

[08/25/26]

TO: PLAN HOLDERS LIST

SUBJECT: PROCUREMENT NO. 072026-1051
ARKEMA INTERIM ACTION-PHASE 1

ADDENDUM NUMBER 01

This addendum is issued to amend the following:

Plan Sheet D3.0:

Added additional demolition note to include removal of (10) Ecology blocks and 3.5'x3.5'x3.5' boulder for shoreline mitigation.

Plan Sheet C2.13:

Changed sheet note for steel coating to match specifications.

00 31 00 – Available Project Information:

Added:

- 1.01.B.2 Attachment 2 – Arkema Mfg Area Shoreline Caps, and
- 1.01.B.3 Attachment 3 – Outfall Shoreline and Impact Mitigation Memo

00 41 00 – Bid Form:

Added Bid Item 30 – Shoreline Debris Removal.

01 20 00 – Price and Payment Procedures:

Added 1.07.DD. Bid Item #30 – Shoreline Debris Removal

Bid item to include removal and upland placement of (10) Ecology blocks and 3.5'x3.5'x3.5' boulder for shoreline mitigation.

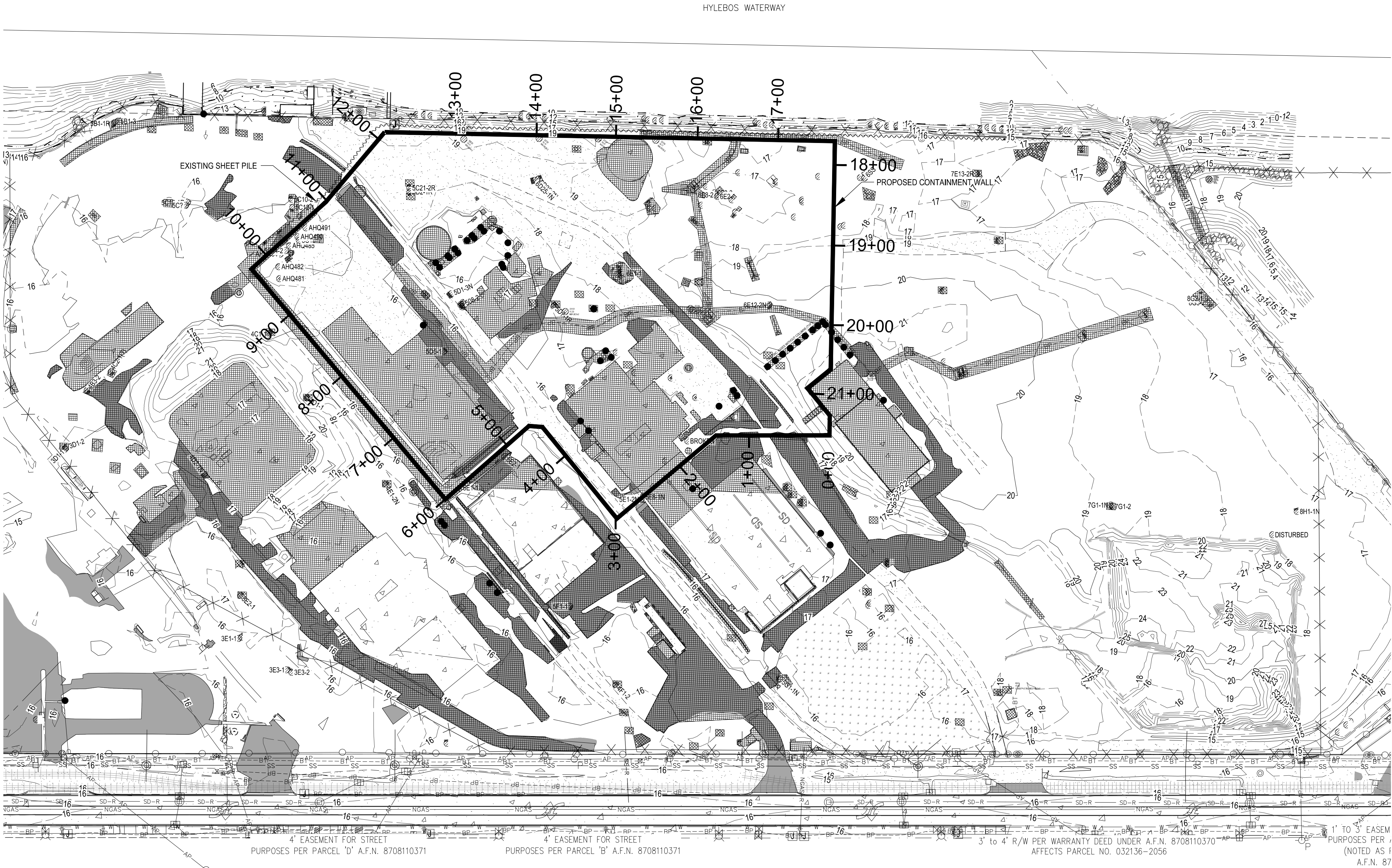
31 20 00 – Earthwork:

Revised 3.02.4

Revised language only allowing upland based equipment to include barge mounted equipment provided barges do not ground out and the Arkema subtidal and intertidal caps are not damaged.

31 56 13.16 – Self-Hardening Slurry Containment Wall:

Updated specification with multiple changes.



LEGEND

○ SANITARY SEWER MANHOLE

○ UTILITY CLEAN OUT

⊙ STORM MANHOLE

⊞ STORM CATCH BASIN

— STORM CULVERT

⊙ WATER MANHOLE

⊙ WATER VALVE

⊙ WATER METER

⊙ FIRE HYDRANT

⊙ IRRIGATION CONTROL VALVE

⊙ GAS VALVE

⊙ GAS RISER

⊙ POWER METER

⊙ POWER CABINET

⊙ UTILITY POLE

⊙ UTILITY POLE WITH DROP(S)

