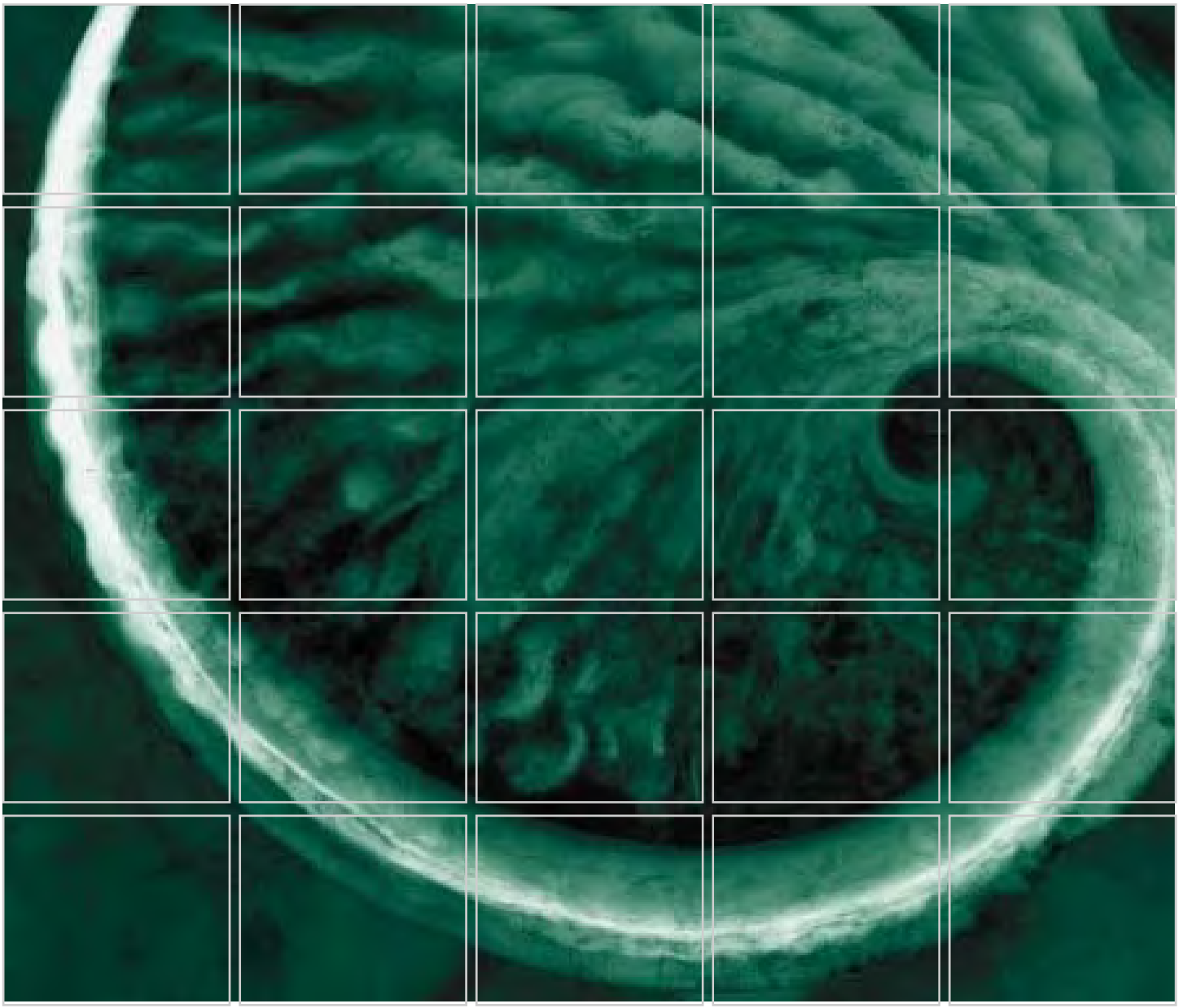

Revised Basis of Design Report - Groundwater Source Control Measure

Premier Edible Oils Site
Portland, Oregon

Prepared for:
MMGL Corp.

September 2015

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Basis of Design Report - Groundwater Source Control Measure

Premier Edible Oils Site
Portland, Oregon

September 2015

Project No. 0283866

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LIST OF ACRONYMS

As	arsenic
bgs	below ground surface
BMP	best management practices
City	the city of Portland
CMMP	Contaminated Materials Management Plan
COC	Chemical of Concern
DTW	depth to water
ERM	ERM-West, Inc.
FS	Feasibility Study
ft	feet
GWBW	groundwater barrier wall
GW SCM	groundwater source control measure
JSCS	Joint Source Control Strategy
LNAPL	light non-aqueous phase liquids
Mn	manganese
ODEQ	State of Oregon Department of Environmental Quality
PEO	Premier Edible Oils
QA/QC	quality assurance/quality control
RAO	Remedial Action Objectives
RI	Remedial Investigation

1.0 *INTRODUCTION*

On behalf of MMGL, Corp., ERM-West, Inc. (ERM) has prepared this Revised Basis of Design Report for the former Premier Edible Oils (PEO) site (herein referred to as "the site") located at 10400 N. Burgard Way, Portland, Oregon (Figure 1). This report has been prepared pursuant to the Voluntary Agreement for Upland Remedial Investigation (FI)/Feasibility Study (FS) and Source Control Measures issued by the Oregon Department of Environmental Quality (ODEQ) and signed 6 March 2001 (ODEQ ECDVC-NWR-01-06) (Voluntary Agreement).

The purpose of this report is to present the basis of design for the project, the proposed groundwater source control measure (GW SCM) which consists of a groundwater barrier wall (GWBW) and an oxygenation/biobarrier system.

1.1 BACKGROUND

1.1.1 Site History

The site is an industrial property located on the Portland Harbor waterfront along the east bank of the Willamette River (Figure 1). The upland portion of the site has been used for a number of industrial operations since approximately 1940, including bulk petroleum storage, ship building, production of dry cell battery materials, and refining of edible oils. PEO operations were discontinued in approximately 1996, and the remaining buildings are vacant. A number of environmental investigations have been performed at the site since 2001 under the ODEQ Voluntary Cleanup Program. Based on the results of these investigations, MMGL has proposed a GW SCM, consisting of a hydraulic barrier wall and potentially an upgradient oxygenation/biobarrier system, to control the potential migration of LNAPL into transition zone water (TZW) and mitigate dissolved phase metal contaminant impacts to the Willamette River. (Treadwell & Rollo 2014). The ODEQ has recommended that a hydraulic control barrier be implemented (ODEQ 2014). The United States Environmental Protection Agency (USEPA) reviewed the recommended alternative and provided comments regarding additional data collection and clarification of applicable preliminary remediation goals (PRGs) (USEPA 2014).

1.1.2 *Groundwater Source Control Measure Development*

The Joint Source Control Strategy (JSCS) was developed by ODEQ and USEPA to identify, evaluate, and control sources of contamination that may impact the Willamette River in a manner that is consistent with the objective and schedule for the Portland Harbor Superfund Site RI/FS (ODEQ and USEPA 2005). The goal of the JSCS is to achieve timely upland source control to prevent the risk of significant recontamination after the Portland Harbor cleanup is complete.

Based on historical investigations and analyses performed, a hanging slurry wall in conjunction with an oxygenation/biobarrier system has been determined as a feasible alternative for control the potential migration of light non-aqueous phase liquids (LNAPL) into TZW and mitigate dissolved phase impacts to the Willamette River (Treadwell & Rollo 2014 and ODEQ 2014). The GW SCM presented in this report includes a GWBW to physically separate the affected upland portions of the site from the Willamette River, and an upgradient oxygenation/biobarrier system to oxygenate the aquifer and promote degradation and stabilization of LNAPL and dissolved phase contaminants.

The *Groundwater Barrier Wall Conceptual Design and Setback Memorandum* (Conceptual Design) was submitted to the ODEQ in May 2015 (ERM 2015); the Conceptual Design provides preliminary design information, including setback from the top of bank, for the GWBW component of the GW SCM. The proposed GWBW alignment is shown in Figure 2. Detailed specifications of the proposed GWBW alignment are presented in Appendix A, Final Groundwater Barrier Wall Final Design.

1.2 *OBJECTIVES*

The objectives of this report are as follows:

- Present the basis of design for the GW SCM;
- Present final design details for the GWBW; and
- Present an updated schedule for overall design and implementation of the GW SCM.

1.3 REPORT ORGANIZATION

The remainder of this report is organized as follows:

- Section 2.0 presents the GW SCM design basis, including the remedial action objectives and existing conditions;
- Section 3.0 presents the required permitting of the GWBW;
- Section 4.0 presents aspects of the GWBW construction management;
- Section 5.0 presents the conceptual performance monitoring of the GWBW; and
- Section 6.0 presents the proposed schedule for design, permitting, and implementation of the GW SCM.

2.0 *GROUNDWATER SOURCE CONTROL MEASURE DESIGN BASIS*

A summary of the GW SCM Conceptual Design as well as its design basis and components is presented in this section.

2.1 REMEDIAL ACTION OBJECTIVES

LNAPL, dissolved petroleum hydrocarbons, polynuclar aromatic hydrocarbons (PAHs) and dissolved metals are present in groundwater at the site (Treadwell & Rollo 2013). Specific constituents of concern potentially requiring source control include total petroleum hydrocarbons as gasoline (TPH-g), benzene, toluene, ethylbenzene and xylenes (BTEX), arsenic (As), and manganese (Mn) (Treadwell & Rollo 2013). MMGL notes that the evaluation of contaminants potentially requiring source control was based on a comparison to JSCS Screening Level Values (SLVs) (ODEQ and USEPA 2005).

Draft PRGs (USEPA 2015) have been published that establish criteria applicable to specific Remedial Action Objectives (RAOs) for Portland Harbor. The RAOs potentially applicable at the PEO site include:

- RAO 3 - Reduce cancer and noncancer risks to people from direct contact (ingestion, inhalation, and dermal contact) with Chemicals of Concern (COCs) in surface water to exposure levels that are acceptable for fishing, occupational, recreational, and potential drinking water supply.
- RAO 4 - Reduce migration of COCs in groundwater to sediment and surface water such that levels are acceptable in sediment and surface water for human exposure.
- RAO 7 - Reduce risks to ecological receptors from ingestion of and direct contact with COCs in surface water to acceptable exposure levels.
- RAO 8 - Reduce migration of COCs in groundwater to sediment and surface water such that levels are acceptable in sediment and surface water for ecological exposure.

An evaluation of the applicable exposure scenarios, complete pathways, and applicable RAOs at the PEO will be presented in the Upland and Transition Zone Water Investigation Report and Source Control Evaluation that is being prepared. MMGL notes that the point of exposure for all the RAOs is sediment or surface water. MMGL will propose

performance monitoring points at the top of the bank in relation to the actual point of compliance in sediment/transition zone water and/or in surface water. . Specific groundwater concentration compliance criteria for this groundwater source control measure will be developed as part of the final Performance Monitoring Plan.

2.2 *EXISTING CONDITIONS*

2.2.1 *Site Soils*

The lithology along the proposed GWBW alignment is comprised of fine and medium sand with interbedded layers of silt, silty sand, and clay generally observed at depths between 30 to 37 feet (ft) below ground surface (bgs) based on recent assessment activities (ERM 2015). The general site lithology is presented in the GWBW profile shown in Appendix A, Sheet 5.

The nature of the native soils will be considered within the construction and slurry mixing activities to ensure stable conditions and proper GWBW installation.

2.2.2 *Extent of Groundwater Impacts*

The lateral extent of LNAPL is limited to the southwestern portion of the site that is directly below and to the southwest of the former tank farm area, as shown on Figure 3 (Treadwell & Rollo 2013). The bulk oil storage tanks that were the source of LNAPL were removed in approximately 1943. Based on the age of the release and observations made during investigation of the site, the residual is LNAPL is highly degraded and considered generally stable in its current configuration (Treadwell & Rollo 2013).

Based on visual and olfactory observations in historical borings and fluorescent sections performed in 2013, LNAPL is generally observed between approximately 20 to 28 ft bgs and is limited by the occurrence of fine grained silt and silty sand lenses below 30 ft bgs (Treadwell & Rollo 2013).

The extent of dissolved As and Mn is related to the extent of the LNAPL and dissolved phase TPH. Development of anaerobic conditions through microbial degradation of the free- and dissolved-phase petroleum hydrocarbons has reduced the oxidation-reduction potential (ORP) of the aquifer. These conditions have promoted the reduction of naturally

occurring As and Mn minerals and resulted in elevated dissolved concentrations of As and Mn in groundwater above acceptable levels. The lateral extent of dissolved As and Mn above acceptable levels is larger than the LNAPL plume, as the aquifer only returns to aerobic and increased ORP conditions beyond the extent of the dissolved petroleum hydrocarbon plume.

2.3 *GROUNDWATER SOURCE CONTROL MEASURE SUMMARY*

The purpose the GW SCM is to control the potential migration of LNAPL to TZW and mitigate dissolved phase impacts to the Willamette River. The GW SCM includes two phases: the first phase consists of the GWBW; and the second phase consists of the proposed oxygenation/biobarrier system.

The proposed GWBW consists of a bentonite slurry wall installed from ground surface down to 35 ft bgs and will be 30 inches thick. The primary objective of the first phase, the GWBW, is to control potential migration of LNAPL to the Willamette River, although it will also assist in mitigating dissolved phase impacts.

The primary objective of the future oxygenation/biobarrier system is to promote further biological degradation of the LNAPL and treat dissolved phase impacts through oxidization and stabilization of dissolved As and Mn. The second phase of the GW SCM (oxygenation/biobarrier)will introduce oxygen into the subsurface to re-oxidize the As and Mn, causing them to form insoluble metal hydroxides and become immobilized. The introduction of oxygen into the aquifer will promote further biological degradation of the LNAPL and dissolved phase TPH, preventing anaerobic conditions from re-developing in the future and causing re-mobilization of As and Mn.

The overall GW SCM design and implementation begins with the GWBW design and construction phase, as the first component. The oxygenation/biobarrier phase of the GW SCM is currently under conceptual design. The design process for the oxygenation/biobarrier phase will include:

- Technology selection (including pilot study);
- System design (including final performance monitoring plan);
- Construction/implementation;
- Performance monitoring and evaluation of the monitoring results; and

- If needed, implementation of an adaptive management process to meet objectives of source control.

The project schedule, including additional elements of the GW SCMs design and implementation, is discussed below in Section 6.0.

2.4 GROUNDWATER BARRIER WALL DESIGN

2.4.1 Existing Conditions

Site conditions that could potentially affect construction of the GWBW primarily include subsurface debris, utilities, and site stratigraphy.

2.4.1.1 Subsurface Debris and Utilities

No identified subsurface debris or obstructions are known in the area of the proposed GWBW based on historical investigation activities. Active utilities do exist at the site and include overhead power lines, utility/electrical poles, light poles, fire hydrants, and sanitary sewers; however, no known utilities have been observed in the immediate area of the proposed GWBW. A comprehensive utility survey will be conducted by the GWBW installation contractor. The Existing Conditions Site Plan, provided in Appendix A, Sheet 3, depicts the current site features, surface topography, and known utilities.

2.4.2 Construction Technique

Construction of a GWBW at the site poses various technical challenges, including sandy (i.e., non-cohesive) soil, proximity of the slurry wall to the crest of the riverbank, and a bend located within the area of higher concentrations of contaminants. Various slurry wall construction options and their effect on the wall alignment were presented in the Conceptual Design (ERM 2015), including lead-in/exit trench beyond turning point, sweeping bend, auger mixing at turning point, vertical trench end wall at turning point, and one-pass trenching. The presumptive construction methodology is one-pass trenching.

2.4.3 Backfill Mix Design

The maximum potential effectiveness of the GWBW (i.e., lowest hydraulic conductivity) is determined by the selection and proportioning of components that make up the slurry wall backfill. Typical slurry wall backfills consist of excavated soil mixed with clay (bentonite or

attapulgite), and may also include cementitious materials (e.g. Portland cement, slag cement). The selection and proportioning of the clay component of the slurry backfill mixture must take into account specific site conditions, as certain groundwater constituents can have a negative effect on the long-term effectiveness of the barrier wall due to chemical and physical interactions. The degree to which a backfill mix is able to withstand degradation by site conditions is referred to as "compatibility."

A notable condition of the site that could potentially affect the compatibility of the backfill mix is the presence of LNAPL, which is known to reduce the water absorption of hydrated clay materials, causing desiccation cracking and thereby increasing the hydraulic conductivity. This has also been shown to occur in mixtures of soil and clay.

Given the potential compatibility concerns, a slurry material testing program was conducted to evaluate the feasibility of several approaches to constructing a GWBW. The testing program was carried out using site-specific materials, including groundwater containing LNAPL and soil, to simulate actual and site conditions the GWBW will experience. The results from the slurry materials testing program will be provided to the GWBW installation contractor. Groundwater and soil samples were generally collected from the areas with the highest known concentrations of LNAPL. The preliminary results of the compatibility testing were favorable (i.e., hydraulic conductivity less than 5×10^{-7} centimeters per second) for all combinations of site soil and clay backfill mixes and site groundwater permeants tested.

The GWBW contractor will be responsible for selecting a specific backfill mix, or selecting a proprietary blend. The contractor will be required to test the proposed backfill mix in a bench scale and/or field testing of their selection. The backfill mix selected by the contractor will need to meet the maximum requirement for hydraulic conductivity *in situ*.

2.4.4 *Wall Alignment*

Ideally, the GWBW would be constructed as close to the top of the riverbank as possible to reduce potential LNAPL mass remaining between the GWBW and the Willamette River (i.e., the "stranded wedge"). However, other factors must be considered, including worker safety, stability of the riverbank, and wall constructability, when locating the GWBW.

Slope stability analyses were performed using geotechnical data to determine the minimum GWBW setback and were presented in the

Conceptual Design (ERM 2015). The minimum required GWBW setback is 20 ft. The GWBW alignment presented in Figure 2 includes an approximate 20-ft setback from the top of the riverbank.

In order to construct the GWBW, sufficient space must be available for operations and equipment maneuvering. For conventional side-mix slurry wall construction, approximately 1 foot of lateral space for every 1 foot of wall depth is required on at least one side of the GWBW. This results in a lateral space requirement of a minimum of 35 ft on the upland side of the GWBW alignment.

The GWBW alignment is presented in plan view in Figure 2. A geologic profile along the GWBW alignment is presented in Appendix A, Sheet 5.

2.4.5 Wall Length and Depth

The lateral and vertical extent of the GW SCM was primarily determined by the known extent of LNAPL at the site. The most recent groundwater gauging results from June 2015 and LNAPL distribution in the GWBW alignment area are shown in Figure 3. The figure indicates that the primary extent of LNAPL is contained by the proposed GW SCM. The proposed GWBW was extended to an approximate length of 453 ft based on observed LNAPL and historical dissolved phase concentrations. The GWBW was extended to an approximate depth of 35 ft bgs based on observations during previous investigations, where LNAPL was generally observed above 30 ft bgs and finer grained lithology was generally observed below this depth. By extending the depth of the GWBW to the finer grained lithology, it is anticipated that the GWBW will more effectively control the potential movement of LNAPL.

3.0 *GROUNDWATER BARRIER WALL CONSTRUCTION PERMITTING*

This section discusses the permits required for the construction of the GWBW component of the GW SCM.

3.1 STATE

The project is being conducted under Oregon State Cleanup Rules through the Voluntary Agreement, with the ODEQ as the lead agency. As this is a cleanup project under ODEQ authority, substantive requirements of relevant state permits must be met, but the administrative requirements associated with the permits are not required. However, a National Pollutant Discharge Elimination System General Construction Storm Water Permit (1200-C) will be obtained for discharge of storm water during construction of the GWBW in order to minimize the ODEQ review schedule. The 1200-C permit is required for projects that have an anticipated disturbed area greater than 1 acre. Projects with a disturbed area less than 5 acres do not require public review of the permit application. The area anticipated to be disturbed during the implementation of the GWBW is approximately 2.6 acres.

3.2 LOCAL

The project is being conducted under Oregon State Cleanup Rules through the Voluntary Agreement, with the ODEQ as the lead agency. It is currently understood, as per preliminary discussions with the city of Portland (the "City") personnel, that development permit approvals will not be required because the project will fall under the City "exempt" review process; however, the substantive requirements of relevant permits must be met. The exempt process has been established as a means of providing City input to an ODEQ-managed cleanup project that is being conducted under the permit waiver process. The exempt review process consists of review by the City of Portland Bureau of Development Services and Bureau of Environmental Services for compliance with applicable City codes and regulations, including greenway overlay zoning requirements. Following a review and incorporation of any necessary design revisions, a letter of determination of compliance with applicable City of Portland Code will be issued, which may contain additional requirements.

4.0 *CONSTRUCTION MANAGEMENT*

This section provides details on the GWBW installation construction management process, as the first component of the GW SCMs.

4.1 WELL ABANDONMENT

It is anticipated that approximately seven monitoring wells (MW-9, MW-10, MW-12, MW-13, MW-18, MW-22, and MW-23) may require abandonment. In accordance with Oregon Department of Water Resources requirements, the designated groundwater monitoring wells shall be abandoned by a licensed well driller prior to construction of the GWBW if there is potential for damaging the designated monitoring wells from construction activities. Further wells may be identified by the contractor for abandonment, if there is potential for damage from construction activities. Abandoned wells are not proposed for re-installation given their proximity to the GWBW or locations within the footprint of the GWBW. Further proposed groundwater monitoring wells will be evaluated as part of the conceptual performance monitoring plan, (see Section 5.0).

4.2 STAGING AREA

Space will be provided at the site for use by the contractor to stage equipment and materials necessary for GWBW construction. The contractor staging area location is depicted in Appendix A, Sheet 3.

4.3 EROSION/SEDIMENT CONTROL AND CONSTRUCTION STORM WATER MANAGEMENT

Local permits pertaining to erosion and sediment control are not required for this project, as discussed above in Section 3.1; however, the substantive requirements must be met. Applicable erosion and sediment control measures, as per the City Erosion and Sediment Control Manual, include construction sequencing, "development activity controls," and best management practices (BMPs). The applicable measures will be detailed in an Erosion, Sediment, and Pollution Control Plan and are summarized in this section.

Construction of the GWBW will be sequenced to reduce the active area (i.e., by segments or continuous trenching). Reducing the amount of disturbed area at a given time will reduce the potential to produce sediment-laden runoff. The construction of the GWBW is also currently scheduled to occur before the typical rainy season.

Development activity controls are non-BMPs, which limit the potential for pollution of storm water during construction. The project will include a contractor staging area, as discussed below, which will limit the potential for pollution due to equipment storage, refueling and maintenance, and materials storage. The staging area will be enclosed on three sides with a silt fence.

Erosion and sediment control BMPs are required if the potential for erosion and sedimentation cannot be eliminated by the use of construction sequencing and development activity controls alone. The BMPs (as per the City Erosion and Sediment Control Manual) best suited to control erosion and sediment at the site include temporary sediment control (silt) fence and storm drain inlet protection. The placement of BMPs will be determined upon final GWBW design. Generally, silt fence will be placed between the proposed GWBW, near the top of bank, and the Willamette River. A wire-reinforced ("super silt") fence will be considered to ensure durability of the silt fence. Storm drain inlet protection will be used to prevent discharge of sediment-laden runoff to the storm sewer system if any active storm drains are present near disturbed areas.

An Erosion Sediment Control Plan is provided in Appendix A, Sheet 4.

4.4 *QUALITY ASSURANCE/QUALITY CONTROL ACTIVITIES*

The ability to ensure a successful slurry wall installation through engineering design is limited, as the slurry wall construction is largely dependent on available contractor methods and expertise. However, this element of uncertainty can be managed through the implementation of a rigorous quality assurance/quality control (QA/QC) program. QA/QC activities are performed for each stage of slurry wall construction, from pre-construction through post-construction, to ensure the finished product will meet the intent of the design. The Draft Construction Quality Assurance Plan, submitted in ERM's *Responses to DEQ/USEPA Comments on Basis of Design Report – Groundwater Source Control Measures* (Response Document) dated September 22, 2015 (ERM, 2015a), details the specific elements of the QA/QC program.

4.5 CONTAMINATED MATERIALS MANAGEMENT

Soils encountered at the site are known to be impacted with petroleum hydrocarbons and PAHs. The revised Contaminated Materials Management Plan (CMMP) was provided in ERM's Response Document and will be provided to the selected GWBW contractor; and the plan may be further modified based on contractor and project specifications.

5.0 *CONCEPTUAL PERFORMANCE MONITORING PLAN*

This section presents a conceptual performance monitoring plan for the GWBW component of the GW SCMs. The performance monitoring plan will be finalized as part of the design of the oxygenation/biobarrier phase of the GW SCM.

The objectives of the conceptual performance monitoring network will be to enable 1) evaluation of the horizontal and vertical flow of groundwater in the area of the GWBW and 2) evaluation of the chemical condition of the aquifer on the southern portion of the property.

Performance monitoring will consist of periodic depth to water (DTW) measurements, groundwater sample collection, and analysis for COCs. The proposed performance monitoring well network will consist of a combination of existing and new groundwater wells. Clusters of wells with shallow and deep screening intervals will be installed to evaluate both horizontal and vertical groundwater flow in the vicinity of the GW SCM. Potential locations of these wells clusters are shown on Figure 4.

Existing wells MW-26 and MW-27 were recently installed with a screened interval below the proposed depth of the GWBW (depths of 34 to 39 and 35 to 40 ft bgs, respectfully) and will be incorporated into the performance monitoring program to evaluate groundwater conditions at the top of bank, which is the presumed performance monitoring point for GW SCM performance evaluation.

5.1 GROUNDWATER ELEVATIONS

Monitoring the movement of groundwater vertically and horizontally as well as monitoring the dissolved concentrations in groundwater will allow evaluation of the impact on groundwater near and downgradient of the GWBW. The DTW data will be used to calculate groundwater elevations and develop groundwater elevation contour maps depicting the groundwater flow direction in the area of the GW SCMs. The groundwater flow results will be used to evaluate the horizontal flow in the aquifer. Groundwater elevations will also be compared to evaluate the vertical flow of the aquifer. Groundwater modeling may be used as a tool, if necessary, to evaluate the vertical groundwater flow.

Pending final GWBW installation and further well installations, the area-wide DTW measurement frequency will be as follows:

- Year 1 – DTW measurements will be completed monthly to evaluate variability of groundwater flow throughout the year;
- Year 2 and beyond – DTW measurements will be conducted quarterly if the corresponding groundwater elevation contour maps from Year 1 demonstrate relatively consistent seasonal conditions.

MMGL will request approval from ODEQ before modifying the monitoring frequency.

5.2 *GROUNDWATER SAMPLE COLLECTION AND ANALYSIS*

Groundwater sample collection and analysis for COCs will be conducted to evaluate contaminant distribution and assess, in combination with the DTW data, whether they are being impacted by the GW SCM. During the first year, quarterly groundwater samples will be collected to evaluate seasonal conditions. After the first year and pending DEQ approval, the frequency will change to semi-annual. MMGL will request approval from ODEQ before modifying the frequency.

6.0 *SCHEDULE*

Appendix B provides an updated schedule for the design and construction of the GW SCMs. This schedule is subject to modification as the design, procurement, installation, and construction progress.

As discussed above, the GWBW component of the GW SCMs is currently underway, with targeted completion in November 2015. Conceptual design of the subsequent oxygenation/biobarrier system of the GW SCMs will be initiated with ODEQ in Fall 2015. Conceptual design will include a technical screening evaluation for selection of the most effective treatment alternative and pilot testing in Winter 2015. Draft design plans and subsequent basis of design report will be submitted for the oxygenation/biobarrier system in first quarter 2016. The final Performance Monitoring Plan for the GW SCMs will also be presented in as part of the basis of design to be submitted in the first quarter 2016.

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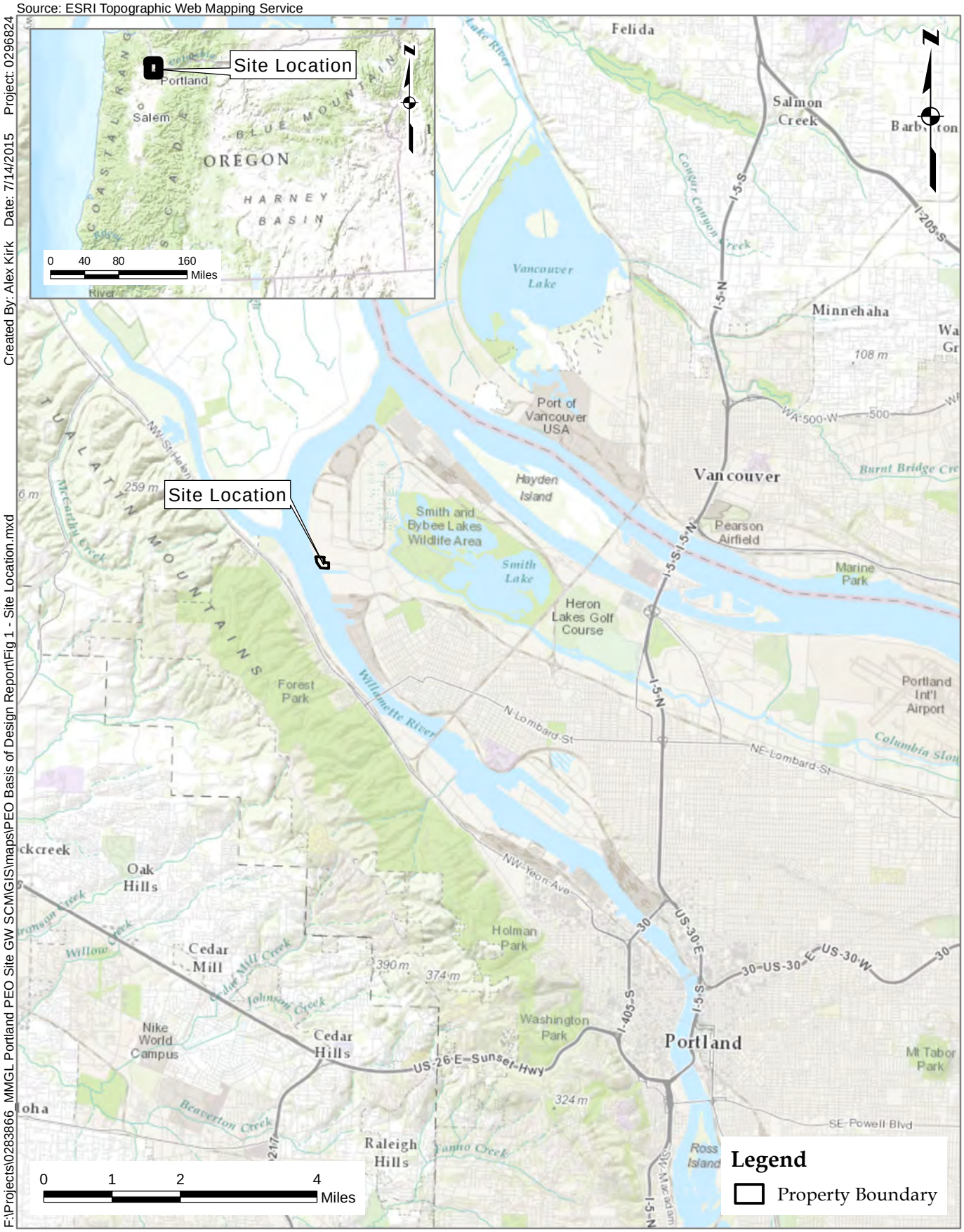
Figures

Source: ESRI Topographic Web Mapping Service



Project: 0296824 Date: 7/14/2015 Created By: Alex Kirk F:\Projects\0283866_MMGL Portland PEO Site GW SCM\GIS\maps\PEO Basis of Design Report\Fig 1 - Site Location.mxd

Environmental Resources Management
1001 SW 5th St, Suite 1010
Portland, Oregon 97204

Figure 1
Site Location
PEO Basis of Design Report
Southern PEO Site
Portland, Oregon

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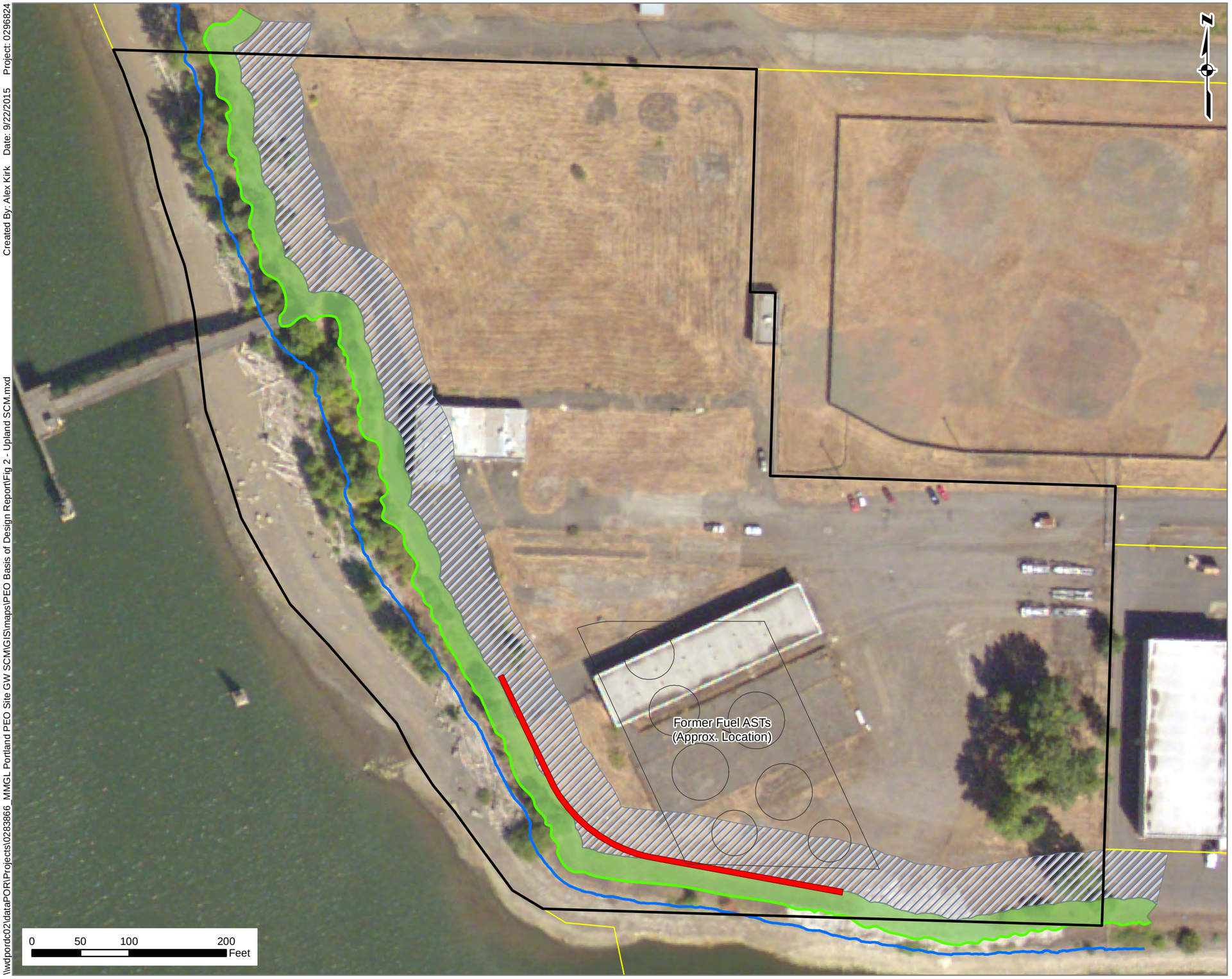

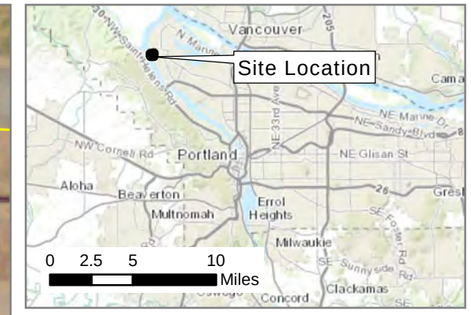

Legend

- Proposed Barrier Wall Alignment
- Ordinary High Water (20.5 ft)
- Top of Bank
- Greenway Setback
- River Industrial Zone Setback
- Historical Structures (Source: Treadwell & Rollo, 2014)
- Property Boundary
- Parcels

Notes:
Elevation data given in NAVD88
Aerial Imagery: City of Portland, flown 7/7/2012

Figure 2
Upland Source Control Measures Layout
PEO Basis of Design Report
Southern PEO Site
Portland, Oregon

Environmental Resources Management
1001 SW 5th St, Suite 1010
Portland, Oregon 97204

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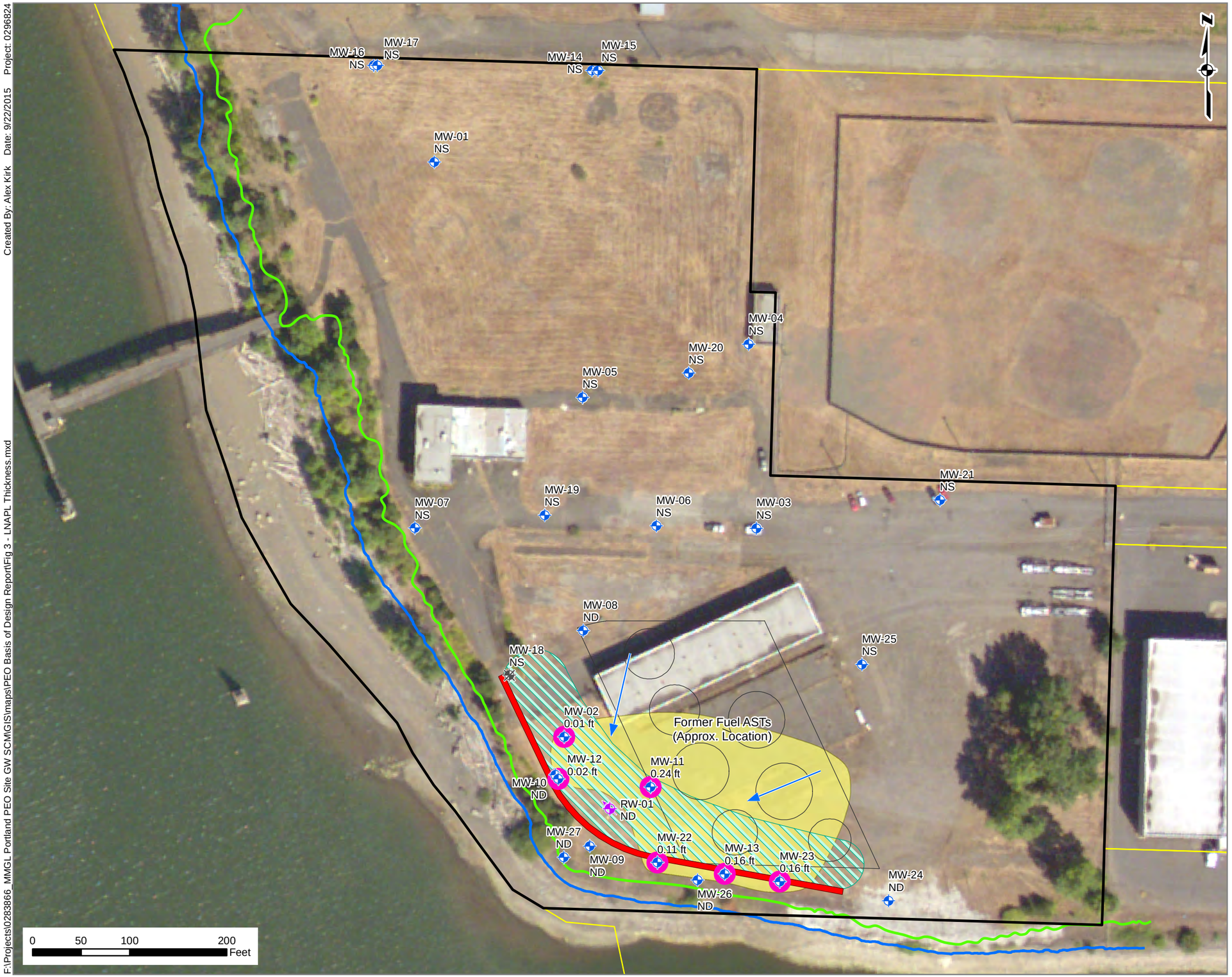

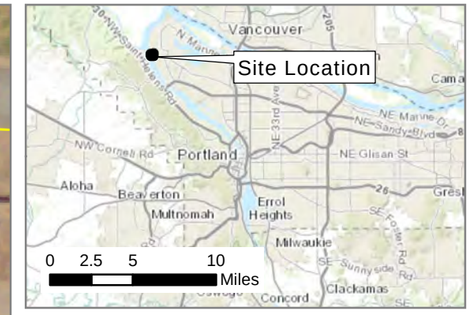

Legend

- Recovery Well
- Monitoring Well
- Destroyed Monitoring Well
- LNAPL Detected (6/3/15)
- Proposed Barrier Wall Alignment
- Ordinary High Water (20.5 ft)
- Top of Bank
- Approx. Direction of Groundwater Flow (August 2012)
- Conceptual Oxygenation/ Biobarrier Area
- LNAPL Extent (Approx.)
- Historical Structures (Source: Treadwell & Rollo, 2014)
- Property Boundary
- Parcels

Notes:
LNAPL: Light Non-Aqueous Phase Liquid
ND: Not Detected
NS: Not Sampled
Monitoring occured on 6/3/2015, except for wells MW-26 and MW-27 which were sampled on 6/7/2015
Elevation data given in NAVD88
Aerial Imagery: City of Portland, flown 7/7/2012

Figure 3
LNAPL Distribution
PEO Basis of Design Report
Southern PEO Site
Portland, Oregon

Environmental Resources Management
1001 SW 5th St, Suite 1010
Portland, Oregon 97204

Created By: Alex Kirk Date: 9/22/2015 Project: 0296824

F:\Projects\0283866_MMGL Portland PEO Site GW SCM\GIS\maps\PEO Basis of Design Report\Fig 3 - LNAPL Thickness.mxd

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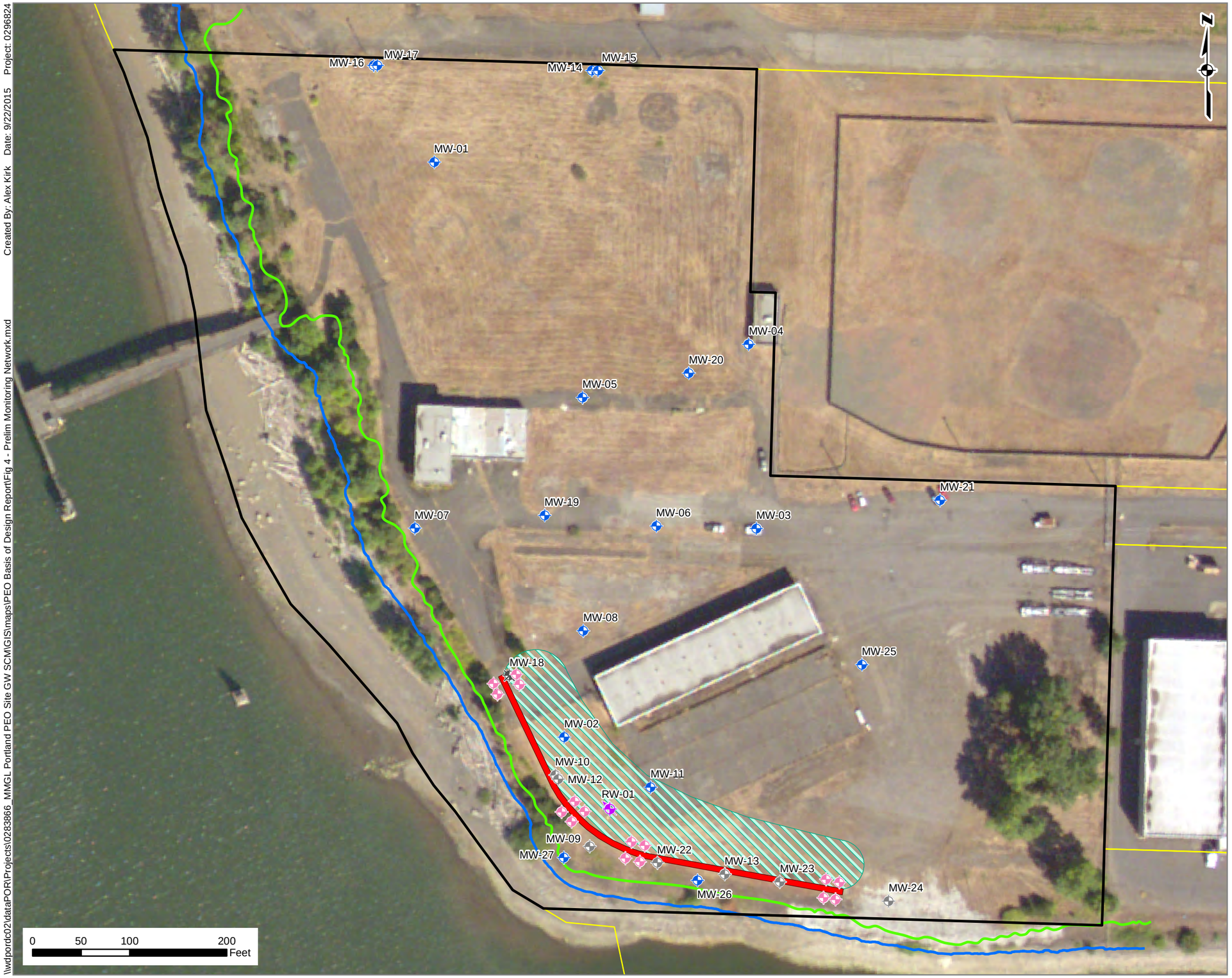

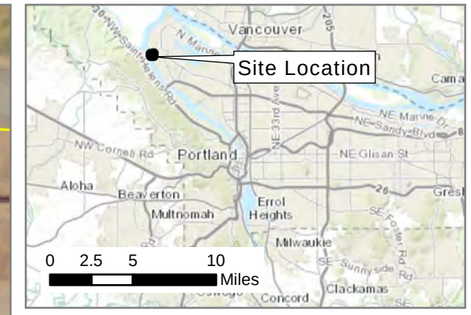

Legend

- Potential Cluster Well
- Monitoring Well
- Recovery Well
- Abandoned Monitoring Well
- Destroyed Monitoring Well
- Proposed Barrier Wall Alignment
- Ordinary High Water (20.5 ft)
- Top of Bank
- Conceptual Oxygenation/ Biobarrier Area
- Property Boundary
- Parcels

Notes:
Elevation data given in NAVD88
Aerial Imagery: City of Portland, flown 7/7/2012

Figure 4
Preliminary Performance Monitoring Network Layout
PEO Basis of Design Report
Southern PEO Site
Portland, Oregon

Environmental Resources Management
1001 SW 5th St, Suite 1010
Portland, Oregon 97204

\\wdpordc02\dataPOR\Projects\0283866_MMGL Portland PEO Site GW SCM\GIS\maps\PEO Basis of Design Report\Fig 4 - Prelim Monitoring Network.mxd
Created By: Alex Kirk Date: 9/22/2015 Project: 0296824

Appendix A
Groundwater Barrier Wall Final Design

Groundwater Barrier Wall
Construction Drawings

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GROUNDWATER SOURCE CONTROL MEASURE - GROUNDWATER BARRIER WALL FOR

SOUTHERN PREMIERE EDIBLE OILS SITE PORTLAND, OREGON

JULY 2015

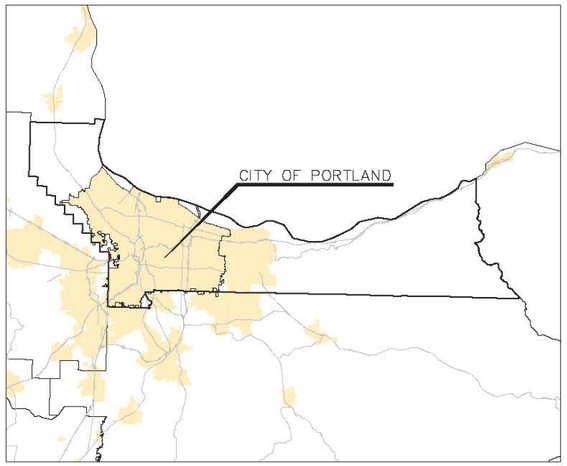
PREPARED FOR:

MMGL Corp.
818 Stewart Street, Suite 700,
Seattle, Washington 98101

BRENDAN ROBINSON P.E.
Oregon Professional Engineer License No. 78496PE

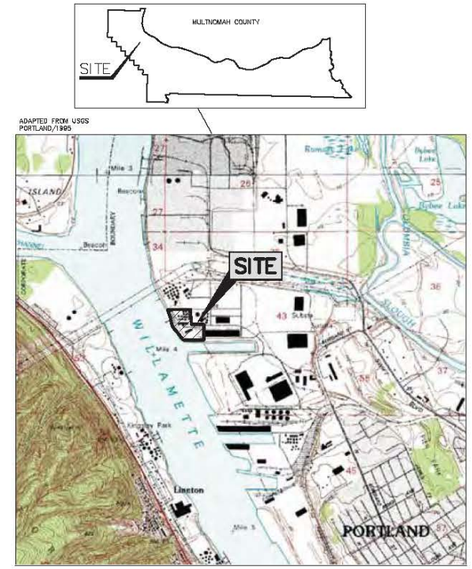
PREPARED BY:

Environmental Resources Management
ERM-West, Inc.
1001 SW 5th Ave, Suite 1010
Portland, Oregon 97204



MULTNOMAH COUNTY
OREGON

0 40000 80000
SCALE (IN FEET)



SECTION 35
T.2N / R.1W
CITY OF PORTLAND, MULTNANOMAH COUNTY, OREGON

SITE LOCATION MAP

0 2000 4000
SCALE (IN FEET)

SITE VICINITY MAP

0 500 1000
SCALE (IN FEET)

GENERAL NOTES

1. SCALES ARE AS NOTED ON EACH DRAWING.
2. THE GENERAL NOTES AND LEGEND ON THIS SHEET APPLY TO ALL DRAWINGS, UNLESS OTHERWISE NOTED.
3. (1) GROUND SURFACE ELEVATIONS SHOWN ARE BASED ON A LIDAR SURVEY PERFORMED BY THE ARMY CORPS OF ENGINEERS IN 2010. ELEVATIONS SHOWN ARE IN FEET ABOVE MEAN SEA LEVEL (AMSL), NAVD 88. HORIZONTAL CONTROL IS BASED ON NAD83 OREGON STATE PLANE ZONE NORTH, IN FEET.
4. EXISTING CONTOUR LINES ARE SHOWN AT 2-FOOT INTERVALS, UNLESS OTHERWISE NOTED.
5. (1) THE SITE IS NOT OPERATING AND IS NOT AN ACTIVE FACILITY. HOWEVER, LIMITED NON-CONSTRUCTION RELATED ACTIVITIES MAY OCCUR AT THE SITE. CONTRACTOR SHALL ENSURE THAT CONSTRUCTION ACTIVITIES DO NOT INTERFERE WITH SITE ACTIVITIES AT ANY TIME.
6. CONTRACTOR SHALL COMPLY WITH ALL REQUIREMENTS OF SITE HEALTH AND SAFETY THROUGHOUT CONSTRUCTION.
7. IN THE EVENT THAT THE DRAWINGS AND TECHNICAL SPECIFICATIONS CONFLICT, THE DRAWINGS SHALL TAKE PRECEDENCE OVER THE SPECIFICATIONS.
8. BENCHMARKS, MONUMENTS, PROPERTY MARKERS, STRUCTURES AND UTILITIES SHALL BE PROTECTED AT ALL TIMES AND SHALL NOT BE DISTURBED BY CONSTRUCTION ACTIVITIES.
9. CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING THE OREGON UTILITY NOTIFICATION CENTER AT 1-800-332-2344 THREE DAYS PRIOR TO THE START OF ANY EXCAVATION WORK.
10. CONTRACTOR SHALL CONTRACT AN APPROVED PRIVATE UTILITY LOCATOR FOR MARKOUT OF OWNER UTILITIES.
11. THE FLOOD HAZARD AREA WAS OBTAINED FROM THE US ARMY CORPS OF ENGINEERS AND METRO DATA RESOURCE CENTER, FEBRUARY 9, 1996, UPDATED FEBRUARY 20 ,2009.
12. THE LOCATION OF UTILITIES AND OTHER SITE FEATURES ARE APPROXIMATE AND SHALL BE FIELD VERIFIED BY THE CONTRACTOR

LIST OF DRAWINGS

SHEET NO.	TITLE
	COVER SHEET
1	LOCATION MAPS, GENERAL NOTES, LIST OF DRAWINGS, ABBREVIATIONS, AND LEGEND
2	EXISTING SITE PLAN
3	WORK AREA PLAN
4	EROSION AND SEDIMENT CONTROL PLAN
5	GROUNDWATER BARRIER WALL PROFILE
6	DETAILS

LEGEND (1)

- (1) REVISION INDICATOR
- RECOVERY WELL
- SOIL BORING LOCATION
- MONITORING WELL LOCATION
- STORM WATER CATCH BASIN (WITH FIBER ROLL PROTECTION)
- UTILITY/ELECTICAL POLE
- LIGHT POLE
- FIRE HYDRANT
- SANITARY SEWER MANHOLE
- 0+00 GWBW TURNING POINT (STATIONED)
- GROUNDWATER BARRIER WALL
- APPROXIMATE PROPERTY BOUNDARY
- INDEX CONTOUR – 10 FOOT INTERVAL
- INTERMEDIATE CONTOUR – 2 FOOT INTERVAL
- ORDINARY HIGH WATER (20.5 FT)
- TOP OF BANK (APPROXIMATE 30 FT)
- RAILROAD TRACK
- SAN — SANITARY SEWER
- CONCRETE CURB
- U/E — OVERHEAD UTILITY
- FLOOD HAZARD AREA (APPROXIMATE 32.5 FT)
- FEMA FLOODWAY
- x — x EXISTING FENCE
- SITE INGRESS/EGRESS
- LIMIT OF DISTURBANCE
- SILT FENCE
- PAVED AREA
- GRAVEL AREA
- GREENWAY BUFFER
- INDUSTRIAL ACTIVITY SETBACK
- EXISTING ONSITE STRUCTURE
- OUTSIDE FLOOD HAZARD AREA
- EXISTING TREED AREAS

ABBREVIATIONS

℄	CENTERLINE
NOM	NOMINAL
DIA.	DIAMETER
R.O.W.	RIGHT OF WAY
EX	EXISTING
N.I.C.	NOT IN CONTRACT
TYP	TYPICAL
WSE	WATER SURFACE ELEVATION
INV	INVERT
STL	STEEL
MIN	MINIMUM
DWG	DRAWING
ELEV	ELEVATION
GAL	GALLONS
CY	CUBIC YARDS
DGA	DENSE GRADED AGGREGATE

602
4
SHEET NUMBER WHERE DETAIL IS LOCATED
DETAIL DESIGNATION
SHEET(S) NUMBER WHERE DETAIL IS IDENTIFIED

REV.	DATE	DESCRIPTION	BY	CHK
1	7/27/15	UPDATED LEGEND, REVISED NOTES	RMK	AK

DRAWN BY RMK | CADD Review FGB | CHECKED BY AK-ANN

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Environmental Resources Management

REGISTERED PROFESSIONAL ENGINEER 78496PE OREGON DECEMBER 31 BRENDAN ANDREW KIRKPATRICK
EXP. 12/31/2016

GROUNDWATER SOURCE CONTROL MEASURE
GROUNDWATER BARRIER WALL
SOUTHERN PREMIERE EDIBLE OILS SITE
PORTLAND, OREGON

LOCATION MAPS, GENERAL NOTES, LIST OF DRAWINGS, ABBREVIATIONS, AND LEGEND

SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0263866	1	1
DATE 06/26/2015			

REVISIONS TO BE MADE ON THE CADD FILE ONLY

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N

0 50 100

SCALE (IN FEET)

LEGEND:

- RECOVERY WELL
- SOIL BORING LOCATION
- MONITORING WELL LOCATION
- STORM WATER CATCH BASIN
- UTILITY/ELECTICAL POLE
- LIGHT POLE
- FIRE HYDRANT
- SANITARY SEWER MANHOLE
- APPROXIMATE STORM SEWER LOCATION
- APPROXIMATE PROPERTY BOUNDARY
- INDEX CONTOUR – 10 FOOT INTERVAL
- INTERMEDIATE CONTOUR – 2 FOOT INTERVAL
- ORDINARY HIGH WATER
- TOP OF BANK (APPROXIMATE 30 FT)
- RAILROAD TRACK
- SAN — SANITARY SEWER
- CONCRETE CURB
- OVERHEAD UTILITY
- FLOOD HAZARD AREA (APPROXIMATE 32.5 FT)
- FEMA FLOODWAY
- EXISTING FENCE
- SITE INGRESS/EGRESS
- OUTSIDE FLOOD HAZARD AREA (AREAS ABOVE 32.5 FT ELEVATION)
- PAVED AREA
- GRAVEL AREA
- GREENWAY BUFFER
- INDUSTRIAL ACTIVITY SETBACK
- EXISTING ONSITE STRUCTURE
- EXISTING TREED AREA

NOTES:

1. THE FEMA FLOOD ZONE ELEVATION IS APPROXIMATELY 32.5 FEET ELEVATION. THIS ELEVATION COVERS ENTIRE SITE EXCEPT SOME MOUNDS AS SHOWN ON THIS SHEET. (REFERENCE LEGEND FOR ELEVATIONS ABOVE 32.5 FT)
2. THE LOCATION OF EXISTING UTILITIES AND OTHER SITE FEATURES ARE APPROXIMATE. THE CONTRACTOR SHALL VERIFY THE EXACT LOCATION OF ALL EXISTING UTILITIES AND SITE FEATURES PRIOR TO THE START OF WORK.
3. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY ACTUAL SITE CONDITIONS PRIOR TO THE START OF ANY WORK. THERE IS NO WARRANTY OR GUARANTEE ON THE COMPLETENESS OR CORRECTNESS OF THE EXISTING CONDITION INFORMATION. ANY DISCREPANCY FOUND SHALL BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE ENGINEER PRIOR TO THE START OF WORK.
4. THIS SITE IS NOT OPERATING AND IS NOT AN ACTIVE FACILITY. HOWEVER, SOME UTILITIES ARE POTENTIALLY ACTIVE. THE CONTRACTOR SHALL FIELD VERIFY THE STATUS OF THE UTILITIES AND NOTIFY THE ENGINEER IF ANY ACTIVE UTILITIES CONFLICT WITH THE WORK.

