the entire Zidell property located at 3121 SW Moody Avenue, as well as adjacent sediments in the Willamette River. The project proposed in the JPA includes only the Willamette River bank and sediments, and does not include remedies upland of the top of the proposed bank.

- Endangered Species Act and Magnuson-Stevens Marine Fisheries and Conservation Act consultation—National Oceanic and Atmospheric Administration Fisheries Service
- Demonstration of substantive compliance with applicable City of Portland Code—City of Portland, Oregon (City)

1.3 Site Description

The Zidell waterfront property encompasses 29.67 acres on the west side of a heavily urbanized and modified reach of the Willamette River in the South Waterfront District (North Macadam Urban Renewal District) of Portland, Oregon (sections 3 and 10, township 1 south, range 1 east of the Willamette Meridian) (see Figure A1). The property is located in Multnomah County and consists of tax lot 1S1E10-00300 (formerly referred to as tax lot 1), which is located north of the Ross Island Bridge, and tax lot 1S1E10AC-00200 (formerly referred to as tax lot 42), which is located south of the Ross Island Bridge. The property owned by Zidell does not include the Oregon Department of Transportation (ODOT) right-of-way below the Ross Island Bridge. By terms of State Waterway Lease ML-8551, Zidell leases 2.342 acres of state-owned submerged lands in the Willamette River adjacent to the property it owns.

For purposes of studies completed by Zidell, and remedial actions required by the Consent Judgment, the entire Zidell "site" includes tax lots 1S1E10AC-00200 and 1S1E10-00300, the area directly under the Ross Island Bridge, the riverbank adjacent to these areas, and the proposed in-water sediment cap area, as shown on Figure A1. The total area of the site is approximately 43 acres. Within the Zidell site, the project area for the proposed riverbank and sediment cap remediation project is limited to the area between the proposed remedial action top of bank (generally within 40 to 50 feet landward [west] of the existing top of bank) and the riverward (east) extent of the sediment cap (Figure A2).

Zidell Marine Corporation builds, sells, and leases steel barges in the operational area of the site located south of the Ross Island Bridge, which includes an office building as well as the barge-building facilities. Barges are launched into the Willamette River approximately once each year at the sloped ramp in the southeast part of the operational area that is referred to as the slipway. The part of the site located north of the Ross Island Bridge consists predominantly of undeveloped, permeable surfaces and small areas of pavement.

1.4 Topography and Bathymetry

1.4.1 Topography

The upland portion of the Zidell site is generally flat, with elevations ranging from 28 feet to 37 feet City of Portland Vertical Datum (COP). Elevations in the north part of the site are generally higher than those in the south part (35 feet versus 30 feet). The 100-year floodplain elevation is approximately 30.4 feet along this reach of the Willamette River. The elevation of the ordinary high water (OHW) line is 18 feet COP. The elevation of the top of the bank ranges from approximately 28 feet to 35 feet.

The topography of the site has been modified over the years by fill placement, consistent with fill placement and urban development that has modified the former floodplain of the entire reach of the Willamette River that passes through Portland. As part of the RI (MFA, 2003), aerial photographs taken between 1936 and 1984 were reviewed to determine the fill history of the site. The most recent fill occurred between 1963 and 1966 along the bank immediately north and south of the Ross Island Bridge. Initial fill placement at the site likely occurred in the early 1900s when heavy industrial activity began in the area. The fill generally consists of gravel with brick, asphalt, wood, metal, plastic, asbestos-containing material (ACM), and glass. The fill thickens from west to east toward the river, and can extend to 40 feet below ground surface on the eastern portion of the uplands.

Like much of the urban river in Portland, the Zidell bank is steeply sloped and consists of construction debris, ballast rock, paving stones, soil, and other material that has acted as armoring against erosion. The bank slopes generally range from 1H:1V (1 foot horizontal to 1 foot vertical) to 2H:1V.

1.4.2 Bathymetry

The channel morphology of the Willamette River varies along the Zidell reach in significant ways, all of which have major impacts on the remedial design and considerations affecting cap stability.

The in-water slope in the slipway and south bridge design reaches is about 2H:1V within 60 to 80 feet from shore, and then rapidly decreases to less than 25H:1V as it approaches the depth of the main channel (see Figure A3 and Drawings C0.2.1 through C0.2.4, attached to the application). The elevation of the bottom of the main channel is approximately -25 to -35 feet COP in this area.

Immediately north of the Ross Island Bridge, the main channel begins to shift farther to the east (i.e., farther away from the site shore). The in-water slope in the north bridge reach and the southern portion of the downstream reach is approximately 2H:1V to 5H:1V within 70 feet of the shoreline (see Figure A3 and Drawings C0.2.4 and C0.2.5). In these areas, a small, shallow depositional area, or sediment bench, is located at the base of the slope. The elevations of the bench range from 5 to -10 feet COP. The width of the bench increases to up to 200 feet wide in the downstream reach, with slopes varying from 5H:1V to over 25H:1V (see Figure A3 and Drawings C0.2.6 and C0.2.9). On the eastern side of the bench, the river bottom falls away at a slope between 3H:1V and 5H:1V to match the bottom of the main channel at a distance of 300 to 400 feet from shore. The elevation of the bottom of the main channel is -35 to -55 feet COP in this area.

In the northern portion of the downstream reach, the in-water slope is generally more than 10H:1V and is fairly consistent down to the main river channel bottom, which is at a depth of approximately -35 to -40 feet COP.

1.5 Stormwater

Stormwater from the Zidell site either infiltrates into the ground or discharges to the Willamette River through two private permitted outfalls (Zidell Outfalls 1 and 2) and one City outfall (Outfall 6) and by direct sheet flow. There are two City stormwater outfalls on or in the vicinity of the Zidell property (Outfalls 6 and 7b). Both of these outfalls discharge in the proposed sediment cap area. Outfall 7b represents a rerouting of stormwater from two outfalls on the property that were abandoned in 2007: City Outfall 07 and ODOT Outfall 42.

1.6 Fluvial Setting

Before the urban development of Portland, the Willamette River was more dynamic, with an active floodplain of variable width and relatively frequent floodplain turnover (i.e., change in the position of the floodplain). The river through the Portland reach was generally wider and shallower than the current river, with extensive shoals throughout. The fluvial characteristics of the portion of the Willamette River that flows through downtown Portland have been extensively altered, nearly eliminating floodplain turnover in the urban reach. In terms of morphology, the river has been highly channelized (narrowed and deepened), and most of the natural floodplain has been filled as a result of Portland's urban growth along both sides of the river for over a century. Flow in the river is also impacted by 13 COE dams on the Willamette River. Even where floodplain remains, much of its habitat quality has been diminished because of hydraulic controls eliminating or significantly reducing the magnitude and duration of natural overbank flooding.