⊙ GUY ANCHOR

⊙ JUNCTION BOX

⊙ POWER VAULT

⊙ LIGHT POLE

⊙ TELECOM RISER

⊙ TELECOM VAULT

⊙ TELECOM JUNCTION BOX

⊙ UTILITY VAULT

⊙ UNKNOWN MANHOLE

⊙ UNKNOWN STAND PIPE

⊙ UNKNOWN VALVE

⊙ UNKNOWN RISER

● COLUMN

● BOLLARD

⊙ SIGN

⊙ MAILBOX

⊙ ECOLOGY BLOCK

⊙ RAILROAD SWITCH

⊙ MONITORING WELL

TPN TAX PARCEL NUMBER

XXNE DISTANCE AND DIRECTION OF NOTED OBJECT FROM PROPERTY LINE

25 SCHD. B EXCEPTION NUMBER

10 MAJOR ELEVATION CONTOUR (5' INTERVAL)

1 MINOR ELEVATION CONTOUR (1' INTERVAL)

— PARCEL LINE

— ROAD CENTERLINE

— RIGHT OF WAY LINE

— EASEMENT LINE

— SD — STORM DRAIN LINE

— SD-R — RECORD STORM LINE

— SS — SS — SANITARY SEWER LINE

— SS-R — RECORD SANITARY LINE

— W — W — BURIED WATER LINE

— W-R — W-R — RECORD WATER LINE

— NGAS-R — RECORD GAS LINE

— BP — BP — BURIED POWER LINE

— BP-R — RECORD BURIED POWER

— AP — AP — OVERHEAD POWER LINE

— BT — BT — BURIED TELECOM LINE

— BT-R — RECORD TELECOM LINE

— CHAIN LINK FENCE

— RAILROAD TRACKS

— WETLAND DELINEATION

2004 POND MAPPING LIMITS

SHEARWALL/SHEET PILE WALL PER 2004 MAPPING

PROPOSED CONTAINMENT WALL ALIGNMENT

PROPOSED SILT FENCE

ASPHALT SURFACE

CONCRETE SURFACE

GRAVEL SURFACE

RIP-RAP SURFACE

WETLAND AREA

GRASS

TO BE DEMOLISHED

- NOTES**
- REMOVE ALL DELETERIOUS MATERIAL FOUND ON-SITE INCLUDING SCRAP WOOD, TRASH, ETC. AND DISPOSE OF AT AN APPROVED OFF-SITE LOCATION.
 - REMOVE ALL RAIL TIES WITHIN THE TESC AREA, PREPARE RAIL TIES FOR DISPOSAL BY REMOVING EXCESS SOIL FROM THE RAIL TIES, AND PROVIDE TRANSPORTATION AND DISPOSAL OF RAIL TIES AT A FACILITY APPROVED BY THE ENGINEER. AVERAGE SPACING OF TIES IS APPROXIMATELY 40 TIES PER 65 LINEAR FEET OF TRACK ALIGNMENT.
 - RAILS HAVE BEEN PREVIOUSLY REMOVED, ADDITIONAL RAIL TIES MAY BE PRESENT, CONTRACTOR TO PICK AND SEGREGATE.
 - REMOVE ALL CONCRETE AND OTHER OBSTRUCTIONS TO FULL DEPTH AS SHOWN ON THIS SHEET. CONCRETE TO BE STOCKPILED ON-SITE AT A LOCATION DETERMINED BY THE CONTRACTOR AND APPROVED BY THE ENGINEER. MATERIALS GENERATED DURING CONCRETE DEMOLITION OTHER THAN CONCRETE, e.g., OBSTRUCTIONS, SHALL BE STOCKPILED SEPARATELY FOR DISPOSAL.
 - REMOVE ALL ASPHALT WITHIN THE TESC AREA, AS SHOWN ON THIS SHEET. ASPHALT TO BE STOCKPILED ON-SITE AT A LOCATION DETERMINED BY THE CONTRACTOR AND APPROVED BY THE ENGINEER.
 - ALL REINFORCING STEEL PRODUCED AS PART OF DEMOLITION WORK SHALL BE RECYCLED AT A CERTIFIED RECYCLING FACILITY APPROVED BY THE ENGINEER.
 - MONITORING WELLS 5E1-1, 5E2-1, AND 5E8-1N WILL BE ABANDONED BY THE ENGINEER AND WILL COINCIDE WITH CONTRACTOR MOBILIZATION ACTIVITIES.
 - SEE SHEETS D3.1 THROUGH D3.4 FOR SUBSURFACE UTILITY ABANDONMENTS AND ABANDONMENTS WITHIN THE BARRIER WALL ALIGNMENT
 - REMOVE 10 ECOLOGY BLOCKS AND 3.5'X3.5'X3.5' BOULDER ON SHORELINE AS SHOWN IN SHEET SV1.7.

KEY PLAN

SCALE: NTS

NOT USED

TRUE NORTH

SITE NORTH

80 0 80

Scale in Feet

6697

D3.0

SH #13 OF #44

CONTRACT/CONS: PA000000403

M. ID: 101585.01

PHASE: FOR BID

ARKEMA INTERIM ACTION - PHASE 1

CONTAINMENT WALL

DEMOLITION PLAN

R. WEBB 07/29/26

CHECKED BY: TLOUVIERE 07/29/26

DIRECTOR ENG. DATE: kbejley Aug 24, 2026

PRINTED BY: kbejley Aug 24, 2026

PORT ADDRESS: ONE SITCUM PLAZA

TACOMA, WA 98401-1837

APPROVED:

Part of Tacoma

P.O. BOX 1837 TACOMA, WA 98401 (206) 861-5441

DOF

DALTON OLMSTED FUGLEVAND

REVISION: Addendum 1

MARK: TL

BY: TL

DATE: 8/24/2026

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PART 1 - GENERAL

1.01 EXISTING CONDITIONS

- A. Supplemental information relating to existing surface and subsurface conditions and structures is available to Bidders online at <https://apps.ecology.wa.gov/cleanupsearch/site/3405> but will not be part of the contract documents unless identified in these specifications.
- B. Certain information relating to existing surface and subsurface conditions and structures is available to Bidders online at www.portoftacoma.com, but will not be part of the Contract Documents, as follows:
 - 1. Geotechnical Report: Entitled Final Geotechnical Engineering Memorandum - Initial Site Investigation Former Arkema Manufacturing Site, dated November 8, 2024.
 - a. This report identifies properties of below grade conditions and offers recommendations for the design of foundations, prepared primarily for the use of Engineer.
 - b. The recommendations described shall not be construed as a requirement of this Contract, unless specifically referenced in the Contract Documents.
 - c. This report, by its nature, cannot reveal all conditions that exist on the site. Should subsurface conditions be found to vary substantially from this report, changes in the design and construction of foundations will be made, with resulting credits or expenditures to the Contract Price accruing to the Port.
 - [1] 2. Arkema Manufacturing Area Shoreline Caps: Entitled Attachment 2 – Arkema Mfg Area Shoreline Caps, dated July 21, 2006
 - a. This attachment shows the location of environmental caps installed under EPA supervision as part of the Tideflats Superfund Site Tacoma, Washington.
 - b. The caps shall not be penetrated or disturbed by Contractor activities.
 - 3. Outfall Shoreline Impact & Mitigation Memo- Arkema Interim Cleanup Action: Entitled Attachment 3 – Outfall Impact & Mitigation Memo, dated July 29, 2026.
 - e.a. This attachment shows the general location and representative photos of ecology blocks and boulder to be removed as part of mitigation.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

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BIDDER'S NAME: _____

PROJECT TITLE: ARKEMA INTERIM ACTION - PHASE 1

The undersigned Bidder declares that it has read the Contract Documents (including documents provided by reference), understands the conditions under which the Work will be performed, has examined the Project site, and has determined for itself all situations affecting the Work herein Bid upon. Bidder proposes and agrees, if this Bid is accepted, to provide at Bidder's own expense, all labor, machinery, tools, materials, etc., including all Work incidental to, or described or implied as incidental to such items, according to the Contract Documents, and that the Bidder will complete the Work within the time stated, and that Bidder will accept in full the lump sum or unit price(s) set forth below:

ITEM NO.	DESCRIPTION OF ITEM	QTY	UOM	UNIT PRICE	EXTENDED PRICE (QTY. X UNIT PRICE)
1	Mobilization and Demobilization	1	LS		
2	Project Administration	1	LS		
3	TESC	1	LS		
4	Clearing and Grubbing	9.2	ACRE		
5	Demolition - Asphalt (4-inch thickness)	1,213	CY		
6	Demolition - Concrete	5,400	CY		
7	Demolition - Rail Road Ties	27	Ton		
8	Demolition - Subsurface Utilities	1	LS		
9	Demolition - Miscellaneous Debris Allowance	17	Tons		
10	Preload Placement & Compaction - On Site Material	3,700	CY		
11	Preload Placement & Compaction - Import Material	9,320	CY		
12	Preload Removal & Stockpiling	10,520	CY		
13	Storm Drain Preload Removal	1	LS		
14	Pre-cap Grading and Earthworks	1	LS		
15	North Outfall	1	LS		
16	South Outfall	1	LS		
17	Storm Piping	1	LS		
18	Utility Structures	1	LS		
19	Treatment Vaults	1	LS		
20	Inline Check Valves	1	LS		
21	Temporary East-West Ditch Stormwater Re-Route Pump System	1	LS		
22	Temporary East-West Stormwater Re-Route Pump System Operation	21	DAY		

23	Temporary Utility Trench Dewatering Pump and Treatment System	1	LS		
24	Temporary Utility Trench Dewatering Pump and Treatment System Operation	21	DAY		
25	Containment Wall	76,491	VSF		
26	Permanent Containment Wall Protective Cap	251,076	SF		
27	Containment Wall Surfacing	1	LS		
28	Trench Safety Systems	1	LS		
29	Utility Trench Over Excavation and Backfill Allowance	100	Tons		
[1] 30	<u>Shoreline Debris Removal</u>	<u>1</u>	<u>LS</u>		

TOTAL BID AMOUNT	
10.3% WASHINGTON STATE SALES TAX (WSST) ON BASE BID SUBTOTAL	
BID TOTAL (WITH WSST)	

Note: Show prices in figures only.