REV.	DATE	DESCRIPTION	BY	CHK
2	9/17/15	ADDED STORM SEWER PER DEQ/EPA COMMENTS	RMK	AK
1	7/27/15	ADDED TREED AREAS	RMK	AK

DRAWN BY RMK CADD Review FGB CHECKED BY AK–ANN

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Environmental Resources Management

REGISTERED PROFESSIONAL ENGINEER 78496PE OREGON DECEMBER 31, 2016 BRENDAN ANDREW ROBINSON

EXP. 12/31/2016

GROUNDWATER SOURCE CONTROL MEASURE

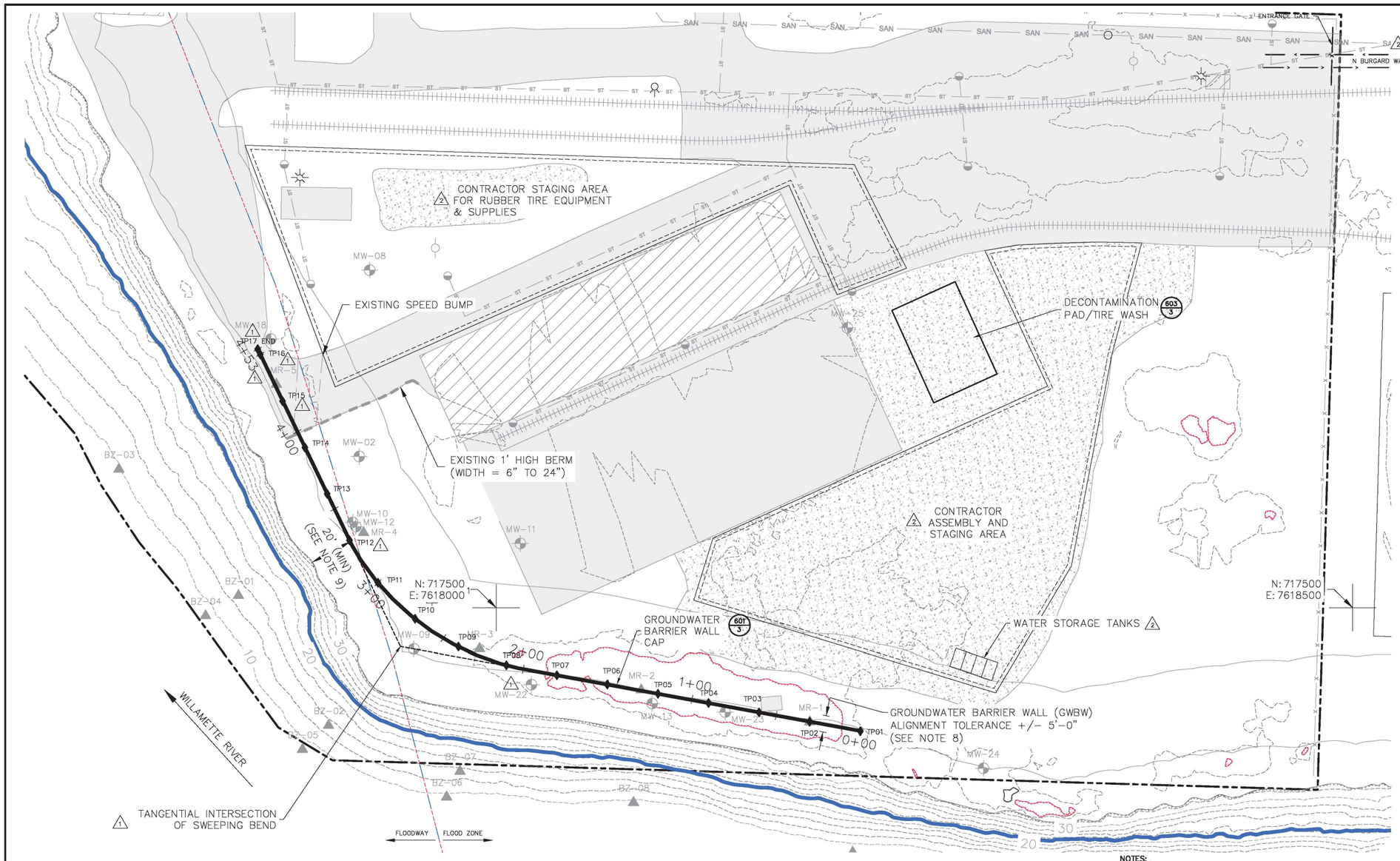
GROUNDWATER BARRIER WALL

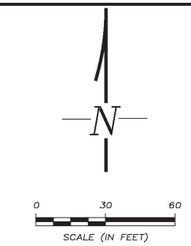
SOUTHERN PREMIERE EDIBLE OILS SITE

PORTLAND, OREGON

EXISTING SITE PLAN

SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0283866	2	2
DATE 08/25/2015			





LEGEND:

- RECOVERY WELL
- SOIL BORING LOCATION
- MONITORING WELL LOCATION
- STORM WATER CATCH BASIN
- UTILITY/ELECTICAL POLE
- LIGHT POLE
- FIRE HYDRANT
- SANITARY SEWER MANHOLE
- TP04 GWBW TURNING POINT (STATION)
- ST APPROXIMATE STORM SEWER LOCATION
- GROUNDWATER BARRIER WALL
- APPROXIMATE PROPERTY BOUNDARY
- INDEX CONTOUR – 10 FOOT INTERVAL
- INTERMEDIATE CONTOUR – 2 FOOT INTERVAL
- ORDINARY HIGH WATER
- TOP OF BANK (APPROXIMATE 30 FT)
- RAILROAD TRACK
- SAN SANITARY SEWER
- CONCRETE CURB
- U/E OVERHEAD UTILITY
- FEMA FLOOD ZONE (APPROXIMATE 32.5 FT)
- FEMA FLOODWAY
- X EXISTING FENCE
- SITE INGRESS/EGRESS
- PAVED AREA
- GRAVEL AREA
- GREENWAY BUFFER
- INDUSTRIAL ACTIVITY SETBACK
- EXISTING ONSITE STRUCTURE
- OUTSIDE FLOOD HAZARD AREA (AREAS ABOVE 32.65 FT ELEVATION)

MONITORING WELL ABANDONMENT SCHEDULE		
WELL ID	WELL SIZE	WELL DEPTH
MW-9	2-INCH	27 FEET
MW-10	2-INCH	53 FEET
MW-12	2-INCH	28 FEET
MW-13	2-INCH	28 FEET
MW-18	2-INCH	27 FEET
MW-22	2-INCH	28 FEET
MW23	2-INCH	28 FEET

GROUNDWATER BARRIER WALL TURNING POINTS

POINT NUMBER	GWBW STATION	NORTHING-Y	EASTING-X
TP01	0+00	717428.05287522	7618212.65804295
TP02	0+30	717433.56185176	7618183.07756316
TP03	0+60	717439.00479445	7618153.52981631
TP04	0+90	717444.46855638	7618124.03155694
TP05	1+20	717449.86980158	7618094.52213440
TP06	1+50	717455.27890155	7618064.92207832
TP07	1+80	717460.67241520	7618035.50261611
TP08	2+10	717466.56045891	7618006.04020779
TP09	2+40	717477.30951754	7617978.03203508
TP10	2+70	717493.46981202	7617952.70715500
TP11	3+00	717514.49755669	7617931.06343621
TP12	3+30	717539.29495425	7617914.43674374
TP13	3+60	717566.35037137	7617901.39672273
TP14	3+90	717593.41137992	7617888.38520966
TP15	4+20	717620.40005167	7617875.34615536
TP16	4+50	717647.65036702	7617862.34616181
TP17	4+53.2 END	717650.74175290	7617860.86153647

NOTES:

1. IF ANY UTILITY IS DETERMINED TO CONFLICT WITH THE WORK, THE CONTRACTOR SHALL COORDINATE WITH PORTLAND GENERAL ELECTRIC TO DISCONNECT OR REMOVE ELECTRIC LINES, IF REQUIRED TO CONSTRUCT THE GROUNDWATER BARRIER WALL.

2. THE CONTRACTOR SHALL CONTROL AND MANAGE SPOILS DURING GROUNDWATER BARRIER WALL CONSTRUCTION SUCH THAT MATERIALS ARE PREVENTED FROM ENTERING THE WILLAMETTE RIVER AND ANY ON-SITE STORM DRAINS OR SURFACE WATER FEATURES. ALL SOILS SHALL BE MANAGED ON THE UPLAND SIDE OF THE GWBW (NORTH AND EAST SIDES)

3. THE GROUNDWATER BARRIER WALL SHALL EXTEND TO 35 FEET BELOW GROUND SURFACE (BGS). THE ANTICIPATED GROUNDWATER BARRIER WALL PROFILE IS PRESENTED ON SHEET 5. THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING STABLE CONDITIONS OF THE GWBW AND TRENCH AT ALL TIMES THROUGHOUT THE PROJECT.

4. THE DEPICTED LOCATION OF THE UTILITIES IS APPROXIMATE AND THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE LOCATION. NO KNOWN UTILITIES INTERSECT THE GROUNDWATER BARRIER WALL ALIGNMENT. HOWEVER, IF ANY UTILITIES ARE ENCOUNTERED ALONG THE ALIGNMENT DURING THE CONSTRUCTION, THEN IT SHALL IMMEDIATELY BE BROUGHT TO THE ATTENTION OF THE ENGINEER. CONTRACTOR SHALL BE PREPARED TO ADDRESS THESE UTILITIES IF ENCOUNTERED. CONTRACTOR SHALL BE PREPARED TO CUT, CAP OR CONCRETE PLUG THE UTILITIES IF ENCOUNTERED ALONG THE WALL ALIGNMENT, IF ANY ENCOUNTERED UTILITIES ARE INACTIVE.

5. THE DESIGNATED GROUNDWATER MONITORING WELLS SHALL BE ABANDONED BY A LICENSED WELL DRILLER IN ACCORDANCE WITH OREGON DEPARTMENT OF WATER RESOURCES REQUIREMENTS PRIOR TO CONSTRUCTION OF THE GROUNDWATER BARRIER WALL, IF THERE IS A POTENTIAL FOR DAMAGING THE DESIGNATED MONITORING WELLS FROM CONSTRUCTION ACTIVITIES. AS WELL ABANDONMENT SCHEDULE INDICATED IN THE THIS ON SHEET, IT IS ANTICIPATED THAT 7 MONITORING WELLS ARE REQUIRED FOR ABANDONMENT. OTHER MONITORING WELLS TO REMAIN WITHIN THE LIMIT OF DISTURBANCE SHALL BE VISUALLY IDENTIFIED WITH FLAGGING AND PHYSICALLY PROTECTED WITH BARRICADE.

6. THE GROUND SURFACE SHALL BE RESTORED TO EXISTING ELEVATIONS AND THE SITE STABILIZED FOLLOWING COMPLETION OF GROUNDWATER BARRIER WALL CONSTRUCTION ACTIVITIES. STABILIZATION SHALL BE IN ACCORDANCE WITH THE TECHNICAL SPECIFICATION AND DRAWING NO. 4 (ESC PLAN).

7. IN AREAS WHERE ASPHALT OR CONCRETE PAVEMENT EXISTS IN THE LOCATION OF THE GROUNDWATER BARRIER WALL, THE CONTRACTOR SHALL REMOVE THE SECTION OF PAVEMENT, AS NECESSARY, TO CONSTRUCT THE WALL. THE PAVEMENT SHALL BE SAWCUT, OR OTHERWISE APPROVED BY THE ENGINEER ACHIEVE A NEAT AND UNIFORM SECTION FOR REMOVAL.

8. THE GWBW ALIGNMENT INCLUDES A SWEEPING BEND BETWEEN STATIONS 2+10 AND 3+00 TO ALLOW FOR CONTINUOUS CONSTRUCTION (WITHOUT WITHDRAWING AND REPOSITIONING). THE BASE BID SCOPE OF WORK INCLUDES CONSTRUCTION OF THE WALL ALONG THE SWEEPING BEND. THIS BEND INCORPORATES A TURNING RADIUS OF APPROXIMATELY 125 FEET. THE CONTRACTOR MAY PROVIDE AN ALTERNATE ALIGNMENT THAT INCLUDES THE WALL LOCATION AT, OR CLOSE TO, THE TANGENTIAL INTERSECTION OF THE SWEEPING BEND. ANY MODIFICATION TO THE ALIGNMENT SHALL BE PROVIDED IN A WORK PLAN, INCLUDING METHODOLOGY, FOR REVIEW AND ACCEPTANCE BY THE ENGINEER.

9. THE CONSTRUCTED GROUNDWATER BARRIER WALL ALIGNMENT SHALL VARY NO MORE THAN 5 FEET LATERALLY FROM THE ALIGNMENT DEPICTED HEREIN. HOWEVER, IN ANY CASE THE OUTBOARD EDGE OF THE SLURRY WALL SHALL BE LOCATED A MINIMUM OF 20 FEET UP-GRADIENT (I.E., INLAND) FROM THE TOP OF THE RIVER BANK.

10. THE CONTRACTOR MAY LOCATE THE STAGING AREA IN AN ALTERNATIVE LOCATION, AS APPROVED BY THE ENGINEER.

REV.	DATE	DESCRIPTION	BY	CHK
2	9/17/15	UPDATED STORM SEWER AND STAGING AREA PER DEQ/EPA COMMENTS	RMK	AK
1	7/27/15	UPDATED TPs AND NOTES	RMK	AK

DRAWN BY RMK | CADD Review FGB | CHECKED BY AK-ANN

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REGISTERED PROFESSIONAL ENGINEER 78496PE OREGON DECEMBER 31, 2016 BENJAMIN ANDREW ROBINSON
EXP. 12/31/2016

GROUNDWATER SOURCE CONTROL MEASURE
GROUNDWATER BARRIER WALL
SOUTHERN PREMIERE EDIBLE OILS SITE
PORTLAND, OREGON

WORK AREA PLAN

SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0283866	3	2
DATE 06/25/2015			

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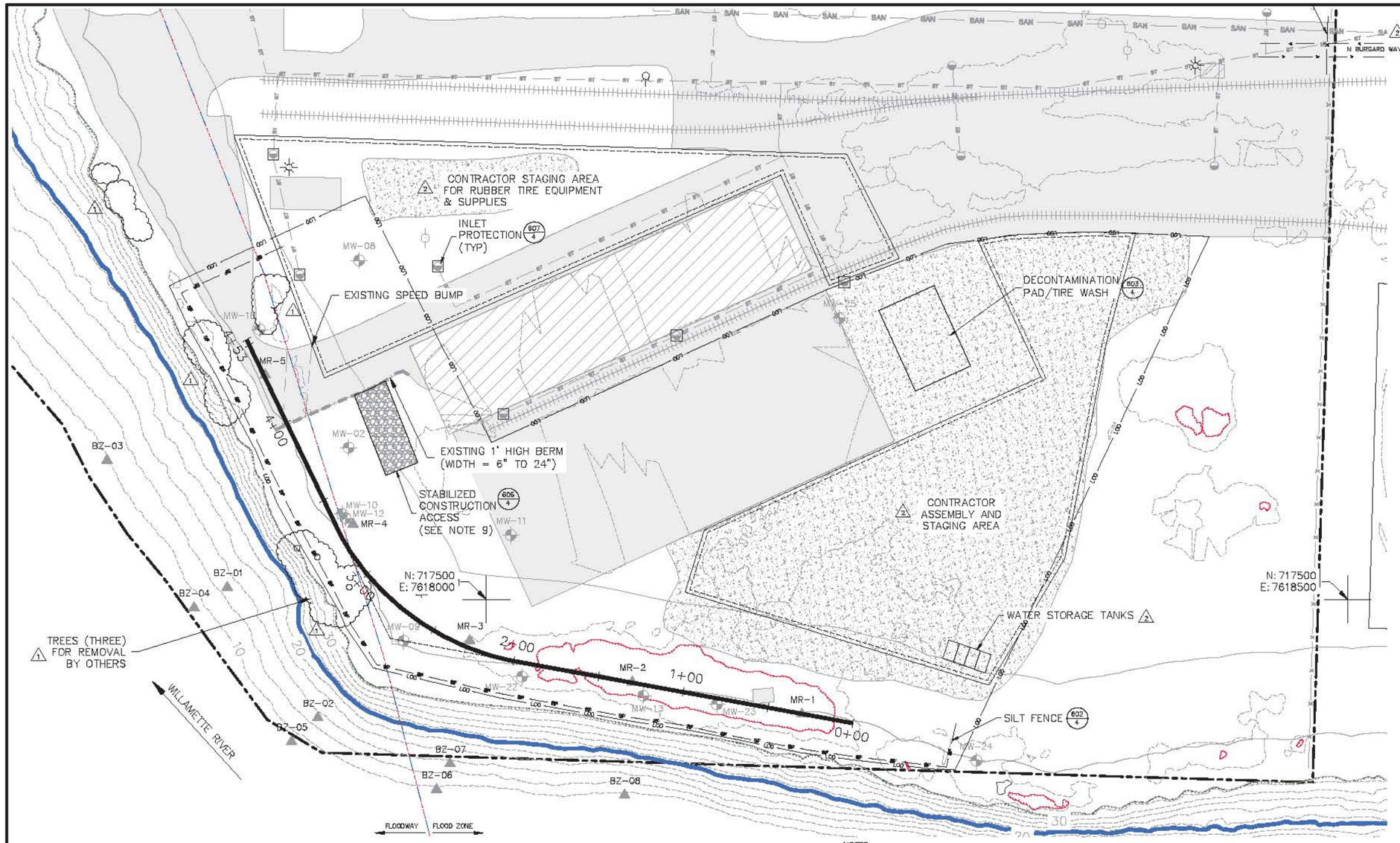

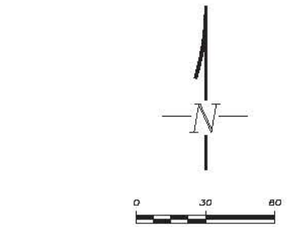

LEGEND:

- INLET PROTECTION
- RECOVERY WELL
- SOIL BORING LOCATION
- MONITORING WELL LOCATION
- STORM WATER CATCH BASIN
- UTILITY/ELECTICAL POLE
- LIGHT POLE
- FIRE HYDRANT
- SANITARY SEWER MANHOLE
- APPROXIMATE STORM SEWER LOCATION
- GROUNDWATER BARRIER WALL
- APPROXIMATE PROPERTY BOUNDARY
- INDEX CONTOUR – 10 FOOT INTERVAL
- INTERMEDIATE CONTOUR – 2 FOOT INTERVAL
- ORDINARY HIGH WATER
- TOP OF BANK (APPROXIMATE 30 FT)
- RAILROAD TRACK
- SANITARY SEWER
- CONCRETE CURB
- OVERHEAD UTILITY
- FEMA FLOOD ZONE (APPROXIMATE 32.5 FT)
- FEMA FLOODWAY
- EXISTING FENCE
- SITE INGRESS/EGRESS
- LIMIT OF DISTURBANCE
- SILT FENCE
- PAVED AREA
- GRAVEL AREA
- GREENWAY BUFFER
- INDUSTRIAL ACTIVITY SETBACK
- EXISTING ONSITE STRUCTURE
- OUTSIDE FLOOD HAZARD AREA (AREAS ABOVE 32.5 FT ELEVATION)
- EXISTING TREED AREA

NOTES:

1. CONTRACTOR SHALL VISUALLY MONITOR FOR POTENTIAL SEEPS, OUTFALL AND OTHER CONDUITS ENCOUNTERED AND TERMINATED DURING GROUNDWATER BARRIER WALL CONSTRUCTION ON A DAILY BASIS AND IMMEDIATELY AFTER A SIGNIFICANT RAIN EVENT (E.G. GREATER THAN 0.5 INCHES OVER 24 HOURS) TO ENSURE THAT A RELEASE OF SLURRY OR OTHER MATERIAL DOES NOT OCCUR. ANY RELEASES SHALL BE STOPPED IMMEDIATELY AND THE AREA RESTORED.

2. EROSION CONTROL DEVICES SHALL BE MAINTAINED UNTIL PERMANENT COVER IS ESTABLISHED AND APPROVED BY THE ENGINEER. UPON ESTABLISHMENT OF PERMANENT COVER THE CONTRACTOR SHALL REMOVE THE EROSION CONTROLS.

3. THE CONTRACTOR MAY SUBMIT AN ALTERNATIVE LOCATION(S) FOR THE THE STAGING AREA, DECONTAMINATION PAD, AND SUPPORT AREA FOR REVIEW AND APPROVAL BY THE ENGINEER. IF THE AREAS ARE RE-LOCATED, THE LIMIT OF DISTURBANCE WILL ALSO BE ADJUSTED ACCORDINGLY.

4. NEITHER SLURRY OR SEDIMENT-LADEN SURFACE WATER SHALL BE PERMITTED TO FLOW BEYOND THE SILT FENCE. THE CONTRACTOR SHALL VISUALLY INSPECT AND VERIFY THE PROPER WORKING ORDER OF THE SILT FENCE AND OTHER CONTROLS ON A DAILY BASIS. REPAIRS OF THE EROSION CONTROLS SHALL BE PERFORMED IMMEDIATELY UPON INSPECTION. IF THE SLURRY IS LOCATED ON, OR FLOWING FROM, THE OUTBOARD SIDE OF THE GWBW THE CONTRACTOR SHALL ENHANCE THE CONTROLS TO MITIGATE SLURRY BEYOND THE LOD, INCLUDING BUT NOT LIMITED CONSTRUCTION OF A BERM OR OTHER FEATURES.

5. SPOILS AND/OR DISTURBED SURFICIAL MATERIALS FROM THE MIXING AND/OR DISTURBED AREAS WITHIN GREENWAY BUFFER SHALL BE REMOVED AS VISUALLY CONFIRMED, TO A MINIMUM 4 INCH BELOW GROUND SURFACE. THIS DISTURBED AREA SHALL THEN BE BACKFILLED WITH DGA (MIN. 4 INCHE THICK), LEVELED WITH THE EXISTING SURROUNDING GRADE. SPOILS AND/OR DISTURBED SURFICIAL MATERIALS OUTSIDE THE GREENWAY BUFFER SHALL BE REMOVED AS VISUALLY CONFIRMED. THIS DISTURBED AREA SHALL THEN BE RESTORED TO THE EXISTING CONDITION. IF THE EXISTING SURFACE CONTAIND GRAVEL, THEN THE AREA SHALL BE STABILIZED WITH A MINIMUM 4 INCH GRAVEL. IF THE EXISTING SURFACE CONTAINS VEGETATION, THEN THE AREA SHALL BE VEGETATED IN ACCORDANCE WITH TECHNICAL SPECIFICATION 02936-ESTABLISHMENT OF VEGETATION.

6. FOR GRAPHICAL PURPOSES, THE SILT FENCE AND LIMIT OF DISTURBANCE ARE SHOWN SEPARATELY. DURING CONSTRUCTION ACTIVITIES, THE SILT FENCE WILL SERVE AS A VISUAL INDICATOR FOR THE LIMIT OF DISTURBANCE.

SEQUENCE OF CONSTRUCTION:

THE FEATURES PRESENTED ON THESE DRAWINGS SHALL BE CONSTRUCTED ACCORDING TO THE SEQUENCE PRESENTED BELOW, UNLESS OTHERWISE APPROVED BY THE ENGINEER.

1. INSTALL SILT FENCE, INLET PROTECTION, AND OTHER EROSION CONTROLS AS DEEMED NECESSARY.

2. INSTALL DECONTAMINATION PAD/TIRE WASH AND STABILIZED CONSTRUCTION ENTRANCE.3. INSTALL GROUNDWATER BARRIER WALL.

4. TRANSPORT AND DISPOSE EXCESS SPOILS AND DEBRIS.

5. STABILIZE DISTURBED AREAS/RESTORE SITE.

6. FOLLOWING STABILIZATION OF ALL DISTURBED AREAS, ALL EROSION AND SEDIMENT CONTROL DEVICES SHALL BE REMOVED, AS APPROVED BY THE ENGINEER.

CITY OF PORTLAND EROSION AND SEDIMENT CONTROL NOTES:

1. APPROVAL OF THIS EROSION, SEDIMENT AND POLLUTION CONTROL PLAN (ESPCP) DOES NOT CONSTITUTE AN APPROVAL OF PERMANENT ROAD OR DRAINAGE DESIGN (E.G., SIZE AND LOCATION OF ROADS, PIPES, RESTRICTORS, CHANNELS, RETENTION FACILITIES, UTILITIES, ETC.).

2. THE IMPLEMENTATION OF THIS ESPCP AND THE CONSTRUCTION, MAINTENANCE, REPLACEMENT, AND UPGRADING OF THESE ESPCP FACILITIES IS THE RESPONSIBILITY OF THE CONTRACTOR UNTIL ALL CONSTRUCTION IS COMPLETED AND APPROVED AND VEGETATION/LANDSCAPING IS ESTABLISHED.

3. THE BOUNDARIES OF THE CLEARING LIMITS SHOWN ON THIS PLAN SHALL BE CLEARLY FLAGGED IN THE FIELD PRIOR TO CONSTRUCTION. DURING THE CONSTRUCTION PERIOD, NO DISTURBANCE BEYOND THE FLAGGED CLEARING LIMITS SHALL BE PERMITTED. THE FLAGGING SHALL BE MAINTAINED BY THE CONTRACTOR FOR THE DURATION OF CONSTRUCTION.

4. THE ESPCP FACILITIES SHOWN ON THIS PLAN MUST BE CONSTRUCTED IN CONJUNCTION WITH ALL CLEARING AND GRADING ACTIVITIES, AND IN SUCH A MANNER AS TO INSURE THAT SEDIMENT, SLURRY, AND SEDIMENT LADEN WATER DO NOT ENTER THE DRAINAGE SYSTEM, ROADWAYS, OR VIOLATE APPLICABLE WATER STANDARDS.

5. THE ESPCP FACILITIES SHOWN ON THIS PLAN ARE THE MINIMUM REQUIREMENTS FOR ANTICIPATED SITE CONDITIONS. DURING THE CONSTRUCTION PERIOD, THESE ESPCP FACILITIES SHALL BE UPGRADED AS NEEDED FOR UNEXPECTED STORM EVENTS AND TO ENSURE THAT SEDIMENT, SLURRY, AND SEDIMENT-LADEN WATER DO NOT LEAVE THE SITE.

6. THE ESPCP FACILITIES SHALL BE INSPECTED DAILY BY THE CONTRACTOR AND MAINTAINED AS NECESSARY TO ENSURE THEIR CONTINUED FUNCTIONING.

7. THE ESPCP FACILITIES ON INACTIVE SITES SHALL BE INSPECTED AND MAINTAINED A MINIMUM OF ONCE A MONTH OR WITHIN THE 24 HOURS FOLLOWING A STORM EVENT.

8. THE DECONTAMINATION PAD/TIRE WASH SHALL BE INSTALLED IN THE LOCATION DEPICTED HEREIN AT THE BEGINNING OF CONSTRUCTION AND MAINTAINED FOR THE DURATION OF THE PROJECT. ADDITIONAL MEASURES MAY BE REQUIRED TO ENSURE THAT ALL ADJACENT OFF SITE PAVED AREAS ARE KEPT CLEAN FOR THE DURATION OF THE PROJECT.

9. THE STABILIZED CONSTRUCTION ACCESS MAY BE RELOCATED AS APPROPRIATE. HOWEVER, ALL CONSTRUCTION VEHICLES MUST PASS THROUGH THE STABILIED CONSTRUCTION ACCESS PRIOR TO ENTERING ONTO A PAVED SURFACE FROM AN UNPAVED SURFACE.

10. ANY TREES THAT ARE NOT DESIGNATED FOR REMOVAL SHALL BE PROTECTED IN ACCORDANCE WITH CITY OF PORTLAND'S TREE PROTECTION REQUIREMENTS.

REV.	DATE	DESCRIPTION	BY	CHK
2	9/17/15	UPDATED STORM SEWER AND STAGING AREA PER DEQ/EPA COMMENTS	RMK	AK
1	7/22/15	ADDED TREED AREAS AND UPDATED NOTES	RMK	AK

DRAWN BY RMK | CADD Review FGB | CHECKED BY AK-ANN

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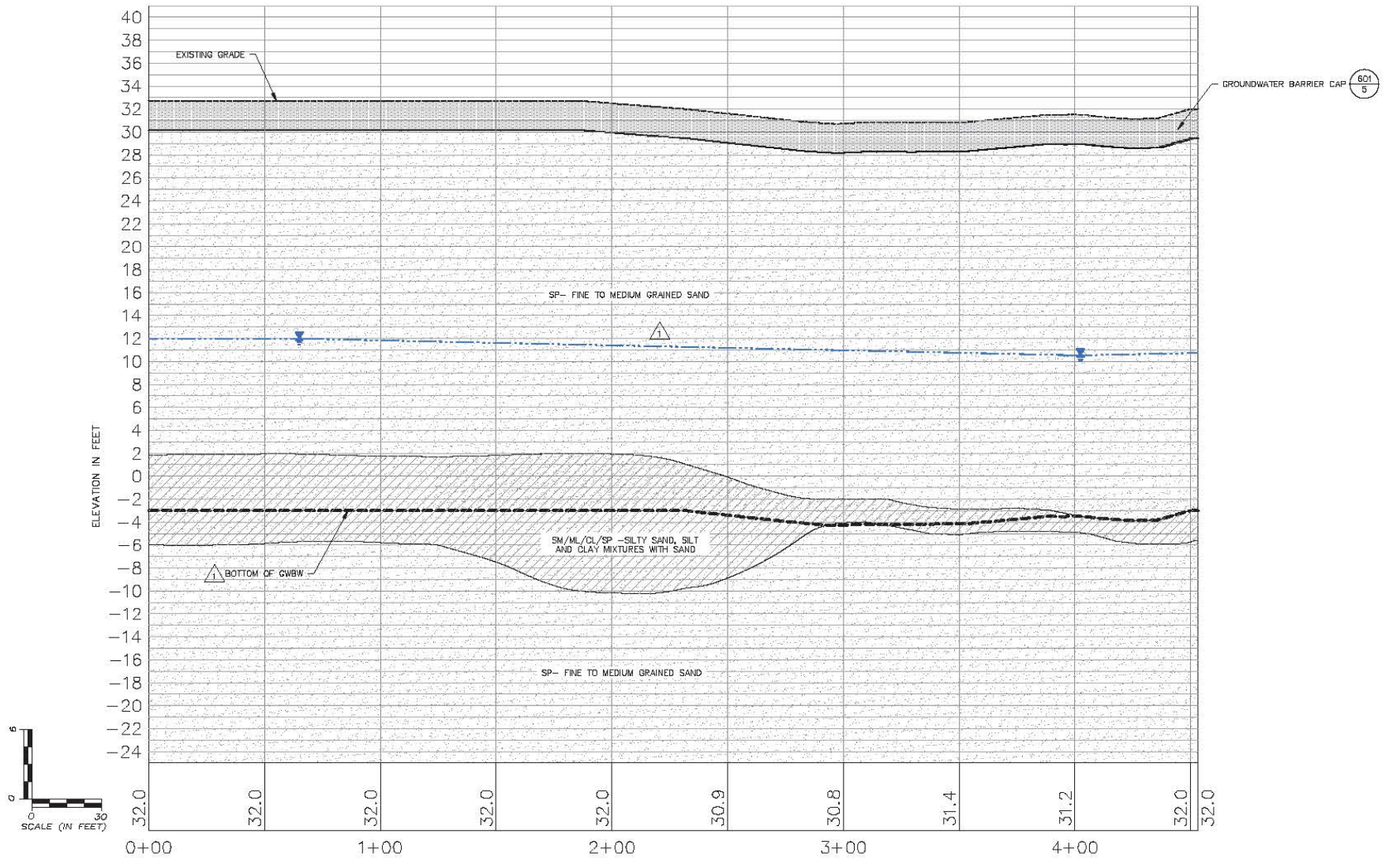
REGISTERED PROFESSIONAL ENGINEER 78496PE OREGON DECEMBER 31, 2016 DEEPAK ANDREW ROBINSON
EXP. 12/31/2016

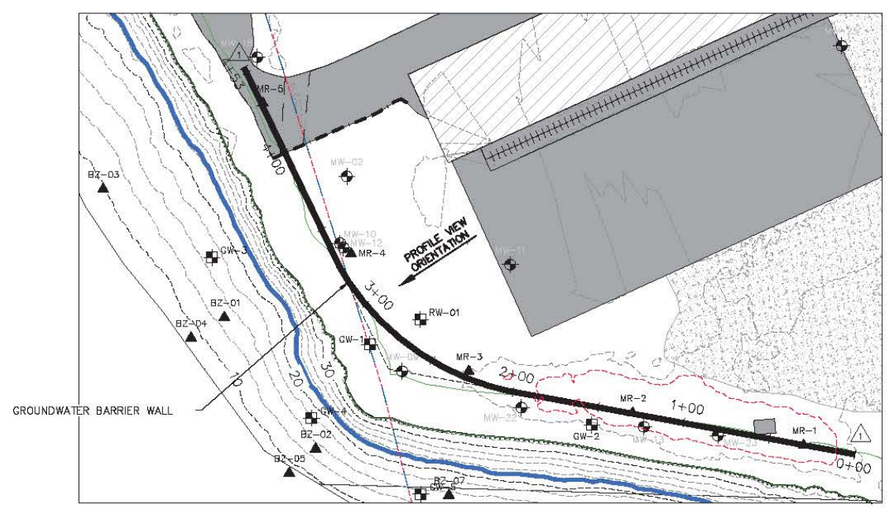
GROUNDWATER SOURCE CONTROL MEASURE
GROUNDWATER BARRIER WALL
SOUTHERN PREMIERE EDIBLE OILS SITE
PORTLAND, OREGON

EROSION AND SEDIMENT CONTROL PLAN

SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0283866	4	2
DATE 08/25/2015			



GROUNDWATER BARRIER WALL PROFILE



GROUNDWATER BARRIER WALL PLAN

0 40 80
SCALE (IN FEET)

LEGEND:

- EXISTING GRADE
- BOTTOM OF CAP
- EXISTING GROUNDWATER ELEVATION
- BOTTOM OF GROUNDWATER BARIER WALL
- BARRIER WALL CAP (2.5' THICK TYP.)
- SP- FINE TO MEDIUM GRAINED SAND
- SM/ML/CL -SILTY SAND, SILT AND CLAY MIXTURES WITH SAND

NOTES:

1. THE SUBSURFACE MATERIAL DESCRIPTION AND BOUNDARY/ZONES PRESENTED HEREIN ARE BASED ON INTERPRETATION OF BORINGS ADVANCED ALONG THE BARRIER WALL ALIGNMENT AND OTHER NEAR BY BORINGS AND WELLS, AND THUS MAY NOT BE EXACT AT THE ALIGNMENT. CONTRACTOR SHALL REVIEW THE BORING LOGS PROVIDED WITH THE TECHNICAL SPECIFICATIONS FOR SPECIFIC SUBSURFACE MATERIAL TYPES AT SPECIFIC LOCATION OF INTEREST.
2. EXCESS EXCAVATED MATERIAL NOT USED DURING PREPARATION OF THE BARRIER WALL MIX SHALL BE DISPOSED AT AN APPROVED OFF SITE FACILITY.

REV.	DATE	DESCRIPTION	BY	CHK
1	7/27/15	REVISED NOTES, REMOVED TURNING POINTS, UPDATED GW ELEVATION	RMK	AK

DRAWN BY RMK | CADD Review FGB | CHECKED BY SL-ANN

Environmental Resources Management

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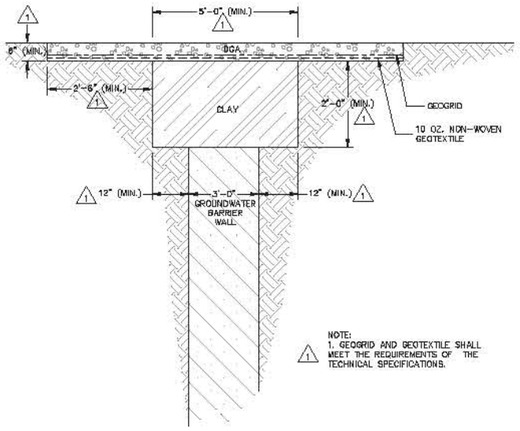
REGISTERED PROFESSIONAL ENGINEER 78496PE OREGON DECEMBER 31, 2007 BRENDAN ANDREW ROBINSON
EXP. 12/31/2016

GROUNDWATER SOURCE CONTROL MEASURE
GROUNDWATER BARRIER WALL
SOUTHERN PREMIERE EDIBLE OILS SITE
PORTLAND, OREGON

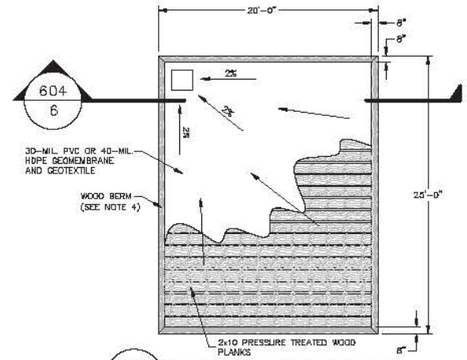
GROUNDWATER BARRIER WALL PROFILE

SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0283866	5	1
DATE 07/20/2010			

REVISIONS TO BE MADE ON THE CADD FILE ONLY



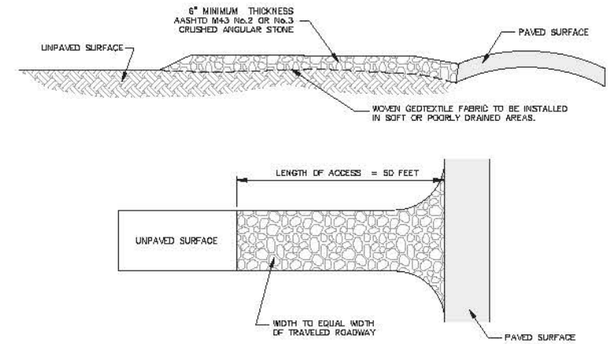
601 / 3,5 GROUNDWATER BARRIER WALL CAP DETAIL
SCALE: NONE



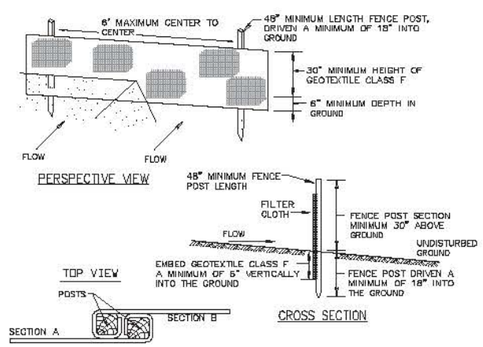
603 / 3,4 DECONTAMINATION PAD PLAN
SCALE: NONE

DECONTAMINATION PAD NOTES

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING THE DECONTAMINATION PAD THROUGHOUT THE DURATION OF THE PROJECT AND FOR DEMOLITION AND DISPOSAL OF THE DECONTAMINATION PAD AT THE CONCLUSION OF THE PROJECT.
2. A 18-INCH THICK LAYER OF POROUS, WASHED GRAVEL SHALL BE PLACED OVER THE 30-MIL PVC OR 40-MIL HDPE GEOMEMBRANE. A 10 oz. NONWOVEN GEOTEXTILE FABRIC SHALL BE INSTALLED BETWEEN THE GEOMEMBRANE AND GRAVEL LAYER. GEOMEMBRANE SHALL WRAP OVER THE WOODEN BERM AND BE ANCHORED A MINIMUM 8-INCHES BELOW THE GROUND SURFACE. THE GEOMEMBRANE SHALL BE PROPERLY SEAMED TO FORM A LEAK-PROOF LINER. THE MATERIALS AND INSTALLATION METHODS SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL.
3. SURFACE OF THE DECONTAMINATION PAD SHALL BE GRADED AT A MINIMUM 2 PERCENT SLOPE TOWARD THE SUMP.
4. THE SUMP SHALL BE OF SIMILAR MATERIAL AS THE GEOMEMBRANE AND SHALL BE WELDED TO THE GEOMEMBRANE. CONTRACTOR SHALL BE RESPONSIBLE FOR TESTING WELDED SEAMS FOR LEAKS. SUMP SHALL BE PROVIDED WITH A STRUCTURAL GRATE AT SURFACE.
5. STAKES SHALL BE USED TO SECURE THE WOODEN BERMS TO THE FOUNDATION SUBBASE. STAKES SHALL BE EMBEDDED A MINIMUM 8 INCHES BELOW THE GROUND SURFACE. BERMS SHALL CONSIST OF AN EARTHEN BERM AND 8"x8" WOODEN TIES PLACED AROUND THE PERIMETER OF THE PAD.
6. THE CONTRACTOR SHALL PROVIDE A SUMP PUMP IN THE SUMP TO COLLECT DECONTAMINATION WATER INTO AN ABOVE-GROUND STORAGE TANK, OR SIMILAR CONTAINMENT. THE CONTRACTOR SHALL ARRANGE FOR TESTING AND DISPOSAL. CONTRACTOR SHALL DISPOSE ALL WATER AT AN APPROVED OFF-SITE FACILITY.
7. TRAFFICABLE RAMPS SHALL BE CONSTRUCTED AT INGRESS AND EGRESS POINTS FOR THE PAD.
8. THE SUBGRADE SHALL BE SMOOTH WITHOUT STONES OR OTHER OBJECTS THAT COULD PUNCTURE THE GEOMEMBRANE. THE SUBGRADE SHALL BE PROOF-ROLLED WITH A LOADED TANDEM, AND ANY SOFT SPONGY OR PUMPING SOIL SHALL BE REMOVED, REPLACED AND RECOMPACTED.
9. CONTRACTOR SHALL MAINTAIN AND REPAIR THE DECONTAMINATION PAD, AS NECESSARY. TIRE RUTS SHALL BE REPAIRED AND AGGREGATE SHALL BE PERIODICALLY REMOVED AND REPLACED, OR CLEANED TO PROHIBIT CLOGGING AND ALLOW FOR THE INFILTRATION OF WATER. AGGREGATE THAT IS REMOVED SHALL BE DISPOSED IN A SIMILAR MANNER AS IMPACTED SOIL.
10. THE CONTRACTOR SHALL HAVE THE OPTION OF ADJUSTING THE SIZE OR DESIGN OF THE DECONTAMINATION PAD SHOWN AS NEEDED FOR SPECIFICALLY-PLANNED EQUIPMENT AND VEHICLES, AND FOR PIPING AND OTHER SALVAGE MATERIAL RECYCLING. ALL ADJUSTMENTS MUST BE SUBMITTED IN WRITING TO THE ENGINEER FOR APPROVAL 10 WORKING DAYS PRIOR TO DECONTAMINATION PAD CONSTRUCTION.
11. THE CONTRACTOR MAY PROPOSE AN ALTERNATIVE DECONTAMINATION PAD SUBJECT TO ENGINEER'S APPROVAL.



606 / 4 STABILIZED CONSTRUCTION ACCESS DETAIL
SCALE: NONE

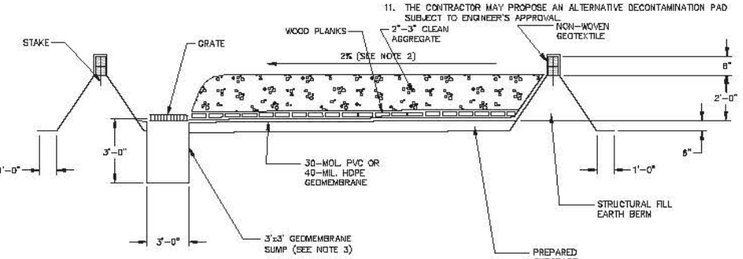


JOINING TWO ADJACENT SILT FENCE SECTIONS

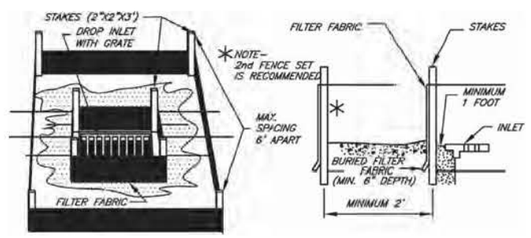
CONSTRUCTION SPECIFICATIONS

1. THE FILTER FABRIC SHALL BE PURCHASED IN A CONTINUOUS ROLL CUT TO THE LENGTH OF THE BARRIER TO AVOID USE OF JOINTS. WHEN JOINTS ARE NECESSARY, FILTER CLOTH SHALL BE SPLICED TOGETHER ONLY AT A SUPPORT POST, WITH A MINIMUM 6-INCH OVERLAP, AND BOTH ENDS SECURELY FASTENED TO THE POST, OR OVERLAP 2 INCH X 2 INCH POSTS AND ATTACH AS SHOWN ON DETAIL.
2. THE FILTER FABRIC FENCE SHALL BE INSTALLED TO FOLLOW THE CONTOURS WHERE FEASIBLE. THE FENCE POSTS SHALL BE SPACED A MAXIMUM OF 6 FEET APART AND DRIVEN SECURELY INTO THE GROUND A MINIMUM OF 16 INCHES.
3. THE FILTER FABRIC SHALL HAVE A MINIMUM VERTICAL BURIAL OF 6 INCHES. ALL EXCAVATED MATERIAL FROM FILTER FABRIC FENCE INSTALLATION, SHALL BE BACKFILLED AND COMPACTED, ALONG THE ENTIRE DISTURBED AREA.
4. STANDARD OR HEAVY DUTY FILTER FABRIC FENCE SHALL HAVE MANUFACTURED STITCHED LOOPS FOR 2 INCH X 2 INCH POST INSTALLATION. STITCHED LOOPS SHALL BE INSTALLED ON THE UP HILL SIDE OF THE SLOPED AREA.
5. FILTER FABRIC FENCES SHALL BE REMOVED WHEN THEY HAVE SERVED THEIR USEFUL PURPOSE, BUT NOT BEFORE THE UPSLOPE AREA HAS BEEN PERMANENTLY PROTECTED AND STABILIZED.
6. FILTER FABRIC FENCES SHALL BE INSPECTED BY CONTRACTOR IMMEDIATELY AFTER EACH RAINFALL AND AT LEAST DAILY DURING PROLONGED RAINFALL. ANY REQUIRED REPAIRS SHALL BE MADE IMMEDIATELY.

602 / 4 SILT FENCE DETAIL
SCALE: NONE



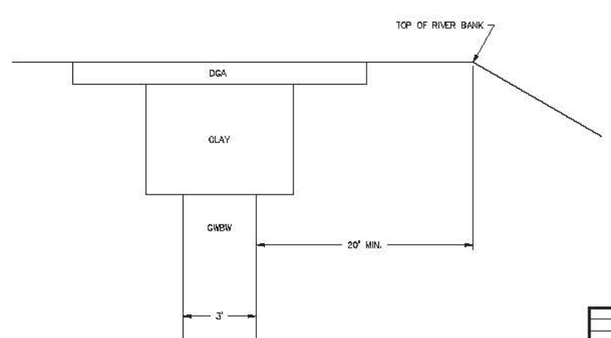
604 / 6 DECONTAMINATION PAD SECTION
SCALE: NONE



NOTES:
1. SECOND SET OF FENCE SHOWN ON THIS DETAIL IS NOT REQUIRED. PROTECTION BLOCKS, INLET PILLOWS, FIBER ROLLS OR WATTLES, OR SAND BAGS SHALL BE USED IN LIEU OF SILT FENCE AROUND THE INLETS THAT ARE IN PAVED AREAS.
2. AT NO TIME SHALL SEDIMENT BE ALLOWED TO ACCUMULATE TO MORE THAN ONE-THIRD THE HEIGHT OF A STORM DRAIN INLET PROTECTION BMP. SEDIMENT SHALL BE REMOVED AND INLET PROTECTION BMPS RESTORED AS NEEDED TO MAINTAIN THEIR SEDIMENT TRAPPING AND/OR FILTERING CAPABILITY.
3. CATCH BASINS SHALL BE CLEARED OF ANY SEDIMENT OR DEBRIS THAT BYPASSED THE BARRIER AND INSERT DURING SITE DEVELOPMENT.
4. INLET PROTECTION SHALL BE THE LAST BMP REMOVED FROM THE SITE AFTER CONSTRUCTION AND CLEANUP ARE COMPLETED AND ALL EROSION AND SEDIMENT CONTROL BMPS ARE REMOVED.

607 / 4 INLET PROTECTION DETAIL
SCALE: NONE

NOTES:
1. SEE DRAWING NO.1 FOR GENERAL NOTES AND LEGEND.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING THE DECONTAMINATION PAD THROUGHOUT THE DURATION OF THE PROJECT AND FOR DEMOLITION AND DISPOSAL OF THE DECONTAMINATION PAD AT THE CONCLUSION OF THE PROJECT.



605 / 3 GWBW OFFSET DETAIL
SCALE: NONE

REV.	DATE	DESCRIPTION	BY	CHK
2	9/17/15	ADDED INLET PROTECTION DETAIL PER DEQ/EPA COMMENT	RMK	AK
1	7/27/15	REVISED NOTES	RMK	AK

DRAWN BY RMK | CADD Review FGB | CHECKED BY AK-ANN

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REGISTERED PROFESSIONAL ENGINEER 78496PE OREGON DECEMBER 31, 2012 BRENDAN ANDREW WOMACK
EXP. 12/31/2016

GROUNDWATER SOURCE CONTROL MEASURE
GROUNDWATER BARRIER WALL
SOUTHERN PREMIERE EDIBLE OILS (PEO) SITE
PORTLAND, OREGON

DETAILS

SCALE	PROJECT NUMBER	SHEET	REV.
AS NOTED	0283866	6	2
DATE 06/25/2015			

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Groundwater Barrier Wall
Technical Specifications

Division 1 – General Requirements

DIVISION 1 – GENERAL REQUIREMENTS

01010
SUMMARY OF WORK

PART 1 - GENERAL

1.01 DEFINITIONS

A. Whenever the following terms are used in these Specifications, it is understood that they represent the following:

1. OWNER:
MMGL Corp. 818 Steward Street, Suite 700 Seattle, Washington 98101

2. ENGINEER:
ERM-West, Inc.
1001 SW 5th Avenue, Suite 1010
Portland, Oregon 97204
(503) 488-5282

3. CONTRACTOR:
The individual, firm, partnership, or corporation which is determined to be the successful Bidder.

During implementation of the project, the OWNER reserves the right to select a Representative to serve the role as ENGINEER, as referenced throughout these Technical Specifications. If the Representative is different than the ENGINEER listed above, the Representative would fulfill all requirements of the ENGINEER as noted in these Technical Specifications.

1.02 SITE CONDITIONS

A. General

There will be no payment for any extras as a consequence of the CONTRACTOR's misunderstanding the descriptions contained in the Contract, Specifications and Drawings. The CONTRACTOR shall inspect the Site and request answers to all questions that relate to the Work, its execution, and other details prior to submitting a Bid.

B. Site Access and Work Areas

Drawings, as referenced in these Specifications, depict the location of the Site and describe the types of access roads that lead to the Site. It is the CONTRACTOR's sole responsibility to use and maintain present access beyond the location depicted on the Drawings. Any access roadways, storage areas, Work areas or other areas that the CONTRACTOR must use are the CONTRACTOR's sole responsibility to keep passable at all times

at its cost. The CONTRACTOR shall understand that certain access roadways must be used by the OWNER to maintain access to Work areas; the CONTRACTOR shall cooperate with others in the establishment and maintenance of these common access roadways. Further, access to the Site by the CONTRACTOR through areas other than the dedicated points as indicated on the Drawings is prohibited, unless otherwise previously approved by the OWNER.

C. Site Conditions

The Site is an 18.5-acre industrial property located on the Portland Harbor waterfront along the Willamette River. The Southern PEO area is in the southwestern part of the Site, where historically aboveground tanks (ASTs) were used for storage of bulk oils. Suspected releases from the ASTs have impacted soil and groundwater. Previous investigations have detected light non-aqueous phase liquid (LNAPL), weathered and degraded dissolved diesel and gasoline, and associated constituents in groundwater beneath the ASTs.. Drawings, as referenced in these Specifications, depict the location of various Site features, including buildings, groundwater monitoring wells, electric utility substation, and other features that may affect the Work. It is the CONTRACTOR's sole responsibility to keep these areas protected and passable at all times at no additional cost to the OWNER.

D. Security

The CONTRACTOR shall comply with all site security measures and procedures during work. The CONTRACTOR is solely responsible for the security of their equipment, materials, and progress of the project.

E. Night and Sunday Work

Unless otherwise specifically authorized by ENGINEER or OWNER, no Work shall be done between the hours of 6:00 p.m. and 7:00 a.m. or on Sunday, except as necessary for the proper care of and protection of Work already performed. If it shall become necessary to perform Work at night or on Sunday, the OWNER and ENGINEER shall be informed at least forty-eight (48) hours in advance of the beginning of performance of such Work; the OWNER shall approve these extended work periods prior to commencing work during these time periods.. Only such Work shall be done at night as can be done satisfactorily and in a safe first-class manner. Good lighting and all other necessary facilities for carrying out and inspecting the Work shall be provided and maintained by the CONTRACTOR at all points where such Work is being done. Amount of lighting required shall be approved by the ENGINEER.

F. Work in Bad Weather

During freezing, stormy or inclement weather, no Work shall be done except such as can be done satisfactorily and in a manner to secure safe first-class construction throughout. Material backfill and compaction shall not be undertaken during freezing, heavy precipitation, or otherwise inclement weather, as determined by the ENGINEER .

1.03 CODES AND STANDARDS

The Work shall conform to all local, state and federal codes, comply with standards referenced in these Specifications, and adhere to regulatory requirements presented in Section 01060-REGULATORY REQUIREMENTS AND RESPONSIBILITY TO THE PUBLIC, which are described elsewhere in these Specifications. The latest issue shall be used unless specifically noted otherwise.

1.04 SCOPE OF WORK

A. The Scope-of-Work shall include, but not be limited to, furnishing all labor, materials, methods, services, tools, machinery and equipment necessary for the construction of the Work as specified in these Specifications and the following Drawings:

Drawing No.	Drawing
-	Cover Sheet
1	Location Maps, General Notes, List of Drawings, Abbreviations, and Legend
2	Existing Site Plan
3	Site Layout Plan
4	Erosion and Sediment Control Plan
5	Vertical Barrier Wall Profile
6	Details

B. The CONTRACTOR shall supply all necessary materials except those specifically designated as furnished by the OWNER, the ENGINEER , or furnished by others.

C. The Work covered under this Contract shall include, but is not limited to, the following items:

1. Mobilization/demobilization.
2. Furnishing temporary field offices, along with temporary electrical power, telephone communications, separate men and women sanitary facilities, and potable water, as needed.
3. Preparing the Site for Work, including but not limited to, staging and stockpile area, health and safety provisions, installation of erosion and sediment controls, utility location verification, coordination with utility authorities for disconnection and/or temporary rerouting of utilities if required, , and other preparatory work.
4. Survey and layout of the groundwater barrier wall alignment.
.
5. Preparation of the working surface along the groundwater barrier wall alignment and installation of the groundwater barrier wall.
6. Management, sampling, testing, transportation, and off-site disposal of excess spoils from groundwater barrier wall installation.
7. Installing a clay cap on top of the groundwater barrier wall.
8. Health and safety activities and nuisance (i.e. dust and odor) control, including air monitoring and suppression.
12. Site restoration, including grading, placement of crushed stone and seeding.
13. Protection of the Willamette River, existing groundwater monitoring wells, and other structures and Site features.
14. Miscellaneous sitework, including site cleanup, site restoration, and permanent stabilization of all areas disturbed during construction.
15. Other Work indicated within these Contract Documents, or as otherwise required for complete and proper groundwater barrier wall installation.

1.05 QUALITY ASSURANCE:

A. All work shall be in accordance with Section 01400 – QUALITY CONTROL and the Construction Quality Assurance/Quality Control (CQA/QC) Plan.

B. The CONTRACTOR warrants in presenting a Bid that all Work will be performed to the highest standards. The CONTRACTOR further warrants that defects that are the result of the CONTRACTOR's methods, workmanship, or protection of Work will be corrected, removed, and/or replaced at the CONTRACTOR's expense immediately. Further, the

CONTRACTOR shall warrant all Work and repairs for one year after the completion and acceptance of the Work or repairs.

1.06 COOPERATION

A. There may be other Engineers and/or Contractors, OWNER personnel and/or Regulators present at the Site. The CONTRACTOR shall make every effort reasonably possible to cooperate with all authorized outside personnel. Any disputes shall be settled by and at the sole discretion of the OWNER.

B. All construction activities shall be carried out in such a manner that there shall be absolutely no possibility of interruption of any operations occurring in the remaining portions of the facility.

C. The ENGINEER may conduct intermittent quality control air and odor monitoring during work. The CONTRACTOR shall be responsible for conducting any required actions based upon the results of either the CONTRACTOR or the ENGINEER sampling and monitoring activities.

1.07 CARE AND STORAGE OF MATERIALS

A. The CONTRACTOR shall unload, inspect, and store all equipment and material items delivered, to the project site for its Work, including items supplied by the OWNER, the ENGINEER or furnished by others. Materials shall be stored on-site only in areas designated by the ENGINEER for that purpose.

B. The CONTRACTOR shall replace, at its sole expense, all OWNER, ENGINEER, or furnished by others, and/or CONTRACTOR-furnished materials damaged by the CONTRACTOR or the CONTRACTOR's Subcontractors during unloading and storage, damaged by weather, or other related causes.

C. Special attention shall be paid to instructions issued by the manufacturer for handling and storage of materials and/or equipment. These instructions shall be followed in every respect.

D. The CONTRACTOR shall be solely responsible for all security of equipment and material items delivered to the Site for its Work, including items supplied by the OWNER, the ENGINEER, or furnished by others. Replacement of any equipment or material shall be at the sole expense of the CONTRACTOR.

E. The CONTRACTOR shall exercise care in the handling, moving, storing, and transporting of the equipment. The integrity of the equipment shall not be compromised at any time. The CONTRACTOR shall be responsible for any damage to the equipment and shall repair or replace, at the OWNER's discretion, the damaged equipment at no additional cost to the OWNER or ENGINEER.

1.08 CONTRACTOR'S RESPONSIBILITIES AND WORK

A. The CONTRACTOR shall furnish all construction equipment, machines, tools, materials, field sanitary facilities, security, protection of Work, other services, supplies, labor, and supervision that are necessary to complete the Work and requirements as described or implied in these Specifications and Drawings.

B. The CONTRACTOR shall provide all transportation for the items included in Part 1.08A of this Section from its headquarters or other locations to and from the Site.

C. The CONTRACTOR shall furnish all housing, travel, required training, personal safety equipment, and related allowances required by its employees to meet the minimum standards of the OWNER and the Site Health and Safety Plan. No housing facilities shall be permitted on the Site.

D. Neither the CONTRACTOR nor any of its employees shall drive or park any vehicle anywhere on the Site, except at such locations as shown or as specifically approved by the OWNER.

E. The CONTRACTOR shall comply with all site security measures and procedures for the duration of work activities.

F. The CONTRACTOR shall provide sufficient workers and supervisory personnel to maintain Work progress so that the various areas of Work will be completed in accordance with the schedule or sequence defined elsewhere in these Specifications. If, in the opinion of the OWNER, the Work is behind schedule or is improperly staffed, the OWNER will direct the CONTRACTOR to increase its complement of supervisors, workmen, or equipment so as to comply with the schedule. The CONTRACTOR shall discharge any such directives promptly and without expectation of additional compensation. If the CONTRACTOR fails to discharge any of these directives, the ENGINEER may arrange for such directives to be discharged at the sole cost of the CONTRACTOR.

G. The CONTRACTOR shall make all overtime, premium, and incentive payments to the CONTRACTOR's employees that may be required to complete the Work in accordance with the schedule. No exceptions shall be allowed for lack of performance, late material deliveries, or interference with other contractors possibly employed at the Site or with the OWNER's authorized personnel.

H. There is no applicable sales tax in the state of Oregon; therefore the CONTRACTOR should not include sales tax in its Bid.

I. The CONTRACTOR shall obtain any state, county, or local building permits required in the performance of its Work, except as provided by the ENGINEER.

J. Prior to a Contract award any questions or assistance the CONTRACTOR may request shall be directed to the ENGINEER.

K. By submitting a Bid for the Work, the CONTRACTOR acknowledges to be entirely familiar with the requirements prescribed by the State of Oregon that relate to the Work, with regulations prescribed by the United States Environmental Protection Agency (USEPA), with the rules and regulations of OSHA, and with local conditions, including weather, availability of supplies, and logistics. The CONTRACTOR further acknowledges itself to be entirely qualified to perform the Work described by these Specifications and the Drawings.

L. The CONTRACTOR shall maintain the site of its activities free of refuse and debris at all times at their expense. The CONTRACTOR shall, promptly comply with any directives from the OWNER, or it's Representative regarding housekeeping. The CONTRACTOR shall provide the appropriate containers at convenient locations for the disposal of disposable personnel protection equipment and other items of trash. Upon completion of the Work and before final payment, the CONTRACTOR shall completely remove all tools, equipment, supplies, materials, structures, and debris from the Site and leave the premises clean. Debris shall be removed to the designated on-site disposal location, as approved by the ENGINEER. Refuse shall be accumulated for a minimum of weekly disposal.