Along the Zidell site, the Willamette River flows northwest and is 1,400 to 1,500 feet wide. The channel is divided by Ross Island near the southern part of the site. During periods of low and medium flows, tidal effects are evident to river mile 26.5 (Willamette Falls); reverse flow has been measured as far upstream as the site and Ross Island during low-flow periods (Caldwell and Doyle, 1995). In contrast, winter floods can create large channelized flows along the reach of the site with discharges of up to 420,000 cubic feet per second.[2]

A 2008 fluvial analysis of the site (MFA, 2008) evaluated changes in bathymetry over time, using grain size distribution and model-generated river velocities in order to delineate estimated potential depositional and erosional areas offshore of the Zidell site (MFA, 2008). Depositional areas appear to be located in the downstream reach

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[2] This is the daily mean flow rate from February 9, 1996, the maximum daily mean flow rate on record at the USGS Station 14211720 (Willamette River at Portland Morrison Bridge). http://waterdata.usgs.gov/or/nwis/sw.

within 150 feet of shore. An erosional area was identified spanning the south bridge reach and extending approximately 100 feet from shore.

Figure A4 shows the existing substrate within the site area, based on field observations. The figure is generally consistent with an evaluation of grain size distribution that was completed as part of the fluvial analysis (MFA, 2008). The fluvial analysis indicated that the percent fines are highest in the central and northern nearshore areas. Between these two nearshore areas, coarser-grained sediments are evident near the former COP Outfall 7 and the former ODOT Outfall 42, both of which were abandoned in 2007. In the southern portion of the study area scouring has occurred, and in many cases in situ gravel and cobble deposits are exposed. In the areas over 250 feet from shore, percent fines are low (generally less than 10 percent) in the southern part of the study area, and grain size appears to be highly variable in the central and northern offshore parts of the study area.

1.7 Water-Dependent Site Activities and Expected Vessels

The southern operational area of the site, located south of the Ross Island Bridge, is currently used to build steel barges. Zidell Marine Corporation launches barges into the Willamette River at the slipway in the slipway design reach. A crane barge is moored next to the slipway ramp and is used to complete finishing work on recently launched barges. After the barges are launched, tugboats maneuver them into position at a location adjacent to the crane barge.

Various vessels (including canoes and kayaks, jet skis, small to large recreational power boats, cruise tour boats, tugboats, fire boats, and barges) use the river along this reach.

1.8 Ordinary High Water

The JPA and the attached plans use 18 feet COP for the OHW elevation. The COE has published tabulated OHW elevations, which at the Zidell site correspond to elevation 18 COP (COE, 2004). COE personnel have told Zidell that the 18-foot COP elevation is used as the OHW elevation for the COE Section 10 Permit for work in navigable waters, but the OHW elevation that is used in the COE Section 404 Permit for discharge of dredge or fill material into water is established based on field indicators of seasonally high river levels. The field indicators include observations of visible changes in soil, vegetation, and other physical conditions. The 2004 riverbank characterization report for Zidell (MFA, 2004a) identified OHW based on field indications to be at approximately 13 feet COP. The DSL has indicated to Zidell that they consider elevation 17.2 feet National Geodetic Vertical Datum of 1929 (18.6 feet COP) to be the elevation of OHW. Based on a review of the Willamette River gauge at the Morrison Bridge, a recurring maximum daily river stage elevation of 13 to 15 feet COP is observed on an annual basis.

2 REMEDIAL ACTION DESCRIPTION

The 16.28-acre proposed project area includes the portions of the site located below the proposed top of the bank (see Figure A2). The proposed project area includes 13.06 acres below OHW (see Table A1).

The proposed project area has been divided into four separate reaches, corresponding to four different design approaches: slipway reach, south bridge reach, north bridge reach, and downstream reach (see Figure A2). The proposed project provides a remedial action for contaminated bank soils and sediments at the Zidell waterfront site. The project involves in-water sediment dredging, bank excavations, bank armor repair and replacement, capping of contaminated bank soils and capping of contaminated sediment. The remedial action is depicted in Drawings C2.0.0 through C3.0.5 of the JPA, and is shown in cross section on Figures A5 through A10. The existing and proposed surface conditions of the proposed project are described in Table A2.

The remedial design for each design reach is based on a number of conditions and design criteria. Variations of hydrology, fluvial dynamics, geomorphology, bathymetry and land/river uses (e.g., barge launching, vessel traffic) are determining factors in the proposed sediment and bank cap designs. The designs must also meet certain factors of safety for slope and seismic stability, as determined by geotechnical modeling, and cap surfaces must remain stable during extreme flow events and hydraulic forces, including waves, generated by vessel activity. Contaminant containment by the sediment cap also has to demonstrate long-term reliability, on a scale of centuries, based on chemical isolation layer modeling.

The existing riverbank of the project area, approximately 3,100 linear feet, is armored with a variety of materials, including rock, ballast stones, brick and tile, concrete, and metal debris from past industrial activities. The approximately 2,700 linear feet of riverbank on Zidell property has been redesigned. Existing rubble/debris armor in the north slipway (approximately 100 linear feet) and south bridge (approximately 450 linear feet) reaches does not provide needed stability or contaminant capping, and will be excavated and replaced with rock armor as described below. Existing armor in the north bridge reach (approximately 400 linear feet) is mostly acceptable and will be left in place, with some repair. The proposed elevation of the top of armor throughout these three design reaches will generally be lower than existing. The existing armor in the downstream design reach (approximately 1,650 linear feet) will be left in place and covered with clean fill planted with native vegetation, as described below.

2.1 Bank Excavation (above and below OHW)

2.1.1 Bank Excavation for Slope Stability and Cap Placement

In the southern part of the site (i.e., in the slipway and bridge reaches), soil, rock, and debris will be excavated from the bank both above and below OHW (18 feet COP) to achieve a stable slope configuration. The volume of soils excavated is summarized in Tables A3 and A4, and in the JPA application form. The bank excavations are described below by reach.

Slipway Reach

The bank of the Willamette River on the north side of the slipway reach will be regraded to have a 2H:1V slope between elevation 3 and 12 feet COP transitioning to a 3H:1V slope above elevation 12 feet COP. This is necessary to achieve acceptable geotechnical factors of safety and to provide a protective cap over contaminated soils. The south side of the slipway reach will be excavated above the existing top of armor line (which varies from 12 to 15 feet COP) to achieve a slope of 3H:1V. Similarly, the south-internal side of the slipway ramp will be excavated above the existing top of armor to achieve a slope of 2H:1V to facilitate placement of the soil cap. The toe of the cut will extend down to elevation 0 feet COP, as shown on Figure A7, so some in-water excavation may be necessary, depending on water levels at the time of the work. Drawings C3.0 and C3.1 show the slope configuration.

Additional excavation will be necessary in the slipway ramp area above elevation 5 feet COP to achieve a flat surface and provide adequate depth for the proposed low-profile cap over the slipway surface, so that the top of the cap will be below the existing barge launch rails and skid ramp.

South Bridge Reach

The riverbank in the South Bridge Reach will be regraded to a 2H:1V slope above elevation 3 feet COP. This is necessary to achieve acceptable geotechnical factors of safety and to provide a protective cap over contaminated bank soil. The toe of the cut will extend down to elevation 0 foot COP, as shown on Figure A8, so some in-water excavation may be necessary, depending on water levels at the time of the work. Drawings C3.0 and C3.1 show the slope configuration.