Evaluation of Bids. In accordance with the provisions of the Contract Documents, Bids will be evaluated to determine the lowest Base Bid Subtotal offered by a responsible Bidder submitting a responsive Bid.

Schedule of Unit Prices. The unit prices are proposed to apply only in the event of additions to, or deletions from, the work required and ordered. All prices shall include complete installation without Washington State Sales Tax. The bidder shall propose a price for each item; failure to propose a price for each item may render the bid non-responsive. The Port reserves the right to accept or reject the unit prices proposed.

Trench Excavation Safety Provision. If the bid amount contains work which requires trenching exceeding a depth of four (4) feet, all costs for trench safety shall be included in the Base Bid and indicated below for adequate trench safety systems in compliance with RCW 39.04 and WAC 296-155-650. Bidder shall include a lump sum amount, excluding Washington State Sales Tax. If trench excavation safety provisions do not pertain to the Work, the Bidder should enter "N.A." or "Not Applicable" in the blank below.

Trench Excavation Safety: _____. In accordance with RCW 39.04.180, Bidders are instructed to write in the cost (\$) of trench safety systems here.

Principal Subcontractors/Suppliers. For Bids greater than one million (\$1,000,000) dollars, the Bidder shall list below the name of each subcontractor or supplier to whom the Bidder proposes to subcontract the portions of the work listed below, or name itself for the work, in accordance with RCW 39.30.060.

Work to be performed	License Number	Name of Firm
HVAC (Heating, Ventilation, and Air Conditioning) Work		
Plumbing Work		
Electrical Work		
Structural Steel Installation		
Rebar Installation		

Non-Collusion Representation. The Bidder declares under penalty of perjury that the Bid submitted is genuine and not a sham or collusive bid, or made in the interest or on behalf of any person or firm not therein named; and further represents that the Bidder has not directly or indirectly induced or solicited any other bidder to submit a sham bid, or encouraged any other person or corporation to refrain from bidding; and that the Bidder has not in any manner sought by collusion to secure to the Bidder an advantage over any other bidder or bidders.

RCW 39.04.350 Certification. The Bidder represents and certifies, under penalty of perjury, that within the three- (3-) year period immediately preceding the Bid Date, the Bidder has not been determined by a final and binding citation and notice of assessment issued by the Department of Labor and Industries, nor through a civil judgment entered by a court of limited or general jurisdiction, to have willfully violated, as defined in RCW 49.48.082, any provision of Chapters 49.46, 49.48, nor 49.52 RCW.

Addenda. Bidder acknowledges receipt and acceptance of all Addenda through No. ____ (Identify Last Addenda By Number)

Bid Security. A certified check, cashier's check, or other obligation of a bank, or a bid bond in substantially the form set forth in Section 00 43 13, Bid Security Form for at least five (5) percent of the Base Bid Subtotal, shall be submitted with this Bid.

Apprenticeship Requirements. For Bids greater than one million (\$1,000,000) dollars, the apprentice labor hours required for this project are fifteen (15) percent of the total labor hours. The Bidder agrees to utilize this level of apprentice participation.

Name of Firm

Date

Signature

Printed Name and Title

Mailing Address

City, State Zip Code

Telephone Number

Email Address

WA State Contractor's License No.

Employment Security Department No.

Identification of Bidder as a sole proprietor, a partnership, a joint venture, a corporation, or another described form of legal entity

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

- A. Procedures for preparation and submittal of applications for progress payments.

1.02 PAYMENT PROCEDURES

- A. Monthly pay estimates shall clearly identify the work performed for the given time period based on the approved Schedule of Values.
1. At the Pre-construction meeting, the Engineer and the Contractor shall agree upon a date each month when payment applications shall be submitted.
- B. For each pay estimate the Contractor shall submit the following:
1. Completed Contractor invoice and updated Schedule of Values tracking sheet as required by Division 01 or as established by the Engineer.
 2. Baseline Project Schedule and narrative updated as required by Section 01 32 16 of the Project Manual.
 3. Completed "Amounts Paid to Subcontracts and Suppliers" showing total contract amount, amount paid this estimate, total paid to date, and balance owing.
 4. Completed "Conditional Release and Waiver of Liens and Claims."
 5. An estimated cashflow statement projecting the Contractor's monthly billings on the project shall be submitted with each payment application.
- C. Prior to submitting a payment application, the Contractor and Engineer shall meet each month to review the work accomplished to determine the actual quantities including labor, materials and equipment charges to be billed.
1. Prior to the payment application meeting, the Contractor shall submit to the Engineer all measurement documentation as referenced in these contract documents; to include all measurement by weight, volume or field.
 2. For all change work being done on a force account basis, the Contractor shall submit prior to meeting with Engineer all Force Account back-up documentation as required to process the payment application where Force Account work is being billed. The Engineer and the Contractor shall review the documentation at the payment application meeting to verify quantities and review the work accomplished.
 3. The Contractor shall bring a copy of all documentation to the pay application meeting with the Engineer.
 4. The Contractor shall submit the updated baseline project schedule for review prior to submitting the payment application to ensure the payment processing is not held up due to necessary schedule revisions.
- D. Following the Engineers' review, the Contractor shall submit the agreed upon pay estimate electronically, with complete supporting documentation attached, using Adobe PDF file format to cpinvoices@portoftacoma.com.

1.03 PAYMENT PRICING

- A. Pricing for the various lump sum or unit prices in the Bid Form, as further specified herein, shall include all compensation to be received by the Contractor for furnishing all tools, equipment, supplies, and manufactured articles, and for all labor, operations, and incidentals appurtenant to the items of work being described, as necessary to complete the various items of the work in accordance with the requirements of the Contract Documents.
- B. Pricing also includes all costs of compliance with the regulations of public agencies having jurisdiction, including safety and health requirements of the Occupational Safety and Health Administration of the U.S. Department of Labor (OSHA).
- C. No separate payment will be made for any item that is not specifically set forth in the Bid Form, and all costs therefore shall be included in the prices named in the Bid Form for the various appurtenant items of work.
- D. All other work not specifically mentioned in the measurement and payment sections identified below shall be considered incidental to the work performed and merged into the various unit and lump sum prices bid. Payment for work under one item will not be paid for under any other item.
- E. The Port of Tacoma reserves the right to make changes should unforeseen conditions necessitate such changes. Where work is on a unit price basis, the actual quantities occasioned by such changes shall govern the compensation.

1.04 LUMP SUM MEASUREMENT

- A. Lump sum measurement will be for the entire item, unit of Work, structure, or combination thereof, as specified and as indicated in the Contractor's submitted bid.
 - 1. If the Contractor requests progress payments for lump sum items, such progress payments will be made in accordance with an approved Schedule of Values. The quantity for payment for completed work shall be an estimated percentage of the lump sum amount, agreed to between the Engineer and Contractor, payable in monthly progress payments in increments proportional to the work performed in amounts as agreed between the Engineer and the Contractor.