M. The CONTRACTOR shall be responsible for all engineering and corresponding support required to perform the scope of work established in the Contract Documents, including but not limited to design and/or verification of shoring, bracing, demonstration of equivalent materials, or other such matters that require engineering expertise.

N. Safety

1. It is the CONTRACTOR's responsibility to perform all Work in a safe manner, and meet all applicable federal, state and local laws and those requirements imposed by the OWNER. The CONTRACTOR shall submit a Site Health and Safety Plan (HASP) to the ENGINEER for review. The plan shall meet, or exceed, all requirements specified in the Contract Documents and federal, state, and local regulations.

2. All employees and subcontractors working on-site with intrusive activities, who may be exposed to hazardous substances, health hazards, or safety hazards and their supervisors and management responsible for the Site will receive training meeting the requirements of 29 CFR 1910.120.

O. Environmental Protection

All Work to be performed by the CONTRACTOR as a part of this project is regulated by the Oregon Department of Environmental Quality (ODEQ). By acceptance of the terms of the Contract, the CONTRACTOR acknowledges that it is familiar with the rules and regulations of the ODEQ. The CONTRACTOR further acknowledges familiarity with, and accepts as a condition of this Contract, all of the terms, stipulations, and commitments pertaining to the Work. Questions concerning the permits or regulations shall be referred to the ENGINEER; the ENGINEER'S decision in all cases shall be final.

P. Project Offices

The CONTRACTOR shall provide an office trailer for its own personnel if office space is deemed necessary. The OWNER will not provide, or make available, any office space or utilities. Provisions for electric, water, air conditioning, heat, sanitary facilities, and telephone are the sole responsibility of the CONTRACTOR. Any office space provided by the CONTRACTOR shall be made available to, and shared with the ENGINEER and OWNER throughout the duration of the project, as necessary.

Q. Utilities

1. Electrical Power

Electrical power is available on site; however, the CONTRACTOR is responsible for all coordination with the OWNER and power company, as well as establishing all connections to the source.

The cost for both establishing service and usage shall be the responsibility of the CONTRACTOR.

2. Water Supply

Water service is available on site; however, the CONTRACTOR is responsible for all coordination with the OWNER and water company, as well as establishing all connections to the source. The cost for both establishing water service and usage shall be the responsibility of the CONTRACTOR. The CONTRACTOR shall be responsible for determining if the available water service is sufficient for the work activities, including groundwater barrier wall construction and dust control.

4. Sanitary Facilities

A sufficient number of chemical-type sanitary structures shall be provided for CONTRACTOR personnel on the project. Separate sanitary facilities are required for men and women located near points of Work, and shall be cleaned daily and adequately serviced.

1.09 TERMS AND CONDITIONS

If the Technical Specifications conflict with the OWNER'S Terms and Conditions, the Terms and Conditions shall supersede the Technical Specifications.

1.10 CLEAN FUELS AND EQUIPMENT TECHNOLOGIES

A. CONTRACTOR, including all Subcontractors, shall follow federal, state, and local equipment and vehicle idling regulations and shall comply with a five (5) minute maximum idling time, whichever is more restrictive. Additionally, no unattended idling shall occur. Exceptions to these requirements shall be allowed for weather, safety concerns, and where implementation may actually slow work and/or increase emissions.

B. The CONTRACTOR shall use clean technologies and/or fuels on all diesel equipment to the extent practicable and/or feasible. The preference is for clean diesel technologies, but alternate fuels, such as biodiesel or natural gas powered vehicles, can also be considered. These alternate fuels shall be used where they are available and within a reasonable distance to the Site. For equipment retrofits, the CONTRACTOR shall employ the Best Available Control Technology (BACT) on off-road and on-road diesel powered equipment used at the Site. Examples of clean diesel technologies include diesel particulate filters and diesel oxidation

catalysis. For alternative fuel usage, the CONTRACTOR shall use at least a B20 blend (i.e., 20 percent biodiesel and 80 percent petrodiesel) or higher in the equipment engines used at the Site.

C. The CONTRACTOR shall provide a discussion of the proposed clean fuel and equipment technologies in their bid.

PART 2 - PRODUCTS

2.01 REGISTERED TRADE NAMES

A. Products are referenced and specified throughout these Specifications by registered trade names. This does not constitute a recommendation of these products to the exclusion of other products. Equivalent products may be used upon receiving approval of the ENGINEER.

B. The reference to registered trade names establishes a standard of required function, dimension, appearance and quality of the required equipment, materials or products.

PART 3 - EXECUTION

(not used)

END OF SECTION

PART 1 - GENERAL

1.01 CONSTRUCTION SCHEDULE

A. A Construction Schedule shall be submitted with the Bid for approval. The schedule shall include sequence and dates of construction operations for all major stages of Work, order and delivery of materials and equipment, and estimated milestones for substantial and final completion. The Construction Schedule shall be subject to review and acceptance by the ENGINEER . The Construction Schedule shall incorporate and meet, at a minimum, Project Milestones as identified in these Specifications and Drawings. The CONTRACTOR can provide alternates to the Construction Schedule in order to expedite the overall project schedule. Any alternates must be approved in writing by the ENGINEER prior to formal acceptance as part of the Construction Schedule. Revisions to the Construction Sequence by the CONTRACTOR shall not be made until approved by the ENGINEER. Changes in the approved schedule shall not be allowed without written approval. If the construction progress does not adhere to the schedule as approved or revised, measures shall be taken by CONTRACTOR to make up for the lost time to assure completion of the Work in accordance with the schedule. The schedule shall be created using Microsoft Project or Primavera, and shall include all appropriate task designations (Predecessor, Successor, Lag, Lead, Slack, Resources, etc.).

B. Certain aspects of the construction are weather dependent. The ENGINEER may, therefore, suspend operations at any time, when in its sole judgment, the conditions are unsuitable for the proper performance of the Work. No measures, aside from those provided elsewhere in the Construction Documents, shall be provided for such suspension of Work or costs associated with them. The CONTRACTOR shall account for typical delays in the schedule associated with normal levels of inclement weather as determined by the average monthly precipitation and temperatures for the period of times specified in the proffered construction schedule.

C. The Contractor shall be responsible for meeting the schedule established for equipment delivery. If, at anytime during implementation of the Work, the OWNER, ENGINEER or CONTRACTOR determines that the Work is behind schedule, the CONTRACTOR shall make every reasonable effort; i.e., additional manpower, equipment, or work hours, to make-up the lost time.

1.02 WEATHER

A. The CONTRACTOR shall take all necessary precautions to prepare for adverse weather so that the Work may be properly performed and be satisfactory in all respects. When required, protection shall be provided by use of tarpaulins, shelters, silt fencing, straw bales, or other approved means. During cold weather, materials shall be preheated, if required, and the materials and structure into which they are to be incorporated shall be kept sufficiently warm so that a proper bond shall take place and a proper curing, aging, or drying shall result. Heating shall be by a method approved by the ENGINEER and shall result in a moist or a dry atmosphere according to the particular requirements of the Work being protected. Ingredients for concrete and mortar shall be sufficiently heated so that the mixture shall be warm throughout when used. The ENGINEER may suspend operations at any time when, in its sole judgment, the conditions are unsuitable or the proper precautions are not being taken.

B. Delays to the schedule caused by adverse weather conditions shall be identified as a request for schedule extension submitted by the CONTRACTOR to the ENGINEER within one (1) day of the termination of the event. Adverse weather for which no extension of time is required shall not necessitate such a request and shall be deemed the responsibility of the CONTRACTOR to make-up the scheduled time to compensate for any lost time. No time extensions will be awarded without proper and timely notification to the ENGINEER. Time extensions will be awarded by OWNER at its sole discretion based on a comparison with the prior average conditions in the vicinity of the site as defined in Part 1.01 of this Section; the CONTRACTOR shall anticipate and initially factor into its schedule normally-occurring weather conditions, for which no time extensions shall be awarded. The methodology for determination of variations from the average shall be determined by the OWNER and ENGINEER. Weather delays may be made up through extended Work times with the approval of the OWNER. The CONTRACTOR shall receive no additional financial compensation as a result of adverse weather conditions.

1.03 PROGRESS REPORTS

A. The CONTRACTOR shall submit to the ENGINEER every two (2) weeks following written issuance of a Notice to Proceed, or more frequently if requested by the OWNER or ENGINEER, a report, in form and substance satisfactory to the OWNER, or its AGENT, stating the progress being made in fulfillment of this Contract, and indicating the progress to date with respect to the Construction Schedule. Included with the report shall be an updated schedule indicating scheduled durations, scheduled start

dates, scheduled completion dates, actual durations, actual start dates and actual completion dates of construction activities identified in the initial approved Construction Schedule. If the Schedule indicates that the CONTRACTOR is behind schedule, a written plan indicating the corrective measures to be implemented to make up lost time shall be submitted with the updated Schedule.

PART 2 - PRODUCTS

(not used)

PART 3 - EXECUTION

(not used)

END OF SECTION

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PART 1 - GENERAL

1.01 ENGINEER'S AUTHORITY

A. The OWNER may appoint a Representative during the life of the Contract as specified in Section 01010 – SUMMARY OF WORK, who will observe the Work in progress on behalf of the OWNER . The Representative shall have authority to: (1) act on behalf of the OWNER'S AGENT to the extent expressly provided in the Contract or otherwise in writing; (2) stop the Work whenever such stoppage may be necessary, in its sole discretion, to prevent improper execution of the Work, or otherwise to protect the interests of the OWNER; (3) determine the amount, quality, acceptability and fitness of all Work, materials and equipment required by the Contract; and, (4) decide all questions which arise in relation to the Work, the execution thereof, and the fulfillment of the Contract Documents.

B. The ENGINEER shall be the sole judge of the intent and meaning of the Contract, Specifications and Drawings, and its decisions thereon, and its interpretation thereof shall be final, conclusive and binding on all parties.

C. The CONTRACTOR shall proceed without delay to perform the Work as directed, instructed, determined or decided by the ENGINEER and shall comply with such directions, instructions, determinations or decisions.

D. Any doubts to the meaning of, or any obscurity as to the working of the Contract, Specifications, and Drawings shall be explained, and all directions and explanations requisite or necessary to complete, explain, or make definite any of the provisions of the Contract, Specifications or Drawings and to give them due effect shall be given by the ENGINEER.

1.02 INSPECTORS

A. Inspectors employed by the ENGINEER shall be authorized to inspect all Work performed and all materials and/or equipment furnished. Such inspection may extend to all or any part of the Work and to the preparation or manufacture of the materials to be used. In case of a dispute arising between the CONTRACTOR and the Inspector as to materials furnished or the manner of performing the Work, the Inspector shall have the authority to reject materials or suspend the Work until the question at issue can be referred to and decided by the ENGINEER. The Inspector shall not be authorized to revoke, alter, enlarge, relax, or release any requirements of the Contract, Specifications or Drawings, nor to approve or accept any portion of the Work, nor to issue instructions contrary to the Contract, Specifications, and Drawings. The Inspector shall in no case act as

foreman or perform other duties for the CONTRACTOR, or interfere with the management of the Work by the CONTRACTOR. Any advice which the Inspector gives the CONTRACTOR shall in no way be construed as binding on the ENGINEER or the OWNER in any way or releasing the CONTRACTOR from the fulfillment of the terms of the Contract.

1.03 INSPECTION

A. The CONTRACTOR shall, at the CONTRACTOR's expense when requested, provide the ENGINEER with ladders, lights, tools, labor, samples and other facilities as may be necessary for inspecting material and Work.

B. Imperfect materials or Work which may be detected, shall be replaced or corrected immediately on the requirement of the ENGINEER not withstanding that it may have been previously overlooked and included in a partial payment. Materials condemned or rejected by the ENGINEER shall be marked and shall, on its demand, be removed at once to a satisfactory distance from the Work. If not removed within twenty-four (24) hours after receipt of written notice from the ENGINEER, it may be removed by the ENGINEER and the cost of removal shall be charged to the CONTRACTOR and deducted from any payment due or which may become due to it.

C. If Work to be done away from the construction site is to be inspected on behalf of the ENGINEER during its fabrication, manufacture, excavation, processing, or testing, or before shipment, the CONTRACTOR shall give notice to the ENGINEER of the place and time where such fabrication, manufacture, excavation, processing, testing, or shipping is to be done. Such notices shall be in writing and delivered to the ENGINEER ten (10) days prior to initiation of such activity so that the necessary arrangements for the inspection can be made.

1.04 CONTRACTOR'S EQUIPMENT AND WORK FORCE

A. All machinery and equipment to be used shall be of sufficient size and in proper operating condition to accomplish the Work as described herein and shall be such as to produce a satisfactory quality of Work. A competent foreman or Superintendent shall be present at all times during the progress of the Work with authority to act for the CONTRACTOR and coordinate with the ENGINEER. A workforce of sufficient size with the required experience and ability shall be employed at all times to assure that the Work is executed in a satisfactory and workmanlike manner.

B. Unless otherwise expressly provided, the means and the methods of construction are at the option of the CONTRACTOR. Only adequate and safe procedures, methods, structures and equipment shall be used. The ENGINEER approval, or failure to exercise its right thereon, shall not relieve the CONTRACTOR of obligations to accomplish the result intended by the Contract, nor shall such create a cause of action for damages or extras.

C. If the ENGINEER at any time gives notice, in writing, to the CONTRACTOR that an employee is, in its opinion, incompetent, unfaithful, disorderly, discourteous, careless, unobservant of instructions, or in any way a detriment to the satisfactory progress of the Work, such employee shall be immediately removed from and not again allowed upon the Site. Likewise, equipment and machinery deemed inadequate and unsatisfactory shall be removed from the Site when such written notice is received by the CONTRACTOR.

PART 2 - PRODUCTS

(not used)

PART 3 - EXECUTION

(not used)

END OF SECTION

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PART 1 - GENERAL

1.01 DESCRIPTION

Primary Line and Grade Measurements

A. Baselines and benchmarks have been established by the ENGINEER by means of suitable marks as provided on the Drawings. All points must be carefully preserved and, if destroyed by the CONTRACTOR, the cost of replacing the points will be charged against the CONTRACTOR.

B. The CONTRACTOR shall employ a competent surveyor registered in the State of Oregon and require said surveyor to establish all lines, elevations, reference marks, batterboards, etc. needed by the CONTRACTOR or ENGINEER during the progress of the Work, and from time to time to verify such marks by instrument or other appropriate means.

C. Surveyor shall provide survey control for each stage of construction, and provide survey "As-Built" documentation for various components of construction. The Surveyor shall furnish all labor, materials, tools, supervision, transportation, and equipment necessary to perform the project surveying Work as specified herein for the groundwater barrier wall and associated Work, as shown on the Drawings.

1.02 QUALIFICATIONS

A. The CONTRACTOR shall employ the services of a competent Surveyor registered in the State of Oregon acceptable to the OWNER, and ENGINEER.

B. The surveyor, in the opinion of the ENGINEER shall have a proven record of successful performance on projects of similar magnitude. Prior to acceptance by the OWNER and ENGINEER, the surveyor will be required to submit a Survey Plan describing qualifications of the survey crew chief, other key personnel, instrumentation to be used, accuracy and precision required, type of grid system to be used, and a description of the other survey points required to establish grades, layout, quantities, and required "As-Builts" and certifications. The Plan must also provide the Surveyor's commitment to meet the project schedule and provide the required "As-Built" documentation as expeditiously as possible, and in accordance with the requirements imposed by the project schedule.

1.03 SURVEY REQUIREMENTS

A. The Surveyor shall locate survey control points prior to starting site Work. The ENGINEER shall be promptly notified in writing of any discrepancies discovered before or during construction. The survey datums are to include NAVD88 and Oregon State Plane North (NAD 83).

B. The Surveyor shall maintain lines and levels, layout, and locate the Work utilizing recognized engineering survey practices. A complete and accurate log of control and survey Work must be maintained. The Surveyor shall establish, at a minimum, a 50-foot by 50-foot (ft) survey grid for construction and "As-Built" documentation. The spacing of the grid shall be reduced in areas of steep slopes, grade change, ditches, impoundments, and other structuring to assure adequate control and accurate "As-Builts". The plan grid shall be approved by the ENGINEER. The Surveyor shall provide, at a minimum, a detailed survey for the following components:

2. The bottom and top elevations and horizontal alignment of the groundwater barrier wall at a minimum of 25 foot intervals and at each bend. The top elevation of the groundwater barrier wall is similar to the bottom elevation of the clay cap.

3. All other items that the CONTRACTOR requires to complete the Work and establish quantities for payment.

4. The top of the clay layer and the final elevation of the DGA stone surface above the groundwater barrier wall.

5. All other reasonable items requested by the ENGINEER.

C. The detailed topographic survey shall extend to a minimum of 100 ft in all directions beyond the limits of disturbance.

D. All locations/stations should be surveyed to include both horizontal coordinates (accuracy 0.1 ft) and vertical elevation (accuracy 0.01 ft).

1.04 CONTRACTOR ENGINEERING REQUIREMENTS

The CONTRACTOR shall provide all necessary engineering, support and coordination necessary to perform the scope of work. These services include, but are not limited to, all work associated with obtaining all necessary permits (except 1200-C Erosion and Sediment and Control Permit which will be obtained by the

ENGINEER), preparing shop drawings and submittals, providing engineering and licensed certification (P.E. stamp) for alternate designs, performing quality control, conducting monitoring and maintenance activities, performing inspections, and any other required activities.

1.05 CONSTRUCTION TOLERANCES

A. Construction tolerances shall be as provided in the various Sections of these Specifications, and as given below.

B. All minimum thicknesses specified within these Contract Documents shall be met with no exception. The construction tolerances on final contours shall be within two tenths of one foot below to five tenths of one foot above (-0.2 to +0.5) the specified grades as they appear on the Drawings, or as otherwise approved by the ENGINEER. No additional payments for actual thicknesses of specified soil layers greater than that required will be approved.

C. No surveying will be allowed between one hour before sunset and one hour after sunrise, unless approved by the ENGINEER.

D. The ENGINEER shall be permitted at all times to check the lines, elevations, reference marks, batterboards, etc. set by the CONTRACTOR, who will correct any errors in lines, elevations, reference marks, batterboards, etc. disclosed by such check. Such a check will not be construed to be an approval of the CONTRACTOR's work and shall not relieve or diminish in any way the responsibility of the CONTRACTOR for the accurate and satisfactory construction and completion of the entire Work. In order to verify the construction, the ENGINEER shall be supplied with survey information at the time of surveying.

E. The CONTRACTOR shall be aware of the surveying activities and shall account for them in the construction schedule.

F. The groundwater barrier wall shall be constructed in the location depicted on the Drawings. The as-built horizontal alignment shall vary no more than five (5) feet in any direction from that depicted on the Drawings, unless otherwise approved by the ENGINEER as an alternative prior to commencement of the Work. Additionally, the groundwater barrier wall shall extend to the depths depicted on the Drawings. If applicable, the CONTRACTOR shall present modified alignments as alternatives with their bid.

1.06 RECORD DOCUMENTATION

At the completion of the Work the CONTRACTOR shall have its Surveyor prepare "As-Built" drawings showing the location of all Work installed, including that Work installed by the OWNER (if any) and submit the "As-Built" drawings to the ENGINEER for review. "As-Built" drawings shall also be provided to the ENGINEER in electronic format (AutoCAD). "As-Built" drawings shall include the various Work components discussed herein. Certification of the "As-Built" drawings by the registered Surveyor is required. Submittals of these "As-Built" drawings shall conform to requirements of Section 01300 – SUBMITTALS.

PART 2 - PRODUCTS

(not used)

PART 3 - EXECUTION

(not used)

END OF SECTION

01060
REGULATORY REQUIREMENTS
AND
RESPONSIBILITY TO THE PUBLIC

PART 1 - GENERAL

1.01 REGULATIONS

A. The Work shall be performed in accordance with all applicable federal, state, county, and municipal regulations.

B. The CONTRACTOR shall give all necessary notices, obtain all necessary permits (except 1200-C Erosion and Sediment and Control Permit which will be obtained by the ENGINEER) and pay all fees and other costs in connection with the Work, file all necessary plans, prepare all documents and obtain all necessary approvals of all governmental departments having jurisdiction, unless previously obtained by the ENGINEER. The CONTRACTOR shall obtain all required Certificates of Inspection and approval for the Work and deliver these documents to the ENGINEER, except as noted.

C. The CONTRACTOR shall include in the Work, without extra cost to the OWNER, labor, materials, services and drawings required to comply with all applicable laws, ordinances, rules and regulations, whether or not shown in the Contract, Specifications, or Drawings.

D. The CONTRACTOR shall become familiar with all federal, state, local and municipal laws, ordinances, rules and regulations which in any manner affect those engaged or employed in the Work, or the materials or equipment used in or upon the Work, or in any way affect the Work, and no pleas of misunderstanding will be considered on account of the ignorance thereof. If the CONTRACTOR discovers any provision in the Contract, Specifications, or Drawings which is contrary to, or inconsistent with, any such law, ordinance, rule or regulation, he shall forthwith report it to the ENGINEER in writing.

E. For the security and safety of persons in or adjacent to construction operations, OWNER's security and safety standards and the "Manual of Accident Prevention in Construction" of the National Safety Council shall be followed as applicable, specifically or with similarity of operation, or as in the opinion of the governing jurisdictions may be necessary for protection.

1.02 RESPONSIBILITY TO THE PUBLIC

A. Traffic

1. Construction operations shall be programmed and conducted to maintain adequate roadway and pedestrian traffic within and adjacent to the Site, including, but not limited to, the following for the Contract duration: flagmen and watchmen; furnishing, erecting and proper maintenance, removal and disposal of traffic controls.

2. Pedestrian access to abutting properties and vehicular access for ambulances, police and fire or other emergency equipment shall be maintained at all times. When vehicular access is temporarily curtailed, it shall be the CONTRACTOR'S responsibility to give adequate notice to affected parties including, but not limited to the police department having jurisdiction for the Site, fire department and emergency ambulance services prior to impairing access, and to provide means of temporary access when and if required.

3. When traffic is interrupted, every effort shall be exercised to restore normal traffic as soon as practicable.

4. Furnishing, erecting, proper maintenance, relocation, removal, replacement, and/or disposal of necessary signs, barricades, cones, warning lights, and other traffic controls shall be in accordance with local requirements and ordinances.

5. The CONTRACTOR shall conduct all operations in a manner which complies with all applicable laws and ordinances, and which will in no way discredit the OWNER at any time.

6 Construction operations shall be programmed and conducted not to impede the daily operations of the OWNER or OWNER'S AGENT.

B. Sanitary Provision

1. The CONTRACTOR shall provide adequate sanitary facilities, per local and federal regulations, for the use of those employed on the Work. Such facilities shall include, but not be limited to restrooms and washrooms. The CONTRACTOR shall provide segregated facilities for male employees, female employees, other site personnel, and visitors. Such facilities shall be made available

when the first employees arrive on site for the Work, shall be properly secluded from public observation, and shall be constructed and maintained during the progress of the Work in suitable numbers and at such points and in such manner as may be required or approved.

2. The CONTRACTOR shall maintain the facilities in a satisfactory and sanitary condition at all times and shall enforce their use. The CONTRACTOR shall rigorously prohibit the committing of nuisances on the site of the Work or on adjacent property.

C. Protection of Property

1. All property along the line of the Work, or which is in the vicinity of, or is in any way affected by the Work, shall be protected and preserved from damage by the CONTRACTOR. Trees, fences, water or gas pipes, sewers, drains, conduits, poles or wires for electrical purposes, or other structures shall not be involved without consent of the persons owning or controlling them, and in crossing or working near them, they shall be sustained securely in place and shall be so treated as to render their condition as efficient and permanent as before.

2. Property damaged shall be immediately repaired and restored at the expense of the CONTRACTOR, or if required, the CONTRACTOR shall make the necessary repairs. In case of failure on the part of the CONTRACTOR to restore such property as it deems necessary, the ENGINEER shall have repairs made and any cost thereof shall be deducted from payments due, or which may become due to the CONTRACTOR under this Contract.

a. Existing Underground Utilities

The CONTRACTOR shall be responsible for determining the exact location of each utility within any area of excavation. Additionally, in accordance with state regulations, “Oregon Utility Notification Center” (1-800-332-2344) shall be contacted three (3) working days prior to any excavation. The CONTRACTOR shall also arrange to have a private utility locator investigate the proposed excavation areas to identify potential utilities and other subsurface obstructions prior to any excavation. Care shall be exercised during such location work to avoid damaging

and/or disrupting the affected utility. The CONTRACTOR shall be responsible for repairing, at its expense, damage or damages to any utility caused by its work occurring during the period of construction or within the period covered by its guarantee bond, unless otherwise designated on the Drawings for removal or abandonment.

With the exception of the utilities identified for removal or relocation on the Drawings, all underground and overhead utilities in actual line and/or grade of a proposed structure or excavation, requiring adjustment to permit proper installations, shall be adjusted by others during the construction operation without charge to the CONTRACTOR. Alternatively, the CONTRACTOR may be directed to adjust such services as extra work, as provided for in the Contract.

When excavating in close proximity of a utility or structure, the ENGINEER, shall be notified thereof sufficiently in advance so that the OWNER may accomplish any special protective measure deemed necessary. Construction operations shall be so conducted as to facilitate access to utility structures by the ENGINEER or its agents.

PART 2 - PRODUCTS

(not used)

PART 3 - EXECUTION

(not used)

END OF SECTION

PART 1 - GENERAL

1.01 GENERAL

A. Payment for work performed under this Contract shall be made as set forth herein under the individual Bid Items contained within the Bid Form and in accordance with the Contract terms and conditions.

B. If a Contract is awarded on a combination of Items, other than the total, the work performed shall be complete and operable with each Item standing alone and in conformance with all provisions of the Contract Documents.

C. There shall be no work or cost added to an Item that has been included under any other Item. The cost for each Bid Item shall be all inclusive for that Item.

D. The Work included under each Item shall consist of providing and installing the materials and/or equipment, complete, as enumerated below. Payment for each Item will be made at the Lump Sum or Fixed Unit Price bid in accordance with the provisions of Sections 1.02 and 1.03 of this Section.

E. The CONTRACTOR shall include in the price bid for each applicable Bid Item listed in the schedule of prices the cost of coordination, labor, health and safety measures, including materials, tools and equipment, soil, material and equipment testing, repairs to the roads due to construction damage, dewatering, protection of adjacent work, maintenance of traffic, displacement, replacement and/or repair of damage to any existing utility and/or structure or adjacent structures by the CONTRACTOR's activity, record drawings, code inspections, quality assurance and quality control and all other costs incurred as necessary to provide, complete in place, all work required to complete each Item in the Bid Form and work described in the Contract Documents.

F. Work Items included with each schedule of prices are described in the following paragraphs.

1.02 BASE BID

A. Mobilization/Demobilization (Bid Item 1)

1. Mobilization shall consist of the furnishing of all work, materials and operations required for the assembling and setting up for the project, including, but not limited to, initial movement of personnel

to the project site; moving on and off site all construction equipment, hauling units, hoisting equipment, and tools required to complete the work; establishing field offices, water supply, and electrical, telephone, and other utilities, if necessary; furnishing of sanitary and other facilities required by the Specifications and state or local regulations; all other work and operations which must be performed prior to beginning work on compensable Items of Work at the project site; and the cost of required insurance and any other initial expenses required, including, but not limited to, submittal of all schedules, contractor health and safety plan, manufacturer's certifications and product literature, and material analysis. Implementing health and safety measures, including air monitoring for occupational health and safety and dust control shall be included within this bid item. Demobilization shall consist of, but not be limited to, removal of the furnishings of all work, material and equipment required for the project, including cleanup of the Work areas of the site to the conditions required by the Specifications and Drawings.

2. Price for this Item shall be included as a lump sum price in the Bid Form as Bid Item 1.

B. Surveying and Record Documents (Bid Item 2)

1. Work under this Item shall consist of, but not be limited to, employing an independent, third party licensed surveyor to establish vertical and horizontal control points, perform staking, surveying, and preparing and submitting final "As-Built" drawings; and, perform all surveys required by the Specifications and necessary to determine pay quantities.

2. Price for this Item shall be included as a lump sum price in the Bid Form as Bid Item 2.

C. Site Preparation (Bid Item 3A through 3C)

1. Work under this Item includes, but is not limited to, preparing the Site for the work; installing, maintaining and removing erosion and sediment controls such as silt fence, stabilized construction entrance and other necessary controls; protecting existing structures; establishing the staging, stockpiling and other management areas; installing, maintaining, and removing the decontamination pad, tire wash, slurry pond, field laboratory, support zone, and mixing area; removing and stockpiling asphalt or concrete pavement to facilitate performance of the Work;;

abandoning groundwater monitoring wells; removing trees and installing maintaining and removing tree protection measures: implementing security measures; site clearing; and, other preparation activities required to perform the Work specified in these Specifications and Drawings. Materials under this Item include, but are not limited to, silt fence, chain link fence, aggregate, , geotextile, geogrid, timber, and other tools and equipment.

2. Price for this Item shall be included as a lump sum price, as specified in the Bid Form, as Bid Items 3A through 3C.

3. No additional payment will be made for damage during construction, replacement of rejected materials, dewatering, freeze/thaw, repair due to desiccation, or conditioning of materials, including, but not limited to, the addition of moisture, removal of moisture, mixing of materials, removal of foreign or detrimental objects, maintenance of materials, or protection.

D. Groundwater Barrier Wall (Bid Item 4A through 4C)

1. Work under this Item includes, but is not limited to, furnishing of all labor, materials, tools, and equipment required for the construction of the Groundwater Barrier Wall, including pre-construction confirmation of mix performance;;; installing the Groundwater Barrier Wall, including furnishing reagent, excavating, mixing and placing slurry and soil-reagent backfill, and performing quality control testing; re-mixing failed areas; furnishing, placing, compacting, and grading the clay cap; and, furnishing and installing geotextile and geogrid. Materials under this Item include, but are not limited to, 30-mil PVC or 40-mil HDPE for temporary lining and cover of spoils, bentonite or other reagents, clay fill, non-woven geotextile, geogrid, conditioning reagent, and other tools and equipment.

2. Price for this Item shall be included as a lump sum or unit price, as specified in the Bid Form, as Bid Items 4A through 4C.

3. No additional payment will be made for replacement of failed or rejected section of Groundwater Barrier Wall, portions of installed Groundwater Barrier Wall which lie outside of the limits of work or are used to make tie-ins, overfilling, excess, losses, settlement, damage during construction, compaction, erosion, over-excavation, wastage, replacement of rejected materials, or dewatering, including, but not limited to the addition of moisture, removal of

moisture, mixing of materials, removal of foreign or detrimental objects, maintenance of materials, or protection.

E. Transportation and Disposal (Bid Item 5A through 5C)

1. Work under this Item includes, but is not limited to, furnishing of all labor, materials, tools, and equipment required for separating, staging, conditioning, and managing debris and excess or impacted soil/spoils; for the collection, hauling, sampling, testing, profiling, disposal and/or administration of excess or impacted soil/spoil materials, asphalt and other debris, decontamination liquids, dewatered liquids, and any remaining equipment or other materials to be managed, in accordance with these Contract Documents and all federal, state, and local requirements.

2. Price for this Item shall be included as a unit price in the Bid Form as Bid Items 5A through 5C.

3. No additional payment will be made for overfilling, excess, losses, settlement, damage during construction, compaction, erosion, over-excavation, wastage, replacement of rejected materials, or dewatering, including, but not limited to, the addition of moisture, removal of moisture, mixing of materials, removal of foreign or detrimental objects, maintenance of materials, or protection.

F. Site Restoration and Clean-up (Bid Item 6)

1. Work under this Item includes, but is not limited to, furnishing of all labor, materials, tools, and equipment necessary for restoring the site to acceptable conditions as determined by the ENGINEER, including surface stabilization with crushed stone and vegetative seeding and site clean-up. Materials may include crushed stone, seed, and mulch..

2. Price for this Item shall be included as a lump sum or unit price, as specified in the Bid Form, as Bid Items 6A through 6C.

3. No additional payment will be made for replacement of rejected materials, dewatering, freeze/thaw, repair due to dessication, or conditioning of materials, including, but not limited to the addition of moisture, removal of moisture, mixing of materials, removal of foreign or detrimental objects, maintenance of materials, or protection.

1.03 PAYMENT PROCEDURE

A. Breakdown of Lump Sum and Fixed Unit Price Items:

1. Within seven (7) days after the OWNER issues the Notice of Award, the CONTRACTOR shall submit to the OWNER, in a form approved by the ENGINEER, a complete, detailed breakdown of all lump sum and fixed unit price items awarded; i.e., a schedule of values. The detailed breakdown shall include quantities with all anticipated material and labor costs for individual Work Items required to complete the lump sum and fixed unit price Item. Quantities estimated by the ENGINEER, and presented on the Bid Form or the Drawing, are for the purpose of verifying and tracking the actual performance of the Work, and shall not be misconstrued as representing the required or specified quantities. The CONTRACTOR shall revise the project breakdown if the OWNER and/or ENGINEER so requests. Extra work will be paid in accordance with the Contract terms and conditions.

2. Payments shall be made in accordance with the Contract terms and conditions. The CONTRACTOR may request periodic payments on a monthly basis in the form of an Application for Payment (refer to General Conditions). However, all payment requests shall be made on the basis of the approved breakdown and accompanied by all supporting documentation required herein.

3. No payment shall be made for materials or equipment that are provided in a routine manner as Work progresses. Such items include, but are not limited to, equipment, fuel, tools, dust preventive materials, protective devices such as personnel protective equipment (PPE), tarps, etc., CONTRACTOR's equipment rental, operating, or repair costs, lumber, stone, gravel, sand or any material that is consumed as Work progresses.

4. No payments will be made by the OWNER until the ENGINEER has reviewed and approved the Application for Payment submitted by the CONTRACTOR.

PART 2 - PRODUCTS

(not used)

PART3 - EXECUTION

(not used)

END OF SECTION

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Pre-Construction Conference

1. Before issuance of the Notice to Proceed, a Pre-Construction Conference will be held to discuss items of significance, including

   a. construction schedule;
   b. work sequence;
   c. responsible personnel;
   d. construction quality control;
   e. procedures for handling shop drawings, schedules, "as-built" drawings, and other submissions;
   f. processing Applications for Payment;
   g. procedures for field decisions and Site Work Order Requests;
   h. preparation of record documents;
   i. applicable safety, health, environmental, security, fire protection, and operating requirements of the facility;
   j. use of premises;
   k. office, work, and storage areas;
   l. equipment and product deliveries;
   m. housekeeping; and,
   n. working hours.

2. Among those present at the Pre-Construction Conference shall be the ENGINEER, the CONTRACTOR and CONTRACTOR's Superintendent and major Subcontractors. All CONTRACTOR's employees and subcontractor may attend, at the CONTRACTOR's discretion.

3. The ENGINEER will arrange for and organize the Pre-Construction Conference.

B. Progress Meetings

1. During the course of the Contract, progress meetings will be organized and conducted by the ENGINEER to discuss the progress of the Contract at a frequency of at least every two (2) weeks, or more frequently at the discretion of the ENGINEER. The CONTRACTOR, its Superintendent, dedicated Safety Officer, and the Construction Quality Control (CQC) Manager shall attend these meetings. The CONTRACTOR shall be fully responsible for any and all of the subcontractors and shall be responsible for

subcontractor attendance and/or input into the meetings. The ENGINEER will take the minutes of the progress meetings and a copy will be furnished to the CONTRACTOR and OWNER. These meetings may, at the ENGINEER'S discretion, be increased if progress is not satisfactory or if coordination problems should arise.

2. The construction schedule, as submitted under Section 01014 - WORK SEQUENCE, shall be updated for each progress meeting. The updated schedule shall be furnished to the ENGINEER listing all parts of Work and providing the planned start and completion date for each part of Work. The schedule completion date shall conform to the contract completion date.

3. A special meeting shall be held when and if a problem or deficiency is present or likely to occur. The attendees at this meeting shall be specific to the incident. The purpose of the meeting shall be to define and resolve the problem or Work deficiency.

C. Weekly Progress Schedule

The CONTRACTOR's Site Superintendent shall submit on a weekly basis to the ENGINEER a schedule of anticipated Work for the following week. This schedule shall be submitted by 12 p.m. (noon) on each Friday, and shall be updated as necessary if the CONTRACTOR's anticipated Work is altered.

D. Health and Safety Meetings

A safety tailgate meeting shall be held on a daily basis prior to commencement of work for that day. At the meeting, site controls and activities scheduled for the day shall be discussed.

PART 2 - PRODUCTS

(not used)

PART 3 - EXECUTION

(not used)

END OF SECTION

01300
SUBMITTALS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Materials, equipment, workmanship, design and arrangement of all Work performed under this Contract shall be subject to the approval of the ENGINEER.

B. Work Included:

1. Procedures for submittal to the ENGINEER, a List of Submittals, certificates and affidavits, samples for testing, material test results, Shop Drawings, operation and maintenance literature and other miscellaneous data for approval.

2. Procedures for turnover of the CONTRACTOR-prepared As-Built drawings and/or Record Documents.

C. The CONTRACTOR is required to review all submittals and certify the completeness, accuracy, and content prior to submitting to the ENGINEER.

PART 2 - PRODUCTS

2.01 LIST OF SUBMITTALS

A. Within ten (10) calendar days after the Contract is awarded, the CONTRACTOR shall furnish the ENGINEER with a List of Submittals.

B. The List of Submittals shall indicate all products which the CONTRACTOR believes will be incorporated in the Work. Omission from this list of any equipment, material, or product required by the Specifications shall not relieve the CONTRACTOR of the Contract requirements for providing the equipment, materials, or products and completing the associated Work as specified. Each such omission discovered by the ENGINEER shall be brought to the CONTRACTOR's attention for the purpose of revising the List of Submittals. The ENGINEER reserves the right to make any revisions to the List of Submittals after award of the Contract, as necessary.

C. For each entry of the List of Submittals, reference to the Specifications shall be made, along with an indication of the type of submittal(s) which the CONTRACTOR plans to make to the ENGINEER. More than one type of submittal may be required. The ENGINEER shall approve the types of submissions offered, or request additional or alternative submissions. Types of submissions are listed below:

1. Sample for testing, approval or filing.

2. Chain of Custody.

3. Sampling and analytical methods used.

4. Testing and sample analysis results.

5. Certificate(s) and Accompanying Affidavit.

6. Shop Drawing.

7. Miscellaneous Data.

D. For each item on the List of Submittals, the CONTRACTOR shall indicate the proposed source of supply or manufacturer for that entry.

E. The ENGINEER will review the CONTRACTOR's proposed source of supply or manufacturer for each entry and note any exceptions taken, and then return the List of Submittals to the CONTRACTOR within fourteen (14) calendar days.

F. The following conditions apply concerning exceptions:

1. No reference to a particular source of supply or manufacturer in the Contract Documents shall not relieve the CONTRACTOR of the obligation to fulfill, all requirements of the Specifications.

2. No exception to a particular manufacturer shall be construed by the CONTRACTOR as obligating the ENGINEER to approve a Shop Drawing for a product from that manufacturer.

3. Subsequent to rejection of a particular source of supply or manufacturer, the CONTRACTOR shall submit to the ENGINEER for approval a different source of supply or manufacturer for that product within seven (7) calendar days after notification of such rejection. The entire List of Submittals shall be resubmitted.

4. As an alternative to rejecting a particular source of supply for equipment, materials, or products, the ENGINEER reserves the option to alter the type of submittal required for that product.

2.02 SAMPLES

A. If the ENGINEER so requires, either prior to or after commencement of the Work, the CONTRACTOR shall submit samples of materials for such special tests, or for file purposes, as the ENGINEER deems necessary to demonstrate that they conform to the Specifications. Such samples shall be furnished, taken, stored, packed and shipped by the CONTRACTOR as directed.

B. All samples shall be packed so as to reach their destination in good condition, and shall be labeled to indicate the material represented, the name of the Work and location for which the material is intended, and the name of the CONTRACTOR submitting the sample. To ensure consideration of samples, the CONTRACTOR shall notify the ENGINEER by letter that the samples have been shipped and shall properly describe the same in the letter; the letter shall have a copy of the Chain of Custody attached. The Letter of Notification and Chain of Custody shall be enclosed with the samples.

C. The CONTRACTOR shall submit data and samples, or place its orders sufficiently early to permit consideration, inspection, testing, and approval before the materials and equipment are needed for incorporation into the Work. The consequences of CONTRACTOR failure to do so shall be the CONTRACTOR's sole responsibility.

D. In order to demonstrate the proficiency of workmen or to facilitate the choice among several textures, type finishes, surfaces, etc., the CONTRACTOR shall provide such samples of workmanship as may be required.

E. When required, the CONTRACTOR shall furnish to the ENGINEER sworn copies of manufacturer's shop or mill tests or reports from independent testing laboratories relative to the materials, equipment performance ratings, and concrete data.

F. The cost of samples, sample testing, and analysis associated with the approval of proposed materials and/or methods shall be borne in their

entirety by the CONTRACTOR.

2.03 CERTIFICATES, AFFIDAVITS, AND WARRANTIES

A. Where specified in the Specifications that a certificate, affidavit, or warranty be submitted to the ENGINEER for a particular material, product or product component, such submittals shall be made in accordance with the following:

1. Equipment, Materials, and Products: A Certificate of Compliance shall indicate that the equipment, material, product, or product component complies with the requirements of the Specifications, and it shall be accompanied by test results and/or other technical data substantiating such compliance. The certificate shall be supplied by the material supplier or product component manufacturer.

2. Installation: A Certificate of Compliance shall indicate that the equipment or system has been properly installed in compliance with manufacturer's instructions and is ready to be operated. The certificate shall be supplied by the equipment or system manufacturer or manufacturer's representative.

3. Equipment, materials, products and their installation shall be warranted in accordance with these Construction Documents. All warranties shall be submitted for review prior to delivery of the equipment, materials or products to the Site and must be acceptable to the OWNER. Limited warranties shall not be acceptable to the OWNER unless specifically agreed to by the OWNER in writing.

B. Each certificate shall include a signed sworn statement by an official of the company originating the certificate attesting to the truth and accuracy of all information contained in the certificate. If such attestation of truth and accuracy cannot be included in the certificate itself, it must be provided as an affidavit accompanying the certificate.

2.04 SHOP DRAWINGS

A. A copy of each Shop Drawing, certified correct for construction, shall be submitted for the review of the ENGINEER as soon as possible after approval of the List of Submittals and with due regard to the sequence in which such information will be required. This includes, but is not limited to, clay materials, mix reagents, slurry mix, silt fence material, topsoil, dense graded aggregate, soil materials, bentonite, details of any deviation which the CONTRACTOR proposes from the details as indicated on the

Drawings and Construction Sequence, and any details not specifically indicated on the Drawings. It is the CONTRACTOR's responsibility to provide finished Shop Drawings for approval, based on field measurements of actual conditions, indicating how he proposes to install the Work and the equipment, materials, and products being furnished under the Contract. Copies of project Drawings will not be accepted for submission as Shop Drawings.

B. Shop Drawings shall be submitted in proper sequence with due regard to the time required for the reviewing, approving and transmittal. Shop Drawings for a particular component shall be submitted complete at least 7 days prior to the anticipated date of furnishing or installations of the particular component.

C. The CONTRACTOR may submit manufacturer's literature as a substitute for, or supplement to, the Shop Drawings, provided the literature is explicit with regard to details of the items to be furnished Samples and/or visual representation of the material shall accompany product data whenever available. Drawings, specifications and manufacturers literature shall bear the name and address of the manufacturer or fabricator, and be clear, detailed, and complete. Catalog numbers of materials or equipment will not suffice.

D. Shop Drawing submissions shall be made to the ENGINEER by the CONTRACTOR only. Any data prepared by Subcontractors and Suppliers shall he submitted through the CONTRACTOR upon review by the CONTRACTOR.

E. All Shop Drawings covering related items, of equipment material, and products or integrated systems of equipment, material, and products shall be submitted at the same time so that their complete installation can be adequately reviewed. No partial submissions will be considered when it is necessary to meet the material delivery times required by the Contract, the ENGINEER may approve partial submissions when accompanied by sufficient data to allow the ENGINEER to determine the effect on the final design of other facilities being furnished under this Contract.

F. Shop Drawings shall be submitted to the ENGINEER which have been checked and stamped with the approval of the CONTRACTOR. The CONTRACTOR's stamp shall include, but not be limited to, the submittal date, contract number, project name, submittal number, corresponding specification and paragraph number and CONTRACTOR's company name, signature and a notation that the Shop Drawing had been reviewed by the CONTRACTOR and is in conformance with the referenced specification section. A copy of the Shop Drawings and data submitted by the CONTRACTOR for approval shall be returned by the ENGINEER to

the CONTRACTOR with comments such as, “No Exceptions Noted”, “Exceptions Noted”, or “Returned for Resubmission”. The CONTRACTOR shall correct the original drawings and data, if required, and resubmit the revised Shop Drawings and data. A copy of such revisions, reviewed by the ENGINEER and OWNER, shall be returned to the CONTRACTOR.

1. All Shop Drawings shall be numbered in chronological order utilizing 001, 002, etc. as the format.

2. All Shop Drawings, when practical, shall be limited in size to 22” x 34”, and have borderlines set back ½” on top, bottom, and right-hand side of the sheet. When the scale to which the drawings must be made for clarity, and the size of the equipment assembly of arrangement, make it impractical to prepare the drawings in 22” x 34” format, larger sheet sizes may be used.

3. The CONTRACTOR shall revise its original Shop Drawings to reflect any and all changes made to the equipment, materials, or products in the field during construction. When the equipment, materials or products have been finally accepted, the CONTRACTOR shall submit a copy of any Shop Drawing or data which have been so corrected. These copies shall be added by the ENGINEER to the bound sets or data submitted as specified below.

G. At the time of each submission, the CONTRACTOR shall, in writing, notify the ENGINEER of any deviation that the Shop Drawings have from the requirements of these Specifications. Failure to note deviations shall not excuse the CONTRACTOR from complying with the requirements of the Specifications.

H. No equipment, materials, or products for which Shop Drawings have been submitted for approval shall be delivered to the project site or incorporated into the Work until the CONTRACTOR has received copies of such reviewed drawings or until the ENGINEER or has authorized CONTRACTOR in writing to do so.

I. The review of the CONTRACTOR's submitted data by the ENGINEER is for general conformance only. Although the ENGINEER may review submitted data in detail, such review is an effort to discover errors and omissions in the CONTRACTOR's submissions and to assist the CONTRACTOR in coordinating and expediting its Work. It shall in no way relieve the CONTRACTOR of its obligation and responsibility to coordinate the Work or to relieve it of its responsibility in fulfilling the purpose and intent of the Contract.

J. Once submitted, all Shop Drawings become the property of the OWNER.

2.05 CONSTRUCTION "AS-BUILT" DRAWINGS

A. The CONTRACTOR shall maintain at the Site a complete set of project Drawings as issued with the Construction Documents. Project Drawings shall be updated by the CONTRACTOR to show any and all deviations made by it during construction. These drawings shall be labeled 'AS-BUILT" with 1/2" high block letters, and submitted to the ENGINEER at the completion of the project within seven (7) days after issuance of a Certificate of Substantial Completion by the ENGINEER. All such revisions shall be marked every week to keep the Drawings set current during the construction process and prior to any item becoming inaccessible for an "As-Built" drawing to be performed.

B. The CONTRACTOR's set of project Drawings showing changes made during construction shall be available to the ENGINEER throughout the construction period, and shall be delivered to the ENGINEER according to the requirements of Paragraph 2.05 A, above.

C. Electronic format drawings shall be in AutoCAD format.

2.06 MISCELLANEOUS DATA

Any other submittal required by these Specifications, but not directly addressed under this Section, shall be submitted in accordance with the requirements for Shop Drawings.

PART 3 - EXECUTION

3.01 GENERAL

During the Pre-Construction Conference, procedures for handling Shop Drawings and other submissions shall be established.

3.02 ALTERNATIVES TO SPECIFIED PRODUCTS

A. The Specifications may indicate the name of a manufacturer, a trade name, or a material to be used in the Contract. Reference made to a particular product of the manufacturer is made to identify a particular design, quality, construction arrangement, or style.

B. Where the CONTRACTOR proposes to use a substitute product for that specified, it shall submit to the ENGINEER, for approval, complete information on such substitute product including all necessary redesign of the structure, equipment, or any other part of these Specifications requiring modification as a result of the use of the requested substitute. All such redesign and all new drawings and detailing required as a result thereof shall be prepared by the CONTRACTOR at its own expense, including regulatory permit acquisition for the modifications. Requests for additional money for such substitution will not be considered. All proposed modifications to DEQ approved final design and work plan elements must be approved by DEQ.

C. If the CONTRACTOR proposes to provide products as “equals” to those specified, it shall be its responsibility to furnish complete, specific detailed information to the ENGINEER for approval from the manufacturer or supplier of the product proposed to be provided in which the requirements of these Specifications are shown to be met. This shall consist of a point-by-point comparison of the Specification requirements which the product proposed to be provided. In the event the Specifications mention a manufacturer, a point-by-point comparison of the product specified and that proposed to be provided shall be furnished by the CONTRACTOR. The burden of responsibility in furnishing this information is with the CONTRACTOR. If incomplete or irrelevant data is submitted as evidence of compliance with this subparagraph, the request for approval to provide this specific substitute shall not be considered. The request for approval by the CONTRACTOR to the ENGINEER for a substitute product shall also be in accordance with Section 01400 – QUALITY CONTROL.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included

1. Where applicable in the Contract Documents, the minimum acceptable quality of equipment, materials, and workmanship has been defined either by a manufacturer's name and product identification, or by reference to recognized industry standards. Standards, testing protocol, inspection procedures, and additional requirements are referenced in these Contract Documents.

2. To ensure that the necessary materials and equipment are furnished, procedures are established herein to allow the CONTRACTOR to obtain approval by the ENGINEER for Work which will be in complete accordance with the Contract Documents; and for substitutions to be reviewed by the ENGINEER, or accepted thereby if sufficient data for unqualified approval are submitted by the CONTRACTOR.

3. For products which do not differ significantly from those specified in the referencing Section, or are, in the CONTRACTOR's judgment, of equal or higher quality, the submission of the Materials List as specified in Section 01300 - SUBMITTALS and its approval by the ENGINEER, shall provide the basis for quality control. Actual quality control during manufacture shall be maintained by the approval of the Shop Drawings and by the final submissions of the manufacturer's Certificates of Compliance, and the Testing and Inspection Services; specified herein.

4. If the CONTRACTOR proposes to provide products as "equals" to those specified in the referencing Section on which the design is based, it shall be its responsibility to furnish complete, specific, detailed information to the ENGINEER for approval, in which the requirements of the Contract Documents are shown to be met.

   a. These data shall be prepared or approved by the manufacturer of the proposed product, and shall include a point-by-point comparison between the features of the proposed product and the corresponding features of the product specified in the Contract Documents as the one on which the design is based. The features of the product specified shall be those of the manufacturer's model specified (including all standard catalog features and any specified options) which were published on the date of the

Invitation for Bids.

b. If applicable, the CONTRACTOR shall also furnish a description of the changes in structures and other equipment which will have to be made because of the proposed substitution.

c. The burden of responsibility for furnishing these data, documentation, engineering, and certifications for substitute products is with the CONTRACTOR.

d. A request to furnish the substitute product shall not be considered if incomplete or irrelevant data are submitted as evidence of compliance with the requirements.

1.02 QUALITY CONTROL

A. Qualification of Manufacturer/Installer

1. The manufacturer/installer shall be regularly engaged in the business of manufacturing material, installing and/or equipment of the type required by the referencing Section.

2. The manufacturer/installer shall be one of those specified by name in the referencing Section, or must be specifically approved by the ENGINEER.

a. Requests for approval of a manufacturer/installer not named in the referencing Section shall be submitted to the ENGINEER, accompanied by the following information:

1) List of at least five (5) installations of material and/or equipment of comparable size and capacity, and operating under anticipated service conditions; showing location, installation date, model, capacity, and service.

2) If the manufacturer/installer cannot list five (5) installations; list all those which have been made, if fewer than five (5).

3) Complete literature, technical, and performance data describing the proposed equipment.

4) The manufacturer’s standard installation, operating, and maintenance instruction bulletins for the

proposed equipment.

b. The ENGINEER shall notify the CONTRACTOR, in writing, that the manufacturer selected by the CONTRACTOR is approved; or shall request further data to justify the selection. Upon the approval of the manufacturer, the CONTRACTOR shall update the Materials List and submit this to the ENGINEER.

c. If the ENGINEER requests additional data on the actual performance of the equipment or system, the CONTRACTOR shall submit evidence that the equipment or system proposed has been installed and has been in operation for a period prior to the date of Invitation for Bids, and that at least two (2) years of such service are considered satisfactory by the operating superintendents of the facilities in which installed. The service and operating conditions for the equipment or system shall be as similar to those described in these Contract Documents, as is practical.

1) The ENGINEER shall review the experience record of the equipment or system proposed to be installed by the CONTRACTOR, and shall advise the CONTRACTOR, in writing, as to whether or not it appears to be suitable for installation under this Contract.

d. If acceptable evidence of satisfactory experience with the proposed material and/or equipment cannot be furnished, but the CONTRACTOR still elects to provide it, the ENGINEER may accept the installation, but to protect the OWNER's interest in the event that the material and/or equipment does not meet the intended use requirements the CONTRACTOR shall submit a bond or deposit in the amount of the portion of the total Contract price represented by the material and installation cost, including overhead profit of the material and/or equipment being proposed. The period of time for which the bond or deposit shall remain in effect shall be two (2) years after final acceptance of the Work. The bond or deposit shall be used by the OWNER to pay for its costs to replace the material and/or equipment with that of an alternative manufacturer or supplier, if the material and/or equipment when installed does not perform in accordance with the intended use, in

the judgment of the OWNER.

1) The original material and/or equipment which has been replaced shall become the property of the CONTRACTOR, who shall promptly remove it from the site.

2) The CONTRACTOR shall be given reasonable opportunity to modify the equipment furnished, if necessary, so that it will be acceptable to the OWNER and ENGINEER,. Continuous operation in accordance with time for such modifications shall be maintained.

3) The decision of the OWNER with respect to replacing unsatisfactory equipment shall be final.

e. Neither approval by the OWNER or ENGINEER of the CONTRACTOR's selection of a particular manufacturer or system supplier, nor accepting the CONTRACTOR's selection together with the posting of a bond or deposit in lieu of satisfactory evidence of experience, shall obligate the OWNER or ENGINEER to approve details on the Working Drawing submissions from that manufacturer which are not in conformance with the requirements of the Contract Documents.

f. Neither approval by the OWNER or ENGINEER of the CONTRACTOR's selection of a particular manufacturer, equipment supplier, or installer, nor accepting the CONTRACTOR's selection together with the posting of a bond or deposit in lieu of satisfactory evidence of experience, shall relieve the CONTRACTOR of its obligations to fulfill all requirements of the Contract Documents.

3. When so specified in the referencing Section, the manufacturer of the equipment or supplier of the system shall furnish, as requested by the ENGINEER and at no additional cost to the OWNER, the services of a qualified Technical AGENT to advise the ENGINEER and the CONTRACTOR in the installation and operation of the equipment or system, and to certify to the ENGINEER, in writing, that the equipment or system is properly installed and ready to be operated.

B. Installation Requirements

1. The CONTRACTOR shall provide at least one person who shall be present at all times during the installation of the items of equipment furnished under the referencing Section who is thoroughly familiar with the type of materials being installed and with the manufacturer's recommended methods of installation and operation, and who shall direct all the Work performed on the equipment item being installed, at no additional cost to the OWNER.

2. The person providing the above service need not be an authorized representative of the manufacturer except when the warranty of the manufacturer shall be voided if not installed by an authorized representative. The Certificate of Compliance required by Section 01300-SUBMITTALS must be issued by the manufacturer of the equipment or supplier of the system.

C. Codes and Standards

1. Equipment and installation shall comply with all pertinent federal, state and local codes and regulations.

2. Materials, equipment, and installation shall comply with:

a. The minimum standards of the governmental agency or industry standardizing organization publishing standards applicable to such Work.

b. The requirements of specific standards listed in the referencing Section.

c. Where the standards of several organizations (including the manufacturer's own published standards) are applicable to the same Work, the Work may be done in accordance with any such other standards that require an equal or higher quality construction for the specified service than those listed in the referencing Section. The selection of such an alternate standard to the one specified shall be subject to the approval of the ENGINEER.

3. Where any provisions of pertinent codes or standards are in conflict with the requirements of the Contract Documents, the provisions requiring greater safety or operability, or higher quality construction for the specified service shall govern, unless specific exemptions to such provisions are made in the referencing Section.

The final determination shall be made by the ENGINEER.

4. If the mandatory standards of governmental agencies are revised subsequent to the date of issue of the Invitation to Bid, but are made applicable to the Work under this Contract, the CONTRACTOR shall advise the ENGINEER as to the additional cost or reduction in costs required to comply with such revisions, and a Change Order will be issued to cover such costs or the CONTRACTOR issue a credit in the event the change required by the governmental agency results in a cost reduction. The cost of rework required for Work not complying with such revised regulations, but installed after the effective date of such code revisions, will be at the CONTRACTOR's expense.

5. The CONTRACTOR shall document construction and installation activities. At a minimum, installation records shall contain the minimum information: time, place, installer, personnel, equipment used or required, testing performed, test locations, results of testing, installation percent completed, duration, conflicts, resolution to conflicts, safety requirements/actions, site conditions, weather, and all other information required to document the proper installation and certification.

D. At the discretion of the ENGINEER, the CONTRACTOR shall make available any materials related to the Work, including but not limited to soils, granular materials, clay, mix reagents, or soil-mix backfill, for confirmation quality control sampling by the ENGINEER.

PART 2 - PRODUCTS

2.01 DESIGN

A. The design of certain items at the site, as shown in the Contract Documents, is based on the performance and dimensions of specific equipment items as furnished by particular manufacturers.

1. When the performance or dimensions of such items are proprietary, and furnished only by one particular manufacturer, the referencing Section will state the design is based on a particular model of that manufacturer.

a. The CONTRACTOR may furnish and install corresponding products produced by an alternate manufacturer; either one named as an alternate in the referencing Section, or any other one selected by the CONTRACTOR and approved or accepted by the ENGINEER on the basis of the information

supplied as requested in Part I of this Section.

b. The CONTRACTOR shall furnish the ENGINEER with those data on the particular model of the alternate manufacturer which are required to demonstrate that the proposed equipment or system is at least equivalent in performance in the specified service to the equipment or system on which the design is based. The ENGINEER's evaluation will include a determination of the ability of the proposed equipment to meet the requirements of these Drawings, and a comparison of the costs of Operation and Maintenance. If the CONTRACTOR proposes a modification to the Contract Price due to the substitute equipment, this will also be evaluated by the ENGINEER.

c. Approval by the ENGINEER of the proposed substitution will not be capriciously withheld.

d. The design of the facilities associated with the equipment or system for which a substitution is proposed may be affected by such substitution. The size of the building or supporting structure, the size and arrangement of piping and wiring, the specification for associated equipment, the necessary controls, and the service requirements will have to be reconsidered by the CONTRACTOR. The CONTRACTOR shall be completely responsible for the necessary engineering, redesign and certification of all facilities affected by the substitution, and shall prepare the revisions to the Drawings required by such substitution. These revisions shall be submitted to the ENGINEER for approval, in accordance with the provisions in Section 01300 – SUBMITTALS, including the specific notice as to the details in which the substitute design differs from the requirements of the Contract Documents. All such redesign and all new drawings and detailing required as a result thereof shall be prepared by the CONTRACTOR, or its Subcontractors, at its own expense. Requests for additional payment for such substitution will not be considered unless made a part of the final request for approval of the substitution itself.

2.02 MATERIALS

A. All materials, including those not specifically described or specified, but required for a complete and proper installation of Work shall be new, first

quality of their respective kinds, and subject to the approval of the ENGINEER.

B. All materials shall be in accordance with details and samples as specified in the referencing Section; and submitted and approved in accordance with Section 01300-SUBMITTALS.