North Bridge Reach

The part of the bank located between elevation 15 and the top of bank will be regraded to achieve a stable slope of 2H:1V. The elevation of the current top of armor ranges from 13 to 28 feet COP in the north bridge reach, so a large amount of existing armoring will be removed as part of the excavation.

2.1.2 Hot Spot Excavation

As required by the ROD, portions of the bank containing hot spot soils will be excavated to a depth of 5 feet below final proposed grade. Hot spot excavations specified to be 1 foot deep are in areas where hot spot soils do not extend below the proposed 1-foot excavation. Hot spot excavation areas are shown on Drawings C0.2.2 through C0.2.9. The hot spot excavation areas are based on the RI findings and encompass the hot spots specified in the ROD. Hot spot excavation areas are located both above and below OHW (18 feet COP). Areas where hot spot soils are removed will be backfilled before or during placement of the soil cap.

2.2 Structure Decommissioning

It is believed that most historical and current operational structures are located above the proposed top of bank and will not be encountered during bank excavation work. However, any historical operational features found in the bank areas during excavation will be decommissioned as part of the proposed project. This will involve breaking, cutting, and dismantling of the structure(s) for removal and off-site disposal and/or decommissioning features in place. Inert material such as concrete may be left on site for use as fill during redevelopment, in accordance with the description of soil management below. The DEQ will be notified of all currently unknown structures that are encountered and removed.

2.3 Sediment Dredging

Sediment dredging may be completed at the mouth of the slipway in the launch rail area of the proposed low-profile cap below elevation 5 feet COP as necessary to construct the low-profile cap. Dredging may extend riverward as far as the end of the rails, but it is anticipated that most of the dredging will be above elevation 0 feet COP. It is anticipated that sediment will be cleared to the top of the existing bents that support the rails. The amount of in-water dredging necessary at the mouth of the slipway will be evaluated further as part of the final design, including a survey of the separation between the top of existing sediment and the top of the skid ramps just before construction of the remedy.

It is likely that the dredged sediment will be dewatered on site before off-site disposal or placed in the interior site area. On-site management of dredged sediment is allowed by the ROD and the Consent Judgment. The design of the on-site sediment management system will be completed as part of the final design.

2.4 Outfall Modifications

An 18-inch private stormwater outfall (Zidell Outfall 1) is located in the lower bank excavation area of the slipway reach just north of the slipway ramp (see Drawing C0.2.2). This outfall will be modified so that the pipe does not extend beyond the edge of the final bank surface. The design of any modifications required for this outfall because of the bank excavation will be completed as part of the final design.

A private 6-inch stormwater outfall (Zidell Outfall 2) is located in the upper bank excavation area of the south bridge reach (see Drawing C0.2.4). This outfall either will be abandoned or will be modified so that the pipe does not extend beyond the edge of the final bank surface. The design of any modifications required for the private outfall will be completed as part of the final design.

City Outfall 6 is located in the existing bank excavation area of the south bridge reach (see Drawing C0.2.4). City Outfall 6 is a brick outfall that was built in 1892 to serve a large upland area west of the Zidell site. Since completion of the City West Side Interceptor, the outfall drains a much smaller area of and east of SW Moody Avenue. Zidell is working with the City to determine the future of this outfall. The present design shows the depression east of the outfall terminus being filled based on an assumption that the outfall will be abandoned; however, this could change during final design.

There are two possible outfalls north of the Ross Island Bridge that previously discharged stormwater from the area of the Zidell site north of the Ross Island Bridge and from the property located west of Zidell. The Zidell property no longer drains to these outfalls. It is believed that stormwater from the adjoining property currently discharges to City Outfall 6, but the City is currently working to confirm this. The two outfalls are shown on historical drawings, but they were not found during site reconnaissance visits. If the outfalls are found during the bank excavation work, they will be plugged and capped.

City Outfall 7b is located near the north end of the proposed sediment cap, north of the Zidell property line (see Drawing C0.2.9). The outfall discharges stormwater from City and ODOT drainage areas; no drainage enters this system from the Zidell property. The water quality of discharges from this outfall is unknown at this time. The outfall invert is at elevation 4.98 feet COP, which is slightly lower than the final grade of the proposed sediment cap. The design for this area of the cap incorporates an armored swale lined with a 6-inch layer of Aquablok (a naturally occurring bentonite clay material) to convey outfall discharge to the edge of the sediment cap and to prevent effluent infiltration (see profile 7, Drawing C4.5.)

2.5 In-Water Structure Removal

In-water obstructions will be removed as necessary for cap installation. Bankline structures associated with the historical dock will be removed or filled over. Based on the 2007 topographic survey, approximately 2,160 old piles from past industrial docks are located in the downstream reach. Piling removal will be achieved by cutting the piling off at the existing ground or sediment surface before placement of the cap. Stringers from the historical dock structure that span the tops of the piling will also be removed as part of the remedy. There are no known piles in the south bridge or north bridge reaches. It is possible that there are eight piles located at the end of the slipway ramp from elevation -8 to -13 feet COP, which are not supporting any structures (see Drawing C0.2.2). These piles are shown on historical drawings, but their presence has not been verified through surveys. If the piles are still present, they will be removed by cutting them flush with the underlying sediment surface before cap placement.

Two ship bows are located on the bank near the mouth of the slipway on the south side of the slipway ramp. Current plans call for these to be removed. They may be provided to the City for its use as future historic/art elements in the South Waterfront area. The removal procedure for the hulls will be developed as part of the final design.

2.6 Bank and Sediment Cap

The remedy includes a cap over all portions of the bank and sediment within the site boundaries. Figure A2 and Drawings C2.0.0 through C2.1.6 show the proposed cap surfaces. The sediment cap boundary was selected to achieve remedial action objectives described in the ROD and to optimize the reduction of risk offshore of Zidell. The delineation of the sediment cap boundary is described in greater detail in the Sediment Cap Boundary Report (MFA, 2009a). Table A2 is a design summary for the entire project, organized by reach and elevation ranges within each reach. The table describes the existing conditions and the final surface appearance of each portion of the cap. The various types of rock armor used for the cap (Types A through E) are described in Table A5. The different cap areas are described in detail in the subsequent sections.

2.6.1 Slipway Reach Bank and Sediment Cap

The slipway reach of the cap extends from station -2+04[3,4] (the southern cap boundary) to station 3+00 (see Drawing C2.0.0). The cap design for this reach must accommodate continued barge construction and barge launching at the slipway ramp. Barges are launched at the slipway ramp approximately once each year. The existing ground surface of the slipway ramp consists of large steel plates covering soil. The steel plates allow the barge to be positioned onto the ramp, using wheeled dollies, prior to launch. Two rails that carry large rail trucks used to maneuver barges into place for launching extend down the ramp to an elevation of approximately 10 feet COP. In addition, a series of three rails and/or beams function as "launching rails" for the barges as they run from the top of the slipway ramp into the Willamette River (see Drawings C2.0.2 and C2.0.3). The northern two launching rails extend to an elevation of approximately 0 foot COP, and the southern launching rail extends to an elevation of approximately -5 feet COP. The launching rails are supported by

[3] Note that station 0+00 is located at the southern Zidell property boundary.