1.05 MEASUREMENT OF QUANTITIES FOR UNIT PRICES

- A. Measurement Standards:
 - 1. All Work to be paid for at a contract price per unit measurement, as indicated in the Contractor's submitted bid, will be measured by the Engineer in accordance with United States Standard Measures.
- B. Measurement by Weight:
 - 1. Unless shipped by rail, material to be measured and paid for by weight shall be weighed on sealed scales regularly inspected by the Washington State Department of Agriculture's Weights and Measures Section or its designated representative. Measurement shall be furnished by and at the expense of the Contractor. All weighing, measuring, and metering devices shall be suitable for the purpose intended and shall conform to the tolerances and specifications as outlined in Washington State Department of Transportation Standard Specifications, Division 1, General Requirements, Article 1-09.2, Weighing Equipment.

2. Provide or utilize platform scales of sufficient size and capacity to permit the entire vehicle or combination of vehicles to rest on the scale platform while being weighed. Combination vehicles may be weighed as separate units provided they are disconnected while being weighed. Scales shall be inspected and certified as often as the Engineer may deem necessary to ascertain accuracy. Costs incurred as a result of regulating, adjusting, testing, inspecting, and certifying scales shall be borne by the Contractor.
 3. A licensed weighmaster shall weigh all Contractor-furnished materials. The Engineer may be present to witness the weighing and to check and compile the daily record of such scale weights. However, in any case, the Engineer will require that the Contractor furnish weight slips and daily summary weigh sheets. In such cases, furnish a duplicate weight slip or a load slip for each vehicle weighed, and deliver the slip to the Engineer at the point of delivery of the material.
 4. If the material is shipped by rail, the certified car weights will be accepted, provided only actual weight of material will be paid for and not minimum car weights used for assessing freight tariff. Car weights will not be acceptable for material to be passed through mixing plants. Material to be measured by weight shall be weighed separately for each bid item under which it is to be paid.
 5. Trucks used to haul material being paid for by weight shall be weighed empty daily and at such additional times as the Engineer may require. Each truck shall bear a plainly legible identification mark. The Engineer may require the weight of the material be verified by weighing empty and loaded trucks on such other scales as the Engineer may designate.
- C. Measurement by Volume:
1. Measurement by volume will be by the cubic dimension indicated in the Contractor's submitted bid. Method of volume measurement will be by the unit volume in place or removed as shown on the Contract Drawings or as specified.
 2. When material is to be measured and paid for on a volume basis and it is impractical to determine the volume by the specified method of measurement, or when requested by the Contractor in writing and accepted by the Engineer in writing, the material may be weighed in accordance with the requirements specified for weight measurement. Such weights will be converted to volume measurement for payment purposes. Factors for conversion from weight measurement to volume measurement will be determined by the Resident Engineer and shall be agreed to by the Contractor before such method of measurement of pay quantities will be accepted.
- D. Measurement by Area: Measurement by area will be by the square dimension shown on the Contract Drawings or as specified. Method of square measurement will be as specified.
- E. Linear Measurement: Linear measurement will be by the linear dimension listed or indicated in the Contractor's submitted bid. Unless otherwise indicated, items, components, or Work to be measured on a linear basis will be measured at the centerline of the item in place.
- F. Field Measurement for Payment:
1. The Contractor shall take all measurements by providing equipment, workers, and survey crews as required to measure quantities in accordance with the provisions for measurement specified herein. No allowance will be made for specified tolerances.
 2. The Engineer will verify all quantities of Work performed by the Contractor on a unit-price basis, for progress payment purposes.

1.06 REJECTED, EXCESS, OR WASTED MATERIALS

- A. Quantities of material wasted or disposed of in a manner not called for under the Contract; rejected loads of material, including material rejected after it has been placed by reasons of the failure of the Contractor to conform to the provisions of the Contract; material not unloaded from the transporting vehicle; material placed outside the lines indicated on the Contract Drawings or established by the Engineer; or material remaining on hand after completion of the Work, will not be paid for, and such quantities shall not be included in the final total quantities. No additional compensation will be permitted for loading, hauling, and disposing of rejected material.

1.07 MEASUREMENT AND PAYMENT

A. Item #1: Mobilization and Demobilization

- 1. Payment for Mobilization and Demobilization shall be for preparatory work and operations performed by the Contractor including, but not limited to, those necessary for the movement of its personnel, equipment, supplies and incidentals to and from the project site; temporary facilities and controls; for the establishment and removal of its offices, buildings and other facilities necessary for work on the project; for other work and operations which it must perform or costs it must incur before beginning production work on the various items on the project site, and for removal of personnel, equipment, supplies, offices, building facilities, sheds, fencing, and other incidentals from the site. This item shall include an office location for the Engineer's representative.
- 2. Mobilization and Demobilization shall be paid at the lump sum price listed in the Contractor's submitted bid. Incremental payment shall be made for each location as follows:
 - a. 40% after completion of 5% of the total contract amount of other bid items have been earned.
 - b. 40% after completion of 20% of the total contract amount of other bid items have been earned.
 - c. 20% after completion of all work on the project has been completed, including cleanup and acceptance of the project by the Port.

B. Item #2: Project Administration

- 1. Item Description: The Work of this item includes all administrative costs associated with administering and supervising the project including, but not limited to supervision of personnel, coordination of all work activities, coordination of subcontractors and/or suppliers, preparation and transmittal of submittals, permit acquisitions, for premiums on bonds and insurance for the project, and project overhead.
- 2. Measurement: This item will be measured based on a percentage complete for the overall lump sum amount.
- 3. Payment: This item will be paid for at the Contract lump sum price as specified in the Contractor's submitted bid, in accordance with the approved Schedule of Values.

C. Item #3: TESC

1. Item Description: The Work of this item includes all labor, equipment and materials necessary to furnish, install, maintain, improve and remove best management practices (BMP's) to manage erosion, water quality and stabilize the site in accordance with project Specifications and Drawings. The Work shall include updating, maintaining and reporting requirements and obligations of the General Construction Stormwater Permit.
 2. Measurement: This item will be measured based on a percentage complete for the overall lump sum amount.
 3. Payment: This item will be paid for at the Contract lump sum price as specified in the Contractor's submitted bid, in accordance with the approved Schedule of Values.
- D. Item #4: Clearing and Grubbing
1. Item Description: The Work of this item includes all labor, equipment and materials necessary to remove and dispose of trees, shrubs and other vegetative growth within the limits shown on the Drawings.
 2. Measurement: This item will be measured by ACRE complete for the overall area complete.
 3. Payment: This item will be paid for by ACRE as specified in the Contractor's submitted bid, in accordance with the approved Schedule of Values.
- E. Item #5: Demolition - Asphalt (4-inch Thickness)
1. Item Description: The Work of this item includes all labor, material and equipment as necessary for the demolition of existing asphalt surfaces. The item shall include the excavation, handling, transport, stockpiling and stockpile covering for future reuse of asphalt material. Stockpile location shall be on site as directed by Engineer.
 2. Measurement: This item will be measured by Cubic Yard (CY) in stockpile locations.
 3. Payment: This item will be paid based on actual quantities for the period being billed.
- F. Item #6: Demolition - Concrete
1. Item Description: The Work of this item includes all labor, material and equipment as necessary for the demolition of existing concrete structures. This item shall include the breaking, excavation, handling, transport, stockpiling and stockpile covering for future reuse of concrete material. Concrete thicknesses range between 6-inches and 2-feet in areas identified for demolition. Stockpile location shall be on site as directed by Engineer.
 2. Measurement: This item will be measured by Cubic Yard (CY) in stockpile locations.
 3. Payment: This item will be paid for based on actual quantities for the period being billed.
- G. Item #7: Demolition - Rail Road Ties
1. Item Description: The Work of this item includes all labor, material, equipment and fees as necessary to legally remove and dispose creosote rail road ties from within the TESC limits. Rail ties remain in historical rail alignments where rails were previously removed.
 2. Measurement: This item will be measured by Ton.
 3. Payment: This item will be paid for based on actual quantities by Ton for the period being billed.
- H. Item #8: Demolition - Subsurface Utilities