2.03 INTERCHANGEABILITY

A. All products of the same size and type and performing the same function shall be, insofar as practical, the products of one manufacturer.

1. Details in the Shop Drawing submissions of the several equipment manufacturers shall be coordinated so that items such as lubricating fittings, for example, are identical on all equipment items requiring the same grade of lubricant.

PART 3 - EXECUTION

3.01 INSTALLATION CONDITIONS

A. Inspection

1. Prior to any Work on a specific equipment unit or material installation, the CONTRACTOR shall carefully inspect the existing and previously installed Work, and verify that all Work is in such a condition that the installation of new Work may properly commence and be carried out to a proper and timely completion.

2. The CONTRACTOR shall verify that each item of Work shall be installed in accordance with all pertinent codes and regulations, the approved design, and the referenced standards.

3. The ENGINEER shall periodically inspect the Work to provide quality assurance in accordance with these Contract Documents.

B. Discrepancies

1. In the event of discrepancies, the CONTRACTOR shall immediately notify the ENGINEER, in writing, of such conditions.

2. The CONTRACTOR shall not proceed with installation in areas of discrepancy until such discrepancies have been corrected in a manner acceptable to the ENGINEER.

3. For any unexpected features arising during the progress of Work and not fully covered herein, the Specifications shall be interpreted by the ENGINEER, to require first-class workmanship and materials, and such interpretation shall be accepted by the CONTRACTOR.

3.02 INSTALLATION

A. The CONTRACTOR shall install each equipment item in strict accordance with the manufacturer's instructions, unless specifically directed otherwise by the ENGINEER. The CONTRACTOR shall not void the manufacturer's guarantee.

B. In the event of discrepancies between the Contract Documents and the equipment manufacturer's formal installation instructions, as submitted for the actual units supplied, the CONTRACTOR shall notify the ENGINEER, in writing, of such discrepancies. The CONTRACTOR shall obtain the equipment manufacturer's approval in writing for any changes required to suit the site conditions, and so advise the ENGINEER.

END OF SECTION

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PART 1 - GENERAL

1.01 DESCRIPTION

The CONTRACTOR shall perform all Work in such manner as to minimize the polluting of air, water, or land, and shall, within reasonable limits, control noise and minimize the generation and disposal of solid waste materials, as well as other pollutants. Disposal of waste materials shall comply with all applicable federal, state, county, and environmental regulations.

1.02 PRE-CONSTRUCTION WALK-THROUGH

Prior to the start of any on-site construction activities, the CONTRACTOR and the ENGINEER shall make a joint condition survey of the Site after which the CONTRACTOR shall prepare a brief report indicating on a layout plan the condition of structures, fences, equipment, stored product and materials, and items near the Work areas and access route(s) as applicable. This report will be signed by both the ENGINEER and the CONTRACTOR upon mutual agreement as to its accuracy and completeness.

1.03 PROTECTION OF LAND AREAS AND UTILITIES

A. Except for any Work, or storage area and access routes specifically assigned for the use of the CONTRACTOR, the land areas outside the limits of disturbance performed shall be preserved in their present condition.

B. The CONTRACTOR shall confine its construction activities to areas defined for Work on the Drawings or specifically assigned for its use within the designated disturbed area. Storage and related areas and access required temporarily by the CONTRACTOR in the performance of the Work shall be coordinated with the ENGINEER.

C. It is the responsibility of the CONTRACTOR to contact the specific utility when working near utility poles. The CONTRACTOR shall coordinate with the utility to ensure adequate, temporary support and protection of the utility poles when working near the poles. The CONTRACTOR shall also coordinate with the utility for any temporary re-routing of the utility or shielding of the utility during the Work.

1.04 PROTECTION OF SURROUNDING AREAS

A. Except for trees, shrubs and other vegetation marked on the Drawings to be removed; the CONTRACTOR shall not deface, injure or destroy trees, shrubs, or vegetation nor remove or cut them without special authority. No ropes, cables, or guys shall be fastened to or attached to any existing

nearby trees for anchorages.

B. The CONTRACTOR shall not damage or compromise the integrity of any infrastructure, equipment, materials, or other items not designated for removal or any Work. Any damage to items within or outside the Work area that are not designated for dismantling shall be restored or replaced in kind at no additional cost to the OWNER.

1.05 PROTECTION OF WATER RESOURCES

A. The CONTRACTOR shall control the disposal of fuels, oils, bitumens, calcium chloride, acids, alkalies, pesticides, herbicides, rodenticides, or other harmful materials, both on- and off-site, and shall comply with applicable federal, state, and local laws concerning the pollution of rivers and streams. Special measures shall be taken to prevent chemicals, fuels, oils, greases, bituminous materials, herbicides, and insecticides from entering public waters.

B. Water used in on-site material processing and other waste waters shall not be allowed to re-enter public waters. These waters and decontamination water or fluids shall be contained and disposed at an appropriate facility in accordance with all federal, state and local requirements.

C. Water accumulating within any excavation containing potentially impacted materials shall be removed/dewatered in accordance with these Specifications. Water shall be disposed in accordance with Section 01500 – TEMPORARY FACILITIES AND CONTROLS.

D. Management, handling, testing, and disposal of contaminated water and soil shall be in accordance with Contaminated Material Management Plan (CMMP).

1.06 WASTE DISPOSAL

A. The CONTRACTOR shall place all general debris and waste; i.e., paper, trash, etc., in a storage container provided by the CONTRACTOR for subsequent disposal by the CONTRACTOR. Soil, sediment, contact water or demolition debris is not considered general debris, but rather, waste that shall be managed as required in the Contract Documents, including Section 02250 – TRANSPORTATION AND DISPOSAL OF MATERIALS. If any waste material is dumped in unauthorized areas, the CONTRACTOR shall remove the material and restore the area to the condition of the adjacent undisturbed areas. Where directed, ground and/or floor areas contaminated by CONTRACTOR operations shall be excavated and/or cleaned, disposed as approved, and replaced with suitable fill material at no additional expense to the OWNER.

B. No material shall be burned on the project site. It shall be the responsibility of the CONTRACTOR to provide disposal of all waste materials in accordance with all state and county regulations.

1.07 DUST CONTROL

A. The CONTRACTOR shall maintain all excavations, stockpiles, access roads, waste areas, off-site roadways and all other work areas free from excess dust to such reasonable degree as to avoid causing a hazard or nuisance to others.

B. Approved temporary methods for dust control consist of sprinkling of water or a dilute solution of water with a biodegradable surfactant (less than 0.05 percent). Chemical treatment, tents, windscreens, or similar methods will be considered for dust control. Approval of such temporary methods must be granted by the ENGINEER prior to initiation.

C. Dust control shall be performed as the Work proceeds and whenever a dust nuisance, hazard, or exceedance of predefined action levels occurs, or as otherwise directed by the ENGINEER.

1.08 EROSION CONTROL

A. Surface drainage from cuts and fills, within the construction limits, whether or not completed, and from excavated areas shall be graded to control erosion within acceptable limits.

B. Temporary control measures shall be provided and maintained throughout construction. Such measures shall include, but not be limited to silt fence and stabilized construction entrance. No additional payment will be considered or approved for repair or maintenance of the erosion control

measures or for erosion repair. Additional measures, such as berms, may be required to meet the requirements herein, including the containment of slurry, so that no slurry flows toward the river bank.

C. The area of bare soil, exposed at any one time by construction operations shall be minimized to the satisfaction of the ENGINEER.

1.09 CORRECTIVE ACTION

The CONTRACTOR shall, upon receipt of a notice in writing from the ENGINEER of any non-compliance with the foregoing provisions, take immediate corrective action in accordance with any and all federal, state, or local laws. If the CONTRACTOR fails or refuses to comply promptly, the ENGINEER may issue an order stopping all or part of the work until satisfactory corrective action has been taken.

1.10 POST-CONSTRUCTION CLEANUP OR OBLITERATION

The CONTRACTOR shall, unless otherwise instructed in writing by the ENGINEER, obliterate all signs of temporary construction facilities such as temporary access roads, Work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the Work. Any disturbed soil areas shall be graded and filled and the entire area stabilized with aggregate or seeded with permanent vegetation..

PART 2 - PRODUCTS

(not used)

PART 3 - EXECUTION

(not used)

END OF SECTION

PART 1 - GENERAL

1.01 FIELD CONDITIONS AND MEASUREMENTS

A. The CONTRACTOR shall base all measurements, both horizontal and vertical, from established benchmarks and monuments. The CONTRACTOR shall be responsible for field verification of all dimensions and conditions at the Site. The ENGINEER shall provide to the CONTRACTOR both coordinates and elevations for monuments as shown on the Drawings.

B. Should the CONTRACTOR discover any discrepancy between actual conditions and those indicated, which prevent following good practice or the intent of the Specifications and Drawings, the CONTRACTOR shall notify the ENGINEER, request clarification and instructions, and shall not proceed with Work until the CONTRACTOR has received the same from the ENGINEER; provided that such wait does not unduly delay the progress of the Work.

C. No claims shall be made for extra payment or extensions of the Contract completion time if the CONTRACTOR fails to notify the ENGINEER of any discrepancy before proceeding with that aspect of that Work.

1.02 SUBMITTALS

A. In accordance with Section 01300 – SUBMITTALS. and the Construction Quality Assurance/Quality Control (CQA/QC) Plan.

1.03 ACCESS AND DRAINAGE

A. The CONTRACTOR shall keep all natural drainage and water courses unobstructed or provide equal courses effectively placed, and prevent accumulations of surface water. The CONTRACTOR shall construct, grade, and stabilize access roads and provide temporary mobilization, parking, storage and staging areas for its use during construction within the areas shown on the Drawings.

B. Access roads and mobilization, parking, and storage areas shall be maintained in a stable and smooth condition throughout the life of the Contract.

1.04 TEMPORARY SANITARY FACILITIES

The CONTRACTOR shall furnish and maintain the necessary temporary self-contained chemical type sanitary facilities in accordance with all applicable regulations. They shall be located near the points of Work and shall be cleaned daily and adequately serviced. The use of these facilities shall be available for the CONTRACTOR's employees as well as the OWNER and ENGINEER representatives and other project personnel on the Site. Separate sanitary facilities are required for men and women; these facilities must be clearly marked and reasonably maintained in a sanitary condition.

1.05 CONTRACTOR STORAGE AREA

A storage area shall be designated by the ENGINEER on the project site for use by the CONTRACTOR for storage of materials, tools, equipment, office and other items necessary for construction. The exact limits of the storage area will be designated in the field by the ENGINEER. The CONTRACTOR shall be fully responsible for the preparation of this area, its maintenance, and its security including fencing, watchmen, and other means of security. Under no circumstances will the OWNER or ENGINEER be responsible for the security of any property belonging to the CONTRACTOR, its Subcontractors or any of its Work forces. The CONTRACTOR shall, upon completion of the project, return the storage area(s) to the original condition. All disturbed areas shall be repaired and covered with surface materials that match the existing adjacent materials; i.e., concrete, topsoil and grass, stone, asphalt, etc.

1.06 STAGING AREAS, STORAGE AND FIELD OFFICES

A. The CONTRACTOR may, during the course of this project, stage construction, store materials, or erect temporary field offices only within the Limits of Disturbance shown on the Drawings or as otherwise approved by the ENGINEER.

B. Requirements for the field offices and utilities are specified in Section 01010 - SUMMARY OF WORK.

1.07 HANDLING AND DISPOSAL OF SITE WATER

A. The CONTRACTOR shall furnish all labor, materials, and equipment necessary for the proper management, including handling, collection, and off-site transport of water accumulated that is generated from stormwater, groundwater, dust control operations, or otherwise.

B. Any stormwater or other ponded water encountered within the areas of excavation or disturbance with potentially impacted material exposed

during construction activities shall be collected and transported off-site in accordance with these Specifications.

C. All waste fluids generated by the CONTRACTOR from decontamination activities, or otherwise, shall be properly contained, managed, and transported off-site by the CONTRACTOR to an approved disposal facility.

D. The CONTRACTOR shall take the necessary measures; i.e., divert runoff from the work area, to minimize the quantity of water generated for disposal.

1.08 TRUCKING

A. All trucks bringing to or removing from the Site, soil, loose materials or debris shall be loaded in a manner so as to prevent the dropping of materials on public or private off-site streets or roadways.

B. At all points where trucks leave the project site and enter adjacent paved roadways, the CONTRACTOR shall provide and maintain a crew or other means necessary to prevent any mud or loose material from being carried onto such adjacent paved roadways.

C. In the event that soil, loose materials or debris are deposited on to public or private streets or roadways on the egress side of the equipment decontamination station, the following actions shall take place:

1. The truck shall return and go through the decontamination station again before proceeding off-site.

2. No additional loads shall leave the site until the decontamination procedures are reviewed and necessary changes implemented to ensure that dropping or tracking of material and debris beyond the decontamination station does not occur.

3. The soil, loose materials or deposited debris is to be immediately removed to avoid additional tracking and exposure.

1.09 EQUIPMENT DECONTAMINATION

A. The CONTRACTOR shall decontaminate any equipment or materials that have contacted potentially hazardous or impacted substances (if any) prior to leaving the area. Decontamination activities shall be performed in a designated location over a contained area such that all materials and contact water are properly contained. All decontaminated residual

materials and contact water shall be tested and properly disposed in accordance with Part 1.07 of this Section.

B. The CONTRACTOR shall provide all wash water required for the decontamination of equipment and personnel.

C. Personnel decontamination procedures shall be followed by the CONTRACTOR as specified in the CONTRACTOR's Health and Safety Plan.

D. Any solids and soils/sediments generated from the decontamination activities shall be considered impacted and disposed in accordance with Section 02250 – TRANSPORTATION AND DISPOSAL OF MATERIALS.

1.10 SECURITY

A. Security for the purpose of this project will be defined as precautionary measures to ensure that equipment, tools, and materials are safe from vandalism, theft, or damage. The CONTRACTOR is responsible for the security of all equipment used and/or stored on the Site.

B. The right of access to this Work area, whether it is in preparation or progress, shall be extended to the OWNER and ENGINEER, as well as local authorities.

C. The entrance of persons and vehicles into the Site shall only be permitted for authorized persons with proper identification.

D. A list of authorized persons shall be maintained, and a copy submitted to the ENGINEER upon request.

E. CONTRACTOR is responsible for security of work progress and equipment until acceptance of work by the ENGINEER and OWNER.

1.11 EROSION AND SEDIMENT CONTROL MEASURES

A. Adequate control of erosion and sediment of both a temporary and permanent nature on areas disturbed by the Work shall be provided under this Specification and/or subject to the approval of the ENGINEER. During the pre-construction walk-through, the CONTRACTOR and the ENGINEER shall review the Erosion and Sediment Control Plan and details and shall determine additional specific sediment and erosion control requirements. All erosion and sediment control measures shall be provided and maintained until the Site is fully stabilized, as approved by the ENGINEER. Maintenance includes, but is not limited to, the clearing

and removal of sediment accumulation in the ditches and silt fence; repair of any damaged or fallen erosion and sediment control components; and all other activities required to ensure proper performance of erosion and sediment control measures.

B. Erosion control shall comply with all applicable State of Oregon and City of Portland regulations.

PART 2 - PRODUCTS

(not used)

PART 3 - EXECUTION

(not used)

END OF SECTION

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PART 1 - GENERAL

1.01 EQUIPMENT AND PRODUCTS SPECIFIED

A. In various detailed Sections of these Specifications, certain items of equipment, materials, or products are specified by proprietary name or trade name and shall be used without exception. It is to be understood that these items are to be furnished by the CONTRACTOR as indicated in this Section and no substitutes will be allowed.

B. In the various detailed Sections of these Specifications where any item of equipment or product is specified by proprietary name or trade name, with the addition of such expressions as “or equal”, it is to be understood that equal quality equipment or products of either a manufacturer named or a manufacturer not named which meet the detailed requirements of the Specifications are subject to the approval of the ENGINEER as to the equality thereof and in accordance with Section 01400 - QUALITY CONTROL.

1.02 STORAGE AND MAINTENANCE OF EQUIPMENT

A. All equipment, materials, and products provided and Work performed under this Contract shall be protected from damage before and after installation. The CONTRACTOR shall be responsible for Work, equipment, materials, and products until inspected, tested, and finally accepted in accordance with this Section, the Contract Documents and all applicable warranties.

B. During construction, and at the end of each working day or other period, the open ends of Work shall be effectively closed with temporary covers or plugs to prevent the entry of foreign material.

C. Where permanent equipment called for under this Contract is installed before the erection of adequate protective structures, the CONTRACTOR without additional compensation therefore, shall provide approved, effective, and durable covers for fully protecting such equipment against damage from the elements or from any other causes.

D. All machinery, equipment, piping, and accessories and appurtenances shall be adequately supported and safeguarded against all damage or injury during performance of Work under this Contract. The CONTRACTOR shall be responsible for all damage or injury resulting from its operations and shall repair such damage immediately and to the satisfaction of the ENGINEER.

E. The CONTRACTOR shall store and protect equipment, materials, and products in accordance with the manufacturer's recommendations and the requirements specified in these Specifications and shall submit the manufacturer's storage and maintenance instructions to the ENGINEER prior to delivery.

F. The CONTRACTOR shall make all arrangements and provisions necessary for the storage of equipment, materials, and products. All excavated material, construction equipment, and materials and equipment to be incorporated into the Work shall be placed so as not to injure any part of the Work or existing facilities, and so that free access can be achieved at all times to all parts of the Work and to all public utility installations in the vicinity of the Work. Equipment, materials, and products shall be kept neatly and compactly stored in locations that will cause a minimum of inconvenience to other contractors, public travel, adjoining owners, tenants, occupants, and the ENGINEER's personnel.

G. Areas available on the project site for storage of equipment, materials, and products shall be as shown, specified, or designated and approved by the ENGINEER. All equipment, materials, and products must be consigned to the CONTRACTOR directly. No delivery of equipment, materials, and products will be accepted by the ENGINEER, and all expenses incurred by the ENGINEER in handling equipment, materials, and products which have been consigned or directed to the ENGINEER will be charged to the CONTRACTOR.

H. Equipment, materials, and products which are to become the property of the OWNER shall be stored to facilitate their inspection and ensure preservation of the quality and fitness of the Work, including proper protection against damage by freezing and moisture. They shall be placed inside storage areas, unless otherwise shown, specified, or acceptable to the ENGINEER.

I. CONTRACTOR shall be fully responsible for loss or damage to stored equipment, materials, and products.

J. Any equipment, materials, or products which, in the opinion of the ENGINEER, have been damaged due to improper storage and/or handling and is unfit for its specified or intended use shall be properly removed from the site or Work. The CONTRACTOR shall receive no compensation for the damaged equipment, material, or product or its removal or replacement.

K. All materials delivered and stored on-site shall bear the manufacturer's trade names, labels, stamps, or other suitable identification clearly marked in a conspicuous place.

PART 2 - PRODUCTS

(not used)

PART 3 - EXECUTION

(not used)

END OF SECTION

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Clean-Up

Upon completion of the Work and before a Certificate of Substantial Completion is issued by the ENGINEER to the CONTRACTOR, the Work site, storage areas, and other areas occupied by the CONTRACTOR during construction shall be cleaned, and all surplus and discarded materials, false Work, and rubbish placed thereon by the CONTRACTOR shall be removed by the CONTRACTOR. No separate payment will be made for clean-up as all such costs shall be included in the Bid.

B. Warranties and Guarantees

All Warranties and Guarantees shall be submitted to the ENGINEER prior to the performance of Work or the delivery of materials to the Site. These Warranties and Guarantees will be referred to the OWNER for review and approval of the Terms and Conditions. Upon completion of the Work and before a Certificate of Substantial Completion is issued by the ENGINEER to the CONTRACTOR, all final Warranties and Guarantees shall be submitted to the ENGINEER.

C. Record Documentation and “As-Built” Drawings

1. Upon Completion of the Work and before a Certificate of Substantial Completion is issued by the ENGINEER to the CONTRACTOR, all “As-Built” documentation shall be completed and submitted to the ENGINEER.

2. Project record documents include, but are not limited to the following:

   a. Drawings;
   b. Specifications;
   c. Addenda;
   d. Site Work Orders, field orders, and other modifications to the Contract,
   e. Approved Shop Drawings;
   f. Product data and samples;
   g. Warranties and Guarantees;

h. "As-Built" documentation; and,
i. Other approved documents submitted by the CONTRACTOR in compliance with these Specifications.

3. CONTRACTOR shall maintain, at the Site, one set of the following record documents; and record actual revisions to the Work.

   a. Contract Drawings;
   b. Specifications;
   c. Addenda;
   d. Change Orders and other Modifications to the Contract; and,
   e. Reviewed Shop Drawings, product data, and samples.

4. CONTRACTOR shall store Record Documents separately from documents used for construction.

5. CONTRACTOR shall record information concurrent with construction progress.

6. Specifications: CONTRACTOR shall legibly mark and record at each product section the description of actual products installed, including the following:

   a. Manufacturer's name and product model and number;
   b. Product substitutions or alternates utilized; and,
   c. Changes made by Addenda and modifications.

7. Record Documents and Shop Drawings: CONTRACTOR shall legibly mark each item to record actual construction, including:

   a. Field changes of dimension and detail.
   b. Details not included on the Drawings.

8. CONTRACTOR shall submit the documents to the ENGINEER or OWNER'S AGENT with the claim for final Application of Payment.

9. CONTRACTOR shall maintain a daily log of Work performed/completed.

10. CONTRACTOR shall maintain a workers log.

11. CONTRACTOR shall submit well abandonment records to the OWNER and Regulatory agencies in accordance with Oregon

Administrative Rules (OAR) Section 690 Division 240.

1.02 CLOSEOUT PROCEDURES

A. When the CONTRACTOR considers that the Work is substantially complete, it shall submit a written request that certifies that the Contract Documents have been reviewed, the Work has been inspected, and that Work is complete in accordance with the Contract Documents and is ready for the ENGINEER's final inspection.

B. CONTRACTOR shall provide to the ENGINEER "As-Built" documentation, all submittals in accordance with Section 01300 - SUBMITTALS of the Technical Specifications, Warranties and Guarantees, and other submittals required by these Specifications or governing authorities prior to, or concurrent with the request for Certification of Substantial Completion.

C. ENGINEER shall, within a reasonable time after receipt of a written request from the CONTRACTOR, conduct an inspection to determine the status of completion. If ENGINEER, determines that the Work is not complete, it shall notify CONTRACTOR in writing giving the reasons thereof. The CONTRACTOR shall remedy the deficiencies noted and submit a certification to the ENGINEER for re-inspection.

D. The CONTRACTOR shall submit project Record Documents to the ENGINEER with the claim for final Application for Payment.

E. Evidence of payment and release of liens shall be provided by the CONTRACTOR in accordance with the requirements provided in the Contract Documents, and is required prior to final payment.

PART 2 - PRODUCTS

(not used)

PART 3 - EXECUTION

(not used)

END OF SECTION

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PART 1- GENERAL

1.01 PROJECT MAINTENANCE AND WARRANTY

A. Maintain in good repair the improvements covered by these Drawings and Specifications during the life of the Contract.

B. Indemnify the OWNER and ENGINEER against any repairs which may become necessary to any part of the work performed and to items of equipment and systems procured of or furnished under this Contract, arising from defective workmanship or materials used therein, for a period of one (1) year after acceptance from the final date of final resolution of the ENGINEER accepting work.

C. The CONTRACTOR shall not be obligated to make replacements which become necessary because of ordinary wear and tear, or as a result of improper operation or maintenance, or to perform any work which is normally performed by a maintenance crew during operation.

D. In the event of multiple failures of major consequences prior to the expiration of the one-year warranty described above, the affected construction of installation shall be removed/disassembled, inspected, and repaired, modified or replaced as necessary to prevent further occurrences. Any related components which may have been damaged or rendered non-serviceable as a consequence of the failure shall be replaced. A new twelve (12) month warranty against defective or deficient design, workmanship, and materials shall commence on the day that the item is reassembled and placed back into operation. As used herein, multiple failures shall be interpreted to mean two (2) or more successive failures of the same kind in the same item or failures of the same kind in two (2) or more items. Major failures may include, but are not limited to, an inadequate GWBW, including sand or slurry pockets, sloughing, subsidence, a non-vertical wall, non-continuous wall, or other deficiencies that would cause any part of the GWBW to not comply with the requirements herein; cracked or settled GWBW cap; failed erosion and sediment controls; or other occurrences that would result in any portion of the project to not comply with these Technical Specifications or Drawings. Should multiple failures occur in a given time, all products of the same size and type shall be disassembled, inspected, modified, or replaced, as necessary, and rewarranted for one year.

E. The CONTRACTOR shall, at his own expense, furnish all labor, materials, tools, and equipment required and shall make such repairs and removals or shall perform such work or reconstruction as may be made necessary by any structural or functional defect or failure resulting from neglect, faulty workmanship, or faulty materials, in any part of the Work

performed. Such repair shall also include excavations or embankments which show settlement or erosion after backfilling or placement.

F. Except as noted on the Drawings or as specified, all structures such as embankments shall be returned to their original condition prior to the completion of the Contract. Any and all damage to any facility not designated for removal, resulting from the CONTRACTOR's operations, shall be promptly repaired by the CONTRACTOR at no cost to the OWNER.

G. In the event the CONTRACTOR fails to proceed to remedy the defects of which he has been notified within fifteen (15) days of the date of such notice, the OWNER reserves the right to cause the required materials to be procured and the work to be done, as described in the Drawings and Specifications, and to hold the CONTRACTOR and the sureties on his bond liable for the cost and expense thereof.

H. Notice to the CONTRACTOR for repairs and reconstruction will be made in the form of a registered letter addressed to the CONTRACTOR at the contract-designated office.

I. Neither the foregoing paragraphs nor any provision in the Contract Documents, nor any special guarantee time limit implies any limitation of the CONTRACTOR's liability with the law of the State of Oregon.

1. Upon completion of the Work and before a Certificate of Substantial Completion is issued by the ENGINEER to the CONTRACTOR, the Work site, storage areas, and other areas occupied by the CONTRACTOR during construction shall be cleaned, and all surplus and discarded materials, false Work, and rubbish placed thereon by the CONTRACTOR shall be removed by the CONTRACTOR. No separate payment will be made for clean-up as all such costs shall be included in the Bid.

PART 2- PRODUCTS

(not used)

PART 3- EXECUTION

(not used)

END OF SECTION

Division 2 – Site Work

DIVISION 2 – SITE WORK

02110
SITE CLEARING

PART 1 – GENERAL

1.01 DESCRIPTION

A. The Work covered by this Section consists of furnishing all equipment, tools, and labor necessary for clearing and grubbing of brush, vegetation, and perishable material of whatever nature; Site preparation activities; removing existing structures, including concrete/asphalt pavements; abandoning the designated groundwater monitoring wells; protecting the trees designated to remain on site; and, preparing the Site for Work. All Work shall be performed in accordance with the limits set forth in the Drawings.

B. Clearing of vegetation shall only occur to the extent that it is necessary to perform the Work. All materials that are cleared and/or removed shall be disposed of off-site at an approved facility.

1.02 MATERIALS OWNERSHIP

Except for materials to be stockpiled for later reuse, CONTRACTOR shall temporarily store cleared materials in roll-off containers provided by the CONTRACTOR until such time that the materials are permanently disposed of off-site.

1.03 SUBMITTALS

In accordance with the provisions of these Contract Documents.

1.04 QUALITY ASSURANCE

A. All materials procedures, operations, and methods shall be in strict conformance with the Drawings and Specifications, and shall be subjected to strict quality control monitoring as detailed in these Contract Documents and the Construction Quality Assurance/Quality Control (CQA/QC) Plan.

B. The CONTRACTOR shall comply with all requirements of the Oregon Department of Environmental Quality (ODEQ), and other federal, state, and county regulatory agencies controlling environmental reviews and safety during construction.

PART 2 – PRODUCTS

(not used)

PART 3 – EXECUTION

3.01 PREPARATION

A. The CONTRACTOR shall protect and maintain benchmarks and survey control points from disturbance during construction.

B. The CONTRACTOR shall retain the services of a private utility locator for utility clearance at the Site prior to initiation of any ground disturbance at the Site including clearing, grading, and grubbing. Identified utilities shall be clearly identified with marking paint on the ground surface. Private utility clearance shall be used as an aid to identify private utilities located at the Site and shall not be used as a comprehensive survey of private site utilities. CONTRACTOR shall be responsible for supplemental means of utility identification and shall proceed with caution when performing the Work in a manner that will allow field identification of utilities not previously marked.

C. The CONTRACTOR shall provide erosion control measures to prevent soil erosion and discharge of slurry or soil/sediment-bearing water runoff or airborne dust to adjacent properties and the Willamette River.

D. The CONTRACTOR shall protect existing vegetation and structures to remain against damage.

3.02 SURFACE DEBRIS

A. Prior to issuance of a Notice-to-Proceed, the OWNER will salvage any desired materials from the work areas, and so inform the CONTRACTOR.

B. All surface debris, rubble, and other deleterious materials of a manmade nature that may be encountered within the limits of disturbance shall be removed and disposed of off-site in accordance with all federal, state and local regulations.

3.03 CLEARING AND GRUBBING

A. Clearing and grubbing shall be performed within the limits of disturbance as indicated on the Drawings and only in those areas that require construction activity, such as excavation, filling, removal activities, and construction access. Clearing and grubbing shall be performed in such a fashion as to minimize as much as possible the overall disturbance to the Site.

B. In the areas to be cleared and grubbed, all trees, stumps, roots, brush, and other vegetation and objectionable organic material shall be removed. Material to be grubbed shall be removed to a depth of not less than 6 inches below the surface elevation of the ground.

C. All trees, logs, brush, crops, grasses, and debris of all kinds, both standing and fallen, shall be cleared, grubbed, and disposed in accordance with Part 3.06 of this Section without damage to adjoining property.

D. Areas outside of the limits of clearing shall be protected from damage and no equipment or materials shall be stored or Work performed in those areas. Wherever possible, equipment and materials shall be stored in an area of the site with a stabilized surface as indicated on the Drawings.

3.04 REMOVAL OF EXISTING STRUCTURES

A. The CONTRACTOR shall remove sections of asphalt or concrete pavement, as necessary, to facilitate installation of the groundwater barrier wall. Saw cutting, or other approved method, shall be used to achieve a neat and uniform section for removal.

3.05 WELL ABANDONMENT

A. The CONTRACTOR shall abandon groundwater monitoring wells in accordance with OAR Section 690 Division 240. The groundwater monitoring wells to be abandoned are designated on the Construction Drawings.

B. Wells shall be abandoned by completely re-drilling the borehole to a minimum of the original diameter. All casing, annular sealing material, drill cuttings, debris, and filter pack material shall be removed prior to sealing. Grout slurries shall be placed from the bottom up by a grout pipe to avoid segregation or dilution of the sealant. The discharge end of the grout pipe shall be submerged in the grout to avoid breaking the seal while filling the annular space.

C. The CONTRACTOR shall record the specifics of the abandonment, such as location and procedure, and submit the abandonment report to the ENGINEER and to other appropriate agencies.

D. Well sealant shall be PureGold®, or approved equivalent, consisting of asmooth grout slurry mixed from granular sodium bentonite.

3.06 DISPOSAL OF MATERIALS

A. General refuse and construction debris that accumulates during the course of construction shall be disposed in separate containers supplied by the CONTRACTOR. Refuse shall be accumulated and disposed periodically.

B. All trees, brush, limbs, and other yard waste materials shall be chipped directly into designated containers provided by the CONTRACTOR for disposal off-site. No chipping equipment shall discharge directly to the ground. Chipping equipment shall be supplied by the CONTRACTOR.

C. The CONTRACTOR is responsible for disposal of all debris, structures, and other materials. CONTRACTOR shall dispose of these waste materials at an off-site disposal facility approved by the OWNER.

END OF SECTION

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PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work covered by this Section consists of furnishing all materials, labor, tools, equipment and transportation necessary for all construction as it pertains to the excavating, handling, stockpiling, backfilling, compacting and grading of earthwork. The Work includes all hauling, stockpiling, covering, wetting or drying, dewatering, conditioning, compacting and other operations pertaining thereto for constructing and preparing the earthwork complete in accordance with these Specifications and Drawings, or as directed by the ENGINEER.

B. The Work shall include, but not be limited to, the following activities:

1. Construction of earthen berms, ditches and/or swales, and other measures for constructing a slurry pond, GWBW support areas or management of surface water flow;
2. Hauling, conditioning, stockpiling, and management of soils removed for installation of the groundwater barrier wall (GWBW);
3. Excavations and backfilling of soils or trench spoils associated with any portion of the Work required herein;
4. Furnishing, preparing, hauling, testing, placing, and compacting common fill;
5. Furnishing, preparing, hauling, testing, placing, and compacting the clay cap;
6. Site grading;
7. Stockpiling and managing materials throughout Work;
8. Dust control; and,
9. Dewatering, transportation, and on-site management and storage of any accumulated storm-water runoff and groundwater within excavations.

C. No soils, debris, or liquids shall be removed from the Site unless otherwise instructed or approved by the ENGINEER. The CONTRACTOR shall store, characterize, decontaminate, transport, dispose of, and otherwise manage all materials in accordance with these Specifications and the Contaminated Material Management Plan, (CMMP), included as Attachment E.

D. All soil types shall consist of materials approved by the ENGINEER from off-site sources and/or approved materials removed from on-site. CONTRACTOR shall not use potentially contaminated soil for use in cap or surface grading. . These common backfill materials shall be tested in accordance with the frequency stated in the Contaminated Material Management Plan (CMMP) and shall not exceed the maximum

concentrations presented in the CMMP. During construction, the construction area shall be well drained. No materials shall be backfilled when either the material or the surfaces on which it is to be placed are frozen, subject to standing water, or excessively wet or soft, unless otherwise specified by the ENGINEER. When the Work is interrupted by heavy precipitation or freezing temperatures, fill operations shall not be resumed until the ENGINEER determines that the moisture content, density and integrity of the previously-placed soils are as specified.

E. All soils shall be removed to the limits and depths as specified on the Drawings and Specifications.

1.02 DEFINITIONS

A. "Common Fill" includes all soils utilized as supplemental fill to backfill excavations or construct earthen berms or other engineered structures, as required.

B. "Clay" includes those clean soils required for the low permeability layer of the soil cap to be installed above the groundwater barrier wall. The soil shall exhibit a laboratory-tested permeability of less than or equal to 1 x 10^{-5} centimeters per second (cm/sec).

C. "Trench Spoils" includes all subsurface materials generated from the excavation or mixing of the GWBW trench.

D. "Impacted Spoils" includes those soils existing within the extent of the groundwater barrier wall, or elsewhere that are observed to be contaminated, as determined by the ENGINEER.

E. "Obstructive Debris" includes those materials encountered during the Work that would interfere or obstruct the installation of the groundwater barrier wall.

1.03 REFERENCES

A. ASTM D-422 Particle-Size Analysis of Soils

B. ASTM D-698 Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5 Pound Rammer and 12-inch Drop

C. ASTM D-2216 Standard Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures

D. ASTM D-2487 Classification of Soils for Engineering Purposes

E. ASTM D-6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

F. ASTM D-4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils

G. ASTM D-2974 Organic Content of Soils

H. ASTM D-1556 Test Method for Density of Soil In Place by Sand-Cone Method

I. ASTM D-1557 Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 Pound Rammer and 18-Inch Drop

J ASTM D-5084 Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

K. EPA 9095-A Paint Filter Liquids Test

1.04 QUALITY ASSURANCE

A. All materials, procedures, operations, and methods shall be in strict conformance with the Drawings and Specifications, and shall be subject to strict quality control monitoring as detailed herein and in the Construction Quality Assurance/Quality Control (CQA/QC) Plan. The backfilled soils shall conform exactly to the Drawings and Specifications, except as otherwise authorized in writing by the ENGINEER.

B. The CONTRACTOR shall comprehend and anticipate construction quality assurance activities by the ENGINEER, or others, and account for these activities in the installation schedule.

1.05 SUBMITTALS

A. The CONTRACTOR shall submit to the ENGINEER for review a Work Plan proposing methods of excavation, separation of materials (i.e., obstructive debris from trench spoils), construction of slurry pond, proper staging, conditioning, dewatering, erosion controls, and sequencing for the various portions of the Work. Review shall be for method only. The CONTRACTOR shall remain fully responsible for the adequacy and safety of the methods proposed.

B. The CONTRACTOR shall submit to the ENGINEER a stockpiling and staging plan for all Work, including soils, trench spoils, obstructive debris, and other materials prior to the commencement of earthwork activities. Any temporary stockpile that includes potentially impacted materials shall have a 40-mil HDPE or 30-mil PVC liner under the pile; the pile shall also be covered with plastic to prevent storm water contact or dust generation. The plan shall indicate the location and contents of each stockpile. Generalized locations for soil stockpiles are as designated on the Drawings; the final stockpiling plan is subject to the approval of the ENGINEER.

C. The CONTRACTOR shall submit a 50-pound sample from each of the off-site borrow sources proposed to furnish the required quantity of fill materials. The samples shall be submitted to the ENGINEER no less than two (2) weeks prior to the anticipated placement of any soil materials.

D. The CONTRACTOR shall submit the location of all off-site borrow sources and the results of the tests listed below to the ENGINEER no less than two (2) weeks prior to the anticipated placement of any soil materials.

E. The CONTRACTOR shall submit the results of the ASTM tests listed below for each borrow pit location and designated fill classification to verify that the soil materials meet the technical requirements of this Section.

PARAMETER	ASTM TEST METHOD	FREQUENCY FOR CQC TESTING	FILL CLASSIFICATION
Moisture Content	D-2216	One per 2,000 cy (minimum of 3 tests per source) or each change in Material Type	Common Fill and Clay
Soil Classification	D-2487	One per 2,000 cy (minimum of 3 tests per source) or each change in Material Type	Common Fill and Clay
Particle-Size Analysis with Hydrometer	D-422	One per 2,000 cy (minimum of 3 tests per source) or each change in Material Type	Common Fill and Clay
Atterberg Limits	D-4318	One per 2,000 cy (minimum of 3 tests per source) or each change in Material Type	Common Fill and Clay
Modified Proctor	D-1557	One per 2,000 cy (minimum of 3 tests per source) or each change in Material Type	Common Fill and Clay
Hydraulic Conductivity	D-5084	One per 2,000 cy (minimum of 2 tests per source) or each change in Material Type	Clay

The test results shall be submitted to the ENGINEER no less than one week prior to the anticipated placement of any general fill materials furnished from off-site.

1.06 SOIL TESTING

A. Prior to the general placement of the fill, and during such placement, the ENGINEER shall select areas within the limits of the fill for testing the degree of compaction obtained. The CONTRACTOR shall be responsible for the cost of all quality control testing. The CONTRACTOR shall cooperate fully to allow the ENGINEER to perform supplemental quality assurance testing.

B. Payment for any in-place quality assurance testing verification will be made by the OWNER. If the results are unsatisfactory, all costs involved in correcting deficiencies in compacted materials to the satisfaction of the ENGINEER and any additional costs for retesting will be borne by the CONTRACTOR.

C. The testing frequency required in Paragraph 1.05 of this Section may be increased at the discretion of the ENGINEER when visual observation or construction performance indicates a potential problem.

PART 2 – MATERIALS

2.01 COMMON FILL SOILS

Common fill soils shall consist of mineral soil substantially free from organic materials, loam, wood, trash, and other objectionable materials which may be compressible or which cannot be properly compacted. Common fill soils shall not contain stones larger than two (2) inches in largest diameter and shall be classified according to the Unified Soil Classification System (USCS) as SM, SC, SC-SM, ML-CL, ML, or CL. Common fill soils shall have a maximum plasticity index of 40. Common fill soils shall not contain granite blocks, broken concrete, masonry, rubble, or other similar materials. It shall have physical properties such that it can readily spread and be compacted during filling. Snow, ice, and frozen soil shall not be permitted. Common fill soils shall be used as backfill for excavated areas. Common fill soils shall be procured from a commercial soil borrow site.

2.02 CLAY

Clay soils shall consist of mineral soil substantially free from organic materials, loam, wood, trash, and other objectionable materials which may be compressible or which cannot be properly compacted. The material shall be classified

according to the Unified Soil Classification System (USCS) as SM, SC, ML, CL, ML-CL, MH, or CH. The material shall have a minimum plasticity index of 10; 100 percent of the particles having a dimension less than two (2) inches; a maximum of 10 percent of the particles, by weight, greater than 0.75 inches in greatest dimension; and, a minimum of 25 percent of the particles, by weight, having a maximum dimension less than 0.002 millimeters. . Clay soil shall not contain granite blocks, broken concrete, masonry rubble, sound rock, or other similar materials. Snow, ice, and frozen soil shall not be permitted. The clay soil shall have a maximum laboratory-tested hydraulic conductivity of 1×10^{-5} cm/sec. Clay shall be procured from a commercial soil borrow site.

PART 3 – EXECUTION

3.01 GENERAL

A. Prior to earthwork activities, the Site shall be prepared in accordance with Section 02110 – SITE CLEARING.

B. Wet, soft, frozen or otherwise unsuitable subgrade, shall be allowed to dry, prior to any grading or backfilling activities, and as approved by the ENGINEER. If a firm subgrade foundation is not achieved, the subbase soils shall be excavated and backfilled with common fill soils so that fill materials will ultimately be placed on a firm foundation.

C. All excavations shall be cut accurately within the lines and limits shown on the Drawings or otherwise as directed by the ENGINEER or OWNER'S AGENT. All roots, stumps, rock and foreign matter in the sides and bottom of excavations shall be removed. Excavations and filling shall conform to the slope, grade, and shape of the section shown. Care shall be taken not to excavate below the grades indicated, unless otherwise approved by the ENGINEER. Excessive excavation shall be backfilled to grade with suitable fill material as directed by the ENGINEER with no additional cost to the OWNER. Any required shoring activities shall be conducted in accordance with local, state and federal codes, and as approved by the ENGINEER. All trenches ditches, and structures excavated under this Section shall be maintained until final acceptance of the Work.

D. Neighboring on-site and off-site structures, utilities, roadways, sidewalks, the Willamette River, and other facilities shall be protected from damage caused by settlement, lateral movement, undermining, wash-out and other hazards created by the earthwork operations or delivery of fill materials.

The CONTRACTOR shall be responsible for retaining engineering services required to perform the scope of work established in the Contract Documents, including, but not limited to, design and/or verification of groundwater barrier wall alternatives; engineered shoring, bracing, and

support; or, other such matters that require engineering expertise. Associated drawings and calculations shall be prepared and sealed by an Oregon Professional Engineer retained by the CONTRACTOR (herein referred to as CONTRACTOR's Engineer).

E. Pumping and Drainage

1. At all times during construction, and up to the point of actual turnover to OWNER, the CONTRACTOR shall provide and maintain proper equipment and facilities to prevent all surface-water from entering excavations, and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fill soils to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels. Where required, design of an appropriate dewatering system will be the responsibility of the CONTRACTOR, submitted to the ENGINEER for review prior to commencing Work.

2. Dewatering shall be conducted in such a manner as to remove all water associated with the naturally occurring groundwater table and surface water runoff that has entered the depressed areas to the extent necessary to conduct the Work.

3. Water entering the limits of the work area from surface runoff shall be re-directed, via berms or ditches, around the perimeter of the excavation, and discharged to stable ground such that no erosion occurs at the point of discharge.

4. Groundwater, or surface water that enters an excavation, shall not be discharged, or permitted to flow, off-site. These fluids that are collected during dewatering operations shall be contained. If the fluids are not re-used in the GWBW trench, they shall be tested and disposed in accordance with these Specifications, or as approved by the ENGINEER.

5. Removal of dewatering equipment shall be accomplished after the system is no longer required; the material and equipment constituting the system shall be removed by the CONTRACTOR.

6. All precautions necessary to preclude the accidental discharge of fuel, oil, etc., shall be taken in order to prevent adverse effects on surface water or groundwater quality.

7. Prior to backfilling stockpiled or off-site common borrow, the areas to be backfilled shall be fully excavated as required and

rough graded in accordance with the Contract Documents. Wherever directed by the ENGINEER, any soft boggy, organic, or otherwise unsuitable material shall be excavated so that backfill material will be placed on a firm foundation. The use of explosives shall not be permitted in the performance of site excavation.

8. The CONTRACTOR shall be responsible for maintaining a dry excavation at all times and shall be responsible for providing the necessary equipment to maintain dry excavations. The CONTRACTOR is advised that any water removed from excavations shall be managed as contaminated water, unless otherwise approved by the ENGINEER.

9. Groundwater, or surface water that enters an excavation, shall not be discharged, or permitted to flow, off-site. These fluids that are collected during dewatering operations shall be contained. If the fluids are not re-used in the GWBW trench, they shall be disposed off-site in accordance with Section 2250 Transportation and Disposal of Materials.

F. If the moisture content of any fill material is outside the accepted range to be returned to the excavation, the soil shall be wetted or dried, as appropriate.

1. Fill material that is too wet to permit compaction shall be removed and stockpiled, or spread and allowed to dry. Drying may be assessed by disking, harrowing, or pulverizing until moisture content is reduced to a satisfactory level.

2. Fill material that is too dry shall be wetted uniformly so as to prevent free water appearing on the surface during or subsequent to compaction operations.

G. Any delays in progress due to the necessary wetting or drying of soil are the responsibility of the CONTRACTOR.

H. Soils placed in fill areas shall be graded to smooth true lines, strictly conforming to grades indicated on the Drawings, or otherwise approved by the ENGINEER.

I. The CONTRACTOR shall subcontract a Professional Land Surveyor registered in the State of Oregon to certify that all soil material has been placed to the lines, grades, and elevations presented on the Drawings. The CONTRACTOR may use in-house personnel for the certifications,

provided the certification is performed by a surveyor registered in the State of Oregon.

J. Fill materials shall be placed in such a manner as to facilitate drainage at all times. Ponding of surface-water runoff shall not be permitted.

K. If compaction or other tests indicate that any portion of the Work does not meet the specified requirements, then the CONTRACTOR shall remove that section, replace and re-compact at no additional cost to the OWNER. Determinations of the extent of removal and the acceptability of the in-place fill materials shall be made by the ENGINEER.

L. If significant precipitation causes wet conditions, placement and compaction activities shall be terminated until the conditions have dried sufficiently to continue according to the ENGINEER.

M. Equipment or vehicles shall not be allowed to travel in a single track or form ruts. Any ruts or irregularities formed shall be scarified and re-compacted by the CONTRACTOR at its expense as required and directed by the ENGINEER.

N. Prior to backfilling fill materials, the areas shall be prepared in accordance with the Specifications. The existing soils shall be proof-rolled to achieve a compact, uniform grade, and the surface shall be free of stones, roots, or other debris.

O. Inspection

1. Prior to implementing any of the Work in this Section, the CONTRACTOR shall carefully inspect the installed Work of all other Sections and verify that all Work is complete to the point where the Work of this Section may properly commence without adverse impact.

2. If the CONTRACTOR has any concerns regarding the installed Work of other Sections, CONTRACTOR shall notify the ENGINEER in writing. Failure to notify the ENGINEER prior to conducting Work within this or other Sections will be construed as CONTRACTOR' s acceptance of the related Work of all other applied Sections.

P. The CONTRACTOR shall protect on-going and completed work from precipitation, excessive heat, freezing, and other elements to avoid compromising the integrity of prior Work. Prior Work affected by such conditions shall be repaired by the CONTRACTOR at no additional cost to the OWNER.

Q. The CONTRACTOR shall provide erosion-control measures to prevent erosion or displacement of soils, or other Work materials, and discharge of sediment-laden runoff or airborne dust to adjacent properties or water bodies.

3.02 TRENCH SPOILS DEWATERING AND CONDITIONING

A. Conditioning of excess spoils generated during groundwater barrier wall installation shall be performed, as necessary, to meet the moisture requirements for off-site disposal of non-liquid waste; i.e., pass the Paint Filter Liquids Test, and/or shall result in a material which meets the acceptance criteria required by the designated disposal facility for the excess spoil. Conditioning may include air drying, blending with clean soils, blending with reagents; e.g. lime or cement kiln dust (CKD), or other conditioning methods approved by the ENGINEER. The CONTRACTOR shall submit the methods for conditioning to the ENGINEER for review prior to commencement of Work. All conditioning shall be performed in the area of the spoils to be conditioned or on a designated area lined with a minimum 40-mil HDPE or 30-mil PVC geomembrane. No conditioning shall be performed in an area where impacted spoils could intermingle with clean or other materials.

B. The CONTRACTOR shall condition the excavated materials, as necessary, using the methods described in Part 3.02 A, to enable proper management; i.e., handling, hauling, and disposal of the materials and to ensure that the materials to be disposed are solids rather than liquids. The CONTRACTOR shall perform a Paint Filter Liquids Test in accordance with the USEPA's test method, Method 9095A. In accordance with this method, if any portion of the test materials collects in the cylinder during the 5-minute test period, the material is deemed to contain free liquids, and therefore, the CONTRACTOR shall further condition the materials and re-test.

C. The CONTRACTOR shall include in the Work Plan, as required in Part 1.05 A, the procedure for conditioning of the waste materials for review and approval by the ENGINEER. Acceptable methods for conditioning include, but are not limited to, air drying, mixing with soil, mixing with lime, and mixing with other agents, as approved by the ENGINEER or OWNER'S AGENT.

3.03 EXCAVATION

A. Excavation for the GWBW and cap shall be in accordance with the Drawings and Specifications. Excavation shall be made to the depths

shown on the Drawings. Care shall be exercised when removing soil as to prevent over-excavation.

B. All excavation activities shall be conducted in compliance with all applicable OSHA regulations. All excavations shall be conducted in a safe and stable manner. The slopes of the excavation shall be stable at all times. The CONTRACTOR is responsible for the design and installation of temporary shoring, if required.

C. If unsuitable subgrade materials are uncovered during excavation or otherwise, it shall be removed, stockpiled for conditioning and off-site disposal as required and approved by the ENGINEER.

D. Unsuitable subgrade materials shall be removed and managed as directed in Paragraph 3.06 of this Section.

E. Excavation of materials shall be accomplished using properly sized hydraulic excavators or equivalent. The equipment will operate so as to eliminate the potential for spreading contamination onto uncontaminated areas or surfaces.

F. Obstructive debris encountered, if any, during groundwater barrier wall construction shall be segregated and stockpiled for subsequent off-site disposal. Obstructive debris includes those materials that, in the opinion of the ENGINEER, may impact or obstruct the construction of the groundwater barrier wall (e.g. objects with a dimension greater than the thickness of the groundwater barrier wall).

G. Impacted spoils encountered during groundwater barrier wall construction shall be segregated and stockpiled for off-site disposal. Impacted spoils include those materials that exhibit visual gross contamination, as determined by the ENGINEER. The CONTRACTOR shall stage impacted spoils on minimum 40-mil HDPE or 30-mil PVC geomembrane.

3.04 APPROVAL OF SUBGRADE

A. CONTRACTOR shall notify ENGINEER when excavations have reached required subgrade.

B. If ENGINEER determines that unsatisfactory soil materials are present, the CONTRACTOR shall continue excavation and replace with acceptable backfill material, as directed.

C. Where accessibility permits; i.e., all locations except on side slopes equivalent to three (3) horizontal to one (1) vertical or steeper, proof-roll subgrade, including all waste materials, with heavy loaded tandem to

identify soft pockets and areas of excess yielding, otherwise, compact subgrade by other methods approved by ENGINEER.

D. CONTRACTOR shall reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the ENGINEER.

3.05 BACKFILLING

A. Final grade shall be backfilled to the contours and elevations indicated on the Drawings, or as otherwise approved by the ENGINEER. Grading and placement of the various materials shall be in conformity with the tolerances specified in this Specification. In accordance with the permit obtained by the OWNER, this project has a no-net-fill requirement, such that filling should not be conducted above the existing grades and elevations.

B. Common Fill

1. Common fill material shall meet the requirements of Part 2.01 of this Section.

2. Common fill shall be placed in a maximum loose lift of approximately twelve (12) inches resulting in a maximum compacted lift of approximately nine (9) inches. Compaction shall be accomplished by designated compaction equipment with a minimum weight of 40,000 lbs. Compaction equipment weighing less than 40,000 lbs may be used if the CONTRACTOR can demonstrate that the equipment can achieve the required compaction results and the equipment is approved by the ENGINEER.

3. Common fill shall be compacted to 90 percent of maximum dry density obtainable, as determined by ASTM D-1557. The fill shall be compacted within a range of 1 percent below to 3 percent above the optimum moisture content, as determined by ASTM D-1557.

4. A maximum 5 percent of all field moisture content test results are permitted outside the specified range. The outliers are, however, not permitted to be concentrated in one lift or one area, and no moisture content shall be less than 2 percent or more than 4 percent of the optimum moisture content. The areal extent is at the discretion of the ENGINEER.

5. A maximum 5 percent of all field dry density test results are permitted outside the specified range. The outliers are, however,

not permitted to be concentrated in one lift or one area, and no dry density less than 87 percent as determined by ASTM D-1557 is permitted. The areal extent is at the discretion of the ENGINEER.

6. If the criteria set forth in (4) and (5) of this part have been exceeded, the CONTRACTOR shall remove the failing common fill and replace, compact and grade new, acceptable fill at no cost to the OWNER.

C. Clay

1. Clay material shall meet the requirements of Part 2.02 of this Section.

2. The maximum final compacted thickness of each lift of clay material shall be six (6) inches. Compaction shall be accomplished with a sheepsfoot roller or similar equipment approved by the ENGINEER. The final grade of all clay material shall be uniform.

3. Clay shall be compacted to 90 percent of maximum dry density obtainable, as determined by ASTM D-1557. The fill shall be compacted within a range of 1 percent below to 3 percent above the optimum moisture content, as determined by ASTM D-1557.

4. A maximum 5 percent of all field moisture content test results are permitted outside the specified range. The outliers are, however, not permitted to be concentrated in one lift or one area, and no moisture content shall be less than 2 percent or more than 4 percent of the optimum moisture content. The areal extent is at the discretion of the ENGINEER.

5. A maximum 5 percent of all field dry density test results are permitted outside the specified range. The outliers are, however, not permitted to be concentrated in one lift or one area, and no dry density less than 87 percent as determined by ASTM D-1557 is permitted. The areal extent is at the discretion of the ENGINEER.

6. If the criteria set forth in (4) and (5) of this part have been exceeded, the CONTRACTOR shall remove the failing clay and replace, compact and grade new, acceptable clay at no cost to the OWNER.

3.06 EXCESS MATERIALS

A. All general waste or debris shall be containerized on-site and periodically disposed off-site in accordance with these Specifications.

B. Suitable materials, as determined by tests discussed in these Specifications, shall be classified and stockpiled in approved areas for immediate or future use.

C. Stockpiles shall be graded to drain; no surface-water ponding is permitted on stockpiles. Stockpiles shall be covered with plastic sheeting or other material to preserve the soil integrity. Proper erosion controls; i.e., silt fence, shall be installed at the perimeter of the stockpile.

D. Stockpiles that are not used for more than 14 days shall be covered as discussed in Paragraph 3.06 C, or be temporarily vegetated in accordance with these Specifications. No fill or piles above the existing contours are permitted upon completion of the project.

E. Obstructive debris, excess or impacted spoils, and other unsuitable materials that are a result of construction activities shall be temporarily stockpiled on a minimum 40-mil HDPE or 30-mil geomembrane that is continuously seamed. The material shall also be covered to provide a protective envelope to prevent contact with any precipitation or surface water runoff. Obstructive debris and excess or impacted spoils shall be disposed off-site in accordance with Section 02250 Transportation and Disposal of Materials.

3.07 GRADING

A. Uneven areas and low spots which may develop in the backfilling operations shall be eliminated via minor excavations or placement of appropriate fill materials. Levels, profiles and contours of the final site configuration shall be maintained as established on the Drawings.

B. The areas to be backfilled shall be uniformly graded to within the limits of grading under this Section. A smooth finished surface shall result within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades to the satisfaction of the ENGINEER.

C. Constructed slopes shall be blended into existing undisturbed areas gradually in order to provide neat, clean transition zones. Feathering of constructed slopes into existing grades shall be accomplished to promote natural drainage and to eliminate possible surface-water ponding.

D. The right is reserved by the ENGINEER to make minor adjustments or revisions in lines or grades if found necessary as the Work progresses, due to discrepancies on the Drawings or in order to obtain satisfactory

construction. Any suspected discrepancies shall be reported to the ENGINEER as soon as detected.

3.08 CRITERIA AND TOLERANCES

A. Compaction and moisture criteria and tolerances are discussed in Part 3.05 of this Section.

B. Final soil grades shall be within two tenths of one (0.2) foot below to five tenths of one (0.5) foot above (-0.2 to +0.5) the grades and contours indicated on Drawings, or as indicated by changed field conditions, and approval by the ENGINEER. Regardless of the final grade tolerance, the thickness of each specified layer shall meet the minimum thickness.

C. In recognition of the moisture-density relationship of soils, the ENGINEER may direct that the compaction and moisture content tolerances be modified if required by variabilities in the soils. This decision, if required, will be based on the ENGINEER'S interpretation of the laboratory analysis for each soil.

D. No additional payment shall be made for quantities of soils placed in excess of that amount required to achieve the minimum specified thickness.

3.09 FIELD QUALITY CONTROL

A. The CONTRACTOR shall test the in-place density and moisture content of the common fill soils by nuclear methods in accordance with ASTM D-6938 and these Specifications. The testing shall be conducted at a frequency not less than three tests per lift per area of interest. Every 25th nuclear density test shall be verified in accordance with ASTM D-1556 and ASTM D-2216. All test locations shall be recorded and provided on the "As-Built" Drawings.

B. The CONTRACTOR shall test the in-place density and moisture content of the clay plug material by nuclear methods in accordance with ASTM D-6938 and these Specifications. Tests must be conducted every 50 lineal feet on each lift. The density and moisture content results shall be verified in accordance with ASTM D-1556 and ASTM D-2216, respectively. A minimum of three verification tests shall be conducted for each soil material type as determined by the ENGINEER. Failing tests shall be repeated. Continued test failure will require re-working of the material prior to re-testing and acceptance. All test locations shall be recorded and provided on the "As-Built" Drawings.

C. The CONTRACTOR shall provide field control; i.e., grade stakes, to determine layer thickness. The ENGINEER shall perform verifying thickness measurements in the field in accordance with quality assurance activities.

D. The CONTRACTOR shall provide a minimum of 24 hours notice to the ENGINEER when each compacted lift is ready for testing.

E. The CONTRACTOR shall provide access and repair any damage to subgrade caused by correctly performed tests, and cooperate in other ways necessary to permit the ENGINEER to conduct testing when and where he/she desires and as expeditiously as possible.

F. Fill material shall not be placed over a lift which has not been tested and accepted by the ENGINEER.

G. All placement operations shall comply with all requirements of these Specifications.

END OF SECTION

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PART 1 - GENERAL

1.01 DESCRIPTION

Work covered by this Section consists of furnishing all labor, materials, tools, equipment and incidentals necessary for obtaining and placing the granular components as indicated on the Drawings and specified herein.

1.02 DEFINITIONS

"Dense-Graded Aggregate (DGA)" includes all aggregate utilized for construction of the Stone surface above the clay cap of the GWBW and stabilization of all disturbed areas located within the Greenway Buffer Zone.

Gravel: Includes aggregate used for preparing the stone surface for other areas at the Site including the base for the decontamination pad and the stabilized construction entrance.

1.03 REFERENCES

A. AASHTO T 27 Sieve Analysis of Fine and Coarse Aggregates

B. ASTM C-136 Standard Method for Particle-Size Analysis of Aggregates

C. 2005 Oregon Department of Environmental Quality Erosion and Sediment Control Manual

D. 2008 Oregon Standard Specifications for Construction, Volume 2

1.04 QUALITY ASSURANCE

All materials, procedures, operations, and methods shall be in strict conformance with the Drawings and these Specifications, and shall be subject to strict quality control monitoring as detailed herein and in the Construction Quality Assurance/Quality Control (CQA/QC) Plan. The placed granular materials shall conform exactly to the Drawings and these Specifications, except as otherwise authorized in writing by the ENGINEER.