[4] The stationing used in this document differs from that used in GeoDesign's bank stability report (GeoDesign, 2009). Areas should be related by references to the specific reach and not by the station value given when referencing between reports.

bents that run north to south. Based on Zidell Marine Corporation as-built drawings, three piles support the bents at each point where the bents cross the launching rails.

The slipway cap design consists of the following components, which are described further in the sections below and shown on Drawings C2.0.1 and C2.0.2:

- Repair of existing bank armor
- Armor replacement cap on lower bank
- Soil cap on upper bank
- Low-profile cap over sediment
- Standard sand cap over sediment
- Armored thin cap over sediment
- Low-profile cap over the slipway ramp surface

Repair of Existing Bank Armor on Lower Bank

The existing bank armor on both internal sides of the slipway ramp and along the Willamette River south of the slipway ramp will be repaired as needed as part of the remedy and will serve as the final bank cap, as shown on Drawings C2.0.1 and C2.0.2. The elevation of the proposed top of the armor repair area ranges from 12 to 15 feet COP in this area. The elevation of the bottom of the existing armor is assumed to be 3 feet COP. The existing bank armor in this area consists primarily of armor rock. Deleterious material (e.g., rebar, wood scrap, wire, rubber) will be removed from the surface of the bank in the armor repair areas, and partially buried materials will be cut off at the surface, but in general the bank will not be excavated to remove these materials unless it is required to complete the selected remedy and to provide stability. If large pieces of unanticipated debris are encountered, Zidell will consult with the DEQ on the planned management before taking action.

The condition of the bank armor will be assessed during construction, once all vegetation and surface deleterious material have been removed from the bank. The individual locations for armor repair will be at the direction of the geotechnical engineer. Areas where the existing armor is discontinuous or is of questionable structural integrity will be individually flagged by the geotechnical engineer. At each repair area, a skilled contractor will hand-excavate soil to accommodate new filter material (i.e., filter gravel and/or filter fabric) and then hand-size and place Type C rock armor to cover the area and tie into the existing armor.

The part of the internal northern slipway ramp bank located under the barge building has been undercut, but the structure is supported by piles. Additional Type C rock armoring will be hand-placed over filter material on this slope under the building and extending to the mouth of the slipway in order to prevent further undermining of the building. It should be noted that the purpose of the rock armoring is to provide the soil cap and to prevent erosion; it is not to support the building.

Armor Replacement Cap on Lower Bank

The portion of the excavated bank north of the slipway ramp between elevation 3 and 12 feet COP will be armored with a 3-foot-thick layer of Type E rock armor with a filter layer consisting of filter gravel and/or filter fabric. Between elevation 12 and 15 feet COP, the excavated bank will be armored with 2 feet of Type D rock armor on a layer of filter gravel and/or filter fabric (see Drawing C2.0.2).

Vegetated Soil Cap on Upper Bank

The cap over the bank soil located between the proposed top of armor and the proposed top of bank will incorporate soil biotechnical engineering techniques of using plantings and geosynthetics to provide stability and erosion control. To construct the cap, a 2-foot soil cap underlain by a demarcation layer (e.g., brightly colored permeable geogrid or other geotextile) and overlain by a turf reinforcement mat (TRM) will be keyed into the excavated slope, as recommended by the geotechnical engineer. The TRM will provide erosion control until the vegetative layer is established. The TRM contains plastic components that provide more certainty of slope stability and protection from flood scour during vegetation establishment, and over the long term, than what is expected from a fully biodegradable erosion-control matting. A variety of planting techniques will be used to achieve the desired results of erosion control and soil stability provided by plant roots and aboveground plant mass, which will be augmented by the geosynthetic components of the TRM.

Low-Profile Cap over Sediment

The low-profile cap will be used in the slipway reach where a thicker standard sand cap cannot be placed because of operational requirements for launching barges on the existing skid rail system. The low-profile cap will be placed in the slipway reach from an elevation of approximately 5 feet COP to an elevation of -22 feet COP.

The slipway low-profile cap will consist of a reactive core mat (RCM), a geotextile cushion layer, and rock armoring. The RCM will serve as the chemical isolation layer of the cap, absorbing contaminants that migrate out of the sediment through groundwater movement. The RCM will contain a blend of two sorptive media: activated carbon (75 percent by volume) for the sorption of organic contaminants, and the mineral apatite (25 percent by volume) for metals sorption. The total media thickness will be a minimum of 1 centimeter. It is anticipated that the RCM will be provided by CETCO, Inc. or an approved equivalent manufacturer. The geotextile cushion layer will consist of 16-ounce, nonwoven geotextile with a minimum puncture strength of 250 pounds. The RCM and geotextile will also prevent erosion of underlying contaminated sediments.

The RCM and the geotextile cushion will be attached to each other in an upland work area and placed using divers to verify proper overlap of 4 to 8 inches and to verify proper installation such that there are no tears or gouges in the RCM. The RCM will be trimmed to fit around any in-water structures. The divers will temporarily anchor the RCM and geotextile, using helical ground screws or duckbill anchors. The anchoring design will be prepared as part of the final design.

Two different types of rock armoring will be used for the low-profile cap. Three feet of Type E rock armor (with additional gravel placed over the top, where possible, to fill void spaces) will be placed in the steeper sloped areas. A 12-inch-thick layer of Type C rock armor will be placed in the flat portions of the slipway ramp rail embayment area (see Drawings C2.0.2 and C2.1.2). The Type C rock armor will require inspection following each barge launch to verify that there is sufficient material present to protect the RCM. The rock armor, along with the geotextile cushion, will serve to protect the RCM from puncture and to prevent the cap from sliding off the slipway ramp or in-water slopes during barge launches.

The rock armor is a necessary part of the design, intended to enhance slope stability over the long term and to prevent catastrophic release of contaminated soils caused by a slope failure. The geotechnical stability modeling demonstrates that a minimum 3-foot-thick layer of rock armor at a maximum slope of 2H:1V is required to stabilize the in-water bank slope for the long term.

Standard Sand Cap over Sediment

A standard sand cap composed of a 2-foot sand layer, a 6-inch gravel filter layer, and a 2-foot Type D rock armor layer will be placed below -22 feet COP to the riverward extent of the cap boundary; see Drawings C2.0.1 and C2.0.2. The standard sand cap will chemically and physically isolate contaminants from receptors in the river (MFA, 2009b).

Type D rock armor is necessary to protect the cap from tugboat propeller wash during barge launching (GeoDesign, 2009). Additional gravel material will be placed over the Type D rock armor in order to fill the void spaces and minimize the potential for scour of the underlying sand cap.

A 60-foot rock armor extension and transition will be placed on the upstream end of the sand cap to protect the upstream (southern) edge of the cap from scour. This extension is anticipated to be necessary because of the high water velocities that may occur during flood stages of the river. The extension will reduce the potential for excessive boundary layer turbulence that could occur at the leading edge of the cap, which could be exacerbated by the sudden 4-foot change in river bottom elevation, as compared to a gradual buildup of material.