1. Item Description: The Work of this item includes all labor, material, equipment and as necessary to cut and grout plug existing utilities and remove obstructions in accordance with the Specifications and Drawings. This work shall include any trenching, backfill and dewatering to complete the work. Dewatering shall include pumping and conveyance to the Temporary Utility Trench Dewatering Pump and Treatment System. Disposal of removed utilities and obstructions shall be paid in accordance with Item #9: Demolition - Miscellaneous Debris Allowance.
 2. Measurement: This item will be measured by LS.
 3. Payment: This item will be paid for based on percentage complete for the period being billed.
- I. Item #9: Demolition - Miscellaneous Debris Allowance
1. Item Description: The Work of this item includes all labor, material and equipment as necessary for the demolition, collection and disposal of existing miscellaneous debris on site. This Item shall include utilities, metal pipe, steel casing, plastic pipe, miscellaneous steel such as grates, covers, and bollards, conduit, conductors, and other debris. The estimate assumes 17 tons of debris could be collected. Concrete debris is not included and shall be stockpiled in accordance with Bid Item #6 - Demolition - Concrete.
 2. Measurement: This item will be measured by Ton.
 3. Payment: This item will be paid for based on actual quantities.
- J. Item #10: Preload Placement & Compaction - On Site Material
1. Item Description: The Work of this item includes all labor, material and equipment as necessary to excavate, transport, place and compact existing site soil material as Preload Placement and Compaction in preparation for Containment Wall installation from within the Dredging Sediment Pile area located at the southwest corner of the site. The Engineer estimates 5,700 cubic yards are available for use on site and assumes 3,700 cubic yards will be used as preload.
 2. Measurement: This item will be measured by cubic yard (CY).
 3. Payment: This item will be paid for based on actual quantities for the period being billed.
- K. Item #11: Preload Placement & Compaction - Import Material
1. Item Description: The Work of this item includes all labor, material and equipment as necessary to transport, place and compact import soil materials as preload in preparation for Containment Wall installation. The Engineer estimates 9,320 cubic yards of import will be necessary to complete preload placement and compaction. Source material approval and testing shall be in conformance with the contract documents and Department of Ecology approved work plans for the site. The Engineer estimates 9,300 cubic yards of imported material for preload placement and compaction will be repurposed under Item #27: Containment Wall Surfacing.
 2. Measurement: This item will be measured by cubic yard (CY).
 3. Payment: This item will be paid for based on actual quantities for the period being billed.
- L. Item #12: Preload Removal & Stockpiling

1. Item Description: The Work of this item includes all labor, material, and equipment as necessary to excavate, transport and stockpile excess surcharge material in accordance with project Specifications and Drawings. The Work shall also include installation of a stockpile cover.
2. Measurement: This item will be measured by Cubic Yard.
3. Payment: This item will be paid for based on actual quantities for the period being billed.

M. Item #13: Storm Drain Preload Removal

1. Item Description: The Work of this item includes all labor and equipment as required to remove the uppermost 2 feet of installed preload material located above the project storm drain utility in accordance with the drawings and specifications. The removed material may be graded down the preload slope and compacted so that the finish graded slope is flatter than the temporary preload slope. The Engineer estimates a volume of 710 cubic yards.
2. Measurement: This item will be measured based on a percentage complete for the overall lump sum amount.
3. Payment: This item will be paid for based on percentage complete for the period being billed.

N. Item #14: Pre-cap Grading and Earthworks

1. Item Description: The Work of this item includes all labor, material, and equipment as necessary to establish the Pre-Cap Grading Plan contours and elevations in accordance with project Specifications and Drawings. This item includes grading existing site soils from within the grading limits as well as grading existing site soils from the Dredging Sediment Pile. The Engineer estimates the grading of 9,400 cubic yards of cut from existing site soils from within the grading limits. The Engineer estimates an additional 2,400 cubic yards of material from the Dredging Sediment Pile will be required to meet the Pre-Cap Grading Plan contours and elevations. The Contractor shall assume 1,200 cubic yards of Preload Placement & Compaction - On Site Material shall be repurposed and paid for under Item #12: Preload Removal and Stockpiling. The contractor shall assume this bid item will include the excavation, transportation, grading and compaction of an additional 1,200 cubic yards of onsite soils from the Dredging Sediment Pile shall be to meet the required elevations .
2. Measurement: This item will be measured based on a percentage complete for the overall lump sum amount.
3. Payment: This item will be paid for at the Contract lump sum price as specified in the Contractor's submitted bid, in accordance with the approved Schedule of Values.

O. Item #15: North Outfall

1. Item Description: The Work of this item includes all labor, material, and equipment as necessary to furnish and install the North Outfall. The North Outfall shall include all work components in accordance with the project Specifications, permits, and Drawings from the start of the slab to the end of the splash pad. This bid item shall include, but not be limited to, excavations, sheet pile wall cofferdams and dewatering installations, import aggregate backfill, the transport of trench spoils to a covered onsite stockpile location, concrete headwall, debris barrier and splash pad installations, and the subsequent removal of temporary facilities. This item does not include Storm Piping or WASTOP In-Line Check Valves.
2. Measurement: This item will be measured based on a percentage complete for the overall lump sum amount.
3. Payment: This item will be paid for based on actual quantities for the period being billed.

P. Item #16: South Outfall

1. Item Description: The Work of this item includes all labor, material, and equipment as necessary to furnish and install the South Outfall. The South Outfall shall include all work components in accordance with the project Specifications, permits, and Drawings from the start of the slab to the end of the splash pad. This bid item shall include, but not be limited to, removal of existing outfall tide gate valve, modifying the existing outfall piles, excavations, the transport of trench spoils to a covered onsite stockpile location, sheet pile wall cofferdams and dewatering installations, import aggregate backfill, concrete headwall, debris barrier and splash pad installations, and the subsequent removal of temporary facilities. This item does not include Storm Piping or WASTOP In-Line Check Valves.
2. Measurement: This item will be measured based on a percentage complete for the overall lump sum amount.
3. Payment: This item will be paid for based on actual quantities for the period being billed.

Q. Item #17: Storm Piping

1. Item Description: The Work of this item includes all labor, material, and equipment as necessary to furnish and install project Storm Piping in accordance with project Specifications and Drawings. The Work shall include, but not be limited to the salvage of existing 36" diameter HDPE storm piping, excavation, dewatering and conveyance of trench groundwater to the Temporary Utility Trench Dewatering Pump and Treatment System, providing and installation of import storm piping bedding, trench dams, and trench backfill aggregate materials, and the transport of trench spoils to a covered onsite stockpile location. The Work shall include drainage system testing and reporting as required by the Specifications and Drawings to verify drainage system performance and the subsequent removal of all temporary facilities.
2. Measurement: This item will be measured based on a percentage complete for the overall lump sum amount.
3. Payment: This item will be paid for based on actual quantities for the period being billed.

R. Item #18: Utility Structures

1. Item Description: The Work of this item includes all labor, material, and equipment as necessary to furnish and install project Utility Structures in accordance with project Specifications and Drawings. The Work includes, but is not limited to, excavation, dewatering and conveyance of trench groundwater to the Temporary Utility Trench Dewatering Pump and Treatment System, providing and installation of import utility structure foundation, bedding and trench backfill aggregate materials, and the transport of trench spoils to a covered onsite stockpile location. The Work shall include the removal of temporary facilities, the required fill transport and grading to establish the proposed finish grade around each structure. Material from the Dredging Sediment Pile may be used to establish indicated finish grades.
2. Measurement: This item will be measured based on a percentage complete for the overall lump sum amount.
3. Payment: This item will be paid for based on actual quantities for the period being billed.