1.05 SUBMITTALS

A. The CONTRACTOR shall submit the location of all borrow pits to the ENGINEER or OWNER'S AGENT no less than two weeks prior to the anticipated placement of any granular materials.

B. The CONTRACTOR shall submit a 50-pound sample from each of the suppliers proposed to furnish the required quantity of granular materials.

The samples shall be submitted to the ENGINEER or OWNER'S AGENT no less than two weeks prior to the anticipated placement of any granular materials.

C. Dense-Graded Aggregate and Gravel

1. The CONTRACTOR shall submit the results of the particle-size analysis for dense-graded aggregate and gravel conducted in accordance with AASHTO T 27 and ASTM C-136, respectively for every 1,000 cubic yards of materials imported to the Site.

2. The test results shall verify that the material meets the technical requirements of these Specifications. The test results shall be submitted to the ENGINEER no less than one week prior to the anticipated placement of granular materials.

1.06 DELIVERY

The CONTRACTOR shall notify the ENGINEER one (1) week in advance of delivery of all granular materials. The CONTRACTOR shall stockpile granular materials only at a location approved by the OWNER and/or ENGINEER.

PART 2- MATERIALS

2.01 GRANULAR MATERIALS

A. Dense-Graded Aggregate

1. Aggregate shall consist of hard, strong, durable particles that are free of any materials, roots, trees, stumps, concrete, construction debris, other organic matter, and deleterious materials. Aggregate shall be procured from a commercial borrow site.

2. The aggregate shall meet the gradation requirements set forth by the Oregon Standard Specifications for Construction for ¾-inch dense-graded aggregate as given below and as determined by AASHTO T 27.

Dense Graded Aggregate ¾ inch to 0

Sieve Size	Percent Passing (by weight)
1"	100
¾"	90-100
½"	-

3/8”	55-75
¼”	40-60
No. 10	*

* Of the fraction passing the ¼-inch sieve, 40% to 60% shall pass the No. 10 sieve

B. Gravel

1. Gravel shall consist of hard, strong, durable, particles that are free of any materials, roots, trees, stumps, concrete, construction debris, other organic matter, and deleterious materials.

2. The gravel shall meet the gradation requirements set forth in the Drawings as determined by ASTM C-136.

PART 3 - EXECUTION

3.01 INSPECTION

A. The CONTRACTOR shall verify that finished grades, slopes, and elevations are level with the existing grades and conform to the specified requirements. Mis-graded Work shall be corrected at no additional cost to the OWNER. CONTRACTOR shall notify the ENGINEER immediately if a specified grade, slope or elevation appears inconsistent with the others specified.

B. At the beginning of each day’s Work, the ENGINEER will inspect the previously placed granular materials and institute whatever corrective action, if any, that the ENGINEER deems appropriate, at no extra cost to the OWNER , unless the action requested is clearly beyond the scope of this Contract. This may include, but is not limited to the removal of unsuitable granular materials.

3.02 PLACEMENT OF GRANULAR MATERIALS

Dense-graded aggregate shall be used for the construction of the stone surface above the clay cap of the GWBW and all stabilization of disturbed areas within the Greenway Buffer Zone as specified in the Drawings. Any roadways required to ensure access to all areas of the Work shall be constructed as deemed necessary by the CONTRACTOR.

A. Granular materials shall be placed, not dumped, to the limits and grades indicated on the Drawings.

C. Material shall be spread and graded in one lift to the thickness indicated on the Drawings and compacted with a steel roller.

3.03 CRITERIA AND TOLERANCES

A. Final grades shall be within two tenths of one (0.2) foot below to five tenths of one (0.5) foot above (-0.2 to +0.5) the grades and contours indicated on the Drawings, or as dictated by changed field conditions, and approval by the ENGINEER. Regardless of the final grade tolerances, the thickness of the granular materials shall at minimum meet the thickness as stated in each application.

B. No additional payment will be made for quantities of granular materials placed in excess of that amount required to achieve the minimum specified thickness.

3.04 FIELD QUALITY CONTROL

A. The ENGINEER will perform thickness measurements in the field to determine compliance with these Specifications.

B. CONTRACTOR shall comply with all quality assurance requirements specified herein.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work covered by this Section consists of furnishing all labor, materials, tools, equipment, transportation, and incidentals as well as laboratory and professional technical services necessary for constructing the soil-reagent groundwater barrier wall (GWBW) that meets or exceeds the requirements specified herein and presented on the Drawings.

B. The Work also includes determination of the appropriate reagent(s), mix design and implementation methodology, including testing and analysis, engineering, and other evaluations pertaining thereto for the construction of the GWBW in accordance with the requirements specified within these specification and Drawings.

C. Prior to commencement of the GWBW construction, the CONTRACTOR is provided the opportunity to conduct a confirmation phase to verify that the CONTRACTOR's mix design will meet the performance criteria specified herein. The confirmation phase may include laboratory studies, pilot test, or other similar methods to verify that the proposed reagents and mix design will meet the project specification. Note that a Treatability Study was performed (Attachment E) to evaluate a few reagents and mix ratios. The Treatability Study Report is provided herein for reference purposes only. It is the sole responsibility of the CONTRACTOR to select the appropriate mix design, independently verify the mix design, and construct a GWBW that will meet or exceed the project specification.

1.02 REFERENCES

A. ASTM C143: Standard Test Method for Slump of Hydraulic Cement Concrete

B. ASTM C150: Standard Specifications for Portland Cement

C. ASTM D421: Standard Practice for Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants

D. ASTM D422: Standard Test Method for Particle-Size Analysis of Soils

E. ASTM D698: Test Method for Laboratory Compaction Characteristics of Soil Using Standard Proctor Effort

F. ASTM D1556 : Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

G. ASTM D1633 : Standard Test Method for Compressive Strength of Molded Soil-Cement Cylinders

H. ASTM D2216 : Standard Test Method for Laboratory Determination of Moisture Content of Soil and Rock

I. ASTM D4016: Standard Test Method for Viscosity of Chemical Grouts by Brookfield Viscometer

J. ASTM D4318 : Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils

K. ASTM D4380 : Standard Test Method for Density of Bentonite Slurries

L. ASTM D5084 : Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

M. ASTM D6938 : Standard Test Method for In-Place Density and Water Content of Soil and Soil Aggregate by Nuclear Methods (Shallow Depth)

N ASTM D7100: Standard Test Method for Hydraulic Conductivity Compatibility Testing of Soils with Aqueous Solutions

O. EPA 160.1: Test Method for Total Dissolved Solids

P. EPA 200.7: Test Method for Dissolved Metals

Q. EPA 215.1: Test Method for Calcium Concentration

R. EPA 242.1: Test Method for Magnesium Concentration

S. EPA 273.1: Test Method for Sodium Concentration

T. EPA 418.1: Test Method for Total Recoverable Hydrocarbons

U. EPA 8240: Test Method for VOC's

V. EPA 9040: Test Method for pH

W. EPA 9090: Test Method for Chemical Compatibility

X. SW-846 9045A: pH Test for Slurry

Y. USP NF X VII: Free Swell Test

Z. API Specification 13A: Drilling Fluid Materials

AA. API RP 13B-1: Recommended Practice for Field Testing Water-Based Drilling Fluids

1.03 DEFINITIONS

The terms used in this Section are defined as follows:

A. The "Groundwater Barrier Wall" is a low permeability hydraulic barrier installed through the existing ground or prepared working surface using one of several methods, including the slurry method of excavation, continuous trenching soil mixing, or jet grouting.

B. The "Slurry Method of Excavation" consists of excavating a vertical walled trench (soil-bentonite slurry trench) and at the same time keeping the trench filled with a bentonite slurry mixture. The purpose of the slurry is to support the walls of the trench and prevent movement of groundwater. The "soil-reagent slurry wall" methodology uses this approach.

C. "Soil Mixing" consists of constructing overlapping wall panels by inserting and withdrawing a single or multi-shaft mixing apparatus at consecutive locations.

D. "Jet Grouting" consists of constructing overlapping wall panes by injecting low permeability grout at consecutive locations.

E. "Continuous Trenching" consists of simultaneous excavating/trenching and in-situ mixing of reagent(s) with subsurface materials in a continuous manner to construct the Groundwater Barrier Wall.

F. "Bentonite" is ultrafine natural clay whose principal mineral constituent is sodium cation montmorillonite.

G. "Bentonite Slurry" is a colloidal mixture of bentonite and water.

H. "Soil-Reagent Backfill" is a homogeneous mixture of material produced by mixing soil with bentonite slurry and additional reagent (such as dry bentonite), as necessary, which is placed into the excavated slurry trench to complete the soil-reagent slurry wall.

I. The "Working Surface" is the top of the stripped and/or prepared natural ground from which the groundwater barrier wall shall be constructed.

1.04 WORK BY CONTRACTOR

A. A groundwater barrier wall (GWBW) shall be constructed along the alignment specified on the Construction Drawings to form a continuous hydraulic barrier along the riverbank, as specified on the Construction Drawings. The GWBW shall be constructed with a soil-bentonite, or other approved reagent mix, utilizing an appropriate construction methodology to meet, or exceed, the specified requirements herein. Construction methods may include slurry wall, jet grouting, soil mixing, continuous trenching, or other appropriate technique to achieve the minimum GWBW dimensions and a maximum in-place coefficient of permeability for the completed wall of 1×10^{-6} cm/sec. The GWBW shall have the depth and minimum width specified in Part 3.04 of this Section.

B. The CONTRACTOR shall furnish the necessary plant, labor, materials, tools, equipment, services, utilities, and the water required to construct the GWBW in accordance with these Specifications.

C. The CONTRACTOR shall furnish and install all supplementary or miscellaneous items, appurtenances, and devices (including, but not limited to, chisel, bore, excavate, or key-in the wall) that are not specifically indicated but which are necessary to complete the installation of the GWBW. The CONTRACTOR shall take all necessary steps to install the GWBW with a maximum, in-place permeability of the completed wall of 1×10^{-6} cm/sec. Specific concerns or omissions are the responsibility of the CONTRACTOR to identify during the bidding process and acknowledge with the bids.

D. The CONTRACTOR shall be responsible for controlling all storm-water runoff and providing run-on controls during the GWBW construction. Surface-water management features may include temporary berms, swales, or other features necessary to manage surface water and divert surface run-on away from the area of construction. All controls shall be pre-approved by the ENGINEER, and no control measures shall create erosive conditions. The CONTRACTOR shall comply with all storm-water requirements presented in the Drawings and approved in the ODEQ 1200-C Permit. This work includes, but shall not be limited to, all trenching, excavations, drilling, mixing, and product storage.

E. The CONTRACTOR shall verify and protect all buried and above-ground utilities during construction of the GWBW. The contractor shall employ the

services of a private utility locator to locate utilities prior to commencement of Work. In the event that a utility line is damaged during construction, the CONTRACTOR shall immediately notify the ENGINEER or OWNER'S AGENT and owner of the affected utility so that damaged items can be repaired at the CONTRACTOR's expense.

F. The CONTRACTOR shall remove any objectionable material such as debris, rock, and other obstructions, if encountered from the area of the GWBW operations, on an as-needed basis. This includes unforeseen buried debris encountered along the alignment of the GWBW. Disposal of an unforeseen material shall be the responsibility of the CONTRACTOR. The CONTRACTOR is responsible for handling materials and placing it in the appropriate containers to be provided by the CONTRACTOR on the Site. The CONTRACTOR is responsible for disposal of debris generated by the CONTRACTOR in order to perform the work, and shall dispose of the materials appropriately.

G. Water required for construction of the GWBW can be obtained at the site from a nearby fire hydrant as indicated on the Drawings. The CONTRACTOR shall be responsible for getting approval from the City or appropriate Owner of the water supply as well as for connection, distribution, and conveyance of water to the Work Area. The CONTRACTOR is responsible for conveying and/or transporting the water to the necessary GWBW construction area as well as providing the means for filling any water-carrying vehicles. Select chemical analyses on the Site's service water supply collected from the tap are presented in the Treatability Study Report for reference purposes only. The CONTRACTOR is responsible for assuring chemical compatibility of the water supply with the GWBW and construction activities.

H. The CONTRACTOR shall take precautions to assure that all groundwater extracted from the trench and used for construction activities, including run-off, is prohibited from leaving the Site. Run-off of the groundwater from the Site shall not be permitted.

I. The CONTRACTOR is solely responsible for the security of the CONTRACTOR's equipment, materials, and the constructed products at the Site at all times throughout the construction period.

1.05 QUALITY CONTROL AND ASSURANCE

A. All materials, procedures, operations, quality control and methods of construction are the responsibility of the CONTRACTOR, and shall be in strict conformance with the Drawings and Specifications. The Work shall

be subjected to strict quality assurance (QA) and quality control (QC) monitoring by the OWNER or ENGINEER and the CONTRACTOR, respectively, as provided in Section 01400 – QUALITY CONTROL of the Specifications and in the Construction Quality Assurance/Quality Control (CQA/QC) Plan. The installed GWBW shall conform to the Drawings and Specifications, except where changes are authorized in writing by the ENGINEER or OWNER.

B. ENGINEER Responsibilities:

1. Review product data and samples.

2. On delivery, inspect products jointly with CONTRACTOR.

3. Conduct QA testing, as deemed necessary. The QA testing shall in no way relieve the CONTRACTOR of the responsibility of performing tests necessary to meet the QC requirements.

C. CONTRACTOR's Responsibilities:

1. Arrange for and deliver information for "Record Drawings", product data, samples, and all testing results and certifications to the OWNER OR ENGINEER in a timely manner. All QC samples and testing shall be referenced to the GWBW alignment station and depth at which the sample was obtained or test was conducted.

2. Receive and unload products at site; inspect for completeness or damage, jointly with the ENGINER and repair or replace items damaged after receipt.

3. Document construction methods and demonstrate that material mixes are acceptable and that the proposed technology shall meet the minimum hydraulic isolation wall specifications.

4. Conduct QC testing in accordance with Section 01400, the CQA/QC Plan, and Part 4.0 of this Section as necessary to control the hydraulic isolation wall installation quality.

5. The CONTRACTOR shall notify the ENGINEER whenever the trench excavation or GWBW installation is near the design depth to allow for inspections. The ENGINEER shall observe any cuttings from the bottom of the GWBW for continuity.

6. The CONTRACTOR shall cooperate with the OWNER or ENGINEER during any inspections or QA testing. The

CONTRACTOR shall provide, at no additional cost, labor and materials to 1) measure the lines and grades associated with the Work and 2) collect samples for QA testing.

7. The CONTRACTOR shall submit to the ENGINEER on a regular schedule (as noted) the following items:

   a. Soundings and As-built Profile (daily): a record of the soundings taken during construction, including depth of trench/GWBW, backfill slope (for slurry wall construction), and other construction-related information obtained at the beginning and end of each day. The CONTRACTOR shall use the soundings to generate the as-built profile.

   b. Reagent Slurry Mix (daily): quantities, proportions, properties and admixtures shall be submitted. The report shall include the mix from the plant and the mix in the trench.

   c. Construction Methodologies and Techniques: Any modifications to the approach presented in the Work Plan shall be submitted to the ENGINEER.

1.06 CONTRACTOR QUALIFICATIONS

The CONTRACTOR shall maintain full-time supervisory personnel, competent in the hydraulic isolation wall technology, on-site during construction to control the Work. The site superintendent and key personnel (including the any equipment operator who is directly involved with the excavation, backfilling, soil mixing, trenching, or installation of the GWBW) shall have not less than five (5) years experience in the technology, shall have participated in the construction of not less than five (5) projects of similar scope and magnitude, including two (2) with a similar or greater depth, and shall have successfully installed a minimum area of 500,000 square feet. Qualifications for these individuals shall be provided at the time of bidding (see Part 1.09 for submittal requirements), and shall be subject to the approval of the OWNER or ENGINEER.

1.07 HEALTH AND SAFETY

A. The CONTRACTOR shall develop and implement the CONTRACTOR's site-specific Health and Safety Plan (HASP) for all GWBW activities to protect on-site personnel. Hazardous waste materials may be disturbed during the Work and contact with waste, waste liquids, and/or waste gases is expected.

B. The CONTRACTOR shall provide adequate health and safety personal protective equipment (PPE) for employees, the OWNER or ENGINEER, representatives of the ODEQ or other regulatory agencies, and others who might be affected by the on-site activities.

C. Work procedures shall conform with all applicable EPA, OSHA, ODEQ, State of Oregon, local government, and other federal and state and county regulations (latest editions).

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All materials shall be delivered in undamaged, unopened containers bearing the manufacturer's original label and shall be handled to prevent contamination, segregation, or damage.

B. The storage location of all materials shall not interfere with construction activities and shall be approved by the OWNER or ENGINEER..

C. Bentonite, hydrophilic sealing material and similar materials shall be stored in weather-tight enclosures to protect against dampness and contamination.

1.09 SUBMITTALS

A. The CONTRACTOR shall submit qualifications of key project personnel, including superintendent and primary equipment operator(s), with their bid. The following information shall be submitted to the ENGINEER for the superintendent, primary equipment operator(s), and other key personnel:

1. Name, address, and telephone number of customer and point of contact for projects forming the experience record;

2. Contract number, contract amount, date of award, and date of completion of the projects forming the experience;

3. GWBW length and depth; and,

4. Description of the method of construction and equipment used.

B. The CONTRACTOR shall submit qualifications, company name, and key contact of the CONTRACTOR's QC Laboratory with their bid. The laboratory shall have previous experience with slurry wall materials, experienced laboratory technicians, and modern permeability testing equipment.

C. The CONTRACTOR shall submit a detailed work plan to the ENGINEER and OWNER for review prior to commencement of work. The work plan shall describe- the proposed GWBW construction methodology, procedures, equipment, and schedules. The work plan shall include, but not be limited to:

1. Construction, maintenance, and removal of working platforms, mixing pads and ponds, and haul roads;

2. Equipment set-up and site use layout, including storage areas, haul roads, mixing pads and ponds, and work platform locations and dimensions;

3. Equipment specifications, including maximum depth capability of excavator, number and type of backfill mixing equipment, and specifications of slurry mixing equipment;

4. Common and chemical names of the proposed reagents, sources and availability of the reagents within the scheduled time period, and suppliers' information.

5. Proposed mix design, including mix ratios for the construction of the GWBW.

6. Proposed method for the confirmation phase (such as laboratory studies, pilot demonstration or similar other methods) to verify that the proposed reagents and mix design will meet the project specification.

7. Method of constructing GWBW such as slurry method of excavation, soil mixing, continuous trenching, or jet grouting.

8. Approach to minimize spoil production; approach to manage soil, spoil and excess slurry; estimated quantity of excess spoils to be managed by the CONTRACTOR upon completion of the GWBW.

9. Procedure for water-bentonite slurry mixing, transportation, and re-circulation;

10. Procedure for trench excavation and backfilling;

11. Material properties, sources, and (manufacturer's) certificates of quality;

12. Control of drainage, spills, wastes, etc.; and,

13. Clean-up, spoils disposal, and slurry disposal.

D. Quality Control Plan

The CONTRACTOR shall submit a quality control plan with details of the personnel, responsibilities, inspections, and organization for ensuring the quality of construction required by these Specifications. The plan shall provide a table listing testing methods, frequencies, and minimum acceptable values. The plan shall explain the methods and locations for obtaining samples for testing and reporting schedules. Copies of quality control forms shall be submitted for review and approval.

E. Results of any pre-construction testing performed by the CONTRACTOR in the confirmation phase, such as Laboratory or pilot test to verify that the proposed reagents and mix design will meet the project specification shall be submitted to the ENGINEER and OWNER.

F. The results of all QC testing required by these Specifications shall be furnished to the ENGINEER. The CONTRACTOR shall furnish records of all observations, measurements, and tests performed, identified with the location, date, and time of testing. These records shall be furnished no later than 24 hours after the observation, measurement, or test is performed.

G. A record of the soundings taken during construction, including the depth of the GWBW and backfill slope (if applicable), shall be submitted to the ENGINEER by noon of the day following the date of the measurement.

H. The CONTRACTOR shall submit a 50-pound sample from each of the off-site borrow sources proposed to furnish the required quantity of fill materials. The samples shall be submitted to the ENGINEER no less than two (2) weeks prior to the anticipated placement of any soil materials.

1.10 SUBSURFACE CONDITIONS

A. Subsurface investigations have been conducted during prior work activities. Boring location maps and corresponding boring logs are provided in Attachment A. Neither the OWNER, nor ENGINEER assumes responsibility for interpretation or deductions made from the borings or logs. Local variations may exist in the subsurface materials between boring locations. Soils classifications presented on the logs are the result of field observations. Geotechnical tests were conducted on selected boring locations and are presented in Attachment B.

B. Test results of select chemical analysis on groundwater and existing subsurface materials (native soils) are provided in Attachment C.

C. Groundwater contour maps for the hydro-geologic units that will be encountered during GWBW installation are presented in Attachment D as well as in the investigation reports presented in Attachment F and G.

1.11 MIX DESIGN TESTING

A. Treatability Study testing was performed using site soils, water, and selected reagents. The report is presented as Attachment F. The report and associated results are presented for informational purposes only and shall not be construed as a recommendation of the appropriate mix design. The CONTRACTOR is responsible for providing a GWBW mix design that meets the performance-based design requirements of this Section.

B. The CONTRACTOR is provided the opportunity to conduct a confirmation phase, as noted herein and identified as a bid item on the bid form, to verify that their mix design meets the criteria herein. It is the CONTRACTOR's responsibility to ensure that the final mix meets the performance requirements defined herein.

PART 2 – PRODUCTS

2.01 MIX REAGENT

A. The GWBW shall be constructed using a reagent mix that demonstrates compliance with the requirements specified herein. Typical reagents include bentonite and/or other alternative reagents.

B. Alternative reagents may be proposed by the CONTRACTOR but are subject to approval by the ENGINEER or OWNER. CONTRACTOR is responsible for demonstrating performance to the satisfaction of the ENGINEER, or OWNER.

2.02 BENTONITE

A. Bentonite shall be a premium grade, high-swelling, sodium-cation montmorillonite bentonite that meets or exceeds the standards of the American Petroleum Institute (API) as contained in API 13A, Section 9 specifications and Table 02242-1. Bentonite that does not meet the specifications shall be promptly removed from the Site at no additional cost to the OWNER or ENGINEER.

B. Bentonite shall be protected from moisture during transportation and storage.

C. The material shall have been manufactured to function in the presence of water soluble contaminants without losing its filtrate control properties.

2.03 WATER

A. Water supply for the CONTRACTOR's use to manufacture all slurries and/or grout can be obtained from a nearby fire hydrant located at the Site (Site's Water). CONTRACTOR shall be responsible for all water connections and transport to the Work site.

B. It shall be the responsibility of the CONTRACTOR to assure that the resulting slurry and/or grout meet the standards and requirements of this Specification. The CONTRACTOR shall verify chemical analysis for pH, hardness, and total dissolved solids (TDS) of the Site's water. If the CONTRACTOR elects to use an alternative water source, it is the CONTRACTOR'S responsibility to obtain chemical analysis for pH, hardness, and TDS for both the Site's water and the alternative water supply to verify the chemical compatibility of the alternative water supply with the GWBW products. Site's water is expected to be substantially clean, fresh, and free from oil, acid, alkali, or other deleterious substances; the water shall comply with Table 02242-1. If the water supply is deemed inappropriate, an alternate source shall be investigated by the CONTRACTOR to verify chemical compatibility. The test results shall indicate that the bentonite, when mixed with the water, will yield the required parameters. It shall be the responsibility of the CONTRACTOR to add bentonite as necessary to meet the slurry viscosity and to have stable excavation.

2.04 SLURRY

A. Base Product: the slurry supporting the sides of the trench (Soil-Reagent Slurry Wall only) and/or for wetting the backfill material shall consist of a stable colloidal suspension of bentonite in water.

B. The bentonite utilized in the slurry shall conform to the requirements outlined in Part 2.02 of this Section.

C. The water utilized in the slurry shall conform to the requirements outlined in Part 2.03 of this Section.

D. Initial Slurry Mixture:

1. At the time of introducing slurry into the trench, the amount of bentonite (percent bentonite per weight of water) in the slurry mixture shall be in accordance with the slurry mix design that has been proposed by the CONTRACTOR to meet the project

specification and verified during the confirmation phase. The initial slurry mixture shall comply with the requirements specified in Table 02242-1 and shall be sufficient to maintain a stable excavation. It is the CONTRACTOR's responsibility to ensure an appropriate slurry mixture to maintain stable conditions and meet the requirements of the GWBW.

2. The CONTRACTOR shall add additional bentonite to make the slurry denser or more viscous than the limits specified herein, if deemed necessary by the ENGINEER, stability of the open trench, or to meet the criteria herein.

3. Admixtures to alter the characteristics of the slurry in the trenches, including but not limited to softening agents, dispersants, retarders or plugging/bridging agents, shall not be permitted, unless otherwise approved by the ENGINEER.

4. A record of mixed bentonite slurry quantities and proportions shall be maintained. Adjustments to the slurry mixture shall be noted.

5. The bentonite must be fully hydrated and the slurry must be homogeneous. Slurry with balls of partially wetted clay will be rejected by the ENGINEER.

E. Slurry Mixture in Trench - Soil-Reagent Slurry Wall Application:

1. The bentonite slurry in the trench shall comply with the requirements specified in Table 02242-1. A record of in-trench bentonite slurry properties shall be maintained. Adjustments to the slurry shall be recorded.

2. The bentonite must be fully hydrated and the slurry must be homogeneous. Slurry with balls of partially wetted clay will be rejected by the ENGINEER at the trench.

2.05. SOIL-REAGENT BACKFILL – Soil-Reagent Slurry Wall Application

A. The CONTRACTOR shall design the soil-reagent backfill mixture to achieve a maximum, in-place permeability of 1×10^{-6} cm/sec, as determined by the QC tests specified herein and ASTM D-5084.

B. The material for trench backfilling shall be composed of fresh slurry, trench slurry, reagents (including bentonite and/or approved alternatives), and trench spoils and/or selected soils obtained from a designated off-site borrow source. Trench spoils or borrow soil shall be friable and free from roots,

organic matter, refuse, rubble, debris, concrete, boulders, frozen materials, or other deleterious materials.

C. The soil-reagent mixture shall be thoroughly mixed and is recommended to have the following minimum percent passing gradation limits:

U.S. Standard Sieve	Percent Passing
3 inch	100
No. 200	20

These recommendations shall be evaluated by the CONTRACTOR for consistency with the criteria required to obtain the minimum coefficient of permeability specified in Paragraph 2.05 A of this Section. If the soil-reagent mixture does not meet the recommended gradation limits, the CONTRACTOR shall notify the ENGINEER immediately and make any necessary changes to the soil-reagent mix design, as approved by the ENGINEER, to ensure that the minimum coefficient of permeability is obtained.

D. Soil excavated from the trench (trench spoils) may be used as backfill provided it is mixed to be homogeneous and the soil-reagent mix meets the Specifications presented in Table 02242-1. If excavated soil does not meet the Specifications, borrow material from other sources shall be added to the excavated soils, thoroughly mixed with the excavated soils to a homogeneous mixture and used as backfill. Soil removed from the trench which may not be suitable for mixing and returning to the trench for any reason shall be disposed of as provided in Section 02250 – TRANSPORTATION AND DISPOSAL OF MATERIALS of the Specifications. Any contaminated items excavated for removal must be loaded into appropriate containers supplied by CONTRACTOR for recycling or disposal.

E. Borrow material to be used as part of the backfill shall come from an accepted source. The CONTRACTOR shall not change the borrow source for the duration of the Work without prior written acceptance from the ENGINEER.

F. The soil-reagent backfill may be mixed in-situ or ex-situ, permitted the performance criteria of the GWBW are met. Trench spoils removed from the trench may be mixed with the reagent(s) along side the trench on the landward side of the excavation. Alternatively, trench spoils may be transported to a central staging or mixing area. Precautions shall be taken to ensure that excess water and fluids from the excavated material, or any storm-water or fluid runoff from the mixing area, shall not discharge from

the site; rather, excess water, fluid, spoils, and slurry shall be managed accordingly to prevent the water, fluids, slurry or spoils from leaving the Site. No excess materials, processing or storage of materials shall occur on the outboard side (river side) of the trench. Collecting, pumping, or transporting fluids, spoils and slurry is the CONTRACTOR's responsibility. The trench spoils must be screened and/or mixed, if necessary, to meet the screen specifications outlined above.

G. The CONTRACTOR shall conduct quality control testing on the soil-reagent backfill, including particle size analysis, permeability, slump, and density. The soil-reagent backfill mixture shall comply with the requirements specified in Table 02242-1.

2.06 GENERAL

A. For determining compliance with the permeability specification, after 28 days of curing, no value of the in-situ backfill coefficient of permeability shall exceed 1×10^{-6} cm/sec for the length of the GWBW. The CONTRACTOR shall obtain one undisturbed sample of the soil-reagent backfill from the ground surface to mid-depth and from mid-depth to the bottom of the GWBW from two locations that are at least 200 feet apart. If QA tests by the ENGINEER or QC tests by the CONTRACTOR indicate that non-compliance exists, all work shall cease until the source of the problem is determined. The CONTRACTOR shall not be paid extra to replace any portions of the soil-reagent wall that do not meet these Specifications. Any in-place portions of the GWBW that do not meet these Specifications shall be replaced at no additional cost.

B. Admixtures: Admixtures shall not be used except as approved in writing by the ENGINEER and shall be submitted with the bid if anticipated before the start of work.

C. The CONTRACTOR shall increase the reagent content and mixing operations, as needed, and account for any variations in the in-situ soil properties to achieve the specified performance criteria.

PART 3 – EXECUTION

3.01 GENERAL

A. The CONTRACTOR is solely responsible for excavating in a safe and legal manner. Provide appropriate measures to retain excavation side

slopes, to prevent slope failures, and to ensure that persons at or near any excavation are protected. Use extreme care to maintain, isolate, and protect all wells, manholes, streets, utilities, and other facilities whether surface or subsurface.

B. Produce slurry by gradually adding dry reagent to clean water and thoroughly mixing in a high shear mixer until a complete dispersion of bentonite is achieved. The CONTRACTOR shall be responsible for determining the percentage of reagent in the slurry to meet the performance criteria specified herein.

C. The CONTRACTOR shall provide a full-time GWBW specialist to regularly test and control the mixing and placing of the slurry in order to maintain the specified properties of the slurry.

D. Keep construction surcharges including, but not limited to, excavated material, slurry mixing operations, and pumping equipment away from the GWBW or trench. Only equipment required for excavation and backfilling shall be allowed adjacent to the GWBW or trench.

E. Do not place any frozen material into the trench. Remove any frozen material in the top of the trench prior to backfilling. Do not place ice or snow, or backfill containing ice or snow into the trench. Do not mix or place backfill when the ambient air temperature is less than 35 degrees F.

3.02 CONFIRMATION PHASE

A. The site information presented in these documents (see supplemental documents) is provided for CONTRACTOR reference purposes only. The CONTRACTOR is solely responsible for determining the soil-reagent mix design and installation methodology for meeting the performance requirements of the GWBW specified herein. Consequently, the CONTRACTOR may elect to conduct confirmation testing prior to full-scale construction of the GWBW to verify the mix design.

B. If the CONTRACTOR elects to conduct confirmation testing, the cost shall be provided in the corresponding bid item in the Bid Form. The CONTRACTOR shall provide the details of the testing program with the bid, including the scope-of-work, specific reagent(s) and the source, schedule, laboratory, and other related elements. C. The results of confirmation testing shall be provided to the ENGINEER for review. If compatibility testing is not performed within the confirmation test, the

CONTRACTOR shall provide a correlation between the proposed mix confirmation test results and the results for the mixes in the compatibility tests provided in Attachment E.

C. If the CONTRACTOR elects to not perform confirmation testing, the CONTRACTOR shall provide sufficient information in their bid and work plan that describes why the mix will meet the performance requirements. Correlations to the compatibility test provided in Attachment E should be provided.

3.03 GROUNDWATER BARRIER WALL CONSTRUCTION

A. A GWBW shall be constructed to the lines, grades, depth, and cross-section indicated on the Drawings. The GWBW shall have vertical walls and have a minimum width of 36 inches, unless otherwise approved by the ENGINEER. The GWBW shall have a maximum in-place permeability of 1 x 10^{-6} cm/sec. and extend to 35 feet below ground surface.

B. Site Preparation: Prior to GWBW construction, the area on both sides of the wall alignment shall be prepared as shown on the Construction Drawings and as specified herein.

1. The GWBW location shall be accurately staked by the CONTRACTOR prior to construction. The GWBW shall be located along the alignment presented on the Drawings. The constructed GWBW alignment shall vary no more than five (5) feet laterally from the alignment presented on the Drawings. However, in any case the outboard edge (i.e., river side) of the slurry wall shall be located a minimum of 20 feet up-gradient (i.e.,landward side) from the top of the river bank. .

3. The CONTRACTOR shall prepare the working surface from which to construct the GWBW, including but not limited to clearing, removal of existing structures, well abandonment and disposal of unsuitable materials, in accordance with Section 02110 – SITE CLEARING.

4. Grade:

a. The longitudinal grade of the working surface shall not exceed one (1) percent, unless otherwise approved by the ENGINEER.

b. In the event that the static ground water table is encountered at a depth of three (3) feet, or less, below the designated working surface, the CONTRACTOR shall raise the working surface with approved fill material to maintain a three-foot separation between the working grade and the water table.

c. The working surface shall be graded to ensure that the excavation/installation equipment produces a vertical GWBW.

d. The CONTRACTOR shall provide and maintain gravity drainage control along the working surface. Controls shall direct flow away from the GWBW during construction. The CONTRACTOR shall prohibit surface water flow into the excavated trench.

5. The CONTRACTOR shall maintain the working surface free of excessive amounts of debris and slurry.

6. The CONTRACTOR shall prepare and maintain a temporary work/staging area at a remote location from the GWBW to support installation of the GWBW, including mixing operations, material storage, equipment storage, and other ancillary activities.

C. Equipment: The CONTRACTOR shall furnish the necessary plant, tools and equipment for efficient construction of the GWBW.

1. Excavation and Drilling Equipment: The equipment used for construction of the GWBW shall be capable of performing excavation, mixing, and/or drilling operations to the required depth of the GWBW and shall be approved by the ENGINEER and OWNER. Excavating, mixing, and/or drilling equipment shall be capable of achieving the minimum GWBW width in a single pass while minimizing raveling of the trench or GWBW sides during use.

2. Preparation and Placement Equipment: The slurry or grout plant shall include the necessary equipment such as a mixer, a mechanically agitated sump, pumps, valves, hoses, supply lines, and small tools; all as may be required to adequately mix and supply slurry or grout to the GWBW location in a continuous manner. A backup system shall be designed to supply sufficient slurry or grout in case substantial slurry or grout loss occurs. Storage ponds shall be constructed wholly or partially above grade; containers shall be constructed above grade (no excavation). Pond berms may be constructed from excavating existing surface soils from the vicinity of the pond If the storage pond is constructed by a combination of excavation and backfilling of a perimeter berm, the resulting area

shall be filled and graded after completion of the GWBW construction by using the berms as fill. All slurry held in storage shall be agitated or recirculated to maintain a homogenous mix. Mixing of slurry or grout shall continue until all particles are thoroughly mixed and the resulting mixture is homogenous. The location of the slurry or grout plant and storage areas shall be approved by the ENGINEER.

3. Backfill Mixing and Placing: Equipment for mixing and placing backfill may consist of suitable earthmoving or grading equipment, such as bulldozers, blade graders, backhoes, or blenders such as a pug mill, that are capable of thoroughly mixing the backfill materials into a homogeneous blend meeting the required properties. Clods shall be broken to a four-inch maximum size by the backfill preparation equipment and methods employed. Deleterious materials, debris, and oversized particles shall be removed from the backfill before approval for placement.

4. Decontamination Area:

   a. All equipment utilized in GWBW construction shall pass through the decontamination area for cleaning prior to leaving the Site in accordance with applicable regulations.
   b. All water from the decontamination area shall be containerized and disposed off-site in accordance with Section 02250 – TRANSPORTATION AND DISPOSAL OF MATERIALS.

D. Personnel: The CONTRACTOR shall provide all workers' PPE in accordance with 29 CFR and OSHA, and with the level of knowledge necessary to implement health and safety procedures. The CONTRACTOR shall designate a health and safety officer for the project who is responsible for maintaining worker's compliance with established health and safety procedures.

E. Construction:

1. The CONTRACTOR shall have equipment capable of excavating/trenching, mixing and/or drilling to the required depths. The CONTRACTOR shall measure and record the distances to the bottom of GWBW and/or trench with the ENGINEER every 20 feet along the wall alignment. The CONTRACTOR shall remove all loose material from the trench. The GWBW shall extend 35 feet below ground surface. Achievement of the design depth shall be determined in the field by the ENGINEER based on depth

measurement at every 20 feet along the wall alignment and visual exam of the excavated material.

2. In areas where materials unsuitable materials for incorporation into the GWBW are removed, as determined by these specifications or the ENGINEER, the material shall be placed in containers by the CONTRACTOR for disposal.

3. At the intersection of two (2) straight line segments, the GWBW shall extend a minimum of five (5) feet beyond the outside of the intersection through all depths. If the GWBW overlaps into a previously completed segment, the GWBW shall extend a minimum of 10 feet into the previously placed segment through all depths. There will be no additional payments for excavation of installed GWBW to make tie-ins.

4. Upon completion of the GWBW and prior to placement of the cap over the wall, no vehicular traffic should cross the GWBW without prior acceptance by the ENGINEER. If access is needed before the wall has "set up" properly, the CONTRACTOR shall provide a temporary bridge for crossing a completed GWBW section so as not to disturb the completed GWBW. If a temporary crossing bridge is required, the CONTRACTOR shall install a minimum 1-inch thick steel plate, overlapped sufficiently so that no gaps and/or cracks are apparent and to permit traffic to proceed normally across it.

5. No blasting is permitted for construction of the GWBW.

6. Stability:

   a. The CONTRACTOR is responsible for ensuring and maintaining the stability of the Work area, including but not limited to the GWBW and surrounding area, at all times during all operations, including excavations/trenching, mixing, drilling, backfilling, injections, and the results of such activities to the adjacent areas, such as the riverbank.
   b. The CONTRACTOR shall control all surcharges from all excavation/trenching, mixing, drilling, injection, grading, backfilling, mixing and other equipment, waste, berm construction, stockpiles, and any other loading situations that may affect GWBW construction stability.

F. Capping:

1. The surface of the GWBW backfill shall not be allowed to desiccate prior to placing the final cap. A temporary cover shall be used to protect the backfill prior to placing the final cap. The temporary cover shall consist of at least one (1) foot of uncompacted backfill placed within one (1) day after the backfill is placed. After a minimum of one (1) week, the temporary cover shall be removed. Any depressions or settlement shall be repaired by placing additional backfill or the permanent cap.

2. Upon removal of the temporary cover and before desiccation of the backfill surface can occur, the GWBW shall be covered with a clay cap meeting the requirements of Section 02200 – EARTHWORK and in accordance with the details depicted on the Drawings.

G. Post-Construction of GWBW:

1. Upon completion of backfilling and grading operations, all remaining excavated material, residual slurry or grout, and mixed backfill shall be removed and disposed by the CONTRACTOR at an approved off-site facility in accordance with Section 02250 – TRANSPORTATION AND DISPOSAL OF MATERIALS and the appropriate ODEQ regulations.

2. All disturbed areas shall be cleaned, leveled, and returned to the original condition as directed by the ENGINEER. In accordance with the permitting requirements, the project shall be completed and restored so that no fill is placed above the pre-construction grades and elevations (i.e., a “no net fill” project). Any excess soil materials (not including excess GWBW spoils) that cannot be replaced in an excavation shall be disposed at an approved off-site facility.

3.04 SOIL-REAGENT SLURRY WALL CONSTRUCTION

A. Equipment: The CONTRACTOR shall furnish the necessary plant, tools and equipment for efficient excavation of the trench, mixing and placing of slurry, and transporting, mixing, and placing backfill material. Equipment shall be capable of excavating the minimum 36-inch wide trench in one pass and to a minimum depth of 35 feet.

B. Slurry Placement:

1. The CONTRACTOR shall maintain the stability of the excavated trench at all times. The excavated trench above the slurry level shall be maintained to prevent cave-in. The CONTRACTOR is

responsible for maintaining slurry densities and levels to ensure stable conditions within any excavations and to the full depth of the excavation and/or trench.

2. The CONTRACTOR shall provide all personnel, equipment and material to maintain the slurry level at all times during the trench construction, after hours, weekends, and holidays included.

3. It is the CONTRACTOR's sole responsibility to ensure that the mixing of any reagents/backfill/slurries do not affect the stability of any open excavations. In the event of sloughing, sliding or other failure of a trench wall prior to completion of backfilling, the CONTRACTOR shall re-excavate the trench, remove all material displaced into the trench, and take corrective action to prevent further deterioration, at the CONTRACTOR's expense.

4. The CONTRACTOR is responsible for testing and maintaining the initial slurry mix and the slurry in the trench, at the frequencies specified in Table 02242-1, to meet the requirements specified herein.

5. The CONTRACTOR shall ensure that the slurry sand content is not excessive and dropping out of the slurry to the bottom of the trench affecting the overall performance of the trench.

6. Slurry shall be introduced into the trench at the time excavation begins. The level of the slurry in the open trench shall be maintained at least three (3) feet above the water table and no more than two (2) feet below the working surface until the placement of the reagent mix backfill is complete, unless otherwise approved by the ENGINEER.

7. Slurry shall not be diluted by surface water.

8. The level of the slurry in the trench shall be routinely monitored throughout the day; the level of slurry shall be monitored and recorded each morning and evening. Any noticeable difference in the elevation of the slurry may indicate a loss of slurry through the formation or cave-ins. Corrective action shall be taken to address any noticeable change in the elevation of the slurry.

C. Trench Excavation:

1. The width of the hydraulic isolation wall shall be equal to or greater than 36 inches, unless otherwise approved by the ENGINEER.

2. The CONTRACTOR shall ensure that no loose material, cuttings, or debris are left in the bottom of the trench before slurry backfilling commences and employ appropriate equipment to verify cleaning of the trench bottom. The CONTRACTOR shall remove from the trench any slurry which contains excessive suspended solids as indicated by a slurry unit weight exceeding 85 pcf or within 15 pcf of the unit weight of the backfill mixture. The removal of this slurry or materials from the bottom of the trench shall be done with suitable equipment. Upon these removal activities, the trench shall be sounded immediately before placing backfill, and the soundings shall be compared to the trench excavation soundings to verify the bottom.

3. At a minimum, soundings shall be taken each morning and each evening and compared to monitor for cave-ins or excessive settlement. Corrective action, including trench bottom cleaning, shall be taken to address soundings that indicate these conditions. The trench bottom shall be cleaned by using an excavator bucket, air lift pump, or other approved equipment to ensure removal of sand, gravel, sediment, and other material left in the trench or settled out of the slurry. Cleaning shall not remove material from the walls of the trench.

4. The CONTRACTOR shall conduct Work to avoid damage to utilities and other structures. Excavation equipment shall remain a safe distance (at least 20 feet or as determined in the HASP) from the overhead utilities, if any.

5. The excavation shall begin at the working surface and shall provide a vertical (within two (2) percent) continuous 36-inch minimum width trench to the required depth along the centerline of the excavation. The toe of the slope of the trench excavation shall not precede the toe of the reagent backfill slope by less than 30 feet or more than 100 feet.

6. A lead-in trench is required at the start of the GWBW and at the intersection of two segments. The lead-in trench shall commence far enough away from the GWBW and ramp down to the full depth of the GWBW at a slope which avoids segregation of backfill particles.

7. Trench spoils that are suitable for backfill mixture may be stockpiled adjacent to, or remote from, the trench for processing. Care shall be taken to ensure that unprocessed spoils do not re-enter the trench. Any spoils or excavated materials that are not used in the backfill

process shall be management accordingly and disposed off-site in accordance with 02250 Transportation and Disposal of Materials.

D. Backfill requirements:

1. Bentonite, or other reagents, shall be added and mixed uniformly and homogeneously with soil backfill such that the soil-reagent backfill mixture meets the requirement in Part 2.05 and the criteria presented in Table 02242-1.

2. The soil-reagent backfill shall be thoroughly mixed, via disking, harrowing, bulldozing, blading, or other approved methods, into a homogeneous mass, free from large lumps or clods of soil or pockets of fines, sand or gravel. Occasional lumps/clods of up to three (3) inches in their largest dimension will be permitted.

3. All particles shall be coated with slurry. Sluicing with water is not permitted.

4. If mixing occurs along the trench, heavy equipment, i.e., bulldozers, shall not operate in a back and forth fashion parallel to the open trench. Unmixed materials shall not be permitted to flow into the trench. Excess slurry shall not flow beyond the limits of Work.

E. Soil-Reagent Backfill Placement:

1. At the beginning of the excavation, the initial layer of backfill shall be placed from one location only. Only in special conditions as approved by the ENGINEER where a lead-in trench is not excavated, the initial backfill shall be placed by lowering the material to the bottom of the trench by means of a clamshell bucket, tremie methods, or other approved equipment until the backfill emerges from below the slurry surface and achieves its natural angle of repose. A lead-in trench shall start at a point outside the limits of the GWBW to allow the soil-reagent backfill face to form prior to reaching the full depth of the required GWBW. The slope of the lead-in trench shall be excavated to prohibit sliding, sloughing, buckling, or other failures which could trap pockets of material or otherwise affect the performance of the wall. Free dropping of soil-reagent backfill through the slurry is not permitted at anytime throughout construction.

2. The point of trench backfilling shall progress towards the areas of active excavation. Backfilling operations shall proceed in such a manner that the slope of the initial backfill will be maintained. The

new backfill material shall be allowed to slide down the slope of the previously placed backfill and shall be placed in such a manner that the pockets of slurry shall not be trapped during subsequent backfilling.

3. Care shall be exercised during mixing and backfilling to ensure that the backfill flows and displaces the slurry in the trench and to ensure that a uniform and homogenous trench is constructed.

4. The CONTRACTOR shall backfill continuously in the direction of the excavation from the beginning of the trench to the end of the trench, unless approved otherwise by the ENGINEER.

5. Backfilling shall occur so that no pockets of slurry are present in the completed GWBW. The backfill shall not be deposited in any manner that will cause segregation.

6. No payments will be made for the portion of trenches which lie outside of the limits of work.

7. No mixing or placing of soil-reagent backfill shall occur when the air temperature is below 30 degrees Fahrenheit.

3.05 CONTINUOUS TRENCHING CONSTRUCTION

A. Equipment: The CONTRACTOR shall furnish the necessary plant, tools and equipment for efficient trenching, mixing, delivery and placing of reagent and reagent slurry (dry reagent and water mix). Equipment shall be capable of continuously trenching and mixing the minimum 36-inch wide trench in one pass and to a minimum depth of 35 feet.

B. Trenching and Mixing:

1. The width of the hydraulic isolation wall shall be equal to or greater than 36 inches, unless otherwise approved by the ENGINEER.

2. The CONTRACTOR shall accurately record the quantity and percentages of dry reagent placed on the reagent starter trench and reagent slurry pumped during GWBW construction.

3. The CONTRACTOR shall conduct Work to avoid damage to utilities and other structures. Trenching equipment shall remain a safe distance (at least 20 feet or as determined in the HASP) from the overhead utilities, if any.

4. The trenching shall begin at the working surface and shall provide a vertical (within two (2) percent) continuous 36-inch minimum width trench to the required depth along the centerline of the excavation.

5. The CONTRACTOR is responsible for ensuring that all materials and soils from the GWBW construction are contained, including the excavation of a bulking containment trench along the GWBW alignment. Excess spoils shall be transported and disposed offsite in accordance with 02250 Transportation and Disposal of Materials.

6. Trenching and mixing speed shall be adjusted to ensure the pumped reagent slurry and in-situ soil are mixed properly to form a uniform and homogenous GWBW.

7. The CONTRACTOR is responsible for testing the slurry and soil-reagent mix in accordance with the methods and frequencies provided in Table 02242-1. The resulting GWBW shall have in-place coefficient of permeability of 1×10^{-6} cm/sec or less, and shall comply with Table 02242-1. The materials, equipment, mix design, construction method, and verification methods shall be submitted to the ENGINEER with the bid to demonstrate assurance for meeting the performance standards.

8. If a lead-in trench is required at either end of the GWBW or at the intersection of two segments, the lead-in trench shall commence far enough away from the GWBW and ramp down to establish the full depth within the limits of the GWBW.

9. Trenching and mixing of the soil-reagent mix shall occur so that there are no pockets of slurry or unmixed materials present in the GWBW.

3.06 JET GROUTING CONSTRUCTION

A. Any jet grout hole lost or damaged as the result of mechanical failure of equipment, inadequacy of grout supplies, or improper drilling or injection procedures shall be backfilled with cement grout and replaced by another hole, drilled and injected by the CONTRACTOR at no additional cost to the OWNER. The replacement hole shall be in a location that maintains the integrity of the wall.

B. Jet grout injection and jet monitor rotation and extraction rates shall be sufficient to produce grout columns/panels meeting the minimum diameter, depth, overlap, and material property requirements specified herein, and to

assure that the completed wall achieves the minimum permeability specifications. The CONTRACTOR shall determine and provide with the bid recommended row numbers, diameters, spacing, overlaps, pressures, construction and verification methods, and other necessary information to the ENGINEER to demonstrate compliance in order to meet the performance standards.

C. Jet grout mix shall be proportioned and injected so that the grout column produced meets the following requirements:

1. Coefficient of permeability not to exceed 1 x 10^{-6} cm/sec; and,

2. Additional tests specified in Table 02242-1.

D. Equipment for mixing, holding, and pumping grout shall be in a secure location and shall be operated to minimize spillage of material. No material will be allowed to enter storm drains or other drainage courses.

F. The wall shall consist of, at a minimum, a single row of overlapping jet grout columns/panels with a minimum diameter of 36 inches. The minimum overlap shall be the greater of 1/8 of the column diameter/panel width or six inches. Multiple rows may, at the discretion of the CONTRACTOR, be employed to assure meeting the minimum performance standards.

G. Upon completion of backfilling and grading operations, all remaining excavated material, residual slurry or grout, and mixed backfill shall be removed and disposed by the CONTRACTOR in accordance with Section 02250 – TRANSPORTATION AND DISPOSAL OF MATERIALS and the appropriate ODEQ regulations.

3.07 SOIL MIXING (SM) CONSTRUCTION

A. Equipment: The SM rig shall consist of a single shaft or a series of overlapping mixing shafts capable of creating a wall with a minimum thickness of 36 inches.

B. Alignment:

1. For equipment with a series of overlapping mixing shafts, the auger flights and mixing blades between the shafts of the SM rig shall be overlapped to achieve continuity in the stabilized soil column.

2. The placement of strokes shall be controlled by the use of a template or other approved means to gauge the distance between strokes.

3. The vertical alignment of the auger stroke shall be controlled by the SM equipment operator.

C. Shaft speed: The mixing shaft speed shall be adjusted to accommodate a constant rate of mixing shaft penetration based on the degree of drilling difficulty.

D. Penetration Rate: The penetration rate of the mixing shafts shall be maintained in the range of 1 to 8 vertical feet per minute during both penetration and withdrawal, unless otherwise demonstrated by the CONTRACTOR.

E. Grout: The grout injection rate per vertical foot of column shall be adjusted to the requirements of the design mix, as proposed by the CONTRACTOR.

F. The resulting soil column wall shall not exceed an in-place coefficient of permeability of 1×10^{-6} cm/sec and shall comply with Table 02242-1. The materials, equipment, mix design, construction method, and verification methods shall be submitted to the ENGINEER with the bid to demonstrate assurance for meeting the performance standards.

G. The CONTRACTOR shall determine the overlap of successive auger locations to ensure a continuous GWBW that meets the required specifications. The ENGINEER shall evaluate the data provided by the CONTRACTOR to confirm that the appropriate overlap is being implemented; a minimum overlap of 30 percent is required between successive auger locations. If insufficient overlap is observed or the GWBW does not meet the performance requirements, the CONTRACTOR shall reprocess the area at no additional cost to the OWNER.

H. Upon completion of backfilling and grading operations, all remaining excavated material, residual slurry or grout, and mixed backfill shall be removed and disposed by the CONTRACTOR in accordance with Section 02250 – TRANSPORTATION AND DISPOSAL OF MATERIALS and the appropriate ODEQ regulations.

PART 4 - QUALITY CONTROL AND QUALITY ASSURANCE

4.01 DEFINITIONS

A. The CONTRACTOR shall be responsible to construct a GWBW which meets these Specifications, and conduct all QC tests as necessary to

demonstrate that the construction of the GWBW meets the Specifications. The CONTRACTOR shall provide quality control inspectors, as needed, to ensure proper quality control of the project and to obtain quality control samples as required herein and on Table 02242-1.

B. The ENGINEER will be responsible for QA testing.

C. Sampling and testing shall be performed by personnel experienced in the type of test required. Samples shall be representative of the overall volume of material from which the sample is taken.

D. Equipment for sampling and testing shall be in good condition. Set up equipment for onsite testing, and perform tests onsite unless otherwise specified.

E. Perform tests in a timely manner. Immediately submit results in writing to ENGINEER. The CONTRACTOR shall be responsible for representative, quality, and accurate sampling and testing. The OWNER or ENGINEER may make its own independent tests.

4.02 QUALITY CONTROL OF DELIVERED PRODUCTS

A. Bentonite:

1. The CONTRACTOR shall supply to the ENGINEER, for each designated load of bentonite, the bentonite manufacturer's certifications and laboratory test results that demonstrate that the bentonite meets the Specifications.

2. The CONTRACTOR shall supply to the ENGINEER samples of bentonite as required by the Specifications or as requested by the ENGINEER.

3. The CONTRACTOR shall keep a log of bentonite deliveries that includes: date, source, time of delivery, weight and laboratory quality control test results supplied by the Manufacturer.

4. It shall be the responsibility of the CONTRACTOR to verify that the bentonite delivered meets the Specifications.

B. Other Reagents:

1. The CONTRACTOR shall supply to the ENGINEER, for each designated load of reagent, the reagent manufacturer’s certifications

and laboratory test results that demonstrate that the reagent meets the Specifications.

2. The CONTRACTOR shall supply to the ENGINEER samples of reagent as required by the Specifications or as requested by the ENGINEER.

3. The CONTRACTOR shall keep a log of reagent deliveries that includes: date, source, time of delivery, weight and laboratory quality control test results supplied by the Manufacturer.

4. It shall be the responsibility of the CONTRACTOR to verify that the reagent delivered meets the Specifications.

4.03 QUALITY CONTROL OF SOIL-REAGENT SLURRY WALL

A. The submittals and tests for reagent and water shall meet the requirements outlined in Table 02242-1.

B. Soil-Reagent Backfill Material:

1. The CONTRACTOR shall obtain samples of the soil-bentonite backfill as required by these Specifications and as deemed necessary to achieve the performance requirements specified in Table 02242-1. The test results shall be supplied to the ENGINEER as soon as possible.

2. Permeability:

a. The CONTRACTOR shall collect bulk and undisturbed samples of the soil-bentonite backfill at the frequencies specified in Table 02242-1 for laboratory permeability testing by a third-party laboratory to be procured by the CONTRACTOR. The tests shall be constant-head type permeability tests performed under a back pressure of 25 psi. During the saturation phase of the flexible wall permeability test, the difference between the chamber pressure and the back pressure shall not exceed 5 psi. The back pressure must be applied in small increments, with adequate time between increments to allow equalization of pore water pressure throughout the specimen. Typically, chamber pressure is about 7 psi and a chamber pressure and back pressure shall be in increment maintaining the back pressure at about 5 psi less than the chamber pressure. The imposed hydraulic

gradient shall be less than 12 to minimize consolidation of the sample during testing. No additional consolidation stresses shall be applied to the test specimen other than that resulting from the imposed hydraulic gradient. Maximum turnaround times for quality control testing shall be required to be within one (1) week. The test results shall be provided to the ENGINEER as soon as possible.

b. The in-place coefficient of permeability of the soil-bentonite backfill shall be as specified in Table 02242-1.

3. The CONTRACTOR shall run additional tests as necessary to construct a GWBW that meets the Specifications. The CONTRACTOR shall split samples with the ENGINEER, at the ENGINEER'S request, to verify test results.

C. Bentonite Slurry: The submittals and tests for initial slurry and in-trench slurry shall meet the requirements specified in Table 02242-1.

4.04 QUALITY CONTROL OF CONTINUOUS TRENCHING

A. Submittals and tests for reagents shall meet the requirements outlined in Table 02242-1.

B. The CONTRACTOR shall conduct quality control tests on the continuous trenching method as specified in Table 02242-1.

C. Soil- Reagent Mix Material:

1. The CONTRACTOR shall obtain samples of the soil-reagent mix after mixing and test, as required in Table 02242-1 and below.

2. Permeability:

a. The CONTRACTOR shall collect bulk and undisturbed samples of the soil-bentonite backfill at the frequencies specified in Table 02242-1 for laboratory permeability testing by a third-party laboratory to be procured by the CONTRACTOR. The tests shall be constant-head type permeability tests performed under a back pressure of 25 psi. During the saturation phase of the flexible wall permeability test, the difference between the chamber pressure and the back pressure shall not exceed 5 psi. The back pressure must be applied in small increments, with adequate time between

increments to allow equalization of pore water pressure throughout the specimen. Typically, chamber pressure is about 7 psi and a chamber pressure and back pressure shall be in increment maintaining the back pressure at about 5 psi less than the chamber pressure. The imposed hydraulic gradient shall be less than 12 to minimize consolidation of the sample during testing. No additional consolidation stresses shall be applied to the test specimen other than that resulting from the imposed hydraulic gradient. Maximum turnaround times for quality control testing shall be required to be within one (1) week. The test results shall be provided to the ENGINEER as soon as possible.

b. The in-place coefficient of permeability of the soil-reagent backfill shall be as specified in Table 02242-1.

3. Soil- Reagent Mix Slump: The CONTRACTOR, in the presence of the ENGINEER, shall measure and record the slump of the mix. The slump of the mix shall be determined after mixing soils with the reagent slurry at the initiation of each day's GWBW installation, and at a minimum of once every 2 hours during the installation of the vertical barrier wall. The soil-reagent mix slump shall be determined in accordance with the procedures given in ASTM C-143. The slump of the mix shall be between 4 and 6 inches. If mix does not meet this slump, the mix shall be modified as necessary, and be tested, unless otherwise approved by the ENGINEER.

4. Density: The CONTRACTOR shall conduct density on the soil-reagent backfill frequency specified in Table 02242-1.

5. The CONTRACTOR shall run additional tests as necessary to construct a GWBW that meets the Specifications. The CONTRACTOR shall split samples with the ENGINEER, at ENGINEER's request, to verify test results.

D. Reagent Slurry: The CONTRACTOR, in the presence of the ENGINEER, shall measure and record the reagent slurry viscosity, unit weight, and pH prior to mixing with backfill or placing the slurry in the trench during excavation. The reagent slurry viscosity, unit weight, and pH shall be determined each time the batch plant begins operation and at a minimum of every 2 hours during the installation of the backfill. The slurry viscosity and unit weight shall be determined with a Marsh funnel and mud balance, respectively.

4.05 QUALITY CONTROL OF JET GROUTING

A. Submittals and tests for reagents shall meet the requirements outlined in Table 02242-1.

C. The CONTRACTOR shall conduct quality control tests on the jet grouting technology as specified in Table 02242-1

4.06 QUALITY CONTROL OF SOIL MIXING

A. Submittals and tests for reagents shall meet the requirements outlined in Table 02242-1.

C. The CONTRACTOR shall conduct quality control tests on the Deep Soil Mixing technology as specified in Table 02242-1

4.07 QUALITY CONTROL OF CLAY CAP

The CONTRACTOR shall test the in-place density and moisture content of the clay cap material in accordance with Section 02200 – EARTHWORK.