Armored Thin Cap over Sediment

An armored thin cap consisting of a minimum 10-inch-thick layer of sand, a 6-inch layer of filter gravel, and a 2-foot layer of Type C rock armor will be placed east of the standard sand cap offshore of the mouth of the slipway (see Drawing C2.0.2). The armored thin cap provides a physical barrier to low-level concentrations of contaminants in sediment. Armoring is required, since the cap will be located in an area subject to erosive forces of the river and, potentially, by barge launching.

Low-Profile Cap over Slipway Ramp Surface

A cap consisting of RCM, geotextile cushion, base rock, and steel plates will be placed between the existing rails on the floor of the slipway ramp from the top of the bank down to an elevation of approximately 5 feet COP (see Drawing C2.1). The configuration of the cap will be the same as the low-profile cap over sediment, but instead of rock armor, a combination of base rock and steel plates will be used to provide a working surface that is able to support the weight of the barge during positioning of the barge prior to launch when the barge is supported on dollies. The cap will utilize the existing 0.75-inch steel plates that are currently used over the slipway ramp surface.

2.6.2 South Bridge Reach Bank and Sediment Cap

The south bridge reach of the cap extends from station 3+00 to station 7+50 (see Drawing C2.0.0) and is characterized by steeper in-water slopes near shore and a relatively steep bank slope. The south bridge reach cap consists of the following components, which are described further in the sections below and shown on Drawings C2.0.2 and C2.0.4:

- Armor replacement cap on lower bank
- Soil cap on upper bank
- Standard sand cap over sediment

Armor Replacement Cap on Lower Bank

Approximately 3 feet of Type E rock armoring will be placed on the lower bank from the toe of the cut slope (elevation 0 foot COP) to an elevation of 15 feet COP. The rock armor will be placed on a filter layer consisting of filter gravel and/or filter fabric to prevent erosion of underlying bank soils.

Soil Cap on Upper Bank

A soil cap will be placed on the upper bank between elevation 15 and the proposed top of bank. The cap will incorporate soil biotechnical engineering techniques of using plantings to provide stability and erosion control. To construct the cap, a 2-foot soil cap underlain by a demarcation layer (e.g., brightly colored geogrid or other geotextile) and overlain by TRM will be keyed into the slope as recommended by the geotechnical engineer. The demarcation layer will be placed on the excavated slope before the lifts of cap soil are placed. The bank will be revegetated as described in Section 2.8. The TRM will provide erosion control until the vegetative layer is established. The TRM contains plastic components that provide more long-term certainty of slope stability during plant establishment than fully biodegradable erosion-control matting. A variety of planting techniques will be used to achieve the desired results of erosion control and soil stability provided by plant roots and aboveground plant mass.

Standard Sand Cap over Sediment

A standard sand cap will be placed in the water at a maximum slope of 5H:1V over the existing sediment and will overlap the toe of the bank rock armor slope (starting at elevation 5 COP). The side slope of the river channel is very steep in the south bridge reach and will require additional fill to construct a stable slope at a repose of 5H:1V, which is the maximum slope that can be achieved using in-water placement (GeoDesign, 2009). The standard sand cap will vary in thickness between 2 and 18 feet as a result of the 5H:1V slope. Erosion resistance will be provided for the sand cap by a 16-inch-thick section of Type B rock armor with a mean grain size of at least 4 inches (GeoDesign, 2009).

2.6.3 North Bridge Reach Bank and Sediment Cap

The north bridge reach of the cap extends from station 7+50 to station 11+50 (see Drawing C2.0.0) and is characterized by steeper in-water slopes near shore and a relatively steep bank slope. The north bridge reach cap design consists of the following components, which are described further in the sections below and which are shown on Drawing C2.0.5:

- Repair of existing bank armor on lower bank
- Soil cap on upper bank
- Sand cap over sediment

Repair of Existing Bank Armor on Lower Bank

The existing bank armor in the north bridge reach will be repaired as part of the remedy and will serve as the final bank cap below an elevation of 15 feet COP. The individual locations for armor repair will be at the direction of the geotechnical engineer. In areas where existing bank armoring extends above elevation 15 feet COP, the armor will be removed. The existing bank armor consists of concrete, rock, brick, and ballast stone. Deleterious material (e.g., rebar, wood scrap, wire, rubber) will be removed from the surface of the bank, but in general, the bank will not be overexcavated to remove these materials unless overexcavation is required to complete the selected remedy and to provide stability. Additional Type C or Type D rock armoring will be hand-sized to fit openings and will be installed in the bank areas where the existing armor is discontinuous or of questionable structural integrity (GeoDesign, 2009). If large pieces of unanticipated debris are encountered, Zidell will consult with the DEQ on the planned management before taking action.

The condition of the bank armor will be assessed by the geotechnical engineer during construction once all vegetation has been removed from the bank. Areas where the existing armor is discontinuous or is of questionable structural integrity will be individually flagged. At each repair area, a skilled contractor will hand-excavate soil and debris to accommodate new filter material and then hand-size Type

C or Type D rock armor to cover the area and tie into the existing armor. Additional information on the armor improvement will be developed as part of the final design.

Soil Cap on Upper Bank

A soil cap will be placed on the upper bank between elevation 15 and the proposed top of bank. The soil cap on the upper bank will incorporate soil biotechnical engineering techniques of using plantings to provide stability and erosion control. To construct the cap, a 2-foot soil cap underlain by a demarcation layer (e.g., brightly colored geogrid or other geotextile) and overlain by TRM will be keyed into the slope as recommended by the geotechnical engineer. The demarcation layer will be placed on the excavated slope before the lifts of cap soil are placed. The bank will be revegetated as described in Section 2.8. The TRM will provide erosion control until the vegetative layer is established. The TRM contains plastic components that provide more long-term certainty of slope stability during vegetation establishment than fully biodegradable erosion-control matting. A variety of planting techniques will be used to achieve the desired results of erosion control and soil stability provided by plant roots and aboveground plant mass.

Standard Sand Cap over Sediment

A standard sand cap will be placed in the water at a 5H:1V slope over the existing sediment and will overlap the bank rock armor slope (starting at elevation 5 COP). Erosion resistance will be provided for the sand cap in the north bridge reach by a 16-inch-thick section of Type B rock armor (GeoDesign, 2009).

The side slope of the river channel is very steep in the north bridge reach and will require additional fill to construct a stable slope of 5H:1V, which is assumed to be the maximum slope that can be achieved using in-water placement (GeoDesign, 2009). The standard sand cap will vary in thickness between 2 and 18 feet as a result of the 5H:1V slope.

2.6.4 Downstream Reach Bank and Sediment Cap

The downstream reach extends from station 11+50 to station 28+59 (see Drawing C2.0.0). This reach is characterized by a shallow in-water bench and steep bank slopes of up to 1H:1V. The in-water bench extends approximately 200 feet from shore and has a relatively flat slope. Existing piles and stringers (beams on top of the piles) associated with a previous dock structure are located between stations 13+00 and 25+00.