S. Item #19: Treatment Vaults

1. Item Description: The Work of this item includes all labor, material, and equipment as necessary to furnish and install project Treatment Vaults in accordance with project Specifications and Drawings. The work shall also include procuring and installing the vault utility structure, the vault media, the vault plumbing, the vault metalwork, excavation, import backfill, the transport of trench spoils to a covered onsite stockpile location, and dewatering and conveyance of groundwater to the Temporary Utility Trench Dewatering Pump and Treatment System as required.
2. Measurement: This item will be measured based on a percentage complete for the overall lump sum amount.
3. Payment: This item will be paid for based on actual quantities for the period being billed.

T. Item #20: Inline Check Valves

1. Item Description: The Work of this item includes all labor, material, and equipment as necessary to furnish and install Inline Check Valves in accordance with project Specifications and Drawings.
2. Measurement: This item will be measured based on a percentage complete for the overall lump sum amount.
3. Payment: This item will be paid for based on actual quantities for the period being billed.

U. Item #21: Temporary East-West Ditch Stormwater Reroute Pump System

1. Item Description: The Work of this item includes all labor, material, and equipment as necessary to furnish, install and remove temporary pump system to reroute stormwater around the existing outfall during Outfall South, Storm Piping and Utility Structure Work that impacts existing ditch drainage. The work shall include restoring the ditch to the lines and grades prior to system installation. Temporary security fencing and relocation of traffic barriers shall be included in this item.
2. Measurement and Payment: This item shall be paid at the lump sum price listed in the Contractor's submitted bid as follows:
 - a. 80% after completion of system installation
 - b. 20% after removal of system and existing ditch restoration

- V. Item #22: Temporary East-West Ditch Stormwater Reroute Pump System Operation
1. Item Description: The Work of this item includes all labor, material, and equipment as necessary to operate and maintain the Temporary East-West Ditch Stormwater Reroute Pump System to manage ditch drainage surface water. This item shall assume the system will operate up to 21 days.
 2. Measurement: This item will be measured by DAY.
 3. Payment: This item will be paid for based on actual quantities for the period being billed.
- W. Item #23: Temporary Utility Trench Dewatering Pump and Treatment System
1. Item Description: The Work of this item includes all labor, material, and equipment as necessary to furnish and install a water treatment system capable of receiving pumped utility trench and excavation groundwater consisting of arsenic contaminated dewatering water. The system shall be designed by the contractor to meet discharge and treatment criteria as specified in the Project Drawings, Specifications and Permits.
 2. Measurement: This item will be measured based on a percentage complete for the overall lump sum amount.
 3. Payment: This item will be paid for at the Contract lump sum price as specified in the Contractor's submitted bid, in accordance with the approved Schedule of Values.
- X. Item #24: Temporary Utility Trench Dewatering Pump and Treatment System Operation
1. Item Description: The Work of this item includes all labor, material, and equipment as necessary to operate and maintain the Dewatering Pump and Treatment System to manage arsenic contaminated utility trench groundwater dewatering discharge. This item shall assume the system will operate up to 21 days.
- Y. Item #25: Containment Wall
1. Item Description: The Work of this item includes all labor, material, testing, and equipment as necessary to furnish and install the Containment Wall to the dimensions and elevations per the Specifications and Drawings. This item shall include Protective Caps Where Subject to Traffic, berms as required to isolate slurry work areas and Work Pad to support Containment Wall construction equipment.
 2. Measurement: This item will be measured by vertical square foot (VSF).
 3. Payment: This item will be paid for based on actual quantities for the period being billed in accordance with the approved Schedule of Values.
- Z. Item #26: Permanent Containment Wall Protective Cap
1. Item Description: The Work of this item includes all labor, material, and equipment as necessary to furnish and install the Permanent Containment Wall Protective Cap per the Specifications and Drawings. This work shall include two (2) layers of non-woven geotextile, the 30-mil PVC liner, and liner key-in trench. This work shall include fusing the cap to PVC monitoring well casings.
 2. Measurement: This item will be measured by square foot (SF).
 3. Payment: This item will be paid for based on actual quantities for the period being billed.
- AA. Item #27: Containment Wall Surfacing

1. Item Description: The Work of this item includes all labor, material, and equipment as necessary to furnish and grade a (1) one-foot thick crushed surfacing base course rock cap on top of and around the Permanent Containment Wall Protective Cap to the elevations and grades of the Restoration Surface. This item estimates import, placement, and compaction of 9,300 cubic yards of either Preload Placement & Compaction - Import Material or virgin material that meets the Specifications.
2. Measurement: This item will be measured based on a percentage complete for the overall lump sum amount.
3. Payment: This item will be paid for based on actual quantities for the period being billed in accordance with the approved Schedule of Values.

BB. Item #28: Trench Safety Systems.

1. Item Description: The Work of this item includes shoring and safety systems for all trench excavations exceeding 4-foot depths.
2. Measurement: This item will be measured as a lump sum unit.
3. Payment: This item will be paid for at the Contract lump sum price as specified in the Contractor's submitted bid.

CC. Item #29: Utility Trench Over Excavation and Backfill Allowance

1. Item Description: The Work of this item includes all labor, material, equipment as necessary to provide authorized over excavation and backfill below the contract trench subgrade elevations. The Work includes, but is not limited to, excavation below the contract trench bedding subgrade elevation to replace a soft trench foundation, shoring, dewatering, replacing the excavated over excavation volumes with 2"-4" quarry spalls backfill, and compaction to the required trench bedding subgrade elevation to provide a firm trench foundation.
2. Measurement: This item shall be field measured (length of trench (ft) x width of trench (ft) x depth of trench (ft) / 27 cft/cy x 1.7 tons/cy) = Tons. The Contractor and the Engineer shall agree upon the measurements in the field prior to requesting payment.
3. Payment: This item will be paid as on a case-by-case basis and deducted from the total or remaining allowance figure. For example, if the total allowance figure is XX tons (100 tons initially), and there are 3 new cases that the total requires 30 tons payment, then 30 tons will be paid at the Unit bid price and the allowance figure total is reduced to XX-30 ton total (100-30 = 70 tons). Should the entire allowance be used, then an additional allowance figure will be established in accordance with contract requirements. Should the contract not require 100 tons, then there will be a net credit to the Port at the project conclusion.

DD. Item #30: Shoreline Debris Removal

- [1]
1. Item Description: The Work of this item includes all labor, material, and equipment as necessary to remove (10) ecology blocks from the shoreline and place them upland at a location within the property as directed by the Engineer. This item shall also include removal of a 3.5 foot by 3.5 foot by 3.5 foot boulder off the northwest corner of the existing concrete pier. The boulder shall be placed in the Demolition - Concrete stockpile. No wetlands shall be disturbed by Contractor operations. Any disturbed shoreline shall be restored to pre-activity conditions. See Section 00 31 00 – Available Project Information for additional information.
 2. Measurement: This item will be measured as a lump sum unit.