4.08 SOUNDINGS AND DEPTH VERIFICATION

A. Reagent Slurry Wall: Soundings shall be taken every 20 feet along the GWBW centerline using a weighted tape, cable, or other device. Soundings shall be recorded to the nearest 0.5 feet. Soundings shall record the following:

1. Bottom of Excavation: The bottom elevation of the GWBW shall be determined subject to approval by the ENGINEER.

2. Bottom of Excavation Prior to Backfilling: Soundings shall be used to monitor for sidewall collapse and accumulation of sediments.

3. Profile of Backfill Slope: The backfill slope and trench bottom, if applicable, shall be sounded at the beginning and end of each shift and converted to an as-built drawing. This drawing shall be reviewed daily as an indication of trench collapse, excessive settlement or sloughing.

B. Continuous trenching, soil mixing, and jet grouting: The CONTRACTOR shall observe and record the depth of the GWBW every 20 feet along the alignment, to the nearest 0.5 feet. The method for verifying the depth shall be approved by the ENGINEER.

4.09 AS-BUILT PROFILE

An as-built profile of the trench bottom, backfill slopes, including descriptions of materials encountered in the trench, and bottom of trench shall be continuously maintained by the CONTRACTOR. This profile shall indicate the extent of excavation and the backfill profile at the beginning and end of each work day or shift, as determined from the soundings, or depth measurements. The daily profile drawing shall be in AutoCAD. Materials encountered in the GWBW and bottom of the GWBW shall be described at a maximum interval of 20 lineal feet. The CONTRACTOR shall furnish profile drawings and records of all observations, measurements, and tests performed, identified with the location, date, and time of testing. These records shall be furnished to the ENGINEER no later than 24 hours after the tests, measurements, and/or observations are made.

4.10 REJECTED GROUNDWATER BARRIER WALL SECTION

If the required quality control parameters are not achieved for a given sample, the corresponding section of GWBW will be rejected. The deficient section limits will be determined by the ENGINEER. If tests fail to meet the specified requirements, the ENGINEER reserves the right to require additional sampling and testing at the CONTRACTOR's expense. For failed/rejected sections, the CONTRACTOR shall remove and replace the GWBW within the limits specified by the ENGINEER at no additional cost to the OWNER.

TABLE 02242-1 QUALITY CONTROL TESTING

Technology	Construction Phase	Component	Parameter	Test Method	Frequency	Acceptance Criteria
Soil-Reagent Slurry Wall	Pre-Construction	Bentonite	Free Swell Test	USP NF XVII	Once per borrow source	16 cm^3 minimum
			YP/PV Ratio	API 13A	Once each truck or railcar shipment	3 minimum
			Plastic Viscosity	API 13A	Once per borrow source	10 minimum
			Filtrate Loss	API 13A	Once each truck or railcar shipment	15 cm^3 maximum
			Moisture Content	ASTM D2216	Once each truck or railcar shipment	10% maximum
			Viscometer	API 13A	Once per borrow source	30 minimum @ 600 rpm
			Residue > 75 um	API 13A	Once per borrow source	4% maximum
		Mix Water	pH	API RP 13B-1	Once per source	6 to 8
			Total Dissolved Solids	EPA 600	Once per source	500 mg/L maximum
			Hardness	API RP 13B-1	Once per source	50 mg/L maximum
		Soil Backfill	Particle Size Analysis	ASTM D422	Once every 500 cy	100% passing 3 in, minimum 20% passing No. 200
			Moisture Content	ASTM D2216	Once every 500 cy	For record
			Atterberg Limits	ASTM D4318	Once every 500 cy	LL > 30, PI > 10
	Construction	Initial Slurry	Viscosity	API RP 13B-1	Twice per 8-hour shift	40 marsh seconds minimum
			Density	ASTM D4380	Twice per 8-hour shift	64 pcf minimum and > 15 pcf less than the backfill
			Filtrate Loss	API RP-13B-1	Twice per 8-hour shift	<25 cm^3 in 30 minutes @ 100 psi
			pH	API RP 13B-1	Twice per 8-hour shift	6 to 9
		In-Trench Slurry	Viscosity	API RP 13B-1	Twice per 8-hour shift	40 marsh seconds minimum
			Density	ASTM D4380	Twice per 8-hour shift	64 to 85 pcf and > 15 pcf less than the backfill
		Soil-Reagent Backfill	Particle Size Analysis	ASTM D422	One per day or one every 100 lineal feet whichever is greater frequency at alternating 20 vertical foot intervals	100% passing 3 in, minimum 20% passing No. 200
			Atterberg Limits	ASTM D4318	One per day or one every 100 lineal feet whichever is greater frequency at alternating 20 vertical foot intervals	LL > 30, PI > 10
			Permeability	ASTM D5084	One per day or one every 100 lineal feet whichever is greater frequency at alternating 20 vertical foot intervals	1 x 10-6 cm/sec maximum
			Slump	ASTM C143	Twice per 8-hour shift	4 to 6 inches
			Density	ASTM D4380	Twice per 8-hour shift	At least 15 pcf greater than the in-trench slurry
	Post-Construction	Soil-Reagent Backfill	Permeability	ASTM D5084	One undisturbed sample from the ground surface to mid-depth and one from mid-depth to the bottom from two areas that are at least 200 feet apart	1 x 10^{-6} cm/sec maximum
Continuous Trenching	Pre-Construction	Bentonite	Free Swell Test	USP NF XVII	Once per borrow source	16 cm^3 minimum
			YP/PV Ratio	API 13A	Once each truck or railcar shipment	3 minimum
			Plastic Viscosity	API 13A	Once per borrow source	10 minimum
			Filtrate Loss	API 13A	Once each truck or railcar shipment	15 cm^3 maximum
			Moisture Content	ASTM D2216	Once each truck or railcar shipment	10% maximum
			Viscometer	API 13A	Once per borrow source	30 minimum @ 600 rpm
			Residue > 75 um	API 13A	Once per borrow source	4% maximum
		Mix Water	pH	API RP 13B-1	Once per source	6 to 8
			Total Dissolved Solids	EPA 600	Once per source	500 mg/L maximum
			Hardness	API RP 13B-1	Once per source	50 mg/L maximum
	Construction	Reagent Slurry	Viscosity	API RP 13B-1	Each time the batch plant begins operation and at a minimum of every 2 hours during the installation of the backfill	40 marsh seconds minimum
			Density	ASTM D4380	Each time the batch plant begins operation and at a minimum of every 2 hours during the installation of the backfill	64 pcf minimum
			pH	API RP 13B-1	Each time the batch plant begins operation and at a minimum of every 2 hours during the installation of the backfill	6 to 9
		Soil-Reagent Mix	Slump	ASTM C143	At the initiation of each day's GWBW installation, and at a minimum of once every 2 hours during the installation of the GWBW	4 to 6 inches
			Density	ASTM D4380	One per day or one every 100 lineal feet whichever is greater frequency at alternating 20 vertical foot intervals	64 to 85 pcf
			Permeability	ASTM D5084	One per day or one every 100 lineal feet whichever is greater frequency at alternating 20 vertical foot intervals	1 x 10^{-6} cm/sec maximum
	Post-Construction	Soil-Reagent Mix	Permeability	ASTM D5084	One undisturbed sample from the ground surface to mid-depth and one from mid-depth to the bottom from two areas that are at least 200 feet apart	1 x 10^{-6} cm/sec maximum

Technology	Construction Phase	Component	Parameter	Test Method	Frequency	Acceptance Criteria
Deep Soil Mixing	Pre-Construction	Bentonite	Free Swell Test	USP NF XVII	Once per borrow source	16 cm^3 minimum
			YP/PV Ratio	API 13A	Once each truck or railcar shipment	3 minimum
			Plastic Viscosity	API 13A	Once per borrow source	10 minimum
			Filtrate Loss	API 13A	Once each truck or railcar shipment	15 cm^3 maximum
			Moisture Content	ASTM D2216	Once each truck or railcar shipment	10% maximum
			Viscometer	API 13A	Once per borrow source	30 minimum @ 600 rpm
			Residue > 75 um	API 13A	Once per borrow source	4% maximum
		Mix Water	pH	API RP 13B-1	Once per source	6 to 8
			Total Dissolved Solids	EPA 600	Once per source	500 mg/L maximum
			Hardness	API RP 13B-1	Once per source	50 mg/L maximum
	Construction	Column Mold	Permeability	ASTM D5084	One per day or one every 100 lineal feet whichever is greater frequency at alternating 20 vertical foot intervals	1 x 10^{-6} cm/sec maximum
	Post-Construction	Cured Core	Permeability	ASTM D5084	One undisturbed sample from the ground surface to mid-depth and one from mid-depth to the bottom from two areas that are at least 200 feet apart	1 x 10^{-6} cm/sec maximum
Jet Grouting	Pre-Construction	Bentonite	Free Swell Test	USP NF XVII	Once per borrow source	16 cm^3 minimum
			YP/PV Ratio	API 13A	Once each truck or railcar shipment	3 minimum
			Plastic Viscosity	API 13A	Once per borrow source	10 minimum
			Filtrate Loss	API 13A	Once each truck or railcar shipment	15 cm^3 maximum
			Moisture Content	ASTM D2216	Once each truck or railcar shipment	10% maximum
			Viscometer	API 13A	Once per borrow source	30 minimum @ 600 rpm
			Residue > 75 um	API 13A	Once per borrow source	4% maximum
		Mix Water	pH	API RP 13B-1	Once per source	6 to 8
			Total Dissolved Solids	EPA 600	Once per source	500 mg/L maximum
			Hardness	API RP 13B-1	Once per source	50 mg/L maximum
	Construction	Column Mold	Permeability	ASTM D5084	One per day or one every 100 lineal feet whichever is greater frequency at alternating 20 vertical foot intervals	1 x 10^{-6} cm/sec maximum
	Post-Construction	Cured Core	Permeability	ASTM D5084	One undisturbed sample from the ground surface to mid-depth and one from mid-depth to the bottom from two areas that are at least 200 feet apart	1 x 10^{-6} cm/sec maximum

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

The CONTRACTOR shall furnish all labor, materials, tools, and equipment, required for the transport and off-site disposal of all concrete/asphalt debris, spoils, impacted materials, liquids, and other waste materials as specified in these Contract Documents. The management of these materials shall be consistent with these specifications and the Contaminated Material Management Plan.

1.02 REGULATORY REQUIREMENTS

A. The debris, liquids, and other waste materials removed during the Work shall be cleaned and properly decontaminated (or contained in the case of contaminated soils and liquids) sufficient for transportation in accordance with these Specifications and all federal, state, and local regulations.

B. All debris, liquids, and other waste materials shall be disposed at an approved waste disposal facility in accordance with all federal, state, and local regulations.

C. The CONTRACTOR shall comply with all applicable regulatory requirements and all federal, state, or local laws, codes, and ordinances which govern the transportation of equipment and disposal of material to be removed from the Site. Materials transported off-site shall comply with all applicable regulations for off-site disposal.

D. The CONTRACTOR shall obtain any and all permits required for transport and disposal and comply with all applicable requirements.

1.03 TRANSPORTATION

A. The CONTRACTOR shall be responsible for transporting all debris, piping, spoils, liquids, impacted materials, and other waste to the appropriate off-site disposal facility.

B. The CONTRACTOR shall be responsible for all sampling and testing required by the off-site disposal facility.

C. The CONTRACTOR shall provide all necessary traffic controls at the Site ingress and egress location such as flagmen, during trucking operations, or as otherwise directed by the ENGINEER.

D. No queuing of trucks shall be permitted on any roads, including but not limited to North Burgard Way, North Burgard Road, or North Time Oil

Road. Any queuing of trucks that occurs on-site shall not interfere with daily traffic.

1.04 SUBMITTALS

A. In accordance with Section 01300 – SUBMITTALS.

B. The CONTRACTOR shall submit written documentation certifying that the disposal facility is in compliance with all regulations and permits, and is willing to accept the material. A copy of the most recent inspection report shall be submitted to the ENGINEER verifying that the facilities have no violations or other environmental conditions that affect the satisfactory operation of the facility.

C. The CONTRACTOR shall submit copies of results of any tests performed at the disposal facility by the disposal facility prior to waste acceptance. The CONTRACTOR shall be responsible for performing any tests required by the receiving facility for the disposal of materials.

E. The CONTRACTOR shall prepare and submit to the ENGINEER information regarding transporting equipment or materials from the site, including type of trucks and/or trailers, method of transportation, the transport route to the facility, the anticipated number of trips, and the proposed types and locations of necessary traffic control devices to be used by the CONTRACTOR. The CONTRACTOR shall also list all federal, state, and local regulations that must be complied with and all permits that must be obtained.

F. The CONTRACTOR shall not commence with the removal of debris, liquids, and other waste materials from the Site until the ENGINEER has reviewed the submitted information.

G. The CONTRACTOR shall submit copies of weigh tickets or other receipts provided by the disposal facility to the ENGINEER as evidence of the arrival and disposal of the material at the disposal site, including any salvaging, recycling, or recovery. The documentation submitted to the ENGINEER shall, at a minimum, identify the origin of the material, the quantity of the material (tons, cubic yards, units, etc.), the identification of the transport vehicle, the type of material, and the date the material was disposed at the facility.

1.05 DISPOSAL FACILITIES

A. The OWNER reserves the right to direct the CONTRACTOR to dispose material at a facility identified by the OWNER.

B. Unless directed by the ENGINEER to dispose material at a particular facility, the CONTRACTOR shall be responsible for locating disposal facilities; e.g., solid waste disposal facility, hazardous waste disposal facility, wastewater disposal facility, etc., which shall accept all materials removed from the site, including materials generated from excavation, excess spoils, site clearing, dismantling, decontamination, or other activities performed within the areas of Work, as applicable.

C. The disposal facilities shall be approved by the ENGINEER. The disposal facility shall be in compliance with all current federal and state regulations governing construction and operation of an appropriate waste disposal facility.

1.06 ALTERNATE DISPOSAL FACILITY

A. In the event that the identified and approved facilities cease to accept the stated materials or the facility ceases operations or the OWNER rejects the facility, it is the CONTRACTOR's responsibility to locate an alternate approved and permitted facility for accepting materials. The CONTRACTOR is responsible for making the necessary arrangements to utilize the facility and the alternate facility must be approved in writing by the OWNER in the same manner and with the same requirements as the original facility before the concrete/asphalt debris, spoils, waste materials, impacted water, or other materials, are removed from the Site.

PART 2 - PRODUCTS

(not used)

PART 3 - EXECUTION

3.01 GENERAL

A. No vehicle shall leave the Site unless it is in a clean condition, free of loose dirt or loose material on tailgates, axles, wheels, etc.

B. No vehicle shall leave the Site unless the materials being transported are secure and tightly covered/tarped or contained so that no material, dust, or water is able to drop off, blow off, or leak out. Trucks shall be lined at the

discretion of the ENGINEER.

C. Loading and transportation of concrete/asphalt debris, piping, spoils, liquids, and other waste materials shall be conducted in a manner as to eliminate all dust.

D. All personnel, equipment, and trucks shall enter and exit the Site from one common location. Prior to exiting the Site all decontamination requirements of these Specifications and the Site Health and Safety Plan shall be met.

E. In the event that the materials being transported are dropped or spilled from the truck during transportation, the CONTRACTOR shall take the following steps.

1. If contents are spilled on-site, the CONTRACTOR shall immediately notify the ENGINEER. The CONTRACTOR is responsible for immediate removal of the waste materials and cleaning the area to the satisfaction of the ENGINEER.

2. If contents are spilled off-site, the CONTRACTOR shall immediately notify the ENGINEER, OWNER, and the appropriate authorities; i.e., local fire and police departments. The appropriate clean-up activities shall be coordinated without delay with these authorities.

3. If contents are spilled, the truck shall return and go through the decontamination station again before proceeding off-site.

4. If contents are spilled, no additional loads shall leave the site until the decontamination procedures are reviewed and necessary changes implemented to ensure that dropping or tracking of material and debris beyond the decontamination station does not occur.

5. The CONTRACTOR shall bear full responsibility for any required clean-up of all spilled material. All clean up and remediation activities associated with spilled materials shall be performed at no extra cost to the OWNER.

6. If contents are spilled, the DEQ project manager (Erin McDonnel, phone: 503.229.6900) shall be notified immediately. If the spill occurs in any amount that affects surface water, Oregon Emergency Response System (1.800.452.0311) shall be notified in accordance with Oregon Administrative Rules (OAR) 340-142-0040.

F. The CONTRACTOR shall be responsible for managing, handling, conditioning, transporting, and disposing of all waste material that is designated to be removed from the Site.

G. No material shall exit the Site unless it has been analyzed and documented (e.g., manifest), as necessary.

H. No material, except dewatering and decontamination liquids, shall exit the Site that fails the Paint Filter Liquid Test, EPA Method 9095A. Wet spoils or other materials shall be properly conditioned to pass the Paint Filter Test, and any other disposal facility-specific requirements, prior to being loaded and transported off-site.

3.02 TRANSPORTATION LOG

A. The CONTRACTOR shall maintain at the Site a log of vehicles leaving the Site with waste materials. The log shall indicate the vehicle identification number, date and time of departure, contents of the truck, and approximate volume or quantity of material carried.

END OF SECTION

PART 1- GENERAL

1.01 DESCRIPTION

A. The Work covered by this Section consists of furnishing all materials, equipment, tools and labor to construct, maintain, and remove soil erosion and sediment control systems.

B. The Work to be performed includes, but is not limited to the installation or construction of silt fence, stabilized construction access, permanent seeding, and any other controls necessary as specified herein, shown on the Drawings, or required to eliminate the potential for sediment-laden surface water to flow beyond the limits of disturbance.

1.02 REFERENCES

A. 2005 Oregon Department of Environmental Quality Erosion and Sediment Control Manual

B. 2008 Portland Erosion and Sediment Control Manual

1.03 QUALITY ASSURANCE

A. All materials, procedures, operations, and methods shall be in strict conformance with the Drawings and these Specifications, and shall be subject to strict quality control monitoring as detailed herein. The installed erosion and sediment controls shall conform exactly to the Drawings and these Specifications, except as otherwise authorized in writing by the ENGINEER.

B. The CONTRACTOR shall comprehend and anticipate quality assurance activities and account for these activities in the installation schedule.

C. The CONTRACTOR shall periodically inspect and maintain proper erosion and sediment control measures throughout the duration of the project, including weekends and holidays. All erosion and sediment controls shall be maintained as necessary for rainfalls one-half inch (1/2”) or greater.

1.04 SUBMITTALS

Product data shall be submitted as indicated in these Contract Documents.

PART 2 - PRODUCTS

2.01 SOIL EROSION AND SEDIMENT CONTROL MATERIALS

Silt Fence: The CONTRACTOR shall supply silt fence to control surface-water runoff and sediment in locations indicated on the Drawings. As specified in the Portland Erosion and Sediment Control Manual, silt fence material shall be heavy-duty fabric and shall retain 85 percent of the soil by weight. The fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable construction life at a temperature range of 0 to 120 degrees Fahrenheit. The CONTRACTOR shall submit the manufacturer's product data to the ENGINEER for approval.

Stabilized Construction Entrance: The CONTRACTOR shall supply and construct a stabilized construction entrance to prevent transporting soil onto public roads in locations indicated on the Drawings. Acceptable stabilized construction entrance materials and design shall meet or exceed the criteria provided on the Drawings.

PART 3 - EXECUTION

3.01 TRANSPORTATION, HANDLING AND STORAGE

Materials shall be handled in such a manner as to prevent damage to the material. Materials shall not be dropped or dragged over the ground. Any materials damaged shall be replaced at no expense to the OWNER.

3.02 EROSION AND SEDIMENT CONTROL STRUCTURES

Silt Fence: The CONTRACTOR shall install silt fence in accordance with the Specifications and installation instructions provided by the manufacturer, as shown on the Drawings, or as directed by the ENGINEER. Presiding authority shall be as follows, in descending order: ENGINEER direction, Drawings, Specifications, manufacturer's installation instructions. The CONTRACTOR shall maintain the silt fence until permanent cover is established, and the entire Site is stabilized, as approved by the ENGINEER.

Stabilized Construction Entrance: The CONTRACTOR shall construct the stabilized construction entrance in the location indicated on the Drawings, or as directed by the ENGINEER, and in accordance with the Drawings, Specifications, or as directed by the ENGINEER.

END OF SECTION

PART 1 – GENERAL

1.01 DESCRIPTION

A. The CONTRACTOR shall furnish all labor, materials, tools, supervision, transportation, and installation equipment necessary for the manufacture, storage, delivery, installation, and testing of the geotextile portions of this project, including installation as herein specified and as shown on the Drawings.

B. The CONTRACTOR shall perform the installation of the geotextiles in conjunction with all necessary construction, as depicted on the Drawings.

1.02 REFERENCES

A.	ASTM D-5261	Measuring Mass Per Unit Area of Geotextiles
B.	ASTM D-3776	Mass Per Unit Area (Weight) of Fabric
C.	ASTM D-449l	Water Permeability of Geotextiles by the Permittivity Method.
D.	ASTM D-4533	Trapezoid Tearing Strength of Geotextiles.
E.	ASTM D-4632	Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
F.	ASTM D-4751	Determining Apparent Opening Size of a Geotextile.
G.	ASTM D-6241	Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile- Related Products Using a 50-mm Probe

1.03 QUALITY ASSURANCE

All materials, procedures, operations, and methods shall be in strict conformance with the Drawings and Specifications and shall be subject to strict quality control monitoring as detailed herein. The installed geotextiles shall conform exactly to the Drawings and Specifications, except as otherwise authorized in writing by the ENGINEER.

1.04 SUBMITTALS

A. Prior to shipment of any geotextile materials, the CONTRACTOR shall submit the necessary information on the geotextile to document compliance with these Specifications to the ENGINEER. The information shall include the following:

1. Roll numbers and identification numbers.

2. Quality control certificates that provide reference to the roll numbers and identification numbers, sampling procedures, test methods and test results, and other items such as:

   a. name of manufacturer
   b. chemical composition
   c. product identification
   d. statement of compliance
   e. signature of authorization

All certificates shall be signed by a representative of the manufacturer.

B. The geotextile manufacturer shall replace any material that is rejected because it does not comply with these Specifications.

C. Upon delivery to the site, the CONTRACTOR and the ENGINEER or OWNER'S AGENT shall inspect the physical condition of the material. If the protective wrapping is damaged, or if damage is suspected, the material shall be replaced.

PART 2-PRODUCTS

2.01 GEOTEXTILE MATERIAL

A. General Requirements

1. Unless otherwise noted on the Drawings, geotextile suppliers shall furnish materials whose "Minimum Average Roll Values", as defined by the Federal Highway Administration (Fl-I WA), meet or exceed the criteria specified in Table 02711-1. The geotextiles provided by the supplier shall meet or exceed the property value specified and shall be stock products; i.e., unless authorized, the supplier shall not furnish products specially, manufactured to meet the specifications of this project.

2. The supplier shall furnish test results for the design criteria, as well as written certification that the materials meet the specifications in

accordance with these Contract Documents.

3. The geotextile material shall also perform the following:

a. Retain its structure during handling, placement and long-term service;

b. The material shall be capable of withstanding direct exposure to sunlight for 30 days with no measurable deterioration; and,

c. The material shall be chemically compatible with the materials that will be in contact with it.

B. Labeling

1. The geotextile shall be supplied wrapped in relatively impermeable and opaque protective covers.

2. The geotextile shall be marked or tagged with the following information:

a. Manufacturer's name;
b. Product identification;
c. Lot number;
d. Roll number; and,
e. Roll dimensions.

3. Additionally, if any special placement is required, it shall be so marked on the textile material; e.g., "This Side Up", or "This Side Against Soil to be Retained".

2.02 TRANSPORTATION, HANDLING, AND STORAGE

A. Transportation of the CONTRACTOR-supplied geotextile materials is the responsibility of the CONTRACTOR.

B. Handling, storage, and care of the CONTRACTOR-supplied geotextile materials prior to and following installation at the site is the responsibility of the CONTRACTOR. The CONTRACTOR shall provide adequate storage space at the site.

C. During shipment and storage, geotextiles shall be protected from ultraviolet light exposure, precipitation, or other inundation, mud, dirt, dust, punctures, cutting or any other damaging or deleterious conditions. Any additional storage procedures required by the geotextile manufacturer shall be the CONTRACTOR's responsibility.

PART 3-EXECUTION

3.01 HANDLING AND PLACEMENT

A. The CONTRACTOR shall handle all geotextiles in such a manner as to ensure that they are not damaged in any way.

B. In the presence of wind, all geotextiles shall be weighted with sandbags or the equivalent. Such sandbags shall be installed during placement and shall remain until replaced with cover material.

C. Inspection:

Prior to implementing any of the Work in this Section, the installed Work of all other Sections shall be complete to the point where the Work of this Section may properly commence without adverse impact.

D. During placement, care shall be taken not to entrap in the geotextile stones, excessive dust, or moisture that could cause damage.

E. An examination of the geotextile over the entire surface, after installation, will be conducted by the ENGINEER to ensure that no potentially harmful foreign objects, such as needles, are present. Any foreign objects so encountered shall be removed or the geotextile shall be replaced.

F. The geotextile shall only be cut using a geotextile cutter or other methods approved by the ENGINEER.

G. After unwrapping the geotextile from its opaque wrapping, the geotextile shall not be left exposed for longer than 14 days, unless approved by the ENGINEER.

3.02 SEAMS AND OVERLAPS

A. The end and edges of all geotextiles shall be overlapped 6 inches with the abutting geotextile.

B. The CONTRACTOR shall pay particular attention at overlaps to ensure that no foreign material is inadvertently inserted beneath a geotextile.

3.03 REPAIR

A. Any holes or tears in the geotextile shall be repaired by one of the following methods:

1. Liestering a patch made from the same geotextile over the affected area, with a minimum of 1 foot overlap in all directions.

2. Sewing a patch made from the same geotextile over the affected area with a minimum of 6 inch overlap in all directions.

3.04 PLACEMENT OF OVERLYING MATERIALS

A. The CONTRACTOR shall place all overlying materials located on top of the geotextile in such a manner as to ensure:

1. No damage of the geotextile or underlying layers;

2. Minimal slippage between the geotextile and the underlying layers; and,

3. No excess tensile stresses in the geotextile.

B. Equipment shall not be driven directly on the geotextile.

Table 02711-1

REQUIRED PROPERTY VALUES FOR NON-WOVEN GEOTEXTILES

PROPERTIES	QUALIFIER	SPECIFIED VALUE	TEST METHOD
Polymer Composition	Minimum	95% weight polypropylene or polyester	----
Fabric Weight	Minimum	10 oz/sq yd	ASTM D-5261
Puncture Strength	Minimum	700 lbs	ASTM D-6241
Grab Tensile Strength	Minimum	250 lbs	ASTM D-4632
Grab Tensile Elongation	Minimum	50 %	ASTM D-4632
Trapezoidal Tear Strength	Minimum	100 lbs	ASTM D-4533
Flow Rate	Minimum	75 gpm/sq ft	ASTM D-4491
Permittivity	Minimum	0.8 sec^{-1}	ASTM D-4491
Apparent Opening Size (A.O.S.)	Maximum	Sieve Size: 100	ASTM D-4751

END OF SECTION

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PART 1 – GENERAL

1.01 DESCRIPTION

The CONTRACTOR shall furnish all materials, equipment, and labor necessary for installing geogrid reinforcement to the lines and grades designated on the Drawings.

1.02 REFERENCES

A. ASTM D-4355 Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus

B. ASTM D-4759 Standard Practice for Determining the Specification Conformance of Geosynthetics

C. ASTM D-5732 Standard Test Method for Stiffness of Nonwoven Fabrics Using the Cantilever Test

D. ASTM D-5818 Standard Practice for Exposure and Retrieval of Samples To Evaluate Installation Damage of Geosynthetics

E. ASTM D-6637 Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-Rib Tensile Method

F. EPA 9090 Test Method for Determining the Chemical Waste Compatibility of Synthetic Liners

G. GRI-GG2 Geogrid Junction Strength

1.03 DELIVERY, STORAGE, AND HANDLING

A. CONTRACTOR shall inspect the geogrid upon delivery to ensure that the proper material has been received.

B. Geogrid shall be stored above -20°F (-29°C) and shall be shielded from direct exposure to sunlight.

C. CONTRACTOR shall prevent excessive mud, wet cement, epoxy, and like materials, which may affix themselves to the geogrid, from contacting the geogrid material.

D. Rolled geogrid material may be laid flat or stood on end for storage.

1.04 QUALITY ASSURANCE

A. All materials, procedures, operations, and methods shall be in strict conformance with these Specifications, and shall be subject to strict quality control monitoring as detailed herein. The installed geogrid shall conform exactly to the Specifications, except as otherwise authorized in writing by the ENGINEER.

B. The CONTRACTOR shall comprehend and anticipate CQA activities and account for these activities in the installation schedule.

1.05 SUBMITTALS

A. In accordance with these Contract Documents.

B. The Manufacturer and the Fabricator shall provide, two weeks prior to delivery, samples and Certificates of Compliance that the material is in accordance with these Specifications and is suitable for use.

C. The Manufacturer of the geogrid shall provide recommendations for overlapping, cable-tying, and general installation recommendations.

D. The CONTRACTOR shall provide, two weeks prior to installation, Shop Drawings showing anchoring details and other details pertinent to the installation of the geogrid under this Contract.

E. The CONTRACTOR shall list all equipment, tools, materials, protective clothing, and labor to be provided prior to the start of installation to ensure the timely completion of all installations.

F. The manufacturer shall submit to the ENGINEER, two weeks prior to delivery, data on the physical and chemical properties of the materials with reference to appropriate ASTM testing methods utilized in obtaining the data and the following information on the raw materials:

1. Origin and production date of the resin;
2. A copy of the quality control certificates issued by the resin supplier;
3. Reports of tests conducted by the Manufacturer to verify that the material is in conformance with all requirements identified in this Section; and,
4. Certification that no reclaimed polymer is added to the resin.

G. The CONTRACTOR shall transport, handle, and store the geogrid as necessary to maintain the integrity of the geogrid prior to its installation.

PART 2 – PRODUCTS

2.01 DEFINITIONS

A. Geogrid: A high density polyethylene (HDPE) grid structure manufactured for use as a subbase reinforcement layer for roadways installed over soft soils or other unstable materials.

B. Biaxial Geogrid: A geogrid which has been manufactured with high junction strength and high tensile strength and modules in two directions, along the roll length and across the roll width.

C. Direction of Geogrid: Refers to the orientation in which the geogrid is used for a particular project, which is along the machine direction (roll direction) for biaxial geogrid.

D. MD: Machine direction.

E. CMD: Cross-machine direction.

F. All slack shall be mechanically removed from the placed geogrids before any material (e.g., aggregate base course) is placed on top of it.

G. All information pertaining to placement of aggregate on top of the geogrid is included in Section 02232 – GRANULAR MATERIALS.

2.02 ACCEPTABLE MANUFACTURERS

A. The Tensar Corporation, Morrow, Georgia.

B. A manufacturer of equivalent products, pre-approved by the ENGINEER.

2.03 MATERIALS

A. The geogrid shall:

1. Be model BX1500 manufactured by Tensar Corporation, or an approved equivalent.
2. Be a biaxially-oriented grid structure.
3. Be composed of high density polyethylene (HDPE).
4. Have aperture geometry and rib and junction cross-sections sufficient to permit mechanical interlock with the material being supported.
5. Have high continuity of tensile strength through all ribs and junctions of the grid structure.
6. Maintain its reinforcement and interlock capabilities under repeated dynamic loads while in service.

7. Be resistant to ultraviolet degradation, to damage under normal construction practices, and to all forms of biological or chemical degradation typically encountered at similar sites.

B. Labeling

1. Geogrid shall be supplied in rolls wrapped in relatively impermeable and opaque protective covers.
2. Geogrid and rolls shall be marked or tagged with the following information:

   a) Manufacturer's name;
   b) Product identification;
   c) Lot number;
   d) Roll number; and,
   e) Roll dimensions.

3. Additionally, if any special placement is required, it shall be so marked on the geogrid material, e.g., "This Side Up", or "This Side Against Soil to be Retained".

C. The geogrid shall conform in all respects to the property requirements listed in Table 02715-1.

PART 3 - EXECUTION

3.01 EXAMINATION

The CONTRACTOR shall check the geogrid upon delivery to verify that the proper material has been received. The geogrid shall be inspected by the Contractor to be free of flaws or damage occurring during manufacturing, shipping, or handling.

3.02 PREPARATION

The subgrade soil shall be prepared as indicated on the Construction Drawings or as directed by the ENGINEER.

3.03 INSTALLATION

A. The geogrid shall be laid at the proper alignment as shown on the Construction Drawings.

B. The geogrid shall be installed in accordance with the installation guidelines provided by the Manufacturer or as directed by the

ENGINEER. Overlapping geogrid panels shall be connected in accordance with the Manufacturer's guidelines.

C. The geogrid may be temporarily secured in place with ties, staples, pins, sand bags or backfill as required by fill properties, fill placement procedures or weather conditions or as directed by the ENGINEER.

3.04 GRANULAR FILL PLACEMENT OVER GEOGRID

A. Granular fill material shall be placed in lifts and compacted as directed under Section 02232 – GRANULAR MATERIALS. Granular fill material shall be placed, spread, and compacted in such a manner that minimizes the development of wrinkles in the geogrid and/or movement of the geogrid.

B. A minimum loose fill thickness of 6 inches is required prior to operation of tracked vehicles over the geogrid. Turning of tracked vehicles should be kept to a minimum to prevent tracks from displacing the fill and damaging the geogrid. When underlying substrate is trafficable with minimal rutting, rubber-tired equipment may pass over the geogrid reinforcement at slow speeds (less than 10 mph) when integrally-formed geogrids are used. When woven, multi-layer or welded-strip geogrids are used, rubber-tired equipment shall not be allowed to pass directly on the geogrid. Sudden braking and sharp turning movements shall be avoided.

3.05 INSPECTION

A. The OWNER or ENGINEER may randomly inspect geogrid before, during and after installation.

B. Any damaged or defective geogrid (i.e. frayed coating, separated junctions, separated layers, tears, etc.) will be repaired/replaced in accordance with Part 3.06 of this Section.

3.06 REPAIR

A. Any roll of geogrid damaged before, during and after installation shall be replaced by the CONTRACTOR at no additional cost to the OWNER.

B. Proper replacement shall consist of replacing the affected area adding three (3) feet of geogrid to either side of the affected area.

3.07 PROTECTION

Follow the Manufacturer's recommendations regarding protection from exposure to sunlight.

Table 02715-1
Geogrid Properties

Property	Test Method	Units	Value[1]
Index Properties			
Aperture Dimensions [2]	ASTM D-4759		
MD		in	1.0 (nom)
XMD		in	1.2 (nom)
Rib Thickness[2]	ASTM D-4759		
MD		in	0.07 (nom)
XMD		in	0.07 (nom)
Tensile Strength @ 2% Strain[3]	ASTM D-6637		
MD		lb/ft	580
XMD		lb/ft	690
Tensile Strength @ 5% Strain[3]	ASTM D-6637		
MD		lb/ft	1,200
XCMD		lb/ft	1,370
Ultimate Tensile Strength[3]	ASTM D-6637		
MD		lb/ft	1,850
XMD		lb/ft	2,050
Structural Integrity			
Junction Efficiency[4]	GRI-GG2	%	93
Flexural Stiffness[5]	ASTM D-5732	mg-cm	2,000,000
Aperture Stability[6]		m-N/deg	0.75
Durability			
Resistance to Installation Damage[7]	ASTM D-5818 ASTM D-6637	%SC/%SW/%GP	95/93/90
Resistance to Long-Term Degradation[8]	EPA 9090	%	100
Resistance to UV Degradation[9]	ASTM D-4355	%	100

Notes:
1. Unless indicated otherwise, values shown are minimum average roll values (MARV) determined in accordance with ASTM D-4759. The row labeled MD represents results

from testing the product in the machine direction. The row labeled XMD represents results from testing the product in the cross-machine (transverse) direction.
2. Nominal dimensions.
3. True resistance to elongation when initially subjected to a load determined in accordance with ASTM D-6637 without deforming test materials under load before measuring such resistance or employing “secant” or “offset” methods of tangent measurement so as to overstate tensile properties.
4. Load transfer capability determined in accordance with GRI-GG2 and expressed as a percentage of ultimate tensile strength.
5. Resistance to bending force determined in accordance with ASTM D-5732, using specimens of width two ribs wide, with transverse ribs cut flush with exterior edges of longitudinal ribs (as a “ladder”), and of length sufficiently long to enable measurement of the overhang dimension. The overall flexural stiffness is calculated as the square root of the product of MD and XMD flexural stiffness values.
6. Resistance to in-plane rotational movement measured by applying a 20 kg-cm (2 m-N) moment to the central junction of a 9 inch x 9 inch specimen restrained at its perimeter in accordance with U.S. Army Corps of Engineers Methodology for measurements for torsional rigidity.
7. Resistance to loss of load capacity or structural integrity when subjected to mechanical installation stress in clayey sand (SC), well graded sand (SW), and crushed stone classified as poorly graded gravel (GP). The geogrid shall be sampled in accordance with ASTM D-5818 and load capacity shall be determined in accordance with ASTM D-6637.
8. Resistance to loss of load capacity or structural integrity when subjected to chemically aggressive environments in accordance with EPA 9090 immersion testing.
9. Resistance to loss of load capacity or structural integrity when subjected to 500 hours of ultraviolet light and aggressive weathering in accordance with ASTM D-4355.

END OF SECTION

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PART 1 - GENERAL

1.01 SCOPE OF WORK

A. CONTRACTOR shall furnish all labor, materials, equipment, and incidentals required to perform miscellaneous Work not specified in other Sections, but necessary for the proper completion of the Work.

B. When applicable, the CONTRACTOR shall perform the Work in accordance with other Sections of these Specifications. When no applicable specification exists, the CONTRACTOR shall perform the Work in accordance with established industry practice and/or as directed by the ENGINEER.

C. The Work of this Section includes, but is not limited to, the following:

1. Cleanup.

2. Incidental work.

3. Restoration of disturbed areas.

4. Restoring easement and right-of-ways.

5. Temporary facilities.

6. Protection of existing equipment, underground and aboveground utilities, including, monitoring wells, utilities, materials and structures that are designated to remain.

PART 2 - PRODUCTS

2.01 MATERIALS

Materials required for this section shall be the same quality of materials that are to be restored. Where possible, the CONTRACTOR may use existing materials that are removed subject to the approval of the ENGINEER.

PART 3 - EXECUTION

3.01 CLEANUP

A. The CONTRACTOR shall remove all construction material, waste, buildings, equipment and other debris remaining on the project, except as otherwise specified, as a result of construction operations and shall restore the site of the Work to a neat and orderly condition.

B. During the course of the Work, the CONTRACTOR shall keep the site of operations in as clean and neat a condition as is possible. CONTRACTOR shall dispose of all residuals resulting from the Work that are not otherwise re-used or replaced.

C. At the completion of the Work, the CONTRACTOR shall:

1. Remove waste materials, rubbish, tools, equipment, machinery, and surplus materials.

2. Remove grease, dust, stains, labels, and other deleterious or foreign materials from the Site.

3. Repair, patch, and touch up marred or otherwise damaged surfaces.

4. Prior to transferring the completed project, conduct an inspection of surfaces, and all Work areas, to verify that the entire Site is in an orderly condition.

D. In order to prevent environmental pollution arising from the construction activities related to the performance of this project, the CONTRACTOR and Subcontractors shall comply with all applicable federal, state and local laws and regulations concerning waste material disposal, as well as the specific requirements stated in this Section and elsewhere in these Specifications.

E. The CONTRACTOR is advised that the disposal of excess excavated material in wetlands, stream corridors, and floodplains is strictly prohibited. Any violation of this restriction by the CONTRACTOR, or any Subcontractor or employee, will be brought to the immediate attention of the responsible regulatory agencies, with a request that appropriate action be taken against the offending parties. Therefore, the CONTRACTOR will be required to remove the fill and restore the area impacted without additional cost to the OWNER.

3.02 INCIDENTAL WORK

CONTRACTOR shall perform all incidental work not otherwise specified, but necessary to the proper completion of the Work as specified and as shown on the Drawings.

3.03 RESTORATION OF DISTURBED AREAS

The CONTRACTOR shall be responsible for restoring and stabilizing all disturbed areas prior to demobilizing from the site. Stabilization and restoration shall be conducted in accordance with the Drawings and Technical Specifications and shall ensure that sediment laden surface water will not enter drainage ways, streams, rivers or other conveyance systems.

3.04 RESTORING EASEMENTS AND RIGHT-OF-WAYS

Existing vegetated surfaces damaged by construction shall be replaced. The CONTRACTOR shall restore the areas with an equivalent depth and quality of loam, seed and fertilizer as necessary to produce a stand of grass at least equal to that existing prior to construction. These areas shall be maintained and re-seeded, if necessary, until the Work has been completed and accepted. Any additional Work required to restore property to the original condition shall be performed by the CONTRACTOR.

3.05 PROTECTION OF EXISTING UNDERGROUND AND ABOVEGROUND UTILITIES AND OTHER INFRASTRUCTURE

A. Utilities (telephone, sewer, culverts, etc.) and other infrastructure may exist within, or adjacent to, the project area. These items shall be maintained and protected at all times. Locations of these items may or may not be shown on the Drawings. Prior to starting work the CONTRACTOR shall be responsible for identifying these items and providing proper protection; barricades, such that the integrity is not compromised. Any damage to such facilities as a direct result of CONTRACTOR operations will be the sole responsibility of the CONTRACTOR to repair and/or replace at no cost to the OWNER.

B. The CONTRACTOR shall cooperate with the OWNER, and other organizations; i.e., utility companies, and shall not allow plant or utility service to be disrupted or relocated without the permission of the ENGINEER and the written permission of the utility owner.

C. In the event that an existing structure or utility not already identified for relocation must be relocated in order to avoid a conflict with the Work, the CONTRACTOR shall notify the ENGINEER and the OWNER promptly.

END OF SECTION

02936
ESTABLISHMENT OF VEGETATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. The CONTRACTOR shall furnish all equipment, tools, materials, and labor necessary for establishing permanent vegetative cover; e.g., seeding, fertilizing, and mulching, on all areas disturbed beyond the Greenway Buffer shown in the Drawings, including any areas disturbed within the Industrial Activity Setback and other previously vegetated areas not within the Greenway Buffer, by performance of the Work.

1.02 REFERENCES

A. The following publications of the issues listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.

1. U.S. DEPARTMENT OF AGRICULTURE (USDA)
   Federal Seed Act of 9 August 1939 (53 Stat 1275)

2. Portland Erosion and Sediment Control Manual, 2008.

1.03 QUALITY ASSURANCE

A. All materials, procedures, operations, and methods shall be in strict conformance with the Drawings and Specifications, and shall be subject to strict quality control monitoring as detailed herein.

1.04 GENERAL REQUIREMENTS

A. The specified seed varieties and quantities shall be uniformly distributed over the disturbed area in such a manner that will produce an even stand of grass over the entire area seeded. The CONTRACTOR shall notify the ENGINGEER at least ten (10) days prior to seeding operations.

1.05 SOIL TEST

A. The CONTRACTOR shall perform agricultural soil tests to determine fertilizer requirements for permanent seeding. Test reports shall be submitted to the ENGINEER in accordance with Paragraph 1.06 of this Section.

1.06 SUBMITTALS

A. In accordance with Section 01300 - SUBMITTALS, the CONTRACTOR shall submit the following items:

1. Certificates of Compliance or Reports:

    a. Seed;
    b. Fertilizer;
    c. Lime; and,
    d. Agricultural Soil Test Report.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. During delivery, seed shall be protected from any drying or contamination by detrimental material.

2. Seeding material shall be inspected upon arrival at the site; unacceptable material shall be immediately removed from the site by the CONTRACTOR.

3. Fertilizer shall be delivered to the site in the original, unopened containers bearing the manufacturers guaranteed chemical analysis, name, trade name, trademark, and conformance with State of Oregon, City of Portland and federal laws and regulations.

4. Pesticides and herbicides shall be delivered to the site in the original unopened containers. Containers without labels, United States Environmental Protection Agency (USEPA) registration numbers, and the manufacturers registered uses will be rejected by the ENGINEER.

B. Storage:

1. Seed and fertilizer shall be stored in cool, dry locations away from contaminants.

2. Pesticides and herbicides shall not be stored with other landscaping materials and shall be handled and stored in accordance with the manufacturer's directions.

3. Materials shall be stored in areas designated or approved by the ENGINEER.

PART 2 - MATERIALS

2.01 MATERIALS

A. Seed shall be of the latest season's crop and shall be delivered in original sealed packages bearing the producer's guaranteed analysis for percentages of mixtures, purity, germination, weed-seed content, and inert material. Labels shall conform with USDA Federal Seed Act, Rules & Regulations and applicable State of Oregon and City of Portland seed laws. Wet, moldy, or otherwise damaged seed will be rejected.

1. Temporary Seed Mixture

   Not applicable

2. Permanent Seed Mixture

   The permanent seed mixture of each lot shall be as described in Table 02936-1: Permanent Seeding Requirements, or as directed by the ENGINEER.

B. Fertilizer shall be controlled-release, commercial grade, granular free flowing, uniform in composition, delivered in fully labeled sealed containers, and shall conform to applicable State of Oregon, City of Portland, and federal regulations. Fertilizer shall bear the manufacturers guaranteed statement of analysis. Granular fertilizer shall contain a minimum percentage by weight of the following elements: 16% nitrogen and 48% phosphoric acid.

C. Natural limestone shall contain and be equivalent to 50 percent calcium plus magnesium oxide, and ground to such fineness that not less than 90 percent passes a 10-mesh sieve and not less than 50 percent passes a 100-mesh sieve.

D. Top Soil

   Top soil shall contain a sufficient amount of organic material to promote the growth of vegetation. Additives, which may be deemed necessary by the CONTRACTOR, shall be submitted to the ENGINEER for review and approval.

E. Mulch

   The choice of materials for mulching will be based on soil and site conditions, season, and economics. Recommendations have been made in the following text. These are to be used as guidelines and any changes to these recommendations must be submitted to and approved by the ENGINEER.

1. Straw Mulch shall be unrotted stalks from oats, wheat or rye that are free from noxious weeds, mold, or other objectionable material. The straw mulch shall contain at least 50 percent by weight of the material to be ten (10) inches or longer. Straw shall be in an air-dry condition and suitable

for placing with blower equipment. Once placed, the straw shall be anchored to reduce loss due to wind.

2. Hydro-Mulch Overspray Tacitifier shall be the same as, or equal to, a recycled slick paper (containing wood cellulose and kaolinite clay), shall not contain any growth or germination-inhibiting factors, and shall be dyed an appropriate color to facilitate visual metering during application. Slick paper composition on air-dry weight basis: 8 percent moisture maximum, pH 4.5 - 6.5. When added to water, it shall form a homogenous slurry specifically for use in hydraulic mulching equipment. This material when sprayed on the straw mulch becomes a tacitifier/binder and provides a stable bed for seed germination.

F. Water shall be of a quality suitable for irrigation.

G. Chemical Treatment Material shall be USEPA-registered and approved herbicides and pesticides. These materials shall comply with all applicable State of Oregon, City of Portland and federal laws and regulations.

PART 3 - EXECUTION

3.01 DATES FOR SEEDING

A. Permanent seeding: Permanent seeding shall be performed when exposed soil surfaces are not anticipated to be disturbed for a period greater than one year, or upon completion of all site work. Permanent seeding shall be conducted within seven (7) days of completing the final grading in the area. The CONTRACTOR shall consider the time of year when seeding. The minimum seeding rates presented in Table 02936-1 may need to be increased based on the time of year to ensure that a full-stand of vegetation is achieved. The CONTRACTOR is responsible for establishing full vegetative coverage and any repairs required within the establishment and maintenance period (see Part 3.05).

3.02 PREPARATION OF SEEDBED

A. Tillage

1. The soil shall be tilled to a depth of at least 4 inches by plowing, disking, harrowing, or rototilling. When drought, excessive moisture, or other unsatisfactory conditions prevail, the Work shall be stopped. The soil surface shall be leveled to meet finish grade requirements before seeding. Seedbed preparation shall be performed on the contour to reduce soil loss.

B. Application of Fertilizer and Lime

1. Fertilizer and Lime shall be incorporated into the soil to a depth of 4 inches during seedbed preparation.

C. Fertilizer and Lime Rate

1. Fertilizer and Lime shall be applied at the rate determined by the results of the CONTRACTOR's Agricultural Soil Test. The following rates are provided as a comparison to the Agricultural Soil Test results.

a. Fertilizer:

1. Permanent Seeding: Fertilize at a rate of 100-100-200 per acre.

b. Lime:

1. Permanent Seeding: Apply 6 tons of agricultural Lime per acre.

3.03 PLANTING SEED

A. Prior to seeding, any previously prepared seedbed areas compacted or damaged by interim rains, traffic, or other cause, shall be reworked to restore the ground condition previously specified. Seed shall be planted at the rate specified herein.

B. Permanent seeding mixture shall be applied at the minimum seeding rates specified on 02936-1. Seed planting shall be accomplished by:

1. Broadcast Seeding

The CONTRACTOR shall broadcast seed by hand or with approved gravity or cyclone types of spreading equipment. Broadcast seedings shall be covered to an avenge depth of ¼ to ½-inch. Completed seeding shall be mixed into soil with a harrow or rake and compacted with a cultipacker-type roller providing 60 to 90 pounds weight per linear foot of roller, light drag, or by equivalent approved hand rolling or compacting methods. Broadcast seeding will not be permitted when wind velocity is such as to prevent uniform seed distribution. Do not sow immediately following rain or when ground is too dry.

2. Drill Seeding

The CONTRACTOR shall plant seed with a Brillon-type seed drill equipped with seeding mechanisms, agitator, double disk furrow openers

and packer wheels. The seed drill shall plant, cover and compact the seedbed in the same operation. The distance between drill rows shall not be more than 3 to 4 inches apart with planting depth of ¼ to ½ inch. Drill seeding is recommended over broadcast for large areas of seeding.

3. Hydroseeding

If Hydroseeding is used and the seed and fertilizer is mixed, they shall be mixed on site and the seeding shall be immediate and without interruption. Slopes must be no steeper then 2 to 1 (horizontal to vertical).

4. Mulching

The CONTRACTOR shall perform mulching on the same day as planting seed.

a. Applying Mulch

Straw mulch shall be spread uniformly in a continuous blanket of a uniform loose depth of 1 to 2 inches over the seeded area, using a minimum of 3 tons per acre, or as directed by the ENGINEER. The mulch shall be spread in such manner as to prevent bunching.

b. Securing Mulch

Immediately following (the same day) the spreading of the mulch, the material shall be anchored securely to the soil by use of the Hydro-Mulch Overspray Tactifier material or by anchoring. The material shall be applied by a hydroseed blower, or as approved by the ENGINEER. The material shall be applied in a raining technique to prevent bunching and displacement of the straw mulch and in accordance with manufacturer's instructions.

c. Mulch Maintenance

All mulches must be inspected periodically by the CONTRACTOR, in particular after rainstorms, to check for erosion and mulch coverage, if bare soil is exposed and not covered by mulch, additional mulch needs to be immediately applied by the CONTRACTOR.

3.04 PROTECTION AND CLEANUP

After seeding and mulching operations have been completed, barricades and approved warning signs shall be erected by the CONTRACTOR as required to provide protection against traffic and trespass. Excess material from seeding and mulching operations, and

all debris, shall be cleaned up and disposed off-site by the CONTRACTOR, unless otherwise directed by the ENGINEER.

3.05 ESTABLISHMENT AND MAINTENANCE PERIOD

A. Establishment Period

The CONTRACTOR is responsible for the establishment and maintenance of permanent seeding for a minimum period of one year from the date of the establishment of vegetative coverage. Establishment of vegetative coverage is defined as follows:

1. Vegetative growth over 95 percent of the seeded surface;

2. Growth of the vegetation shall have reached a minimum blade length of at least 6 inches;

3. No bare spots greater than 10 square feet can be observed; and,

4. Ground cover is achieved which is mature enough to control soil erosion and to survive severe weather conditions.

Otherwise, the establishment and maintenance period shall be extended until such time that these criteria are met, as determined by the ENGINEER.

B. Maintenance Period

The CONTRACTOR shall be responsible for maintenance of temporary and permanent seeding and mulch for up to one year. In the event that the earthwork is completed after the growth season and the CONTRACTOR elects to delay the application of permanent vegetation, the CONTRACTOR shall winterize the site, including but not limited to temporary seed, mulch, tackifier, erosion control measures, and other best management practices to mitigate erosion and sedimentation. The CONTRACTOR shall be responsible for maintenance of the installed soils, repair of erosion, and replacement of soils, as needed, throughout the period between completion of earthwork and the establishment/maintenance period set forth herein that is initiated upon vegetative establishment. Maintenance activities performed by the CONTRACTOR shall include:

1. The CONTRACTOR shall repair and seed patches of dead vegetation which are the result of improper seeding practices or lack of protection.

2. Eroded or damaged areas shall be repaired and reseeded by the CONTRACTOR.

3. The CONTRACTOR shall ensure that mulch covers the soil surface.

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Table 02936-1. Permanent Seeding Mixtures [1]

Total Amount (lbs per acre)	Seed Species	Comments
10	Grassy-leafed Sweet Flag	Rates are for Pure Live Seed.
10	Blue Fescue	
30	Grooved Rush	

[1] Permanent seeding mixture shall be in accordance with Table 02936-14 or suitable mix per the City of Portland Bureau of Development Services Tree and Landscaping Manual- Plant Materials.

END OF SECTION

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Groundwater Barrier Wall
Technical Specifications Red-line
Version (electronic only)

PART 1 - GENERAL

1.01 DESCRIPTION

The CONTRACTOR shall perform all Work in such manner as to minimize the polluting of air, water, or land, and shall, within reasonable limits, control noise and minimize the generation and disposal of solid waste materials, as well as other pollutants. Disposal of waste materials shall comply with all applicable federal, state, county, and environmental regulations.

1.02 PRE-CONSTRUCTION WALK-THROUGH

Prior to the start of any on-site construction activities, the CONTRACTOR and the ENGINEER shall make a joint condition survey of the Site after which the CONTRACTOR shall prepare a brief report indicating on a layout plan the condition of structures, fences, equipment, stored product and materials, and items near the Work areas and access route(s) as applicable. This report will be signed by both the ENGINEER and the CONTRACTOR upon mutual agreement as to its accuracy and completeness.

1.03 PROTECTION OF LAND AREAS AND UTILITIES

A. Except for any Work, or storage area and access routes specifically assigned for the use of the CONTRACTOR, the land areas outside the limits of disturbance performed shall be preserved in their present condition.

B. The CONTRACTOR shall confine its construction activities to areas defined for Work on the Drawings or specifically assigned for its use within the designated disturbed area. Storage and related areas and access required temporarily by the CONTRACTOR in the performance of the Work shall be coordinated with the ENGINEER.

C. It is the responsibility of the CONTRACTOR to contact the specific utility when working near utility poles. The CONTRACTOR shall coordinate with the utility to ensure adequate, temporary support and protection of the utility poles when working near the poles. The CONTRACTOR shall also coordinate with the utility for any temporary re-routing of the utility or shielding of the utility during the Work.

1.04 PROTECTION OF SURROUNDING AREAS

A. Except for trees, shrubs and other vegetation marked on the Drawings to be removed; the CONTRACTOR shall not deface, injure or destroy trees, shrubs, or vegetation nor remove or cut them without special authority. No ropes, cables, or guys shall be fastened to or attached to any existing

nearby trees for anchorages.

B. The CONTRACTOR shall not damage or compromise the integrity of any infrastructure, equipment, materials, or other items not designated for removal or any Work. Any damage to items within or outside the Work area that are not designated for dismantling shall be restored or replaced in kind at no additional cost to the OWNER.

1.05 PROTECTION OF WATER RESOURCES

A. The CONTRACTOR shall control the disposal of fuels, oils, bitumens, calcium chloride, acids, alkalies, pesticides, herbicides, rodenticides, or other harmful materials, both on- and off-site, and shall comply with applicable federal, state, and local laws concerning the pollution of rivers and streams. Special measures shall be taken to prevent chemicals, fuels, oils, greases, bituminous materials, herbicides, and insecticides from entering public waters.

B. Water used in on-site material processing and other waste waters shall not be allowed to re-enter public waters. These waters and decontamination water or fluids shall be contained and disposed at an appropriate facility in accordance with all federal, state and local requirements.

C. Water accumulating within any excavation containing potentially impacted materials shall be removed/dewatered in accordance with these Specifications. Water shall be disposed in accordance with Section 01500 – TEMPORARY FACILITIES AND CONTROLS.

D. Management, handling, testing, and disposal of contaminated water and soil shall be in accordance with Contaminated Material Management Plan (CMMP).

1.06 WASTE DISPOSAL

A. The CONTRACTOR shall place all general debris and waste; i.e., paper, trash, etc., in a storage container provided by the CONTRACTOR for subsequent disposal by the CONTRACTOR. Soil, sediment, contact water or demolition debris is not considered general debris, but rather, waste that shall be managed as required in the Contract Documents, including Section 02250 – TRANSPORTATION AND DISPOSAL OF MATERIALS. If any waste material is dumped in unauthorized areas, the CONTRACTOR shall remove the material and restore the area to the condition of the adjacent undisturbed areas. Where directed, ground and/or floor areas contaminated by CONTRACTOR operations shall be excavated and/or cleaned, disposed as approved, and replaced with suitable fill material at no additional expense to the OWNER.

B. No material shall be burned on the project site. It shall be the responsibility of the CONTRACTOR to provide disposal of all waste materials in accordance with all state and county regulations.

1.07 DUST CONTROL

A. The CONTRACTOR shall maintain all excavations, stockpiles, access roads, waste areas, off-site roadways and all other work areas free from excess dust to such reasonable degree as to avoid causing a hazard or nuisance to others.

B. Approved temporary methods for dust control consist of sprinkling of water or a dilute solution of water with a biodegradable surfactant (less than 0.05 percent). Chemical treatment, tents, windscreens, or similar methods will be considered for dust control. Approval of such temporary methods must be granted by the ENGINEER prior to initiation.

C. Dust control shall be performed as the Work proceeds and whenever a dust nuisance, hazard, or exceedance of predefined action levels occurs, or as otherwise directed by the ENGINEER.

1.08 EROSION CONTROL

A. Surface drainage from cuts and fills, within the construction limits, whether or not completed, and from excavated areas shall be graded to control erosion within acceptable limits.

B. Temporary control measures shall be provided and maintained throughout construction. Such measures shall include, but not be limited to silt fence and stabilized construction entrance. No additional payment will be considered or approved for repair or maintenance of the erosion control

measures or for erosion repair. Additional measures, such as berms, may be required to meet the requirements herein, including the containment of slurry, so that no slurry flows toward the river bank.

C. The area of bare soil, exposed at any one time by construction operations shall be minimized to the satisfaction of the ENGINEER.

1.09 CORRECTIVE ACTION

The CONTRACTOR shall, upon receipt of a notice in writing from the ENGINEER of any non-compliance with the foregoing provisions, take immediate corrective action in accordance with any and all federal, state, or local laws. If the CONTRACTOR fails or refuses to comply promptly, the ENGINEER may issue an order stopping all or part of the work until satisfactory corrective action has been taken.

1.10 POST-CONSTRUCTION CLEANUP OR OBLITERATION

The CONTRACTOR shall, unless otherwise instructed in writing by the ENGINEER, obliterate all signs of temporary construction facilities such as temporary access roads, Work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the Work. Any disturbed soil areas shall be graded and filled and the entire area stabilized with aggregate or seeded with permanent vegetation..

PART 2 - PRODUCTS

(not used)

PART 3 - EXECUTION

(not used)

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Clean-Up

Upon completion of the Work and before a Certificate of Substantial Completion is issued by the ENGINEER to the CONTRACTOR, the Work site, storage areas, and other areas occupied by the CONTRACTOR during construction shall be cleaned, and all surplus and discarded materials, false Work, and rubbish placed thereon by the CONTRACTOR shall be removed by the CONTRACTOR. No separate payment will be made for clean-up as all such costs shall be included in the Bid.