The downstream reach cap consists of the following components, which are described further in the sections below and shown in Drawings C2.0.6 through C2.0.9:

- Bank and sediment cap
- Thin cap over sediment

Bank and Sediment Cap

In the downstream reach, there will be a continuous cap consisting of clean fill placed from the top of the bank over the existing armor and out to the eastern edge of the sediment cap boundary. The fill located between the top of the bank and approximately 10 feet COP will consist of a minimum thickness of 2 feet of clean, imported general fill (loam, sand, or topsoil) placed at a 3H:1V slope; see Drawing C2.1.5. At approximately 10 feet COP, the fill will transition to a maximum slope of 5H:1V. Material placed below elevation 5 feet COP will generally consist of clean dredge sand. The minimum thickness of the sand layer within the chemical isolation cap boundary is 2 feet. The cap in this reach ranges from 2 to 18 feet thick. Below the OHW line (elevation 18 feet COP), a 12-inch-thick layer of Type A subrounded to rounded rock armor will be placed to protect the fill from erosion.

Thin Cap over Sediment

Two areas of thin cap are included within the downstream reach as shown in Drawings C2.0.7, C2.0.8, and C2.1.5. The thin cap consists of a 6- to 10-inch layer of clean dredge sand. The purpose of the thin cap is to provide a clean substrate that separates benthic organisms from low-level concentrations of contaminants. The thin caps are located in areas of relatively low contamination where there is evidence of deposition documented in the fluvial evaluation (MFA, 2008).

2.7 In-Water Institutional Controls

The United States Coast Guard Notice to Mariners system may be used to control activities of vessels near the cap area. This system uses radio broadcasts, as well as postings in all marinas, to inform watercraft in the area. In addition, the perimeter may be marked with buoys and signs to control the use of the area over the cap.

The State of Oregon owns the river bottom where the sediment cap would be placed. Zidell has initiated discussions with DSL to facilitate remedy implementation. Use restrictions, including limitations on in-water development, may be placed on the sediment cap area. Potential use restrictions will be assessed further as part of the final design, with the goal of minimizing disturbance of the cap. Placement of the cap, use restrictions, and other in-water institutional controls will require coordination and/or approval by DSL and the Oregon State Marine Board. Zidell has initiated discussions with DSL regarding these issues. As part of the final design, Zidell will work with the Coast Guard, DSL, and the Oregon State Marine Board to refine the implementation of in-water institutional controls.

2.8 Landscaping Plan

The recommended planting plan consists of native plant communities, with a plant list based on recommendations of the South Waterfront Greenway Development Plan (City, 2004). The planting plan was developed through consideration of plant location in relation to river water depth, depth of the fill (i.e., cap) material, and steepness of slope. Trees and large shrubs are located where there is at least 6 feet of fill to support the plant without compromising the integrity of the cap if the tree later topples. The proposed soil biotechnical engineering planting techniques, in conjunction with the engineered bank armoring, will protect against bank erosion and provide additional bank stability. The plant material additionally will provide fish and wildlife habitat and a variety of ecological functions. Habitat diversity and complexity will be greatly increased compared to the existing condition. Where slopes are steeper than 3H:1V (i.e., the slopes cut at 2H:1V), the plants will be limited to grasses, herbaceous material, and smaller shrubs.

As part of the final design, a planting medium appropriate for each particular elevation will be developed consistent with applicable City greenway objectives. The planting medium specified may include compost-amended soil. Below the OHW elevation, the fill material will be covered with either a TRM or a 12- to 16-inch rock armoring layer. Plants will be planted into the underlying fill through TRM or the rock armoring layer, depending on the class or type of rock armor used.

The recommended plants are listed on Drawing L1.0.1. The planting plan is shown in Drawings L1.1.1 through L1.1.9. Several plants overlap from one group to another to reflect the natural transitioning in the riparian environment.

3 CONSTRUCTION METHODS

3.1 Site Preparation and Erosion Control

Site preparation will begin before the start of earth-moving activities. Generally, site preparation will include the installation of turbidity and erosion controls consistent with the best management practices (BMPs) described in the City Erosion Control Manual (City, 2008) and with the requirements of the DEQ 1200C National Pollutant Discharge Elimination System permit for construction activities, which will be obtained before the start of construction. Turbidity- and erosion-control plans and details are shown on Drawings C1.0.1 through C1.0.4, respectively.

3.1.1 Perimeter Sediment Control BMPs

Perimeter sediment control BMPs will prevent sediment from entering roadways, adjacent properties, and the Willamette River. Perimeter sediment controls that may be used at the site include silt fencing and straw bales or additional perimeter sediment controls specified in the City Erosion Control Manual (City, 2008), if needed.

If bank-related earthwork above OHW is to be conducted outside of the in-water work window (the work window is between July 1 and October 31), straw bales will be placed along the riverbank at about elevation 19, just above the OHW line. The straw bales will provide turbidity control of runoff from storm events and will provide a visual boundary to limit work above the OHW line. Straw bales are not a perimeter sediment control described in the City erosion-control manual, but were selected as the most appropriate perimeter sediment control for placement on the steep bank slopes, which are constructed of debris fill. Straw bales would have an added benefit of providing a barrier that can better contain loose soils and prevent them from eroding into the Willamette River. Note that the in-water turbidity controls described in Section 3.1.4 will be used for bank earthwork completed below the OHW line and for work completed above the OHW line during the in-water work window.

3.1.2 Erosion Prevention BMPs

Earthwork that is conducted within the City's wet season work timeframe (October 1 through April 30) will be covered by erosion-control blankets or plastic sheeting during periods of extended rain, or if the area is to be left exposed for more than two days. If soil is temporarily stockpiled, the stockpile will be covered with plastic sheeting at the end of each working day to prevent or minimize wind erosion or stormwater contact. Compost berms (filtration berms) may also be used around the perimeter of stockpiles. Stockpiles that are to remain in place for more than three months will be stabilized with reinforced plastic sheeting or by seeding to establish vegetative cover. Erosion-control blankets, plastic sheeting, filtration berm, and vegetative cover BMPs are described in detail in Sections 4.5.4, 4.5.5, 4.3.7, and 4.5.2, respectively, of the City's erosion-control manual (City, 2008).

3.1.3 Site Entry BMPs

Construction access to the site will be from Moody Avenue and through the Zidell property. In order to prevent the tracking of mud, dirt, rocks, etc., onto the public right-of-way, a rock construction entrance will be built. The construction entrance will consist of a 12-inch layer of quarry spalls placed on a separation geotextile fabric. The rock will extend a length of 50 feet and will be operated consistent with the City's erosion-control manual (City, 2008). The location of the rock construction entrance will be somewhere between the top of bank and Moody Avenue, depending on the location of the construction staging areas for both this project and the proposed TriMet Light Rail Bridge project.

To further prevent the spread of potentially contaminated materials onto the public right-of-way, a truck tire wash will be constructed immediately behind the rock entrance and all trucks leaving the site will be required to use it. The tire wash will incorporate the recommendations in the City's erosion-control manual (City, 2008).