- [1] 3. Payment: This item will be paid for at the Contract lump sum price as specified in the Contractor's submitted bid.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXEUTION - NOT USED

END OF SECTION

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PART 1 – GENERAL

1.01 SUMMARY

- A. This section of the specifications includes requirements for constructing a continuous wall with a self-hardening slurry consisting of a mixture of ground granulated blast furnace slag (GGBFS), select clay and water to create a low permeability barrier for the containment of groundwater (containment wall). Specifications are provided for construction of the containment wall with regard to materials, monitoring, sampling, quality control, documentation, site restoration, acceptance, and potential remedial actions.
- B. Objective: The objective of the containment wall is to develop a continuous low permeability barrier surrounding the main arsenic plume as shown on the Contract Drawings with adequate strength by using a self-hardening slurry.
- C. The Contractor's means and methods shall be sufficient to enable placement of slurry and removal of excess hardened slurry.
- D. The Contractor shall develop and implement an installation approach to meet the objective described above. Contractor's means and methods are subject to review by the Engineer for conformance to the stated objectives and performance requirements. The containment wall alignment, profile, and details are illustrated on Contract Drawings C1.0 and C1.3 through C1.5. Alternate approaches developed by and proposed by the Contractor shall be submitted to the Engineer for review and may only be implemented if approved. The written approach and its implementation shall address the following:
 - 1. Ensure Surveyor has clearly and carefully marked subsurface utilities and known structures in the vicinity of work prior to intrusive activities. The limits of any intrusive work shall be clearly marked in the field and thoroughly checked for utilities prior to proceeding with any excavation or subsurface work. Protect utilities and structures as needed.
 - 2. Remove all foundations or other obstructions impacting the containment wall alignment which include monitoring wells, manhole sections, leachate or other conveyance piping, French drain systems, and any other items shown on the Contract Drawings and identified for removal. Notify the Engineer of any French drain systems to be left in place, as needed, to facilitate construction.
 - 3. Ensure all conveyance piping is properly cut and capped to prevent pathways for slurry loss. Pipe bedding, gravel conduits and/or porous backfill shall be sealed to prevent slurry loss.
 - 4. Prepare working pads with berms for containment wall installation as shown on the Contract Drawings.
 - 5. Layout of containment wall locations and design depths.
 - 6. Plan and install one test section of containment wall a minimum of 30 feet long and provide sufficient QA/QC testing to document that the construction means are suitable and that the resulting containment wall meets project requirements. The location of the test section shall be along the alignment (Contract Drawing C1.0), determined by the Contractor, subject to approval by the Engineer.
 - 7. Install containment wall as shown on Contract Drawings and indicated in the notes.
 - 8. Reroute surface water as required during installation of containment wall to maintain site drainage and stormwater management.

9. Contain and treat contact water, as needed, within the working corridor and discharge to specified infiltration area.
10. Excavated trench spoils shall be used as general fill for site grading. Excess hardened slurry mix shall be handled as directed by Engineer.
11. Protect containment wall during the curing process and place cover over containment wall after it has obtained sufficient strength (10 psi UCS) as shown on Contract Drawings.
12. Plan for managing construction water. Management of Construction Water is described in Section 01 57 13 Temporary Erosion and Sediment Control and Construction Stormwater Pollution Prevention and 31 23 19 Dewatering.

1.02 SCOPE OF WORK/DEFINITIONS

- A. Furnish all plant, labor, equipment and materials, and perform all operations as required to construct a self-hardening slurry containment wall (Containment Wall) as shown on the Contract Drawings and specified herein at the Port of Tacoma Arkema Facility in Tacoma, Washington.
- B. The Containment Wall shall be installed using a steel wide flange beam measuring approximately 33 inches wide and capable of reaching depths up to 45 feet to produce each wall panel. The alignment and minimum depth of the panels are indicated on the Contract Drawings. The self-hardening slurry shall be injected as a slurry using the specified beam as it is vibrated into the ground. To ensure the wall remains continuous, an approximately 14-inch long lateral fin or similar shall be attached to the aft side of the beam at the base and inserted into the previously constructed panel as a guide.
- C. The work pad shall be designed and constructed by the Contractor. The work pad shall be a soil surface graded and compacted to the minimum lines and grades indicated on the Contract Drawings. The work pad is intended to support truck traffic and barrier wall construction equipment including a crane with a vibratory hammer of sufficient size to install the containment wall panels. The work pad shall have an average width of 24 feet, and a minimum width of 16 feet, unless otherwise approved in writing by the Engineer.
- D. The Containment Wall shall have an average thickness of 6 inches, and achieve an in-situ hydraulic conductivity of less than or equal to 1×10^{-8} cm/sec.
- E. A self-hardening slurry consisting of a clay and slag-cement mixed with potable water shall be injected through a vibrated beam from the base of the beam driven to bottom of containment wall depth, as shown in Contract Drawings, to form the Containment Wall. Overlapping panels shall be constructed to form a continuous barrier along the planned alignment.

1.03 REFERENCES

- A. AMERICAN PETROLEUM INSTITUTE (API)
 1. API RP 13B-1 (2019; Errata 1 2020; Errata 2 2021; Errata 3 2023) Recommended Practice for Field Testing Water-Based Drilling Fluids
 2. API Spec 13A (2020; Addendum 1 2020; Addendum 2 2022, Errata 1 2024) Specification for Drilling- Fluid Materials
- B. ASTM INTERNATIONAL (ASTM)
 1. ASTM C989 (2025) Standard Specification for Slag Cement for Use in Concrete and Mortars

2. ASTM D2166 (2016) Standard Test Method for Unconfined Compressive Strength of Cohesive Soil
 3. ASTM D4380 (2020) Standard Test Method for Determining Density of Construction Slurries
 4. ASTM D4832 (2023) Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders
 5. ASTM D5084 (2024) Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
 6. ASTM D6910 (2019) Standard Test Method for Marsh Funnel Viscosity of Construction Slurries
 7. ASTM D7100 (2020) Standard Test Method for Hydraulic Conductivity Compatibility Testing of Soils with Aqueous Solutions
- C. Where reference is made to one of the above standards, the revision in effect at the time of the Work shall apply.

1.04 SITE CONDITIONS

- A. The Contractor is responsible for becoming familiar with site conditions.
- B. Verify that containment wall construction conditions are suitable at the site.
- C. The proposed alignment crosses subsurface utilities.

1.05 QUALIFICATIONS

- A. The installation of the Containment Wall shall be performed by a qualified Contractor experienced in the vibrating beam method and/or the equipment and processes necessary to successfully implement this method. A qualified Contractor is defined as having experience with at least two (2) projects in the past 15 years using the vibrating beam method and/or each of the following:
1. A minimum of two (2) projects of similar scope involving installation of a containment wall using a mixture of water, clay and cement, or similar low permeability grout mixture. And;
 2. A minimum of two (2) projects using vibratory pile driving equipment to install steel H-beam or other steel piling similar to that used for the vibrating beam method and;
 3. A minimum of two (2) projects using grout mixing equipment capable of high shear colloidal mixing and positive displacement pumps for delivery of mixed grout, and;
 4. Experience with and Quality Control methods to:
 - a. track and adjust grout mix for strength and permeability
 - b. record and adjust grout pumping rate, volume and pressure
 - c. methods to maintain beam verticality and control beam depth

The Contractor shall submit documentation of prior experience if requested as required in the Supplemental Bidder Responsibility Criteria.

- B. A construction and slurry wall specialist provided by the Contractor shall be used to supervise the containment wall construction. The specialist shall be on site at all times during installation. The Contractor shall submit credentials of the specialist. The specialist shall have previous experience with the vibrating beam method and understand:

1. Mixing methods required for proper preparation of the slurry mix.
 2. Construction equipment, materials, testing, and quality control required for proper installation of the barrier wall.
- C. The Contractor shall use competent personnel to perform the Work and submit credentials for personnel. Personnel shall have prior experience using the vibrating beam or similar equivalent methods.