B. Warranties and Guarantees

All Warranties and Guarantees shall be submitted to the ENGINEER prior to the performance of Work or the delivery of materials to the Site. These Warranties and Guarantees will be referred to the OWNER for review and approval of the Terms and Conditions. Upon completion of the Work and before a Certificate of Substantial Completion is issued by the ENGINEER to the CONTRACTOR, all final Warranties and Guarantees shall be submitted to the ENGINEER.

C. Record Documentation and "As-Built" Drawings

1. Upon Completion of the Work and before a Certificate of Substantial Completion is issued by the ENGINEER to the CONTRACTOR, all "As-Built" documentation shall be completed and submitted to the ENGINEER.

2. Project record documents include, but are not limited to the following:

   a. Drawings;
   b. Specifications;
   c. Addenda;
   d. Site Work Orders, field orders, and other modifications to the Contract,
   e. Approved Shop Drawings;
   f. Product data and samples;
   g. Warranties and Guarantees;

h. "As-Built" documentation; and,
i. Other approved documents submitted by the CONTRACTOR in compliance with these Specifications.

3. CONTRACTOR shall maintain, at the Site, one set of the following record documents; and record actual revisions to the Work.

   a. Contract Drawings;
   b. Specifications;
   c. Addenda;
   d. Change Orders and other Modifications to the Contract; and,
   e. Reviewed Shop Drawings, product data, and samples.

4. CONTRACTOR shall store Record Documents separately from documents used for construction.

5. CONTRACTOR shall record information concurrent with construction progress.

6. Specifications: CONTRACTOR shall legibly mark and record at each product section the description of actual products installed, including the following:

   a. Manufacturer's name and product model and number;
   b. Product substitutions or alternates utilized; and,
   c. Changes made by Addenda and modifications.

7. Record Documents and Shop Drawings: CONTRACTOR shall legibly mark each item to record actual construction, including:

   a. Field changes of dimension and detail.
   b. Details not included on the Drawings.

8. CONTRACTOR shall submit the documents to the ENGINEER or OWNER'S AGENT with the claim for final Application of Payment.

9. CONTRACTOR shall maintain a daily log of Work performed/completed.

10. CONTRACTOR shall maintain a workers log.

11. CONTRACTOR shall submit well abandonment records to the OWNER and Regulatory agencies in accordance with Oregon

Administrative Rules (OAR) Section 690 Division 240.

1.02 CLOSEOUT PROCEDURES

A. When the CONTRACTOR considers that the Work is substantially complete, it shall submit a written request that certifies that the Contract Documents have been reviewed, the Work has been inspected, and that Work is complete in accordance with the Contract Documents and is ready for the ENGINEER's final inspection.

B. CONTRACTOR shall provide to the ENGINEER "As-Built" documentation, all submittals in accordance with Section 01300 - SUBMITTALS of the Technical Specifications, Warranties and Guarantees, and other submittals required by these Specifications or governing authorities prior to, or concurrent with the request for Certification of Substantial Completion.

C. ENGINEER shall, within a reasonable time after receipt of a written request from the CONTRACTOR, conduct an inspection to determine the status of completion. If ENGINEER, determines that the Work is not complete, it shall notify CONTRACTOR in writing giving the reasons thereof. The CONTRACTOR shall remedy the deficiencies noted and submit a certification to the ENGINEER for re-inspection.

D. The CONTRACTOR shall submit project Record Documents to the ENGINEER with the claim for final Application for Payment.

E. Evidence of payment and release of liens shall be provided by the CONTRACTOR in accordance with the requirements provided in the Contract Documents, and is required prior to final payment.

PART 2 - PRODUCTS

(not used)

PART 3 - EXECUTION

(not used)

END OF SECTION

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PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work covered by this Section consists of furnishing all materials, labor, tools, equipment and transportation necessary for all construction as it pertains to the excavating, handling, stockpiling, backfilling, compacting and grading of earthwork. The Work includes all hauling, stockpiling, covering, wetting or drying, dewatering, conditioning, compacting and other operations pertaining thereto for constructing and preparing the earthwork complete in accordance with these Specifications and Drawings, or as directed by the ENGINEER.

B. The Work shall include, but not be limited to, the following activities:

1. Construction of earthen berms, ditches and/or swales, and other measures for constructing a slurry pond, GWBW support areas or management of surface water flow;
2. Hauling, conditioning, stockpiling, and management of soils removed for installation of the groundwater barrier wall (GWBW);
3. Excavations and backfilling of soils or trench spoils associated with any portion of the Work required herein;
4. Furnishing, preparing, hauling, testing, placing, and compacting common fill;
5. Furnishing, preparing, hauling, testing, placing, and compacting the clay cap;
6. Site grading;
7. Stockpiling and managing materials throughout Work;
8. Dust control; and,
9. Dewatering, transportation, and on-site management and storage of any accumulated storm-water runoff and groundwater within excavations.

C. No soils, debris, or liquids shall be removed from the Site unless otherwise instructed or approved by the ENGINEER. The CONTRACTOR shall store, characterize, decontaminate, transport, dispose of, and otherwise manage all materials in accordance with these Specifications and the Contaminated Material Management Plan, (CMMP), included as Attachment E.

D. All soil types shall consist of materials approved by the ENGINEER from off-site sources and/or approved materials removed from on-site. CONTRACTOR shall not use potentially contaminated soil for use in cap or surface grading. ~~associated with non-GWBW elements, including but not limited to the materials designated for cap construction, grading, or erosion control features, such as common fill, clay, dense graded~~

~~aggregate, gravel, or topsoil~~. These common backfill materials ~~non-GWBW~~ shall be tested in accordance with the frequency stated in the Contaminated Material Management Plan (CMMP) and shall not exceed the maximum concentrations presented in the CMMP. During construction, the construction area shall be well drained. No materials shall be backfilled when either the material or the surfaces on which it is to be placed are frozen, subject to standing water, or excessively wet or soft, unless otherwise specified by the ENGINEER. When the Work is interrupted by heavy precipitation or freezing temperatures, fill operations shall not be resumed until the ENGINEER determines that the moisture content, density and integrity of the previously-placed soils are as specified.

E. All soils shall be removed to the limits and depths as specified on the Drawings and Specifications.

1.02 DEFINITIONS

A. "Common Fill" includes all soils utilized as supplemental fill to backfill excavations or construct earthen berms or other engineered structures, as required.

B. "Clay" includes those clean soils required for the low permeability layer of the soil cap to be installed above the groundwater barrier wall. The soil shall exhibit a laboratory-tested permeability of less than or equal to 1 x 10^{-5} centimeters per second (cm/sec).

C. "Trench Spoils" includes all subsurface materials generated from the excavation or mixing of the GWBW trench.

D. "Impacted Spoils" includes those soils existing within the extent of the groundwater barrier wall, or elsewhere that are observed to be contaminated, as determined by the ENGINEER.

E. "Obstructive Debris" includes those materials encountered during the Work that would interfere or obstruct the installation of the groundwater barrier wall.

1.03 REFERENCES

A. ASTM D-422 Particle-Size Analysis of Soils

B. ASTM D-698 Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5 Pound Rammer and 12-inch Drop

C. ASTM D-2216 Standard Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures

D. ASTM D-2487 Classification of Soils for Engineering Purposes

E. ASTM D-6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

F. ASTM D-4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils

G. ASTM D-2974 Organic Content of Soils

H. ASTM D-1556 Test Method for Density of Soil In Place by Sand-Cone Method

I. ASTM D-1557 Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 Pound Rammer and 18-Inch Drop

J ASTM D-5084 Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

K. EPA 9095-A Paint Filter Liquids Test

1.04 QUALITY ASSURANCE

A. All materials, procedures, operations, and methods shall be in strict conformance with the Drawings and Specifications, and shall be subject to strict quality control monitoring as detailed herein and in the Construction Quality Assurance/Quality Control (CQA/QC) Plan. The backfilled soils shall conform exactly to the Drawings and Specifications, except as otherwise authorized in writing by the ENGINEER.

B. The CONTRACTOR shall comprehend and anticipate construction quality assurance activities by the ENGINEER, or others, and account for these activities in the installation schedule.

1.05 SUBMITTALS

A. The CONTRACTOR shall submit to the ENGINEER for review a Work Plan proposing methods of excavation, separation of materials (i.e., obstructive debris from trench spoils), construction of slurry pond, proper staging, conditioning, dewatering, erosion controls, and sequencing for the various portions of the Work. Review shall be for method only. The CONTRACTOR shall remain fully responsible for the adequacy and safety of the methods proposed.

B. The CONTRACTOR shall submit to the ENGINEER a stockpiling and staging plan for all Work, including soils, trench spoils, obstructive debris, and other materials prior to the commencement of earthwork activities. Any temporary stockpile that includes potentially impacted materials shall have a 40-mil HDPE or 30-mil PVC liner under the pile; the pile shall also be covered with plastic to prevent storm water contact or dust generation. The plan shall indicate the location and contents of each stockpile. Generalized locations for soil stockpiles are as designated on the Drawings; the final stockpiling plan is subject to the approval of the ENGINEER.

C. The CONTRACTOR shall submit a 50-pound sample from each of the off-site borrow sources proposed to furnish the required quantity of fill materials. The samples shall be submitted to the ENGINEER no less than two (2) weeks prior to the anticipated placement of any soil materials.

D. The CONTRACTOR shall submit the location of all off-site borrow sources and the results of the tests listed below to the ENGINEER no less than two (2) weeks prior to the anticipated placement of any soil materials.

E. The CONTRACTOR shall submit the results of the ASTM tests listed below for each borrow pit location and designated fill classification to verify that the soil materials meet the technical requirements of this Section.

PARAMETER	ASTM TEST METHOD	FREQUENCY FOR CQC TESTING	FILL CLASSIFICATION
Moisture Content	D-2216	One per 2,000 cy (minimum of 3 tests per source) or each change in Material Type	Common Fill and Clay
Soil Classification	D-2487	One per 2,000 cy (minimum of 3 tests per source) or each change in Material Type	Common Fill and Clay
Particle-Size Analysis with Hydrometer	D-422	One per 2,000 cy (minimum of 3 tests per source) or each change in Material Type	Common Fill and Clay
Atterberg Limits	D-4318	One per 2,000 cy (minimum of 3 tests per source) or each change in Material Type	Common Fill and Clay
Modified Proctor	D-1557	One per 2,000 cy (minimum of 3 tests per source) or each change in Material Type	Common Fill and Clay
Hydraulic Conductivity	D-5084	One per 2,000 cy (minimum of 2 tests per source) or each change in Material Type	Clay

The test results shall be submitted to the ENGINEER no less than one week prior to the anticipated placement of any general fill materials furnished from off-site.

1.06 SOIL TESTING

A. Prior to the general placement of the fill, and during such placement, the ENGINEER shall select areas within the limits of the fill for testing the degree of compaction obtained. The CONTRACTOR shall be responsible for the cost of all quality control testing. The CONTRACTOR shall cooperate fully to allow the ENGINEER to perform supplemental quality assurance testing.

B. Payment for any in-place quality assurance testing verification will be made by the OWNER. If the results are unsatisfactory, all costs involved in correcting deficiencies in compacted materials to the satisfaction of the ENGINEER and any additional costs for retesting will be borne by the CONTRACTOR.

C. The testing frequency required in Paragraph 1.05 of this Section may be increased at the discretion of the ENGINEER when visual observation or construction performance indicates a potential problem.

PART 2 – MATERIALS

2.01 COMMON FILL SOILS

Common fill soils shall consist of mineral soil substantially free from organic materials, loam, wood, trash, and other objectionable materials which may be compressible or which cannot be properly compacted. Common fill soils shall not contain stones larger than two (2) inches in largest diameter and shall be classified according to the Unified Soil Classification System (USCS) as SM, SC, SC-SM, ML-CL, ML, or CL. Common fill soils shall have a maximum plasticity index of 40. Common fill soils shall not contain granite blocks, broken concrete, masonry, rubble, or other similar materials. It shall have physical properties such that it can readily spread and be compacted during filling. Snow, ice, and frozen soil shall not be permitted. Common fill soils shall be used as backfill for excavated areas. Common fill soils shall be procured from a commercial soil borrow site.

2.02 CLAY

Clay soils shall consist of mineral soil substantially free from organic materials, loam, wood, trash, and other objectionable materials which may be compressible or which cannot be properly compacted. The material shall be classified

according to the Unified Soil Classification System (USCS) as SM, SC, ML, CL, ML-CL, MH, or CH. The material shall have a minimum plasticity index of 10; 100 percent of the particles having a dimension less than two (2) inches; a maximum of 10 percent of the particles, by weight, greater than 0.75 inches in greatest dimension; and, a minimum of 25 percent of the particles, by weight, having a maximum dimension less than 0.002 millimeters. . Clay soil shall not contain granite blocks, broken concrete, masonry rubble, sound rock, or other similar materials. Snow, ice, and frozen soil shall not be permitted. The clay soil shall have a maximum laboratory-tested hydraulic conductivity of 1×10^{-5} cm/sec. Clay shall be procured from a commercial soil borrow site.

PART 3 – EXECUTION

3.01 GENERAL

A. Prior to earthwork activities, the Site shall be prepared in accordance with Section 02110 – SITE CLEARING.

B. Wet, soft, frozen or otherwise unsuitable subgrade, shall be allowed to dry, prior to any grading or backfilling activities, and as approved by the ENGINEER. If a firm subgrade foundation is not achieved, the subbase soils shall be excavated and backfilled with common fill soils so that fill materials will ultimately be placed on a firm foundation.

C. All excavations shall be cut accurately within the lines and limits shown on the Drawings or otherwise as directed by the ENGINEER or OWNER'S AGENT. All roots, stumps, rock and foreign matter in the sides and bottom of excavations shall be removed. Excavations and filling shall conform to the slope, grade, and shape of the section shown. Care shall be taken not to excavate below the grades indicated, unless otherwise approved by the ENGINEER. Excessive excavation shall be backfilled to grade with suitable fill material as directed by the ENGINEER with no additional cost to the OWNER. Any required shoring activities shall be conducted in accordance with local, state and federal codes, and as approved by the ENGINEER. All trenches ditches, and structures excavated under this Section shall be maintained until final acceptance of the Work.

D. Neighboring on-site and off-site structures, utilities, roadways, sidewalks, the Willamette River, and other facilities shall be protected from damage caused by settlement, lateral movement, undermining, wash-out and other hazards created by the earthwork operations or delivery of fill materials.

The CONTRACTOR shall be responsible for retaining engineering services required to perform the scope of work established in the Contract Documents, including, but not limited to, design and/or verification of groundwater barrier wall alternatives; engineered shoring, bracing, and

support; or, other such matters that require engineering expertise. Associated drawings and calculations shall be prepared and sealed by an Oregon Professional Engineer retained by the CONTRACTOR (herein referred to as CONTRACTOR's Engineer).

E. Pumping and Drainage

1. At all times during construction, and up to the point of actual turnover to OWNER, the CONTRACTOR shall provide and maintain proper equipment and facilities to prevent all surface-water from entering excavations, and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fill soils to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels. Where required, design of an appropriate dewatering system will be the responsibility of the CONTRACTOR, submitted to the ENGINEER for review prior to commencing Work.

2. Dewatering shall be conducted in such a manner as to remove all water associated with the naturally occurring groundwater table and surface water runoff that has entered the depressed areas to the extent necessary to conduct the Work.

3. Water entering the limits of the work area from surface runoff shall be re-directed, via berms or ditches, around the perimeter of the excavation, and discharged to stable ground such that no erosion occurs at the point of discharge.

4. Groundwater, or surface water that enters an excavation, shall not be discharged, or permitted to flow, off-site. These fluids that are collected during dewatering operations shall be contained. If the fluids are not re-used in the GWBW trench, they shall be tested and disposed in accordance with these Specifications, or as approved by the ENGINEER.

5. Removal of dewatering equipment shall be accomplished after the system is no longer required; the material and equipment constituting the system shall be removed by the CONTRACTOR.

6. All precautions necessary to preclude the accidental discharge of fuel, oil, etc., shall be taken in order to prevent adverse effects on surface water or groundwater quality.

7. Prior to backfilling stockpiled or off-site common borrow, the areas to be backfilled shall be fully excavated as required and

rough graded in accordance with the Contract Documents. Wherever directed by the ENGINEER, any soft boggy, organic, or otherwise unsuitable material shall be excavated so that backfill material will be placed on a firm foundation. The use of explosives shall not be permitted in the performance of site excavation.

8. The CONTRACTOR shall be responsible for maintaining a dry excavation at all times and shall be responsible for providing the necessary equipment to maintain dry excavations. The CONTRACTOR is advised that any water removed from excavations shall be managed as contaminated water, unless otherwise approved by the ENGINEER.

9. Groundwater, or surface water that enters an excavation, shall not be discharged, or permitted to flow, off-site. These fluids that are collected during dewatering operations shall be contained. If the fluids are not re-used in the GWBW trench, they shall be disposed off-site in accordance with Section 2250 Transportation and Disposal of Materials.

F. If the moisture content of any fill material is outside the accepted range to be returned to the excavation, the soil shall be wetted or dried, as appropriate.

1. Fill material that is too wet to permit compaction shall be removed and stockpiled, or spread and allowed to dry. Drying may be assessed by disking, harrowing, or pulverizing until moisture content is reduced to a satisfactory level.

2. Fill material that is too dry shall be wetted uniformly so as to prevent free water appearing on the surface during or subsequent to compaction operations.

G. Any delays in progress due to the necessary wetting or drying of soil are the responsibility of the CONTRACTOR.

H. Soils placed in fill areas shall be graded to smooth true lines, strictly conforming to grades indicated on the Drawings, or otherwise approved by the ENGINEER.

I. The CONTRACTOR shall subcontract a Professional Land Surveyor registered in the State of Oregon to certify that all soil material has been placed to the lines, grades, and elevations presented on the Drawings. The CONTRACTOR may use in-house personnel for the certifications,

provided the certification is performed by a surveyor registered in the State of Oregon.

J. Fill materials shall be placed in such a manner as to facilitate drainage at all times. Ponding of surface-water runoff shall not be permitted.

K. If compaction or other tests indicate that any portion of the Work does not meet the specified requirements, then the CONTRACTOR shall remove that section, replace and re-compact at no additional cost to the OWNER. Determinations of the extent of removal and the acceptability of the in-place fill materials shall be made by the ENGINEER.

L. If significant precipitation causes wet conditions, placement and compaction activities shall be terminated until the conditions have dried sufficiently to continue according to the ENGINEER.

M. Equipment or vehicles shall not be allowed to travel in a single track or form ruts. Any ruts or irregularities formed shall be scarified and re-compacted by the CONTRACTOR at its expense as required and directed by the ENGINEER.

N. Prior to backfilling fill materials, the areas shall be prepared in accordance with the Specifications. The existing soils shall be proof-rolled to achieve a compact, uniform grade, and the surface shall be free of stones, roots, or other debris.

O. Inspection

1. Prior to implementing any of the Work in this Section, the CONTRACTOR shall carefully inspect the installed Work of all other Sections and verify that all Work is complete to the point where the Work of this Section may properly commence without adverse impact.

2. If the CONTRACTOR has any concerns regarding the installed Work of other Sections, CONTRACTOR shall notify the ENGINEER in writing. Failure to notify the ENGINEER prior to conducting Work within this or other Sections will be construed as CONTRACTOR' s acceptance of the related Work of all other applied Sections.

P. The CONTRACTOR shall protect on-going and completed work from precipitation, excessive heat, freezing, and other elements to avoid compromising the integrity of prior Work. Prior Work affected by such conditions shall be repaired by the CONTRACTOR at no additional cost to the OWNER.

Q. The CONTRACTOR shall provide erosion-control measures to prevent erosion or displacement of soils, or other Work materials, and discharge of sediment-laden runoff or airborne dust to adjacent properties or water bodies.

3.02 TRENCH SPOILS DEWATERING AND CONDITIONING

A. Conditioning of excess spoils generated during groundwater barrier wall installation shall be performed, as necessary, to meet the moisture requirements for off-site disposal of non-liquid waste; i.e., pass the Paint Filter Liquids Test, and/or shall result in a material which meets the acceptance criteria required by the designated disposal facility for the excess spoil. Conditioning may include air drying, blending with clean soils, blending with reagents; e.g. lime or cement kiln dust (CKD), or other conditioning methods approved by the ENGINEER. The CONTRACTOR shall submit the methods for conditioning to the ENGINEER for review prior to commencement of Work. All conditioning shall be performed in the area of the spoils to be conditioned or on a designated area lined with a minimum 40-mil HDPE or 30-mil PVC geomembrane. No conditioning shall be performed in an area where impacted spoils could intermingle with clean or other materials.

B. The CONTRACTOR shall condition the excavated materials, as necessary, using the methods described in Part 3.02 A, to enable proper management; i.e., handling, hauling, and disposal of the materials and to ensure that the materials to be disposed are solids rather than liquids. The CONTRACTOR shall perform a Paint Filter Liquids Test in accordance with the USEPA's test method, Method 9095A. In accordance with this method, if any portion of the test materials collects in the cylinder during the 5-minute test period, the material is deemed to contain free liquids, and therefore, the CONTRACTOR shall further condition the materials and re-test.

C. The CONTRACTOR shall include in the Work Plan, as required in Part 1.05 A, the procedure for conditioning of the waste materials for review and approval by the ENGINEER. Acceptable methods for conditioning include, but are not limited to, air drying, mixing with soil, mixing with lime, and mixing with other agents, as approved by the ENGINEER or OWNER'S AGENT.

3.03 EXCAVATION

A. Excavation for the GWBW and cap shall be in accordance with the Drawings and Specifications. Excavation shall be made to the depths

shown on the Drawings. Care shall be exercised when removing soil as to prevent over-excavation.

B. All excavation activities shall be conducted in compliance with all applicable OSHA regulations. All excavations shall be conducted in a safe and stable manner. The slopes of the excavation shall be stable at all times. The CONTRACTOR is responsible for the design and installation of temporary shoring, if required.

C. If unsuitable subgrade materials are uncovered during excavation or otherwise, it shall be removed, stockpiled for conditioning and off-site disposal as required and approved by the ENGINEER.

D. Unsuitable subgrade materials shall be removed and managed as directed in Paragraph 3.06 of this Section.

E. Excavation of materials shall be accomplished using properly sized hydraulic excavators or equivalent. The equipment will operate so as to eliminate the potential for spreading contamination onto uncontaminated areas or surfaces.

F. Obstructive debris encountered, if any, during groundwater barrier wall construction shall be segregated and stockpiled for subsequent off-site disposal. Obstructive debris includes those materials that, in the opinion of the ENGINEER, may impact or obstruct the construction of the groundwater barrier wall (e.g. objects with a dimension greater than the thickness of the groundwater barrier wall).

G. Impacted spoils encountered during groundwater barrier wall construction shall be segregated and stockpiled for off-site disposal. Impacted spoils include those materials that exhibit visual gross contamination, as determined by the ENGINEER. The CONTRACTOR shall stage impacted spoils on minimum 40-mil HDPE or 30-mil PVC geomembrane.

3.04 APPROVAL OF SUBGRADE

A. CONTRACTOR shall notify ENGINEER when excavations have reached required subgrade.

B. If ENGINEER determines that unsatisfactory soil materials are present, the CONTRACTOR shall continue excavation and replace with acceptable backfill material, as directed.

C. Where accessibility permits; i.e., all locations except on side slopes equivalent to three (3) horizontal to one (1) vertical or steeper, proof-roll subgrade, including all waste materials, with heavy loaded tandem to

identify soft pockets and areas of excess yielding, otherwise, compact subgrade by other methods approved by ENGINEER.

D. CONTRACTOR shall reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the ENGINEER.

3.05 BACKFILLING

A. Final grade shall be backfilled to the contours and elevations indicated on the Drawings, or as otherwise approved by the ENGINEER. Grading and placement of the various materials shall be in conformity with the tolerances specified in this Specification. In accordance with the permit obtained by the OWNER, this project has a no-net-fill requirement, such that filling should not be conducted above the existing grades and elevations.

B. Common Fill

1. Common fill material shall meet the requirements of Part 2.01 of this Section.

2. Common fill shall be placed in a maximum loose lift of approximately twelve (12) inches resulting in a maximum compacted lift of approximately nine (9) inches. Compaction shall be accomplished by designated compaction equipment with a minimum weight of 40,000 lbs. Compaction equipment weighing less than 40,000 lbs may be used if the CONTRACTOR can demonstrate that the equipment can achieve the required compaction results and the equipment is approved by the ENGINEER.

3. Common fill shall be compacted to 90 percent of maximum dry density obtainable, as determined by ASTM D-1557. The fill shall be compacted within a range of 1 percent below to 3 percent above the optimum moisture content, as determined by ASTM D-1557.

4. A maximum 5 percent of all field moisture content test results are permitted outside the specified range. The outliers are, however, not permitted to be concentrated in one lift or one area, and no moisture content shall be less than 2 percent or more than 4 percent of the optimum moisture content. The areal extent is at the discretion of the ENGINEER.

5. A maximum 5 percent of all field dry density test results are permitted outside the specified range. The outliers are, however,

not permitted to be concentrated in one lift or one area, and no dry density less than 87 percent as determined by ASTM D-1557 is permitted. The areal extent is at the discretion of the ENGINEER.

6. If the criteria set forth in (4) and (5) of this part have been exceeded, the CONTRACTOR shall remove the failing common fill and replace, compact and grade new, acceptable fill at no cost to the OWNER.

C. Clay

1. Clay material shall meet the requirements of Part 2.02 of this Section.

2. The maximum final compacted thickness of each lift of clay material shall be six (6) inches. Compaction shall be accomplished with a sheepsfoot roller or similar equipment approved by the ENGINEER. The final grade of all clay material shall be uniform.

3. Clay shall be compacted to 90 percent of maximum dry density obtainable, as determined by ASTM D-1557. The fill shall be compacted within a range of 1 percent below to 3 percent above the optimum moisture content, as determined by ASTM D-1557.

4. A maximum 5 percent of all field moisture content test results are permitted outside the specified range. The outliers are, however, not permitted to be concentrated in one lift or one area, and no moisture content shall be less than 2 percent or more than 4 percent of the optimum moisture content. The areal extent is at the discretion of the ENGINEER.

5. A maximum 5 percent of all field dry density test results are permitted outside the specified range. The outliers are, however, not permitted to be concentrated in one lift or one area, and no dry density less than 87 percent as determined by ASTM D-1557 is permitted. The areal extent is at the discretion of the ENGINEER.

6. If the criteria set forth in (4) and (5) of this part have been exceeded, the CONTRACTOR shall remove the failing clay and replace, compact and grade new, acceptable clay at no cost to the OWNER.

3.06 EXCESS MATERIALS

A. All general waste or debris shall be containerized on-site and periodically disposed off-site in accordance with these Specifications.

B. Suitable materials, as determined by tests discussed in these Specifications, shall be classified and stockpiled in approved areas for immediate or future use.

C. Stockpiles shall be graded to drain; no surface-water ponding is permitted on stockpiles. Stockpiles shall be covered with plastic sheeting or other material to preserve the soil integrity. Proper erosion controls; i.e., silt fence, shall be installed at the perimeter of the stockpile.

D. Stockpiles that are not used for more than 14 days shall be covered as discussed in Paragraph 3.06 C, or be temporarily vegetated in accordance with these Specifications. No fill or piles above the existing contours are permitted upon completion of the project.

E. Obstructive debris, excess or impacted spoils, and other unsuitable materials that are a result of construction activities shall be temporarily stockpiled on a minimum 40-mil HDPE or 30-mil geomembrane that is continuously seamed. The material shall also be covered to provide a protective envelope to prevent contact with any precipitation or surface water runoff. Obstructive debris and excess or impacted spoils shall be disposed off-site in accordance with Section 02250 Transportation and Disposal of Materials.

3.07 GRADING

A. Uneven areas and low spots which may develop in the backfilling operations shall be eliminated via minor excavations or placement of appropriate fill materials. Levels, profiles and contours of the final site configuration shall be maintained as established on the Drawings.

B. The areas to be backfilled shall be uniformly graded to within the limits of grading under this Section. A smooth finished surface shall result within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades to the satisfaction of the ENGINEER.

C. Constructed slopes shall be blended into existing undisturbed areas gradually in order to provide neat, clean transition zones. Feathering of constructed slopes into existing grades shall be accomplished to promote natural drainage and to eliminate possible surface-water ponding.

D. The right is reserved by the ENGINEER to make minor adjustments or revisions in lines or grades if found necessary as the Work progresses, due to discrepancies on the Drawings or in order to obtain satisfactory

construction. Any suspected discrepancies shall be reported to the ENGINEER as soon as detected.

3.08 CRITERIA AND TOLERANCES

A. Compaction and moisture criteria and tolerances are discussed in Part 3.05 of this Section.

B. Final soil grades shall be within two tenths of one (0.2) foot below to five tenths of one (0.5) foot above (-0.2 to +0.5) the grades and contours indicated on Drawings, or as indicated by changed field conditions, and approval by the ENGINEER. Regardless of the final grade tolerance, the thickness of each specified layer shall meet the minimum thickness.

C. In recognition of the moisture-density relationship of soils, the ENGINEER may direct that the compaction and moisture content tolerances be modified if required by variabilities in the soils. This decision, if required, will be based on the ENGINEER'S interpretation of the laboratory analysis for each soil.

D. No additional payment shall be made for quantities of soils placed in excess of that amount required to achieve the minimum specified thickness.

3.09 FIELD QUALITY CONTROL

A. The CONTRACTOR shall test the in-place density and moisture content of the common fill soils by nuclear methods in accordance with ASTM D-6938 and these Specifications. The testing shall be conducted at a frequency not less than three tests per lift per area of interest. Every 25th nuclear density test shall be verified in accordance with ASTM D-1556 and ASTM D-2216. All test locations shall be recorded and provided on the "As-Built" Drawings.

B. The CONTRACTOR shall test the in-place density and moisture content of the clay plug material by nuclear methods in accordance with ASTM D-6938 and these Specifications. Tests must be conducted every 50 lineal feet on each lift. The density and moisture content results shall be verified in accordance with ASTM D-1556 and ASTM D-2216, respectively. A minimum of three verification tests shall be conducted for each soil material type as determined by the ENGINEER. Failing tests shall be repeated. Continued test failure will require re-working of the material prior to re-testing and acceptance. All test locations shall be recorded and provided on the "As-Built" Drawings.

C. The CONTRACTOR shall provide field control; i.e., grade stakes, to determine layer thickness. The ENGINEER shall perform verifying thickness measurements in the field in accordance with quality assurance activities.

D. The CONTRACTOR shall provide a minimum of 24 hours notice to the ENGINEER when each compacted lift is ready for testing.

E. The CONTRACTOR shall provide access and repair any damage to subgrade caused by correctly performed tests, and cooperate in other ways necessary to permit the ENGINEER to conduct testing when and where he/she desires and as expeditiously as possible.

F. Fill material shall not be placed over a lift which has not been tested and accepted by the ENGINEER.

G. All placement operations shall comply with all requirements of these Specifications.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work covered by this Section consists of furnishing all labor, materials, tools, equipment, transportation, and incidentals as well as laboratory and professional technical services necessary for constructing the soil-reagent groundwater barrier wall (GWBW) that meets or exceeds the requirements specified herein and presented on the Drawings.

B. The Work also includes determination of the appropriate reagent(s), mix design and implementation methodology, including testing and analysis, engineering, and other evaluations pertaining thereto for the construction of the GWBW in accordance with the requirements specified within these specification and Drawings.

C. Prior to commencement of the GWBW construction, the CONTRACTOR is provided the opportunity to conduct a confirmation phase to verify that the CONTRACTOR's mix design will meet the performance criteria specified herein. The confirmation phase may include laboratory studies, pilot test, or other similar methods to verify that the proposed reagents and mix design will meet the project specification. Note that a Treatability Study was performed (Attachment E) to evaluate a few reagents and mix ratios. The Treatability Study Report is provided herein for reference purposes only. It is the sole responsibility of the CONTRACTOR to select the appropriate mix design, independently verify the mix design, and construct a GWBW that will meet or exceed the project specification.

1.02 REFERENCES

A. ASTM C143: Standard Test Method for Slump of Hydraulic Cement Concrete

B. ASTM C150: Standard Specifications for Portland Cement

C. ASTM D421: Standard Practice for Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants

D. ASTM D422: Standard Test Method for Particle-Size Analysis of Soils

E. ASTM D698: Test Method for Laboratory Compaction Characteristics of Soil Using Standard Proctor Effort

F. ASTM D1556 : Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

G. ASTM D1633 : Standard Test Method for Compressive Strength of Molded Soil-Cement Cylinders

H. ASTM D2216 : Standard Test Method for Laboratory Determination of Moisture Content of Soil and Rock

I. ASTM D4016: Standard Test Method for Viscosity of Chemical Grouts by Brookfield Viscometer

J. ASTM D4318 : Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils

K. ASTM D4380 : Standard Test Method for Density of Bentonite Slurries

L. ASTM D5084 : Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

M. ASTM D6938 : Standard Test Method for In-Place Density and Water Content of Soil and Soil Aggregate by Nuclear Methods (Shallow Depth)

N ASTM D7100: Standard Test Method for Hydraulic Conductivity Compatibility Testing of Soils with Aqueous Solutions

O. EPA 160.1: Test Method for Total Dissolved Solids

P. EPA 200.7: Test Method for Dissolved Metals

Q. EPA 215.1: Test Method for Calcium Concentration

R. EPA 242.1: Test Method for Magnesium Concentration

S. EPA 273.1: Test Method for Sodium Concentration

T. EPA 418.1: Test Method for Total Recoverable Hydrocarbons

U. EPA 8240: Test Method for VOC's

V. EPA 9040: Test Method for pH

W. EPA 9090: Test Method for Chemical Compatibility

X. SW-846 9045A: pH Test for Slurry

Y. USP NF X VII: Free Swell Test

Z. API Specification 13A: Drilling Fluid Materials

AA. API RP 13B-1: Recommended Practice for Field Testing Water-Based Drilling Fluids

1.03 DEFINITIONS

The terms used in this Section are defined as follows:

A. The "Groundwater Barrier Wall" is a low permeability hydraulic barrier installed through the existing ground or prepared working surface using one of several methods, including the slurry method of excavation, continuous trenching soil mixing, or jet grouting.

B. The "Slurry Method of Excavation" consists of excavating a vertical walled trench (soil-bentonite slurry trench) and at the same time keeping the trench filled with a bentonite slurry mixture. The purpose of the slurry is to support the walls of the trench and prevent movement of groundwater. The "soil-reagent slurry wall" methodology uses this approach.

C. "Soil Mixing" consists of constructing overlapping wall panels by inserting and withdrawing a single or multi-shaft mixing apparatus at consecutive locations.

D. "Jet Grouting" consists of constructing overlapping wall panes by injecting low permeability grout at consecutive locations.

E. "Continuous Trenching" consists of simultaneous excavating/trenching and in-situ mixing of reagent(s) with subsurface materials in a continuous manner to construct the Groundwater Barrier Wall.

F. "Bentonite" is ultrafine natural clay whose principal mineral constituent is sodium cation montmorillonite.

G. "Bentonite Slurry" is a colloidal mixture of bentonite and water.

H. "Soil-Reagent Backfill" is a homogeneous mixture of material produced by mixing soil with bentonite slurry and additional reagent (such as dry bentonite), as necessary, which is placed into the excavated slurry trench to complete the soil-reagent slurry wall.

I. The "Working Surface" is the top of the stripped and/or prepared natural ground from which the groundwater barrier wall shall be constructed.

1.04 WORK BY CONTRACTOR

A. A groundwater barrier wall (GWBW) shall be constructed along the alignment specified on the Construction Drawings to form a continuous hydraulic barrier along the riverbank, as specified on the Construction Drawings. The GWBW shall be constructed with a soil-bentonite, or other approved reagent mix, utilizing an appropriate construction methodology to meet, or exceed, the specified requirements herein. Construction methods may include slurry wall, jet grouting, soil mixing, continuous trenching, or other appropriate technique to achieve the minimum GWBW dimensions and a maximum in-place coefficient of permeability for the completed wall of 1×10^{-6} cm/sec. The GWBW shall have the depth and minimum width specified in Part 3.04 of this Section.

B. The CONTRACTOR shall furnish the necessary plant, labor, materials, tools, equipment, services, utilities, and the water required to construct the GWBW in accordance with these Specifications.

C. The CONTRACTOR shall furnish and install all supplementary or miscellaneous items, appurtenances, and devices (including, but not limited to, chisel, bore, excavate, or key-in the wall) that are not specifically indicated but which are necessary to complete the installation of the GWBW. The CONTRACTOR shall take all necessary steps to install the GWBW with a maximum, in-place permeability of the completed wall of 1×10^{-6} cm/sec. Specific concerns or omissions are the responsibility of the CONTRACTOR to identify during the bidding process and acknowledge with the bids.

D. The CONTRACTOR shall be responsible for controlling all storm-water runoff and providing run-on controls during the GWBW construction. Surface-water management features may include temporary berms, swales, or other features necessary to manage surface water and divert surface run-on away from the area of construction. All controls shall be pre-approved by the ENGINEER, and no control measures shall create erosive conditions. The CONTRACTOR shall comply with all storm-water requirements ~~contained~~presented in the Drawings and~~of~~ approved in the ODEQ 1200-C Permit.~~the ODEQ.~~ This work includes, but shall not be limited to, all trenching, excavations, drilling, mixing, and product storage.

E. The CONTRACTOR shall verify and protect all buried and above-ground utilities during construction of the GWBW. The contractor shall employ the

services of a private utility locator to locate utilities prior to commencement of Work. In the event that a utility line is damaged during construction, the CONTRACTOR shall immediately notify the ENGINEER or OWNER'S AGENT and owner of the affected utility so that damaged items can be repaired at the CONTRACTOR's expense.

F. The CONTRACTOR shall remove any objectionable material such as debris, rock, and other obstructions, if encountered from the area of the GWBW operations, on an as-needed basis. This includes unforeseen buried debris encountered along the alignment of the GWBW. Disposal of an unforeseen material shall be the responsibility of the CONTRACTOR. The CONTRACTOR is responsible for handling materials and placing it in the appropriate containers to be provided by the CONTRACTOR on the Site. The CONTRACTOR is responsible for disposal of debris generated by the CONTRACTOR in order to perform the work, and shall dispose of the materials appropriately.

G. Water required for construction of the GWBW can be obtained at the site from a nearby fire hydrant as indicated on the Drawings. The CONTRACTOR shall be responsible for getting approval from the City or appropriate Owner of the water supply as well as for connection, distribution, and conveyance of water to the Work Area. The CONTRACTOR is responsible for conveying and/or transporting the water to the necessary GWBW construction area as well as providing the means for filling any water-carrying vehicles. Select chemical analyses on the Site's service water supply collected from the tap are presented in the Treatability Study Report for reference purposes only. The CONTRACTOR is responsible for assuring chemical compatibility of the water supply with the GWBW and construction activities.

H. The CONTRACTOR shall take precautions to assure that all groundwater extracted from the trench and used for construction activities, including run-off, is prohibited from leaving the Site. Run-off of the groundwater from the Site shall not be permitted.

I. The CONTRACTOR is solely responsible for the security of the CONTRACTOR's equipment, materials, and the constructed products at the Site at all times throughout the construction period.

1.05 QUALITY CONTROL AND ASSURANCE

A. All materials, procedures, operations, quality control and methods of construction are the responsibility of the CONTRACTOR, and shall be in strict conformance with the Drawings and Specifications. The Work shall

be subjected to strict quality assurance (QA) and quality control (QC) monitoring by the OWNER or ENGINEER and the CONTRACTOR, respectively, as provided in Section 01400 – QUALITY CONTROL of the Specifications and in the Construction Quality Assurance/Quality Control (CQA/QC) Plan. The installed GWBW shall conform to the Drawings and Specifications, except where changes are authorized in writing by the ENGINEER or OWNER.

B. ENGINEER Responsibilities:

1. Review product data and samples.

2. On delivery, inspect products jointly with CONTRACTOR.

3. Conduct QA testing, as deemed necessary. The QA testing shall in no way relieve the CONTRACTOR of the responsibility of performing tests necessary to meet the QC requirements.

C. CONTRACTOR's Responsibilities:

1. Arrange for and deliver information for "Record Drawings", product data, samples, and all testing results and certifications to the OWNER OR ENGINEER in a timely manner. All QC samples and testing shall be referenced to the GWBW alignment station and depth at which the sample was obtained or test was conducted.

2. Receive and unload products at site; inspect for completeness or damage, jointly with the ENGINER and repair or replace items damaged after receipt.

3. Document construction methods and demonstrate that material mixes are acceptable and that the proposed technology shall meet the minimum hydraulic isolation wall specifications.

4. Conduct QC testing in accordance with Section 01400, the CQA/QC Plan, and Part 4.0 of this Section as necessary to control the hydraulic isolation wall installation quality.

5. The CONTRACTOR shall notify the ENGINEER whenever the trench excavation or GWBW installation is near the design depth to allow for inspections. The ENGINEER shall observe any cuttings from the bottom of the GWBW for continuity.

6. The CONTRACTOR shall cooperate with the OWNER or ENGINEER during any inspections or QA testing. The

CONTRACTOR shall provide, at no additional cost, labor and materials to 1) measure the lines and grades associated with the Work and 2) collect samples for QA testing.

7. The CONTRACTOR shall submit to the ENGINEER on a regular schedule (as noted) the following items:

   a. Soundings and As-built Profile (daily): a record of the soundings taken during construction, including depth of trench/GWBW, backfill slope (for slurry wall construction), and other construction-related information obtained at the beginning and end of each day. The CONTRACTOR shall use the soundings to generate the as-built profile.

   b. Reagent Slurry Mix (daily): quantities, proportions, properties and admixtures shall be submitted. The report shall include the mix from the plant and the mix in the trench.

   c. Construction Methodologies and Techniques: Any modifications to the approach presented in the Work Plan shall be submitted to the ENGINEER.

1.06 CONTRACTOR QUALIFICATIONS

The CONTRACTOR shall maintain full-time supervisory personnel, competent in the hydraulic isolation wall technology, on-site during construction to control the Work. The site superintendent and key personnel (including the any equipment operator who is directly involved with the excavation, backfilling, soil mixing, trenching, or installation of the GWBW) shall have not less than five (5) years experience in the technology, shall have participated in the construction of not less than five (5) projects of similar scope and magnitude, including two (2) with a similar or greater depth, and shall have successfully installed a minimum area of 500,000 square feet. Qualifications for these individuals shall be provided at the time of bidding (see Part 1.09 for submittal requirements), and shall be subject to the approval of the OWNER or ENGINEER.

1.07 HEALTH AND SAFETY

A. The CONTRACTOR shall develop and implement the CONTRACTOR's site-specific Health and Safety Plan (HASP) for all GWBW activities to protect on-site personnel. Hazardous waste materials may be disturbed during the Work and contact with waste, waste liquids, and/or waste gases is expected.

B. The CONTRACTOR shall provide adequate health and safety personal protective equipment (PPE) for employees, the OWNER or ENGINEER, representatives of the ODEQ or other regulatory agencies, and others who might be affected by the on-site activities.

C. Work procedures shall conform with all applicable EPA, OSHA, ODEQ, State of Oregon, local government, and other federal and state and county regulations (latest editions).

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All materials shall be delivered in undamaged, unopened containers bearing the manufacturer's original label and shall be handled to prevent contamination, segregation, or damage.

B. The storage location of all materials shall not interfere with construction activities and shall be approved by the OWNER or ENGINEER..

C. Bentonite, hydrophilic sealing material and similar materials shall be stored in weather-tight enclosures to protect against dampness and contamination.

1.09 SUBMITTALS

A. The CONTRACTOR shall submit qualifications of key project personnel, including superintendent and primary equipment operator(s), with their bid. The following information shall be submitted to the ENGINEER for the superintendent, primary equipment operator(s), and other key personnel:

1. Name, address, and telephone number of customer and point of contact for projects forming the experience record;

2. Contract number, contract amount, date of award, and date of completion of the projects forming the experience;

3. GWBW length and depth; and,

4. Description of the method of construction and equipment used.

B. The CONTRACTOR shall submit qualifications, company name, and key contact of the CONTRACTOR's QC Laboratory with their bid. The laboratory shall have previous experience with slurry wall materials, experienced laboratory technicians, and modern permeability testing equipment.

C. The CONTRACTOR shall submit a detailed work plan to the ENGINEER and OWNER for review prior to commencement of work. The work plan shall describe- the proposed GWBW construction methodology, procedures, equipment, and schedules. The work plan shall include, but not be limited to:

1. Construction, maintenance, and removal of working platforms, mixing pads and ponds, and haul roads;

2. Equipment set-up and site use layout, including storage areas, haul roads, mixing pads and ponds, and work platform locations and dimensions;

3. Equipment specifications, including maximum depth capability of excavator, number and type of backfill mixing equipment, and specifications of slurry mixing equipment;

4. Common and chemical names of the proposed reagents, sources and availability of the reagents within the scheduled time period, and suppliers' information.

5. Proposed mix design, including mix ratios for the construction of the GWBW.

6. Proposed method for the confirmation phase (such as laboratory studies, pilot demonstration or similar other methods) to verify that the proposed reagents and mix design will meet the project specification.

7. Method of constructing GWBW such as slurry method of excavation, soil mixing, continuous trenching, or jet grouting.

8. Approach to minimize spoil production; approach to manage soil, spoil and excess slurry; estimated quantity of excess spoils to be managed by the CONTRACTOR upon completion of the GWBW.

9. Procedure for water-bentonite slurry mixing, transportation, and re-circulation;

10. Procedure for trench excavation and backfilling;

11. Material properties, sources, and (manufacturer's) certificates of quality;

12. Control of drainage, spills, wastes, etc.; and,

13. Clean-up, spoils disposal, and slurry disposal.

D. Quality Control Plan

The CONTRACTOR shall submit a quality control plan with details of the personnel, responsibilities, inspections, and organization for ensuring the quality of construction required by these Specifications. The plan shall provide a table listing testing methods, frequencies, and minimum acceptable values. The plan shall explain the methods and locations for obtaining samples for testing and reporting schedules. Copies of quality control forms shall be submitted for review and approval.

E. Results of any pre-construction testing performed by the CONTRACTOR in the confirmation phase, such as Laboratory or pilot test to verify that the proposed reagents and mix design will meet the project specification shall be submitted to the ENGINEER and OWNER.

F. The results of all QC testing required by these Specifications shall be furnished to the ENGINEER. The CONTRACTOR shall furnish records of all observations, measurements, and tests performed, identified with the location, date, and time of testing. These records shall be furnished no later than 24 hours after the observation, measurement, or test is performed.

G. A record of the soundings taken during construction, including the depth of the GWBW and backfill slope (if applicable), shall be submitted to the ENGINEER by noon of the day following the date of the measurement.

H. The CONTRACTOR shall submit a 50-pound sample from each of the off-site borrow sources proposed to furnish the required quantity of fill materials. The samples shall be submitted to the ENGINEER no less than two (2) weeks prior to the anticipated placement of any soil materials.

1.10 SUBSURFACE CONDITIONS

A. Subsurface investigations have been conducted during prior work activities. Boring location maps and corresponding boring logs are provided in Attachment A. Neither the OWNER, nor ENGINEER assumes responsibility for interpretation or deductions made from the borings or logs. Local variations may exist in the subsurface materials between boring locations. Soils classifications presented on the logs are the result of field observations. Geotechnical tests were conducted on selected boring locations and are presented in Attachment B.

B. Test results of select chemical analysis on groundwater and existing subsurface materials (native soils) are provided in Attachment C.

C. Groundwater contour maps for the hydro-geologic units that will be encountered during GWBW installation are presented in Attachment D as well as in the investigation reports presented in Attachment F and G.

1.11 MIX DESIGN TESTING

A. Treatability Study testing was performed using site soils, water, and selected reagents. The report is presented as Attachment F. The report and associated results are presented for informational purposes only and shall not be construed as a recommendation of the appropriate mix design. The CONTRACTOR is responsible for providing a GWBW mix design that meets the performance-based design requirements of this Section.

B. The CONTRACTOR is provided the opportunity to conduct a confirmation phase, as noted herein and identified as a bid item on the bid form, to verify that their mix design meets the criteria herein. It is the CONTRACTOR's responsibility to ensure that the final mix meets the performance requirements defined herein.

PART 2 – PRODUCTS

2.01 MIX REAGENT

A. The GWBW shall be constructed using a reagent mix that demonstrates compliance with the requirements specified herein. Typical reagents include bentonite and/or other alternative reagents.

B. Alternative reagents may be proposed by the CONTRACTOR but are subject to approval by the ENGINEER or OWNER. CONTRACTOR is responsible for demonstrating performance to the satisfaction of the ENGINEER, or OWNER.

2.02 BENTONITE

A. Bentonite shall be a premium grade, high-swelling, sodium-cation montmorillonite bentonite that meets or exceeds the standards of the American Petroleum Institute (API) as contained in API 13A, Section 9 specifications and Table 02242-1. Bentonite that does not meet the specifications shall be promptly removed from the Site at no additional cost to the OWNER or ENGINEER.

B. Bentonite shall be protected from moisture during transportation and storage.

C. The material shall have been manufactured to function in the presence of water soluble contaminants without losing its filtrate control properties.

2.03 WATER

A. Water supply for the CONTRACTOR's use to manufacture all slurries and/or grout can be obtained from a nearby fire hydrant located at the Site (Site's Water). CONTRACTOR shall be responsible for all water connections and transport to the Work site.

B. It shall be the responsibility of the CONTRACTOR to assure that the resulting slurry and/or grout meet the standards and requirements of this Specification. The CONTRACTOR shall verify chemical analysis for pH, hardness, and total dissolved solids (TDS) of the Site's water. If the CONTRACTOR elects to use an alternative water source, it is the CONTRACTOR'S responsibility to obtain chemical analysis for pH, hardness, and TDS for both the Site's water and the alternative water supply to verify the chemical compatibility of the alternative water supply with the GWBW products. Site's water is expected to be substantially clean, fresh, and free from oil, acid, alkali, or other deleterious substances; the water shall comply with Table 02242-1. If the water supply is deemed inappropriate, an alternate source shall be investigated by the CONTRACTOR to verify chemical compatibility. The test results shall indicate that the bentonite, when mixed with the water, will yield the required parameters. It shall be the responsibility of the CONTRACTOR to add bentonite as necessary to meet the slurry viscosity and to have stable excavation.

2.04 SLURRY

A. Base Product: the slurry supporting the sides of the trench (Soil-Reagent Slurry Wall only) and/or for wetting the backfill material shall consist of a stable colloidal suspension of bentonite in water.

B. The bentonite utilized in the slurry shall conform to the requirements outlined in Part 2.02 of this Section.

C. The water utilized in the slurry shall conform to the requirements outlined in Part 2.03 of this Section.

D. Initial Slurry Mixture:

1. At the time of introducing slurry into the trench, the amount of bentonite (percent bentonite per weight of water) in the slurry mixture shall be in accordance with the slurry mix design that has been proposed by the CONTRACTOR to meet the project

specification and verified during the confirmation phase. The initial slurry mixture shall comply with the requirements specified in Table 02242-1 and shall be sufficient to maintain a stable excavation. It is the CONTRACTOR's responsibility to ensure an appropriate slurry mixture to maintain stable conditions and meet the requirements of the GWBW.

2. The CONTRACTOR shall add additional bentonite to make the slurry denser or more viscous than the limits specified herein, if deemed necessary by the ENGINEER, stability of the open trench, or to meet the criteria herein.

3. Admixtures to alter the characteristics of the slurry in the trenches, including but not limited to softening agents, dispersants, retarders or plugging/bridging agents, shall not be permitted, unless otherwise approved by the ENGINEER.

4. A record of mixed bentonite slurry quantities and proportions shall be maintained. Adjustments to the slurry mixture shall be noted.

5. The bentonite must be fully hydrated and the slurry must be homogeneous. Slurry with balls of partially wetted clay will be rejected by the ENGINEER.

E. Slurry Mixture in Trench - Soil-Reagent Slurry Wall Application:

1. The bentonite slurry in the trench shall comply with the requirements specified in Table 02242-1. A record of in-trench bentonite slurry properties shall be maintained. Adjustments to the slurry shall be recorded.

2. The bentonite must be fully hydrated and the slurry must be homogeneous. Slurry with balls of partially wetted clay will be rejected by the ENGINEER at the trench.

2.05. SOIL-REAGENT BACKFILL – Soil-Reagent Slurry Wall Application

A. The CONTRACTOR shall design the soil-reagent backfill mixture to achieve a maximum, in-place permeability of 1×10^{-6} cm/sec, as determined by the QC tests specified herein and ASTM D-5084.

B. The material for trench backfilling shall be composed of fresh slurry, trench slurry, reagents (including bentonite and/or approved alternatives), and trench spoils and/or selected soils obtained from a designated off-site borrow source. Trench spoils or borrow soil shall be friable and free from roots,

organic matter, refuse, rubble, debris, concrete, boulders, frozen materials, or other deleterious materials.

C. The soil-reagent mixture shall be thoroughly mixed and is recommended to have the following minimum percent passing gradation limits:

U.S. Standard Sieve	Percent Passing
3 inch	100
No. 200	20

These recommendations shall be evaluated by the CONTRACTOR for consistency with the criteria required to obtain the minimum coefficient of permeability specified in Paragraph 2.05 A of this Section. If the soil-reagent mixture does not meet the recommended gradation limits, the CONTRACTOR shall notify the ENGINEER immediately and make any necessary changes to the soil-reagent mix design, as approved by the ENGINEER, to ensure that the minimum coefficient of permeability is obtained.

D. Soil excavated from the trench (trench spoils) may be used as backfill provided it is mixed to be homogeneous and the soil-reagent mix meets the Specifications presented in Table 02242-1. If excavated soil does not meet the Specifications, borrow material from other sources shall be added to the excavated soils, thoroughly mixed with the excavated soils to a homogeneous mixture and used as backfill. Soil removed from the trench which may not be suitable for mixing and returning to the trench for any reason shall be disposed of as provided in Section 02250 – TRANSPORTATION AND DISPOSAL OF MATERIALS of the Specifications. Any contaminated items excavated for removal must be loaded into appropriate containers supplied by CONTRACTOR for recycling or disposal.

E. Borrow material to be used as part of the backfill shall come from an accepted source. The CONTRACTOR shall not change the borrow source for the duration of the Work without prior written acceptance from the ENGINEER.

F. The soil-reagent backfill may be mixed in-situ or ex-situ, permitted the performance criteria of the GWBW are met. Trench spoils removed from the trench may be mixed with the reagent(s) along side the trench on the landward side of the excavation. Alternatively, trench spoils may be transported to a central staging or mixing area. Precautions shall be taken to ensure that excess water and fluids from the excavated material, or any storm-water or fluid runoff from the mixing area, shall not discharge from

the site; rather, excess water, fluid, spoils, and slurry shall be managed accordingly to prevent the water, fluids, slurry or spoils from leaving the Site. No excess materials, processing or storage of materials shall occur on the outboard side (river side) of the trench. Collecting, pumping, or transporting fluids, spoils and slurry is the CONTRACTOR's responsibility. The trench spoils must be screened and/or mixed, if necessary, to meet the screen specifications outlined above.

G. The CONTRACTOR shall conduct quality control testing on the soil-reagent backfill, including particle size analysis, permeability, slump, and density. The soil-reagent backfill mixture shall comply with the requirements specified in Table 02242-1.

2.06 GENERAL

A. For determining compliance with the permeability specification, after 28 days of curing, no value of the in-situ backfill coefficient of permeability shall exceed 1×10^{-6} cm/sec for the length of the GWBW. The CONTRACTOR shall obtain one undisturbed sample of the soil-reagent backfill from the ground surface to mid-depth and from mid-depth to the bottom of the GWBW from two locations that are at least 200 feet apart. If QA tests by the ENGINEER or QC tests by the CONTRACTOR indicate that non-compliance exists, all work shall cease until the source of the problem is determined. The CONTRACTOR shall not be paid extra to replace any portions of the soil-reagent wall that do not meet these Specifications. Any in-place portions of the GWBW that do not meet these Specifications shall be replaced at no additional cost.

B. Admixtures: Admixtures shall not be used except as approved in writing by the ENGINEER and shall be submitted with the bid if anticipated before the start of work.

C. The CONTRACTOR shall increase the reagent content and mixing operations, as needed, and account for any variations in the in-situ soil properties to achieve the specified performance criteria.

PART 3 – EXECUTION

3.01 GENERAL

A. The CONTRACTOR is solely responsible for excavating in a safe and legal manner. Provide appropriate measures to retain excavation side

slopes, to prevent slope failures, and to ensure that persons at or near any excavation are protected. Use extreme care to maintain, isolate, and protect all wells, manholes, streets, utilities, and other facilities whether surface or subsurface.

B. Produce slurry by gradually adding dry reagent to clean water and thoroughly mixing in a high shear mixer until a complete dispersion of bentonite is achieved. The CONTRACTOR shall be responsible for determining the percentage of reagent in the slurry to meet the performance criteria specified herein.

C. The CONTRACTOR shall provide a full-time GWBW specialist to regularly test and control the mixing and placing of the slurry in order to maintain the specified properties of the slurry.

D. Keep construction surcharges including, but not limited to, excavated material, slurry mixing operations, and pumping equipment away from the GWBW or trench. Only equipment required for excavation and backfilling shall be allowed adjacent to the GWBW or trench.

E. Do not place any frozen material into the trench. Remove any frozen material in the top of the trench prior to backfilling. Do not place ice or snow, or backfill containing ice or snow into the trench. Do not mix or place backfill when the ambient air temperature is less than 35 degrees F.

3.02 CONFIRMATION PHASE

A. The site information presented in these documents (see supplemental documents) is provided for CONTRACTOR reference purposes only. The CONTRACTOR is solely responsible for determining the soil-reagent mix design and installation methodology for meeting the performance requirements of the GWBW specified herein. Consequently, the CONTRACTOR may elect to conduct confirmation testing prior to full-scale construction of the GWBW to verify the mix design.

B. If the CONTRACTOR elects to conduct confirmation testing, the cost shall be provided in the corresponding bid item in the Bid Form. The CONTRACTOR shall provide the details of the testing program with the bid, including the scope-of-work, specific reagent(s) and the source, schedule, laboratory, and other related elements. C. The results of confirmation testing shall be provided to the ENGINEER for review. If compatibility testing is not performed within the confirmation test, the

CONTRACTOR shall provide a correlation between the proposed mix confirmation test results and the results for the mixes in the compatibility tests provided in Attachment E.

C. If the CONTRACTOR elects to not perform confirmation testing, the CONTRACTOR shall provide sufficient information in their bid and work plan that describes why the mix will meet the performance requirements. Correlations to the compatibility test provided in Attachment E should be provided.

3.03 GROUNDWATER BARRIER WALL CONSTRUCTION

A. A GWBW shall be constructed to the lines, grades, depth, and cross-section indicated on the Drawings. The GWBW shall have vertical walls and have a minimum width of 36 inches, unless otherwise approved by the ENGINEER. The GWBW shall have a maximum in-place permeability of 1 x 10^{-6} cm/sec. and extend to 35 feet below ground surface.

B. Site Preparation: Prior to GWBW construction, the area on both sides of the wall alignment shall be prepared as shown on the Construction Drawings and as specified herein.

1. The GWBW location shall be accurately staked by the CONTRACTOR prior to construction. The GWBW shall be located along the alignment presented on the Drawings. The constructed GWBW alignment shall vary no more than five (5) feet laterally from the alignment presented on the Drawings. However, in any case the outboard edge (i.e., river side) of the slurry wall shall be located a minimum of 20 feet up-gradient (i.e.,landward side) from the top of the river bank. .

3. The CONTRACTOR shall prepare the working surface from which to construct the GWBW, including but not limited to clearing, removal of existing structures, well abandonment and disposal of unsuitable materials, in accordance with Section 02110 – SITE CLEARING.