3.1.4 In-Water Turbidity Control

As part of the final design, Zidell will develop a water quality management plan for work completed below the OHW line and during the in-water work window, which will be described in the 401 Water Quality Certification to be approved by the DEQ. Attachment C of the JPA provides a draft water quality plan. The anticipated turbidity controls include a series of BMPs for containment and operations. In addition, the Water Quality Certification will describe the monitoring program required to demonstrate compliance. The main elements of the management plan will include the use of containment turbidity curtains for all dredging activities and some capping activities, and placement of a thin-layer sand cap to cover contaminants prior to production capping, combined with operational restrictions to reduce or eliminate the potential for downstream distribution of contaminants and turbidity.

Part of the turbidity management plan may include the use of floating turbidity control curtains around the mouth of the slipway and at the base of bank excavation areas. The need for turbidity control curtains will be coordinated with water quality control requirements and recommendations from the biological assessment that will be completed as part of the permitting process.

In addition to turbidity control curtains, BMPs will be employed during the project to limit the potential for generation of turbidity in the Willamette River. Sediment will be removed in unsaturated conditions to the maximum extent possible. Furthermore, operational requirements will be employed as needed to limit resuspension of fine materials during removal (e.g., slow dredge movements, dewatering of the dredge bucket, limiting work directly over water, minimizing allowable fall height during placement of materials).

3.2 Clearing and Grubbing

Before soil excavation activities, but after installation of erosion-control measures, the bank areas being excavated or capped will be cleared and grubbed to remove existing vegetation, which in most areas consists of noxious weeds. General brush and nonnative vegetation will be containerized and transported to a composting facility. Large, woody, and/or native vegetation may be stockpiled for later use as habitat features in the riparian area. Woody debris to be kept for later reuse will be identified and flagged by the project biologist.

3.3 Bank Excavation

3.3.1 Bank Excavation for Slope Stability and Cap Placement

Bank cuts are required both above and below OHW in the slipway and bridge reaches to increase slope stability and/or to allow placement of the bank caps. Before July 1 (the start of the in-water work window), bank cuts may proceed only as long as work does not extend below the OHW elevation. After July 1, the bank cuts in the slipway and bridge reaches below OHW will be completed as the first step of work below the OHW line.

Bank cuts will generally be made using excavators. Soil from a bank cut that is not a hot spot may be placed on site or will be hauled to a permitted landfill for disposal. The excavator will finish the bank cut with a keyed (benched) surface to accommodate the placement of the cap soil (described below), per the geotechnical design recommendations. Soil will be managed as designated in the soil management plan (SMP), which will be prepared as part of the final design. Excavated soils will either be loaded directly into a transport truck for disposal at a landfill or be stockpiled on a plastic liner in the flat area above the top of bank. If the soil is stockpiled, the pile will be covered with erosion-control matting or plastic at the end of each working day to prevent or minimize wind erosion or stormwater contact.

Once the bank cut is completed, a demarcation geogrid will be placed on the slope to provide a visual indicator to future workers that the soils below may contain potentially hazardous materials.

3.3.2 Excavation of Hot Spot Soils

Ecological and human health hot spot soils are largely located above OHW, but some soils exist below OHW. Before July 1 (the start of the in-water work window), the excavation of hot spot soils may proceed only as long as work does not extend below the OHW elevation.

Hot spot excavation areas will be staked by surveyors and verified by the field engineer. Excavation of the soils into stockpiles or directly into road trucks will generally involve an excavator, backhoe, front-end loader, and/or bulldozer. Soil will be managed as described in Section 3.3.3.

Completed hot spot excavations will be lined with a demarcation geosynthetic before they are backfilled with clean soil. The demarcation layer will provide a visible indicator for future workers that underlying soils may contain hazardous materials. The demarcation layer may be a geogrid, brightly colored geotextile, or orange construction fencing.

3.3.3 Soil Management

All soil excavated during and after the remedy (including soil excavated during future redevelopment) will be managed as specified in the SMP that will be developed as part of the final design. Soils from each type of hot spot excavation (human health or ecological) will be managed separately. If soil is temporarily stockpiled, it will be placed on plastic sheeting on the flat area above the top of the bank to prevent contact with underlying soils. A stake indicating the type of soil will be placed on each pile. Following placement, the stockpile will be covered with plastic sheeting at the end of each working day to prevent or minimize wind erosion or stormwater contact.

Soil Screening: Fill material historically placed on the site, especially along the bank, consists of large amounts of oversize, primarily inert material. Soil screening may be used to isolate soil from oversized rocks and concrete debris. At this point in the design, it has not been determined to what extent screening will be utilized. It is currently assumed that a 4-inch screen will be used. Oversized rocks and concrete that does not pass through the screen may remain on site. Oversized pieces of metal may be segregated for off-site recycling. If any on-site or off-site recycling options are identified for other inert materials during final design or construction, Zidell will coordinate and seek approval from the DEQ before completing such recycling. Oversize debris unsuitable for fill, such as woodwaste, solid waste, and ACM, may be segregated from soil, depending on whether the soil is being considered for upland placement or off-site disposal.

Soil Testing: No additional soil testing to evaluate concentrations against hot spot criteria is required as part of the remedial action, unless unexpected conditions or contamination is discovered. Some analysis of screened soil may be required to verify appropriate management procedures. Any additional sampling requirements will be specified in the SMP that will be prepared as part of the final design.

Off-Site Disposal: Soils with contamination exceeding human health hot spot concentrations must be disposed of off site in accordance with applicable state and federal regulations.[5] Bulk ACM encountered during excavation will be transported off site for disposal in accordance with asbestos-disposal regulations. Soil that does not contain bulk ACM will be disposed of as special waste at a Subtitle D landfill or as a characteristic hazardous waste at a Subtitle C landfill. If necessary, treatment (either on site or off site) of soil slated for off-site disposal may be completed to render it nonhazardous (i.e., remove hazardous waste leaching characteristics). Existing soil data suggest that only a relatively small volume of soil, if any, may potentially have hazardous waste leaching characteristics, and treatment may not be warranted. As part of the final design, areas containing soils potentially containing hazardous levels of contaminants will be identified and appropriate testing will be completed before or during soil excavation. The requirement for testing soils for hazardous characteristics will also be described in the SMP.

Optional Upland Placement of Soil: The ROD allows for excavated bank soil with contaminant concentrations below human health hot spot levels to be managed on site west (inland) of the greenway area. Ecological hot spot soils and non–hot-spot soils excavated from the bank could be managed on site in this way. However, human health hot spot soils must be disposed of off site. The soil stockpiled on site for a longer term (e.g., stockpiled for use during site redevelopment) would be temporarily placed in geotextile-lined containment cells west of the greenway area until the final capping remedy in this area is completed (required by the Consent Judgment by 2016). It is unknown at this time whether any soil will be managed in this way on site. This decision depends, in part, on the future final grade of the site, which will be dictated by future redevelopment plans.

3.4 Debris Identification, Removal, and Management

All debris fill and deleterious materials (e.g., rebar, wood scrap, wire, rubber) identified during construction activities will be managed as specified in the SMP that will be developed as part of the final design. Deleterious materials will be removed from the surface in the armor repair area in the north bridge reach. In general, excavation areas will not be overexcavated to remove debris fill or deleterious materials, unless overexcavation is necessary to complete the selected remedy and ensure stability. If large pieces of unanticipated debris are encountered, Zidell will consult with the DEQ on the planned management before taking action.

[5] The ROD sets the off-site disposal volume for human health hot spots at no more than 8,000 cubic yards, using a worst-first approach. Based on the proposed design, less than 8,000 cubic yards of human health hot spot soil will be generated and it is therefore assumed that all human health hot spot soil will be disposed of off site.

3.5 Fill Activities

3.5.1 Backfill of Hot Spot Excavations

The limits of areas overexcavated to remove hot spot soil will be surveyed upon completion. Hot spot excavation areas will then be lined with demarcation fabric before backfill with general fill. The fill will be placed and compacted as required in the project specifications.

3.5.2 Soil Cap Placement

Above the top of the proposed armor areas, a 2-foot vegetated soil cap will be constructed. Clean cap soil will be brought to the site by trucks with trailers and then spread. It is anticipated that possible sources of cap soil will include various commercial sources or nearby development sites that may have excess clean soil. The specification for the cap soil will require the contractor to provide certification that the cap soil is not contaminated. Cap soil will be placed in two 1-foot lifts and loosely compacted into place using track equipment. A TRM will be installed over the soil cap to prevent soil erosion.

3.5.3 Low-Profile Cap Placement

The low-profile sediment cap in the slipway reach will be placed before construction of the sand cap. It is anticipated that the RCM and heavyweight geotextile cushion will be attached to each other in an upland work area prior to placement in the water. Divers will then roll the RCM/geotextile assembly into the water. The diver crews will anchor the RCM in place and ensure proper overlap of 4 to 8 inches and and verify proper installation such that there are no tears or gouges in the RCM. The RCM will be trimmed to fit around any in-water structures. The divers will temporarily anchor the RCM and geotextile, using helical ground screws or duckbill anchors or other appropriate fasteners. Rock armoring will be carefully placed using a clamshell bucket or excavator.

The low-profile cap over the slipway ramp surface above elevation 5 foot COP will be constructed above water, so no divers will be required. Once the RCM and geotextile cushion are placed, the base rock will be spread using a loader or an excavator. The existing 0.75-inch steel plates will then be installed over the base rock.

3.5.4 Sand Placement in Water

Clean dredge sand fill will likely be brought to the site by barge for construction of the sand cap beneath the daily high water elevation (assumed to be approximately 5 feet COP). It is anticipated that possible sources of the sand cap material will include clean midchannel dredge sand from the Columbia River supplied by various commercial sources. A lead time of as much as six months may be necessary for securing the large quantity of material required. The sand cap may be placed using several different methods. Measures will be taken to minimize mixing of the cap sand with the contaminated sediment during placement. At other capping sites, the slow placement of a thin layer of clean cap sand (on the order of 6 to 12 inches) kept the mixing to a zone of 1 to 2 inches. Placement of the thin layer, or "lift," also helps to dewater the surface of the existing contaminated sediment and prevent the likelihood of a sliding failure. The initial two to three lifts of the sediment cap will be placed using a spreading method that gradually builds the thickness of the lift while minimizing the potential for a sliding slope failure. Sand spreaders (from road applications) and shaker boxes have been used successfully at other sites to gradually build the first thin lifts. The thin lift placement will progress from upstream end to downstream end of the site so that the placement of clean fill is not occurring downstream of any portion of the site that has not yet received the initial thin lift.

Bulk placement of the sediment cap will proceed in lifts no thicker than 2 feet, as specified by the geotechnical engineer (GeoDesign, 2009). Bulk placement of cap sand may utilize GPS-guided clamshell placement from a barge, reverse-dredge, or other similar technique. Although it is anticipated that additional specificity on the construction method will be developed during the permitting and final design process, Zidell also intends to allow the contractor maximum flexibility in construction methods, as long as the basic requirements described above are met.

3.5.5 General Fill Placement on Riverbank

In the downstream reach, general fill will be placed to create a stable slope. The fill will be placed both above OHW and below OHW in areas occurring above the daily high water elevation (assumed to be approximately 5 feet COP). The fill areas below OHW will be adequately armored before they are inundated. It is anticipated that the clean general soil fill will be brought to the site by trucks or barge and that potential sources of this material will include nearby borrow sites and other large-scale excavation sites (uncontaminated). Fill along the riverbank will proceed in 2-foot compacted lifts, as specified by the geotechnical report (GeoDesign, 2009). Placement of general bank fill will involve standard earthwork equipment: excavators, graders, rolling compactors, bulldozers, and dump trucks.

3.5.6 Rock Armor Placement on Bank and over Sediment Cap

Rock armor will be placed below OHW in the lower bank areas and over the sediment cap. Between 1 and 3 feet of rock armor (Type A, B, C, D, or E) will be placed as shown on Drawings C2.0.0 through C2.0.9. The rock armor will likely be placed and spread to a uniform thickness using excavators, bulldozers, and/or clamshell dredge buckets.

In the southern portion of the slipway reach and in the north bridge reach, repair of the existing armor will require the contractor to work at the direction of the field engineer to identify areas where gaps in the armor exist. These gaps will be filled with filter material and then appropriately-sized pieces of rock armor will be hand-placed to completely cover the exposed soils.

3.6 Planting of Bank

Planting will take place as major construction areas are completed or during the next low-water season. If planting is to be done during the next low-water season following cap and bank construction, the rock armor and TRM layers will prevent erosion of the cap during the interim. Planting in a specific work area will not occur until the other construction activities in that area have been completed. Live plants will generally be placed by hand by digging a planting hole or by making a bar-hole within the armor, as appropriate. Revegetated areas requiring the application of grass/herbaceous seed mixes will be addressed through hydroseeding. The planting plan is shown on Drawings L1.0.1 through L1.1.9.

3.7 Construction Phasing and Schedule

Construction work above the OHW line (elevation 18 feet COP) may occur at any time as long as the preconstruction controls are in place. While bank excavation to remove hot spots or regrade the bank slope will likely occur before the in-water work window (before July 1), placement of the bank cap in these areas will not occur until all bank excavation (including excavation below OHW) is completed.

Construction below the OHW line may be conducted only during the in-water work window (July 1 through October 31), and may be started following the deployment of the turbidity control curtain, where indicated. Following the start of the in-water work window, bank excavations will be completed before the start of any of the sediment capping work.

Construction is scheduled to start in 2011. The schedule assumes that in-water construction permits will be available prior to the 2011 in-water work window (July 1 through October 31). If in-water permits become available later, it will be necessary to adjust the construction schedule.

LIMITATIONS

The services undertaken in completing this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this report.

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TABLES

FIGURES

APPENDIX

BANK PHOTOGRAPHS