4. Grade:

a. The longitudinal grade of the working surface shall not exceed one (1) percent, unless otherwise approved by the ENGINEER.

b. In the event that the static ground water table is encountered at a depth of three (3) feet, or less, below the designated working surface, the CONTRACTOR shall raise the working surface with approved fill material to maintain a three-foot separation between the working grade and the water table.

c. The working surface shall be graded to ensure that the excavation/installation equipment produces a vertical GWBW.

d. The CONTRACTOR shall provide and maintain gravity drainage control along the working surface. Controls shall direct flow away from the GWBW during construction. The CONTRACTOR shall prohibit surface water flow into the excavated trench.

5. The CONTRACTOR shall maintain the working surface free of excessive amounts of debris and slurry.

6. The CONTRACTOR shall prepare and maintain a temporary work/staging area at a remote location from the GWBW to support installation of the GWBW, including mixing operations, material storage, equipment storage, and other ancillary activities.

C. Equipment: The CONTRACTOR shall furnish the necessary plant, tools and equipment for efficient construction of the GWBW.

1. Excavation and Drilling Equipment: The equipment used for construction of the GWBW shall be capable of performing excavation, mixing, and/or drilling operations to the required depth of the GWBW and shall be approved by the ENGINEER and OWNER. Excavating, mixing, and/or drilling equipment shall be capable of achieving the minimum GWBW width in a single pass while minimizing raveling of the trench or GWBW sides during use.

2. Preparation and Placement Equipment: The slurry or grout plant shall include the necessary equipment such as a mixer, a mechanically agitated sump, pumps, valves, hoses, supply lines, and small tools; all as may be required to adequately mix and supply slurry or grout to the GWBW location in a continuous manner. A backup system shall be designed to supply sufficient slurry or grout in case substantial slurry or grout loss occurs. Storage ponds shall be constructed wholly or partially above grade; containers shall be constructed above grade (no excavation). Pond berms may be constructed from excavating existing surface soils from the vicinity of the pond If the storage pond is constructed by a combination of excavation and backfilling of a perimeter berm, the resulting area

shall be filled and graded after completion of the GWBW construction by using the berms as fill. All slurry held in storage shall be agitated or recirculated to maintain a homogenous mix. Mixing of slurry or grout shall continue until all particles are thoroughly mixed and the resulting mixture is homogenous. The location of the slurry or grout plant and storage areas shall be approved by the ENGINEER.

3. Backfill Mixing and Placing: Equipment for mixing and placing backfill may consist of suitable earthmoving or grading equipment, such as bulldozers, blade graders, backhoes, or blenders such as a pug mill, that are capable of thoroughly mixing the backfill materials into a homogeneous blend meeting the required properties. Clods shall be broken to a four-inch maximum size by the backfill preparation equipment and methods employed. Deleterious materials, debris, and oversized particles shall be removed from the backfill before approval for placement.

4. Decontamination Area:

   a. All equipment utilized in GWBW construction shall pass through the decontamination area for cleaning prior to leaving the Site in accordance with applicable regulations.
   b. All water from the decontamination area shall be containerized and disposed off-site in accordance with Section 02250 – TRANSPORTATION AND DISPOSAL OF MATERIALS.

D. Personnel: The CONTRACTOR shall provide all workers' PPE in accordance with 29 CFR and OSHA, and with the level of knowledge necessary to implement health and safety procedures. The CONTRACTOR shall designate a health and safety officer for the project who is responsible for maintaining worker's compliance with established health and safety procedures.

E. Construction:

1. The CONTRACTOR shall have equipment capable of excavating/trenching, mixing and/or drilling to the required depths. The CONTRACTOR shall measure and record the distances to the bottom of GWBW and/or trench with the ENGINEER every 20 feet along the wall alignment. The CONTRACTOR shall remove all loose material from the trench. The GWBW shall extend 35 feet below ground surface. Achievement of the design depth shall be determined in the field by the ENGINEER based on depth

measurement at every 20 feet along the wall alignment and visual exam of the excavated material.

2. In areas where materials unsuitable materials for incorporation into the GWBW are removed, as determined by these specifications or the ENGINEER, the material shall be placed in containers by the CONTRACTOR for disposal.

3. At the intersection of two (2) straight line segments, the GWBW shall extend a minimum of five (5) feet beyond the outside of the intersection through all depths. If the GWBW overlaps into a previously completed segment, the GWBW shall extend a minimum of 10 feet into the previously placed segment through all depths. There will be no additional payments for excavation of installed GWBW to make tie-ins.

4. Upon completion of the GWBW and prior to placement of the cap over the wall, no vehicular traffic should cross the GWBW without prior acceptance by the ENGINEER. If access is needed before the wall has "set up" properly, the CONTRACTOR shall provide a temporary bridge for crossing a completed GWBW section so as not to disturb the completed GWBW. If a temporary crossing bridge is required, the CONTRACTOR shall install a minimum 1-inch thick steel plate, overlapped sufficiently so that no gaps and/or cracks are apparent and to permit traffic to proceed normally across it.

5. No blasting is permitted for construction of the GWBW.

6. Stability:

   a. The CONTRACTOR is responsible for ensuring and maintaining the stability of the Work area, including but not limited to the GWBW and surrounding area, at all times during all operations, including excavations/trenching, mixing, drilling, backfilling, injections, and the results of such activities to the adjacent areas, such as the riverbank.
   b. The CONTRACTOR shall control all surcharges from all excavation/trenching, mixing, drilling, injection, grading, backfilling, mixing and other equipment, waste, berm construction, stockpiles, and any other loading situations that may affect GWBW construction stability.

F. Capping:

1. The surface of the GWBW backfill shall not be allowed to desiccate prior to placing the final cap. A temporary cover shall be used to protect the backfill prior to placing the final cap. The temporary cover shall consist of at least one (1) foot of uncompacted backfill placed within one (1) day after the backfill is placed. After a minimum of one (1) week, the temporary cover shall be removed. Any depressions or settlement shall be repaired by placing additional backfill or the permanent cap.

2. Upon removal of the temporary cover and before desiccation of the backfill surface can occur, the GWBW shall be covered with a clay cap meeting the requirements of Section 02200 – EARTHWORK and in accordance with the details depicted on the Drawings.

G. Post-Construction of GWBW:

1. Upon completion of backfilling and grading operations, all remaining excavated material, residual slurry or grout, and mixed backfill shall be removed and disposed by the CONTRACTOR at an approved off-site facility in accordance with Section 02250 – TRANSPORTATION AND DISPOSAL OF MATERIALS and the appropriate ODEQ regulations.

2. All disturbed areas shall be cleaned, leveled, and returned to the original condition as directed by the ENGINEER. In accordance with the permitting requirements, the project shall be completed and restored so that no fill is placed above the pre-construction grades and elevations (i.e., a “no net fill” project). Any excess soil materials (not including excess GWBW spoils) that cannot be replaced in an excavation shall be disposed at an approved off-site facility.

3.04 SOIL-REAGENT SLURRY WALL CONSTRUCTION

A. Equipment: The CONTRACTOR shall furnish the necessary plant, tools and equipment for efficient excavation of the trench, mixing and placing of slurry, and transporting, mixing, and placing backfill material. Equipment shall be capable of excavating the minimum 36-inch wide trench in one pass and to a minimum depth of 35 feet.

B. Slurry Placement:

1. The CONTRACTOR shall maintain the stability of the excavated trench at all times. The excavated trench above the slurry level shall be maintained to prevent cave-in. The CONTRACTOR is

responsible for maintaining slurry densities and levels to ensure stable conditions within any excavations and to the full depth of the excavation and/or trench.

2. The CONTRACTOR shall provide all personnel, equipment and material to maintain the slurry level at all times during the trench construction, after hours, weekends, and holidays included.

3. It is the CONTRACTOR's sole responsibility to ensure that the mixing of any reagents/backfill/slurries do not affect the stability of any open excavations. In the event of sloughing, sliding or other failure of a trench wall prior to completion of backfilling, the CONTRACTOR shall re-excavate the trench, remove all material displaced into the trench, and take corrective action to prevent further deterioration, at the CONTRACTOR's expense.

4. The CONTRACTOR is responsible for testing and maintaining the initial slurry mix and the slurry in the trench, at the frequencies specified in Table 02242-1, to meet the requirements specified herein.

5. The CONTRACTOR shall ensure that the slurry sand content is not excessive and dropping out of the slurry to the bottom of the trench affecting the overall performance of the trench.

6. Slurry shall be introduced into the trench at the time excavation begins. The level of the slurry in the open trench shall be maintained at least three (3) feet above the water table and no more than two (2) feet below the working surface until the placement of the reagent mix backfill is complete, unless otherwise approved by the ENGINEER.

7. Slurry shall not be diluted by surface water.

8. The level of the slurry in the trench shall be routinely monitored throughout the day; the level of slurry shall be monitored and recorded each morning and evening. Any noticeable difference in the elevation of the slurry may indicate a loss of slurry through the formation or cave-ins. Corrective action shall be taken to address any noticeable change in the elevation of the slurry.

C. Trench Excavation:

1. The width of the hydraulic isolation wall shall be equal to or greater than 36 inches, unless otherwise approved by the ENGINEER.

2. The CONTRACTOR shall ensure that no loose material, cuttings, or debris are left in the bottom of the trench before slurry backfilling commences and employ appropriate equipment to verify cleaning of the trench bottom. The CONTRACTOR shall remove from the trench any slurry which contains excessive suspended solids as indicated by a slurry unit weight exceeding 85 pcf or within 15 pcf of the unit weight of the backfill mixture. The removal of this slurry or materials from the bottom of the trench shall be done with suitable equipment. Upon these removal activities, the trench shall be sounded immediately before placing backfill, and the soundings shall be compared to the trench excavation soundings to verify the bottom.

3. At a minimum, soundings shall be taken each morning and each evening and compared to monitor for cave-ins or excessive settlement. Corrective action, including trench bottom cleaning, shall be taken to address soundings that indicate these conditions. The trench bottom shall be cleaned by using an excavator bucket, air lift pump, or other approved equipment to ensure removal of sand, gravel, sediment, and other material left in the trench or settled out of the slurry. Cleaning shall not remove material from the walls of the trench.

4. The CONTRACTOR shall conduct Work to avoid damage to utilities and other structures. Excavation equipment shall remain a safe distance (at least 20 feet or as determined in the HASP) from the overhead utilities, if any.

5. The excavation shall begin at the working surface and shall provide a vertical (within two (2) percent) continuous 36-inch minimum width trench to the required depth along the centerline of the excavation. The toe of the slope of the trench excavation shall not precede the toe of the reagent backfill slope by less than 30 feet or more than 100 feet.

6. A lead-in trench is required at the start of the GWBW and at the intersection of two segments. The lead-in trench shall commence far enough away from the GWBW and ramp down to the full depth of the GWBW at a slope which avoids segregation of backfill particles.

7. Trench spoils that are suitable for backfill mixture may be stockpiled adjacent to, or remote from, the trench for processing. Care shall be taken to ensure that unprocessed spoils do not re-enter the trench. Any spoils or excavated materials that are not used in the backfill

process shall be management accordingly and disposed off-site in accordance with 02250 Transportation and Disposal of Materials.

D. Backfill requirements:

1. Bentonite, or other reagents, shall be added and mixed uniformly and homogeneously with soil backfill such that the soil-reagent backfill mixture meets the requirement in Part 2.05 and the criteria presented in Table 02242-1.

2. The soil-reagent backfill shall be thoroughly mixed, via disking, harrowing, bulldozing, blading, or other approved methods, into a homogeneous mass, free from large lumps or clods of soil or pockets of fines, sand or gravel. Occasional lumps/clods of up to three (3) inches in their largest dimension will be permitted.

3. All particles shall be coated with slurry. Sluicing with water is not permitted.

4. If mixing occurs along the trench, heavy equipment, i.e., bulldozers, shall not operate in a back and forth fashion parallel to the open trench. Unmixed materials shall not be permitted to flow into the trench. Excess slurry shall not flow beyond the limits of Work.

E. Soil-Reagent Backfill Placement:

1. At the beginning of the excavation, the initial layer of backfill shall be placed from one location only. Only in special conditions as approved by the ENGINEER where a lead-in trench is not excavated, the initial backfill shall be placed by lowering the material to the bottom of the trench by means of a clamshell bucket, tremie methods, or other approved equipment until the backfill emerges from below the slurry surface and achieves its natural angle of repose. A lead-in trench shall start at a point outside the limits of the GWBW to allow the soil-reagent backfill face to form prior to reaching the full depth of the required GWBW. The slope of the lead-in trench shall be excavated to prohibit sliding, sloughing, buckling, or other failures which could trap pockets of material or otherwise affect the performance of the wall. Free dropping of soil-reagent backfill through the slurry is not permitted at anytime throughout construction.

2. The point of trench backfilling shall progress towards the areas of active excavation. Backfilling operations shall proceed in such a manner that the slope of the initial backfill will be maintained. The

new backfill material shall be allowed to slide down the slope of the previously placed backfill and shall be placed in such a manner that the pockets of slurry shall not be trapped during subsequent backfilling.

3. Care shall be exercised during mixing and backfilling to ensure that the backfill flows and displaces the slurry in the trench and to ensure that a uniform and homogenous trench is constructed.

4. The CONTRACTOR shall backfill continuously in the direction of the excavation from the beginning of the trench to the end of the trench, unless approved otherwise by the ENGINEER.

5. Backfilling shall occur so that no pockets of slurry are present in the completed GWBW. The backfill shall not be deposited in any manner that will cause segregation.

6. No payments will be made for the portion of trenches which lie outside of the limits of work.

7. No mixing or placing of soil-reagent backfill shall occur when the air temperature is below 30 degrees Fahrenheit.

3.05 CONTINUOUS TRENCHING CONSTRUCTION

A. Equipment: The CONTRACTOR shall furnish the necessary plant, tools and equipment for efficient trenching, mixing, delivery and placing of reagent and reagent slurry (dry reagent and water mix). Equipment shall be capable of continuously trenching and mixing the minimum 36-inch wide trench in one pass and to a minimum depth of 35 feet.

B. Trenching and Mixing:

1. The width of the hydraulic isolation wall shall be equal to or greater than 36 inches, unless otherwise approved by the ENGINEER.

2. The CONTRACTOR shall accurately record the quantity and percentages of dry reagent placed on the reagent starter trench and reagent slurry pumped during GWBW construction.

3. The CONTRACTOR shall conduct Work to avoid damage to utilities and other structures. Trenching equipment shall remain a safe distance (at least 20 feet or as determined in the HASP) from the overhead utilities, if any.

4. The trenching shall begin at the working surface and shall provide a vertical (within two (2) percent) continuous 36-inch minimum width trench to the required depth along the centerline of the excavation.

5. The CONTRACTOR is responsible for ensuring that all materials and soils from the GWBW construction are contained, including the excavation of a bulking containment trench along the GWBW alignment. Excess spoils shall be transported and disposed offsite in accordance with 02250 Transportation and Disposal of Materials.

6. Trenching and mixing speed shall be adjusted to ensure the pumped reagent slurry and in-situ soil are mixed properly to form a uniform and homogenous GWBW.

7. The CONTRACTOR is responsible for testing the slurry and soil-reagent mix in accordance with the methods and frequencies provided in Table 02242-1. The resulting GWBW shall have in-place coefficient of permeability of 1×10^{-6} cm/sec or less, and shall comply with Table 02242-1. The materials, equipment, mix design, construction method, and verification methods shall be submitted to the ENGINEER with the bid to demonstrate assurance for meeting the performance standards.

8. If a lead-in trench is required at either end of the GWBW or at the intersection of two segments, the lead-in trench shall commence far enough away from the GWBW and ramp down to establish the full depth within the limits of the GWBW.

9. Trenching and mixing of the soil-reagent mix shall occur so that there are no pockets of slurry or unmixed materials present in the GWBW.

3.06 JET GROUTING CONSTRUCTION

A. Any jet grout hole lost or damaged as the result of mechanical failure of equipment, inadequacy of grout supplies, or improper drilling or injection procedures shall be backfilled with cement grout and replaced by another hole, drilled and injected by the CONTRACTOR at no additional cost to the OWNER. The replacement hole shall be in a location that maintains the integrity of the wall.

B. Jet grout injection and jet monitor rotation and extraction rates shall be sufficient to produce grout columns/panels meeting the minimum diameter, depth, overlap, and material property requirements specified herein, and to

assure that the completed wall achieves the minimum permeability specifications. The CONTRACTOR shall determine and provide with the bid recommended row numbers, diameters, spacing, overlaps, pressures, construction and verification methods, and other necessary information to the ENGINEER to demonstrate compliance in order to meet the performance standards.

C. Jet grout mix shall be proportioned and injected so that the grout column produced meets the following requirements:

1. Coefficient of permeability not to exceed 1 x 10^{-6} cm/sec; and,

2. Additional tests specified in Table 02242-1.

D. Equipment for mixing, holding, and pumping grout shall be in a secure location and shall be operated to minimize spillage of material. No material will be allowed to enter storm drains or other drainage courses.

F. The wall shall consist of, at a minimum, a single row of overlapping jet grout columns/panels with a minimum diameter of 36 inches. The minimum overlap shall be the greater of 1/8 of the column diameter/panel width or six inches. Multiple rows may, at the discretion of the CONTRACTOR, be employed to assure meeting the minimum performance standards.

G. Upon completion of backfilling and grading operations, all remaining excavated material, residual slurry or grout, and mixed backfill shall be removed and disposed by the CONTRACTOR in accordance with Section 02250 – TRANSPORTATION AND DISPOSAL OF MATERIALS and the appropriate ODEQ regulations.

3.07 SOIL MIXING (SM) CONSTRUCTION

A. Equipment: The SM rig shall consist of a single shaft or a series of overlapping mixing shafts capable of creating a wall with a minimum thickness of 36 inches.

B. Alignment:

1. For equipment with a series of overlapping mixing shafts, the auger flights and mixing blades between the shafts of the SM rig shall be overlapped to achieve continuity in the stabilized soil column.

2. The placement of strokes shall be controlled by the use of a template or other approved means to gauge the distance between strokes.

3. The vertical alignment of the auger stroke shall be controlled by the SM equipment operator.

C. Shaft speed: The mixing shaft speed shall be adjusted to accommodate a constant rate of mixing shaft penetration based on the degree of drilling difficulty.

D. Penetration Rate: The penetration rate of the mixing shafts shall be maintained in the range of 1 to 8 vertical feet per minute during both penetration and withdrawal, unless otherwise demonstrated by the CONTRACTOR.

E. Grout: The grout injection rate per vertical foot of column shall be adjusted to the requirements of the design mix, as proposed by the CONTRACTOR.

F. The resulting soil column wall shall not exceed an in-place coefficient of permeability of 1×10^{-6} cm/sec and shall comply with Table 02242-1. The materials, equipment, mix design, construction method, and verification methods shall be submitted to the ENGINEER with the bid to demonstrate assurance for meeting the performance standards.

G. The CONTRACTOR shall determine the overlap of successive auger locations to ensure a continuous GWBW that meets the required specifications. The ENGINEER shall evaluate the data provided by the CONTRACTOR to confirm that the appropriate overlap is being implemented; a minimum overlap of 30 percent is required between successive auger locations. If insufficient overlap is observed or the GWBW does not meet the performance requirements, the CONTRACTOR shall reprocess the area at no additional cost to the OWNER.

H. Upon completion of backfilling and grading operations, all remaining excavated material, residual slurry or grout, and mixed backfill shall be removed and disposed by the CONTRACTOR in accordance with Section 02250 – TRANSPORTATION AND DISPOSAL OF MATERIALS and the appropriate ODEQ regulations.

PART 4 - QUALITY CONTROL AND QUALITY ASSURANCE

4.01 DEFINITIONS

A. The CONTRACTOR shall be responsible to construct a GWBW which meets these Specifications, and conduct all QC tests as necessary to

demonstrate that the construction of the GWBW meets the Specifications. The CONTRACTOR shall provide quality control inspectors, as needed, to ensure proper quality control of the project and to obtain quality control samples as required herein and on Table 02242-1.

B. The ENGINEER will be responsible for QA testing.

C. Sampling and testing shall be performed by personnel experienced in the type of test required. Samples shall be representative of the overall volume of material from which the sample is taken.

D. Equipment for sampling and testing shall be in good condition. Set up equipment for onsite testing, and perform tests onsite unless otherwise specified.

E. Perform tests in a timely manner. Immediately submit results in writing to ENGINEER. The CONTRACTOR shall be responsible for representative, quality, and accurate sampling and testing. The OWNER or ENGINEER may make its own independent tests.

4.02 QUALITY CONTROL OF DELIVERED PRODUCTS

A. Bentonite:

1. The CONTRACTOR shall supply to the ENGINEER, for each designated load of bentonite, the bentonite manufacturer's certifications and laboratory test results that demonstrate that the bentonite meets the Specifications.

2. The CONTRACTOR shall supply to the ENGINEER samples of bentonite as required by the Specifications or as requested by the ENGINEER.

3. The CONTRACTOR shall keep a log of bentonite deliveries that includes: date, source, time of delivery, weight and laboratory quality control test results supplied by the Manufacturer.

4. It shall be the responsibility of the CONTRACTOR to verify that the bentonite delivered meets the Specifications.

B. Other Reagents:

1. The CONTRACTOR shall supply to the ENGINEER, for each designated load of reagent, the reagent manufacturer’s certifications

and laboratory test results that demonstrate that the reagent meets the Specifications.

2. The CONTRACTOR shall supply to the ENGINEER samples of reagent as required by the Specifications or as requested by the ENGINEER.

3. The CONTRACTOR shall keep a log of reagent deliveries that includes: date, source, time of delivery, weight and laboratory quality control test results supplied by the Manufacturer.

4. It shall be the responsibility of the CONTRACTOR to verify that the reagent delivered meets the Specifications.

4.03 QUALITY CONTROL OF SOIL-REAGENT SLURRY WALL

A. The submittals and tests for reagent and water shall meet the requirements outlined in Table 02242-1.

B. Soil-Reagent Backfill Material:

1. The CONTRACTOR shall obtain samples of the soil-bentonite backfill as required by these Specifications and as deemed necessary to achieve the performance requirements specified in Table 02242-1. The test results shall be supplied to the ENGINEER as soon as possible.

2. Permeability:

a. The CONTRACTOR shall collect bulk and undisturbed samples of the soil-bentonite backfill at the frequencies specified in Table 02242-1 for laboratory permeability testing by a third-party laboratory to be procured by the CONTRACTOR. The tests shall be constant-head type permeability tests performed under a back pressure of 25 psi. During the saturation phase of the flexible wall permeability test, the difference between the chamber pressure and the back pressure shall not exceed 5 psi. The back pressure must be applied in small increments, with adequate time between increments to allow equalization of pore water pressure throughout the specimen. Typically, chamber pressure is about 7 psi and a chamber pressure and back pressure shall be in increment maintaining the back pressure at about 5 psi less than the chamber pressure. The imposed hydraulic

gradient shall be less than 12 to minimize consolidation of the sample during testing. No additional consolidation stresses shall be applied to the test specimen other than that resulting from the imposed hydraulic gradient. Maximum turnaround times for quality control testing shall be required to be within one (1) week. The test results shall be provided to the ENGINEER as soon as possible.

b. The in-place coefficient of permeability of the soil-bentonite backfill shall be as specified in Table 02242-1.

3. The CONTRACTOR shall run additional tests as necessary to construct a GWBW that meets the Specifications. The CONTRACTOR shall split samples with the ENGINEER, at the ENGINEER'S request, to verify test results.

C. Bentonite Slurry: The submittals and tests for initial slurry and in-trench slurry shall meet the requirements specified in Table 02242-1.

4.04 QUALITY CONTROL OF CONTINUOUS TRENCHING

A. Submittals and tests for reagents shall meet the requirements outlined in Table 02242-1.

B. The CONTRACTOR shall conduct quality control tests on the continuous trenching method as specified in Table 02242-1.

C. Soil- Reagent Mix Material:

1. The CONTRACTOR shall obtain samples of the soil-reagent mix after mixing and test, as required in Table 02242-1 and below.

2. Permeability:

a. The CONTRACTOR shall collect bulk and undisturbed samples of the soil-bentonite backfill at the frequencies specified in Table 02242-1 for laboratory permeability testing by a third-party laboratory to be procured by the CONTRACTOR. The tests shall be constant-head type permeability tests performed under a back pressure of 25 psi. During the saturation phase of the flexible wall permeability test, the difference between the chamber pressure and the back pressure shall not exceed 5 psi. The back pressure must be applied in small increments, with adequate time between

increments to allow equalization of pore water pressure throughout the specimen. Typically, chamber pressure is about 7 psi and a chamber pressure and back pressure shall be in increment maintaining the back pressure at about 5 psi less than the chamber pressure. The imposed hydraulic gradient shall be less than 12 to minimize consolidation of the sample during testing. No additional consolidation stresses shall be applied to the test specimen other than that resulting from the imposed hydraulic gradient. Maximum turnaround times for quality control testing shall be required to be within one (1) week. The test results shall be provided to the ENGINEER as soon as possible.

b. The in-place coefficient of permeability of the soil-reagent backfill shall be as specified in Table 02242-1.

3. Soil- Reagent Mix Slump: The CONTRACTOR, in the presence of the ENGINEER, shall measure and record the slump of the mix. The slump of the mix shall be determined after mixing soils with the reagent slurry at the initiation of each day's GWBW installation, and at a minimum of once every 2 hours during the installation of the vertical barrier wall. The soil-reagent mix slump shall be determined in accordance with the procedures given in ASTM C-143. The slump of the mix shall be between 4 and 6 inches. If mix does not meet this slump, the mix shall be modified as necessary, and be tested, unless otherwise approved by the ENGINEER.

4. Density: The CONTRACTOR shall conduct density on the soil-reagent backfill frequency specified in Table 02242-1.

5. The CONTRACTOR shall run additional tests as necessary to construct a GWBW that meets the Specifications. The CONTRACTOR shall split samples with the ENGINEER, at ENGINEER's request, to verify test results.

D. Reagent Slurry: The CONTRACTOR, in the presence of the ENGINEER, shall measure and record the reagent slurry viscosity, unit weight, and pH prior to mixing with backfill or placing the slurry in the trench during excavation. The reagent slurry viscosity, unit weight, and pH shall be determined each time the batch plant begins operation and at a minimum of every 2 hours during the installation of the backfill. The slurry viscosity and unit weight shall be determined with a Marsh funnel and mud balance, respectively.

4.05 QUALITY CONTROL OF JET GROUTING

A. Submittals and tests for reagents shall meet the requirements outlined in Table 02242-1.

C. The CONTRACTOR shall conduct quality control tests on the jet grouting technology as specified in Table 02242-1

4.06 QUALITY CONTROL OF SOIL MIXING

A. Submittals and tests for reagents shall meet the requirements outlined in Table 02242-1.

C. The CONTRACTOR shall conduct quality control tests on the Deep Soil Mixing technology as specified in Table 02242-1

4.07 QUALITY CONTROL OF CLAY CAP

The CONTRACTOR shall test the in-place density and moisture content of the clay cap material in accordance with Section 02200 – EARTHWORK.

4.08 SOUNDINGS AND DEPTH VERIFICATION

A. Reagent Slurry Wall: Soundings shall be taken every 20 feet along the GWBW centerline using a weighted tape, cable, or other device. Soundings shall be recorded to the nearest 0.5 feet. Soundings shall record the following:

1. Bottom of Excavation: The bottom elevation of the GWBW shall be determined subject to approval by the ENGINEER.

2. Bottom of Excavation Prior to Backfilling: Soundings shall be used to monitor for sidewall collapse and accumulation of sediments.

3. Profile of Backfill Slope: The backfill slope and trench bottom, if applicable, shall be sounded at the beginning and end of each shift and converted to an as-built drawing. This drawing shall be reviewed daily as an indication of trench collapse, excessive settlement or sloughing.

B. Continuous trenching, soil mixing, and jet grouting: The CONTRACTOR shall observe and record the depth of the GWBW every 20 feet along the alignment, to the nearest 0.5 feet. The method for verifying the depth shall be approved by the ENGINEER.

4.09 AS-BUILT PROFILE

An as-built profile of the trench bottom, backfill slopes, including descriptions of materials encountered in the trench, and bottom of trench shall be continuously maintained by the CONTRACTOR. This profile shall indicate the extent of excavation and the backfill profile at the beginning and end of each work day or shift, as determined from the soundings, or depth measurements. The daily profile drawing shall be in AutoCAD. Materials encountered in the GWBW and bottom of the GWBW shall be described at a maximum interval of 20 lineal feet. The CONTRACTOR shall furnish profile drawings and records of all observations, measurements, and tests performed, identified with the location, date, and time of testing. These records shall be furnished to the ENGINEER no later than 24 hours after the tests, measurements, and/or observations are made.

4.10 REJECTED GROUNDWATER BARRIER WALL SECTION

If the required quality control parameters are not achieved for a given sample, the corresponding section of GWBW will be rejected. The deficient section limits will be determined by the ENGINEER. If tests fail to meet the specified requirements, the ENGINEER reserves the right to require additional sampling and testing at the CONTRACTOR's expense. For failed/rejected sections, the CONTRACTOR shall remove and replace the GWBW within the limits specified by the ENGINEER at no additional cost to the OWNER.

TABLE 02242-1 QUALITY CONTROL TESTING

Technology	Construction Phase	Component	Parameter	Test Method	Frequency	Acceptance Criteria
Soil-Reagent Slurry Wall	Pre-Construction	Bentonite	Free Swell Test	USP NF XVII	Once per borrow source	16 cm^3 minimum
			YP/PV Ratio	API 13A	Once each truck or railcar shipment	3 minimum
			Plastic Viscosity	API 13A	Once per borrow source	10 minimum
			Filtrate Loss	API 13A	Once each truck or railcar shipment	15 cm^3 maximum
			Moisture Content	ASTM D2216	Once each truck or railcar shipment	10% maximum
			Viscometer	API 13A	Once per borrow source	30 minimum @ 600 rpm
			Residue > 75 um	API 13A	Once per borrow source	4% maximum
		Mix Water	pH	API RP 13B-1	Once per source	6 to 8
			Total Dissolved Solids	EPA 600	Once per source	500 mg/L maximum
			Hardness	API RP 13B-1	Once per source	50 mg/L maximum
		Soil Backfill	Particle Size Analysis	ASTM D422	Once every 500 cy	100% passing 3 in, minimum 20% passing No. 200
			Moisture Content	ASTM D2216	Once every 500 cy	For record
			Atterberg Limits	ASTM D4318	Once every 500 cy	LL > 30, PI > 10
	Construction	Initial Slurry	Viscosity	API RP 13B-1	Twice per 8-hour shift	40 marsh seconds minimum
			Density	ASTM D4380	Twice per 8-hour shift	64 pcf minimum and > 15 pcf less than the backfill
			Filtrate Loss	API RP-13B-1	Twice per 8-hour shift	<25 cm^3 in 30 minutes @ 100 psi
			pH	API RP 13B-1	Twice per 8-hour shift	6 to 9
		In-Trench Slurry	Viscosity	API RP 13B-1	Twice per 8-hour shift	40 marsh seconds minimum
			Density	ASTM D4380	Twice per 8-hour shift	64 to 85 pcf and > 15 pcf less than the backfill
		Soil-Reagent Backfill	Particle Size Analysis	ASTM D422	One per day or one every 100 lineal feet whichever is greater frequency at alternating 20 vertical foot intervals	100% passing 3 in, minimum 20% passing No. 200
			Atterberg Limits	ASTM D4318	One per day or one every 100 lineal feet whichever is greater frequency at alternating 20 vertical foot intervals	LL > 30, PI > 10
			Permeability	ASTM D5084	One per day or one every 100 lineal feet whichever is greater frequency at alternating 20 vertical foot intervals	1 x 10-6 cm/sec maximum
			Slump	ASTM C143	Twice per 8-hour shift	4 to 6 inches
			Density	ASTM D4380	Twice per 8-hour shift	At least 15 pcf greater than the in-trench slurry
	Post-Construction	Soil-Reagent Backfill	Permeability	ASTM D5084	One undisturbed sample from the ground surface to mid-depth and one from mid-depth to the bottom from two areas that are at least 200 feet apart	1 x 10^{-6} cm/sec maximum
Continuous Trenching	Pre-Construction	Bentonite	Free Swell Test	USP NF XVII	Once per borrow source	16 cm^3 minimum
			YP/PV Ratio	API 13A	Once each truck or railcar shipment	3 minimum
			Plastic Viscosity	API 13A	Once per borrow source	10 minimum
			Filtrate Loss	API 13A	Once each truck or railcar shipment	15 cm^3 maximum
			Moisture Content	ASTM D2216	Once each truck or railcar shipment	10% maximum
			Viscometer	API 13A	Once per borrow source	30 minimum @ 600 rpm
			Residue > 75 um	API 13A	Once per borrow source	4% maximum
		Mix Water	pH	API RP 13B-1	Once per source	6 to 8
			Total Dissolved Solids	EPA 600	Once per source	500 mg/L maximum
			Hardness	API RP 13B-1	Once per source	50 mg/L maximum
	Construction	Reagent Slurry	Viscosity	API RP 13B-1	Each time the batch plant begins operation and at a minimum of every 2 hours during the installation of the backfill	40 marsh seconds minimum
			Density	ASTM D4380	Each time the batch plant begins operation and at a minimum of every 2 hours during the installation of the backfill	64 pcf minimum
			pH	API RP 13B-1	Each time the batch plant begins operation and at a minimum of every 2 hours during the installation of the backfill	6 to 9
		Soil-Reagent Mix	Slump	ASTM C143	At the initiation of each day's GWBW installation, and at a minimum of once every 2 hours during the installation of the GWBW	4 to 6 inches
			Density	ASTM D4380	One per day or one every 100 lineal feet whichever is greater frequency at alternating 20 vertical foot intervals	64 to 85 pcf
			Permeability	ASTM D5084	One per day or one every 100 lineal feet whichever is greater frequency at alternating 20 vertical foot intervals	1 x 10^{-6} cm/sec maximum
	Post-Construction	Soil-Reagent Mix	Permeability	ASTM D5084	One undisturbed sample from the ground surface to mid-depth and one from mid-depth to the bottom from two areas that are at least 200 feet apart	1 x 10^{-6} cm/sec maximum

Technology	Construction Phase	Component	Parameter	Test Method	Frequency	Acceptance Criteria
Deep Soil Mixing	Pre-Construction	Bentonite	Free Swell Test	USP NF XVII	Once per borrow source	16 cm^3 minimum
			YP/PV Ratio	API 13A	Once each truck or railcar shipment	3 minimum
			Plastic Viscosity	API 13A	Once per borrow source	10 minimum
			Filtrate Loss	API 13A	Once each truck or railcar shipment	15 cm^3 maximum
			Moisture Content	ASTM D2216	Once each truck or railcar shipment	10% maximum
			Viscometer	API 13A	Once per borrow source	30 minimum @ 600 rpm
			Residue > 75 um	API 13A	Once per borrow source	4% maximum
		Mix Water	pH	API RP 13B-1	Once per source	6 to 8
			Total Dissolved Solids	EPA 600	Once per source	500 mg/L maximum
			Hardness	API RP 13B-1	Once per source	50 mg/L maximum
	Construction	Column Mold	Permeability	ASTM D5084	One per day or one every 100 lineal feet whichever is greater frequency at alternating 20 vertical foot intervals	1 x 10^{-6} cm/sec maximum
	Post-Construction	Cured Core	Permeability	ASTM D5084	One undisturbed sample from the ground surface to mid-depth and one from mid-depth to the bottom from two areas that are at least 200 feet apart	1 x 10^{-6} cm/sec maximum
Jet Grouting	Pre-Construction	Bentonite	Free Swell Test	USP NF XVII	Once per borrow source	16 cm^3 minimum
			YP/PV Ratio	API 13A	Once each truck or railcar shipment	3 minimum
			Plastic Viscosity	API 13A	Once per borrow source	10 minimum
			Filtrate Loss	API 13A	Once each truck or railcar shipment	15 cm^3 maximum
			Moisture Content	ASTM D2216	Once each truck or railcar shipment	10% maximum
			Viscometer	API 13A	Once per borrow source	30 minimum @ 600 rpm
			Residue > 75 um	API 13A	Once per borrow source	4% maximum
		Mix Water	pH	API RP 13B-1	Once per source	6 to 8
			Total Dissolved Solids	EPA 600	Once per source	500 mg/L maximum
			Hardness	API RP 13B-1	Once per source	50 mg/L maximum
	Construction	Column Mold	Permeability	ASTM D5084	One per day or one every 100 lineal feet whichever is greater frequency at alternating 20 vertical foot intervals	1 x 10^{-6} cm/sec maximum
	Post-Construction	Cured Core	Permeability	ASTM D5084	One undisturbed sample from the ground surface to mid-depth and one from mid-depth to the bottom from two areas that are at least 200 feet apart	1 x 10^{-6} cm/sec maximum

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

The CONTRACTOR shall furnish all labor, materials, tools, and equipment, required for the transport and off-site disposal of all concrete/asphalt debris, spoils, impacted materials, liquids, and other waste materials as specified in these Contract Documents. The management of these materials shall be consistent with these specifications and the Contaminated Material Management Plan.

1.02 REGULATORY REQUIREMENTS

A. The debris, liquids, and other waste materials removed during the Work shall be cleaned and properly decontaminated (or contained in the case of contaminated soils and liquids) sufficient for transportation in accordance with these Specifications and all federal, state, and local regulations.

B. All debris, liquids, and other waste materials shall be disposed at an approved waste disposal facility in accordance with all federal, state, and local regulations.

C. The CONTRACTOR shall comply with all applicable regulatory requirements and all federal, state, or local laws, codes, and ordinances which govern the transportation of equipment and disposal of material to be removed from the Site. Materials transported off-site shall ~~meet the ODEQ off-site disposal policy and~~ comply with all applicable regulations for off-site disposal.

D. The CONTRACTOR shall obtain any and all permits required for transport and disposal and comply with all applicable requirements.

1.03 TRANSPORTATION

A. The CONTRACTOR shall be responsible for transporting all debris, piping, spoils, liquids, impacted materials, and other waste to the appropriate off-site disposal facility.

B. The CONTRACTOR shall be responsible for all sampling and testing required by the off-site disposal facility.

C. The CONTRACTOR shall provide all necessary traffic controls at the Site ingress and egress location such as flagmen, during trucking operations, or as otherwise directed by the ENGINEER.

D. No queuing of trucks shall be permitted on any roads, including but not limited to North Burgard Way, North Burgard Road, or North Time Oil

Road. Any queuing of trucks that occurs on-site shall not interfere with daily traffic.

1.04 SUBMITTALS

A. In accordance with Section 01300 – SUBMITTALS.

B. The CONTRACTOR shall submit written documentation certifying that the disposal facility is in compliance with all regulations and permits, and is willing to accept the material. A copy of the most recent inspection report shall be submitted to the ENGINEER verifying that the facilities have no violations or other environmental conditions that affect the satisfactory operation of the facility.

C. The CONTRACTOR shall submit copies of results of any tests performed at the disposal facility by the disposal facility prior to waste acceptance. The CONTRACTOR shall be responsible for performing any tests required by the receiving facility for the disposal of materials.

E. The CONTRACTOR shall prepare and submit to the ENGINEER information regarding transporting equipment or materials from the site, including type of trucks and/or trailers, method of transportation, the transport route to the facility, the anticipated number of trips, and the proposed types and locations of necessary traffic control devices to be used by the CONTRACTOR. The CONTRACTOR shall also list all federal, state, and local regulations that must be complied with and all permits that must be obtained.

F. The CONTRACTOR shall not commence with the removal of debris, liquids, and other waste materials from the Site until the ENGINEER has reviewed the submitted information.

G. The CONTRACTOR shall submit copies of weigh tickets or other receipts provided by the disposal facility to the ENGINEER as evidence of the arrival and disposal of the material at the disposal site, including any salvaging, recycling, or recovery. The documentation submitted to the ENGINEER shall, at a minimum, identify the origin of the material, the quantity of the material (tons, cubic yards, units, etc.), the identification of the transport vehicle, the type of material, and the date the material was disposed at the facility.

1.05 DISPOSAL FACILITIES

A. The OWNER reserves the right to direct the CONTRACTOR to dispose material at a facility identified by the OWNER.

B. Unless directed by the ENGINEER to dispose material at a particular facility, the CONTRACTOR shall be responsible for locating disposal facilities; e.g., solid waste disposal facility, hazardous waste disposal facility, wastewater disposal facility, etc., which shall accept all materials removed from the site, including materials generated from excavation, excess spoils, site clearing, dismantling, decontamination, or other activities performed within the areas of Work, as applicable.

C. The disposal facilities shall be approved by the ENGINEER. The disposal facility shall be in compliance with all current federal and state regulations governing construction and operation of an appropriate waste disposal facility.

1.06 ALTERNATE DISPOSAL FACILITY

A. In the event that the identified and approved facilities cease to accept the stated materials or the facility ceases operations or the OWNER rejects the facility, it is the CONTRACTOR's responsibility to locate an alternate approved and permitted facility for accepting materials. The CONTRACTOR is responsible for making the necessary arrangements to utilize the facility and the alternate facility must be approved in writing by the OWNER in the same manner and with the same requirements as the original facility before the concrete/asphalt debris, spoils, waste materials, impacted water, or other materials, are removed from the Site.

PART 2 - PRODUCTS

(not used)

PART 3 - EXECUTION

3.01 GENERAL

A. No vehicle shall leave the Site unless it is in a clean condition, free of loose dirt or loose material on tailgates, axles, wheels, etc.

B. No vehicle shall leave the Site unless the materials being transported are secure and tightly covered/tarped or contained so that no material, dust, or water is able to drop off, blow off, or leak out. Trucks shall be lined at the

discretion of the ENGINEER.

C. Loading and transportation of concrete/asphalt debris, piping, spoils, liquids, and other waste materials shall be conducted in a manner as to eliminate all dust.

D. All personnel, equipment, and trucks shall enter and exit the Site from one common location. Prior to exiting the Site all decontamination requirements of these Specifications and the Site Health and Safety Plan shall be met.

E. In the event that the materials being transported are dropped or spilled from the truck during transportation, the CONTRACTOR shall take the following steps.

1. If contents are spilled on-site, the CONTRACTOR shall immediately notify the ENGINEER. The CONTRACTOR is responsible for immediate removal of the waste materials and cleaning the area to the satisfaction of the ENGINEER.

2. If contents are spilled off-site, the CONTRACTOR shall immediately notify the ENGINEER, OWNER, and the appropriate authorities; i.e., local fire and police departments. The appropriate clean-up activities shall be coordinated without delay with these authorities.

3. If contents are spilled, the truck shall return and go through the decontamination station again before proceeding off-site.

4. If contents are spilled, no additional loads shall leave the site until the decontamination procedures are reviewed and necessary changes implemented to ensure that dropping or tracking of material and debris beyond the decontamination station does not occur.

5. The CONTRACTOR shall bear full responsibility for any required clean-up of all spilled material. All clean up and remediation activities associated with spilled materials shall be performed at no extra cost to the OWNER.

6. If contents are spilled, the DEQ project manager (Erin McDonnel, phone: 503.229.6900) shall be notified immediately. If the spill occurs in any amount that affects surface water, Oregon Emergency Response System (1.800.452.0311) shall be notified in accordance with Oregon Administrative Rules (OAR) 340-142-0040.

F. The CONTRACTOR shall be responsible for managing, handling, conditioning, transporting, and disposing of all waste material that is designated to be removed from the Site.

G. No material shall exit the Site unless it has been analyzed and documented (e.g., manifest), as necessary.

H. No material, except dewatering and decontamination liquids, shall exit the Site that fails the Paint Filter Liquid Test, EPA Method 9095A. Wet spoils or other materials shall be properly conditioned to pass the Paint Filter Test, and any other disposal facility-specific requirements, prior to being loaded and transported off-site.

3.02 TRANSPORTATION LOG

A. The CONTRACTOR shall maintain at the Site a log of vehicles leaving the Site with waste materials. The log shall indicate the vehicle identification number, date and time of departure, contents of the truck, and approximate volume or quantity of material carried.

END OF SECTION

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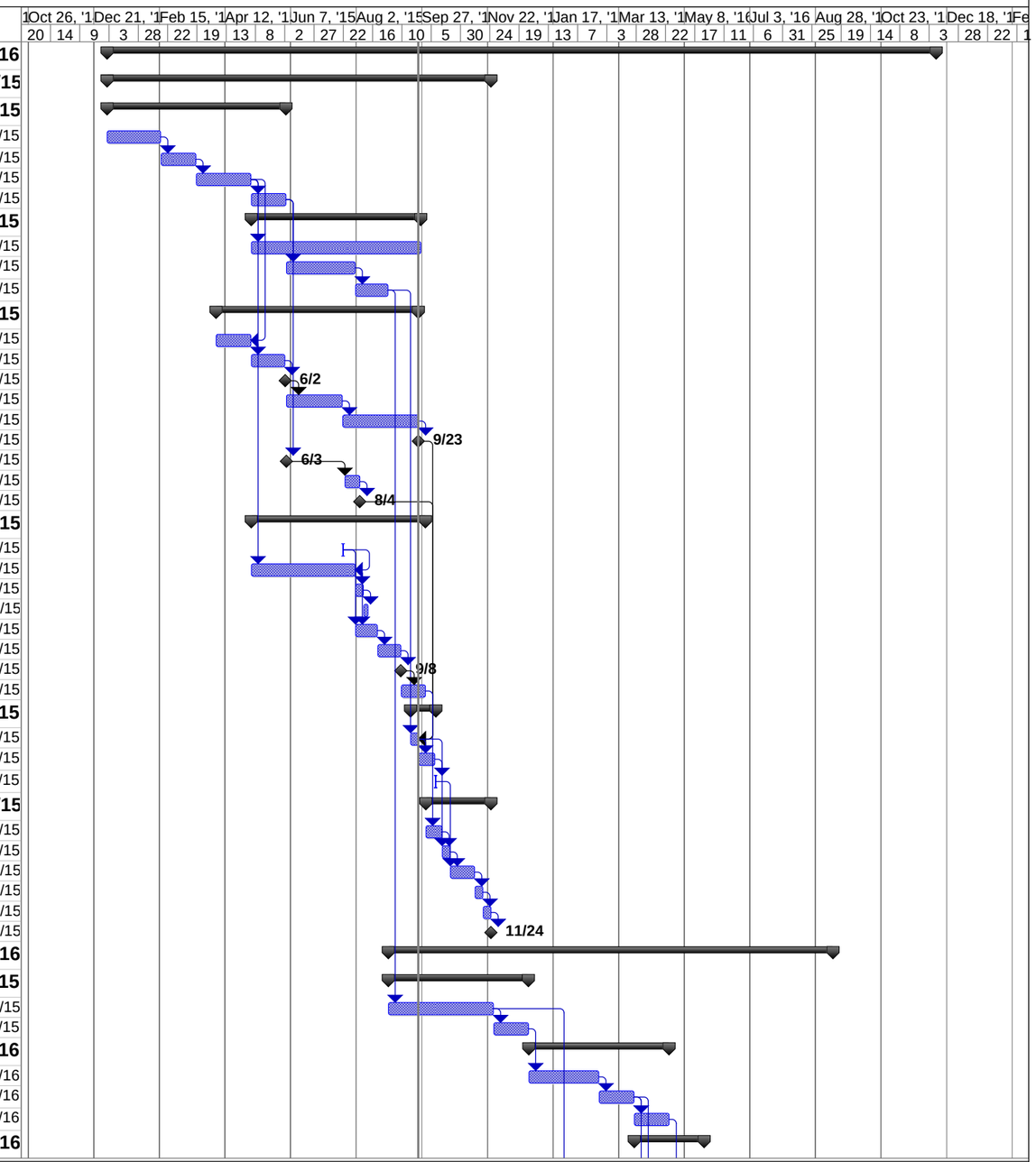
Appendix B
Project Schedule

Groundwater Source Control Measure
Design and Implementation Schedule
Premier Edible Oils Site - Portland, Oregon
DRAFT FOR REVIEW

ID		Task Name	Duration	Start	Finish
1		**Southern PEO Site Source Control Measure**	**708 days**	**Thu 1/1/15**	**Thu 12/8/16**
2		**GWBW Design & Implementation**	**328 days**	**Thu 1/1/15**	**Tue 11/24/15**
3	✓	**GWBW Conceptual Design**	**153 days**	**Thu 1/1/15**	**Tue 6/2/15**
4	✓	Existing Data Review	46 days	Thu 1/1/15	Sun 2/15/15
5	✓	Geotechnical Investigation	30 days	Mon 2/16/15	Tue 3/17/15
6	✓	Conceptual Design Summary Memorandum	47 days	Wed 3/18/15	Sun 5/3/15
7	✓	ODEQ Conceptual Design Summary Memorandum Review	30 days	Mon 5/4/15	Tue 6/2/15
8		**GWBW Draft Design**	**145 days**	**Mon 5/4/15**	**Fri 9/25/15**
9		Slurry Compatibility Study (Estimated)	145 days	Mon 5/4/15	Fri 9/25/15
10	✓	Prepare Draft Design Package	59 days	Wed 6/3/15	Fri 7/31/15
11	✓	ODEQ Review of Draft Design Package	28 days	Sat 8/1/15	Fri 8/28/15
12		**Permitting**	**173 days**	**Sat 4/4/15**	**Wed 9/23/15**
13	✓	City of Portland Pre-Application Conference Submittal	30 days	Sat 4/4/15	Sun 5/3/15
14	✓	City of Portland Pre-Application Review (Estimated)	29 days	Mon 5/4/15	Mon 6/1/15
15	✓	City of Portland Pre-Application Conference	1 day	Tue 6/2/15	Tue 6/2/15
16	✓	City of Portland Permit Exempt Submittal Preparation	48 days	Wed 6/3/15	Mon 7/20/15
17		City of Portland Permit Exempt Review (Estimated)	65 days	Tue 7/21/15	Wed 9/23/15
18		Letter of Determination Issued	0 days	Wed 9/23/15	Wed 9/23/15
19	✓	NPDES 1200C Construction Stormwater Permit Application Preparation	50 days	Wed 6/3/15	Wed 7/22/15
20	✓	ODEQ NPDES 1200C Construction Stormwater Permit Review (Estimated)	13 days	Thu 7/23/15	Tue 8/4/15
21	✓	NPDES1200C Construction Stormwater Permit Approval	0 days	Tue 8/4/15	Tue 8/4/15
22		**Contractor Bidding**	**149 days**	**Mon 5/4/15**	**Tue 9/29/15**
23	✓	Contractor Bid Walk	1 day	Tue 7/21/15	Tue 7/21/15
24	✓	Preparation of Bid Documents	89 days	Mon 5/4/15	Fri 7/31/15
25	✓	Contractor Question Submittal	7 days	Sat 8/1/15	Fri 8/7/15
26	✓	Bid Addendum and Response to Questions	4 days	Sat 8/8/15	Tue 8/11/15
27	✓	Contractor Bid Submission	19 days	Sat 8/1/15	Wed 8/19/15
28	✓	Evaluation of Contractor Bids	20 days	Thu 8/20/15	Tue 9/8/15
29	✓	Contractor Selection	0 days	Tue 9/8/15	Tue 9/8/15
30		Contract Execution	21 days	Wed 9/9/15	Tue 9/29/15
31		**GWBW Final Design**	**22 days**	**Thu 9/17/15**	**Thu 10/8/15**
32		Final Design Preparation	7 days	Thu 9/17/15	Wed 9/23/15
33		ODEQ Review of Final Design	14 days	Thu 9/24/15	Wed 10/7/15
34		Approval of Final Design	1 day	Thu 10/8/15	Thu 10/8/15
35		**GWBW Construction (Estimated)**	**56 days**	**Wed 9/30/15**	**Tue 11/24/15**
36		Pre-Construction Planning	14 days	Wed 9/30/15	Tue 10/13/15
37		Mobilization, and Site Preparation	7 days	Wed 10/14/15	Tue 10/20/15
38		Slurry Wall Construction (Estimated)	21 days	Wed 10/21/15	Tue 11/10/15
39		Slurry Wall Capping	7 days	Wed 11/11/15	Tue 11/17/15
40		Demobilization	7 days	Wed 11/18/15	Tue 11/24/15
41		Commence Long Term Operation and Maintenance	0 days	Tue 11/24/15	Tue 11/24/15
42		**Oxygenation System Design & Implementation**	**380 days**	**Sat 8/29/15**	**Sun 9/11/16**
43		**Oxygenation System Conceptual Design**	**120 days**	**Sat 8/29/15**	**Sat 12/26/15**
44		Conceptual Design Summary Memorandum	90 days	Sat 8/29/15	Thu 11/26/15
45		ODEQ Conceptual Design Summary Memorandum Review	30 days	Fri 11/27/15	Sat 12/26/15
46		**Oxygenation System Draft Design**	**120 days**	**Sun 12/27/15**	**Sun 4/24/16**
47		Oxygenation Pilot Test Study	60 days	Sun 12/27/15	Wed 2/24/16
48		Prepare Draft Design Package	30 days	Thu 2/25/16	Fri 3/25/16
49		ODEQ Review of Draft Design Package	30 days	Sat 3/26/16	Sun 4/24/16
50		**Permitting (if necessary)**	**60 days**	**Sat 3/26/16**	**Tue 5/24/16**

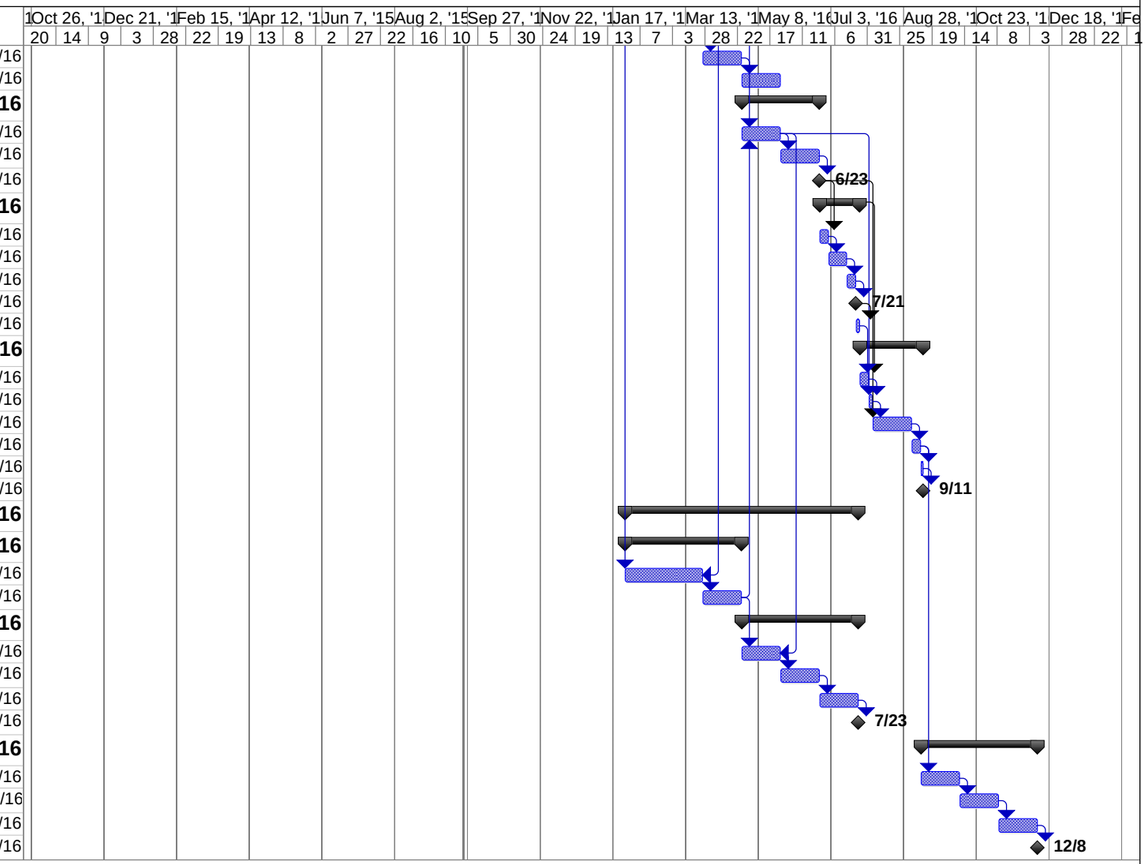


Date: Thu 9/24/15

Task | Split | Milestone | Summary | Project Summary | Manual Summary

Groundwater Source Control Measure
Design and Implementation Schedule
Premier Edible Oils Site - Portland, Oregon
DRAFT FOR REVIEW

ID	Task Name	Duration	Start	Finish
51	Underground Injection Control Permit Application (if necessary)	30 days	Sat 3/26/16	Sun 4/24/16
52	Underground Injection Control Permit Review (if necessary)	30 days	Mon 4/25/16	Tue 5/24/16
53	**Oxygenation System Final Design**	**60 days**	**Mon 4/25/16**	**Thu 6/23/16**
54	Final Design Preparation	30 days	Mon 4/25/16	Tue 5/24/16
55	ODEQ Review of Final Design	30 days	Wed 5/25/16	Thu 6/23/16
56	Approval of Final Design	0 days	Thu 6/23/16	Thu 6/23/16
57	**Contractor Bidding**	**31 days**	**Fri 6/24/16**	**Sun 7/24/16**
58	Preparation of Bid Documents	7 days	Fri 6/24/16	Thu 6/30/16
59	Contractor Bid Submission	14 days	Fri 7/1/16	Thu 7/14/16
60	Evaluation of Contractor Bids	7 days	Fri 7/15/16	Thu 7/21/16
61	Contractor Selection	0 days	Thu 7/21/16	Thu 7/21/16
62	Contract Execution	3 days	Fri 7/22/16	Sun 7/24/16
63	**Oxygenation System Construction (Estimated)**	**49 days**	**Mon 7/25/16**	**Sun 9/11/16**
64	Pre-Construction Planning	7 days	Mon 7/25/16	Sun 7/31/16
65	Mobilization, and Site Preparation	3 days	Mon 8/1/16	Wed 8/3/16
66	Oxygenation System Construction (Estimated)	30 days	Thu 8/4/16	Fri 9/2/16
67	Bump Testing and Start Up	7 days	Sat 9/3/16	Fri 9/9/16
68	Demobilization	2 days	Sat 9/10/16	Sun 9/11/16
69	Commence Long Term Operation and Maintenance	0 days	Sun 9/11/16	Sun 9/11/16
70	**Performance Monitoring**	**180 days**	**Tue 1/26/16**	**Sat 7/23/16**
71	**Draft Performance Monitoring Plan**	**90 days**	**Tue 1/26/16**	**Sun 4/24/16**
72	Prepare Draft Performance Monitoring Plan	60 days	Tue 1/26/16	Fri 3/25/16
73	ODEQ Review of Draft Performance Monitoring Plan	30 days	Sat 3/26/16	Sun 4/24/16
74	**Final Performance Monitoring Plan**	**90 days**	**Mon 4/25/16**	**Sat 7/23/16**
75	Prepare Final Performance Monitoring Plan	30 days	Mon 4/25/16	Tue 5/24/16
76	ODEQ Review of Final Performance Monitoring Plan	30 days	Wed 5/25/16	Thu 6/23/16
77	Negotiation and Finalization of Final Performance Monitoring Plan	30 days	Fri 6/24/16	Sat 7/23/16
78	Approval of Final Performance Monitoring Plan	0 days	Sat 7/23/16	Sat 7/23/16
79	**Construction Completion Report**	**90 days**	**Sat 9/10/16**	**Thu 12/8/16**
80	Draft Construction Completetion Report Preparation	30 days	Sat 9/10/16	Sun 10/9/16
81	ODEQ Review of Draft Construction Completion Report	30 days	Mon 10/10/16	Tue 11/8/16
82	Negotiation and Finalization of Construction Completion Report	30 days	Wed 11/9/16	Thu 12/8/16
83	Approval of Final Construction Completion Report	0 days	Thu 12/8/16	Thu 12/8/16



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Task | Split | Milestone | Summary | Project Summary | Manual Summary