1.06 QUALITY CONTROL

- A. The Contractor shall provide quality control measures as necessary to assure that the containment wall is constructed in a manner that satisfies the performance requirements set forth in these Specifications. Quality control measures shall be implemented by the Contractor during the construction sequence to avoid defects in the finished wall that would reduce the effectiveness of the barrier.
- B. These measures shall include but are not limited to visual observations and measurements by the Contractor's experienced personnel on installation procedures, wall depths and alignment, barrier verticality, barrier continuity, and testing of slurry, as necessary, to provide a containment wall meeting these Specifications and the Contract Drawings.
- C. The Contractor is required to perform quality control testing in accordance with Parts 2 and 3 of this Specification and to provide the Engineer with the results of quality control testing, measurements and documentation of observations on a daily basis.

1.07 QUALITY ASSURANCE

- A. The Engineer will perform additional testing, measurements, and observations as outlined in quality control procedures to ensure quality assurance. The Contractor is required to fully cooperate with the Engineer during all quality assurance testing activities.

1.08 SUBMITTALS

- A. The Contractor shall submit a detailed safety program demonstrating how the Contractor intends to protect their own personnel, other job site personnel, on project equipment and structures, outside personnel and equipment passing across the project, the general public, and adjacent embankments/impoundments, structures and utilities. Provide emergency contact information for Contractor (primary and backup contact) reachable 24 hours per day, 7 days per week including holidays in the event conditions requiring emergency response actions arise. As a minimum meet all Health and Safety requirements of the Engineer's Health and Safety Plan provided in Appendix A, sub-Appendix J.
- B. Containment Wall Work Plan. The Contractor shall submit a detailed Work Plan describing proposed construction procedures, materials, equipment, and schedules. Allow 2 weeks for Engineer review of this Plan. This Work Plan shall include, but not be limited to, the Contractor's plan for:
1. Coordinating the construction, maintenance, and removal of working pads, mixing pads, and stockpile areas.
 2. Equipment set-up and site use layout including storage areas, working pad locations, and dimensions.
 3. Plan for protecting adjacent embankments/impoundments, utilities, and structures, as needed.

4. Equipment specifications: including maximum vibrated beam depth capabilities, equipment model numbers, and types for slurry mixing equipment.
5. Materials properties, sources, and (manufacturer's) certificates of quality.
- [1] 6. Procedure for clay (~~sepiolite~~ attapulgite or alternate clay source) slurry mixing, storage, and transportation.
7. Procedure for self-hardening slurry mixing, including fillers and additives (if any), and transportation.
8. Procedure for containment wall panel installation and immediate self-hardening slurry placement.
9. Procedures for the control and management of stormwater to minimize stormwater contact with contaminated materials and divert stormwater around work areas. Refer to Section 01 57 13 TESC and CSWPP requirements.
10. Procedures for excavation spoils containment, spill prevention, and stockpile storage.
11. Cleanup, spoils disposal, and slurry disposal. Must include estimation of the volume of spoils, work pad removal, and waste slurry, and how material will be managed, processed, or stabilized for disposal.
12. Monitoring plan for stability of the trench and slope stability of adjacent embankments during Containment Wall construction along portions of the alignment bordered by water bodies. Containment Wall construction along the sheet pile wall adjacent to the Hylebos Waterway requires survey points along transects spaced at maximum 50' centers and monitored at least once per shift as per section 3.4 E below. Survey measurements shall be made available to the Engineer within 24 hours after they are taken. Survey system shall be capable of repeatable measurements with horizontal accuracy of 0.05 ft and vertical accuracy of 0.01 ft or better.
13. Procedures for reinstalling or repairing containment wall sections in the case of cave-ins or other indications of potential adverse effects to containment wall integrity or localized instability of the slurry trench, and response plan in the event of larger scale instability including larger trench sidewall cave-ins or movement indicating inadequate adjacent slope stability.

C. Contractor's Construction Quality Control Plan

1. The Contractor's Construction Quality Control Plan shall include methods and procedures for mixing the slurry and delivering it to the vertical barrier panels, checking verticality and continuity of the panels and ensuring the containment wall meets specification requirements for physical properties and performance.
2. Refer to Section 1.06 for additional requirements of the Contractor's Construction Quality Control Plan.

D. Design Mix

1. Pre-approved Design Mix

- a. A pre-approved design mix has been developed using select materials from pre-approved sources. See Sections 2.02 and 2.03 for descriptions of the pre-approved sources. These materials shall be used in construction of the containment wall unless otherwise proposed and tested by the Contractor to show compatibility of the design mix with existing groundwater conditions such that the resulting mix achieves containment wall requirements for strength under conditions of ASTM D2166 and ASTM D4832 and permeability under conditions of ASTM D7100. Alternate materials of containment wall construction will not be permitted unless approved by the Engineer.
2. Alternate Design Mix
 - a. Any alternate design mix proposed by the Contractor shall include the following:
 - 1) A description of the methods used to test samples during alternate design mix testing (if proposed), including mix water, permeant, slag-cement, clay, and any admixtures.
 - 2) Laboratory slag-cement-clay design mix and trial mix reports, including proportions, density, slag-cement content, clay content, unconfined compressive strength, moisture content, and hydraulic conductivity on at least four samples of the proposed design mix.
 - 3) Hydraulic conductivity tests of proposed mixes should be conducted using site groundwater as permeant and continue long enough to evaluate for long-term compatibility. Consideration for compatibility of the design mix with site conditions will be given to samples prepared with site groundwater as the mix water during sample preparation.
 - 4) Source (supplier) and relevant properties of all materials used for design mix (e.g., water, slag-cement, clay, and admixtures).
- E. During progress of Work, the Contractor shall submit on a regular basis to the Engineer documentation of the following:
 1. Daily reports submitted by noon of the following working day for the date of the report. Daily reports shall include:
 - a. A written record of the actual installed depth of each panel constructed that day along with the design depth and top elevation of the installed panel. Document any discrepancies between depth measurements and requirements and how discrepancies were rectified.
 - [1] b. A record of plant-mixed ~~sepiolite-attapulgite~~ slurry quantities, proportions, and admixtures. Adjustments to slurry mixture shall be noted.
 - c. A record of plant-mixed slag-cement quantities, proportions, and admixtures. Adjustments to slurry mixture shall be noted.
 - [1] d. A record of plant-mixed slag-cement- ~~attapulgite sepiolite~~ slurry quantities, proportions, and admixtures. Adjustments to slurry mixture shall be noted.
 - [1] e. A record of in-trench slag-cement- ~~attapulgite sepiolite~~ slurry properties taken during construction. Procedures and admixtures used to modify slurry properties shall be noted.
 - f. A record of in-trench grab sample locations (alignment and depth) noting the number of cylinders cast and designated laboratory testing.

- g. A record of all quality control samples taken, showing dates, locations, type of tests, and field test results for those samples tested on-site. All strength testing shall include the number of days the samples were cured prior to testing.
 - h. A record of quality control samples sent to a laboratory for off-site testing.
- 2. Laboratory test results submitted to Engineer within two days of receipt of report from the laboratory.
- 3. A final report shall be submitted within four weeks of the completion of work, which shall include:
 - a. Containment Wall As-Built Plan: Plan shall depict location, dimensions, and depths of each panel installed, including actual installation depth with top and bottom of wall elevation.
 - b. Quality Control Data: A record of the quantity, location, and results of quality control samples.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Materials described herein to be used in construction of the Containment Wall have been pre-tested and approved for meeting project goals and achieving long-term compatibility with site conditions. The selected materials are ~~attapulgitite sepiolite~~ and ground granulated blast furnace slag (GGBFS) as described in Sections 2.02 and 2.03, respectively.
- B. Contractor may propose alternate materials for preparation of the slurry for containment wall construction other than the pre-approved mix design described in this Section, subject to review and approval by the Engineer. Additional laboratory and field demonstrations performed by the Contractor will be required prior to implementation of modified slurry mix designs. Refer to Section 1.04.C.2.

[1] 2.02 ~~SEPIOLITE~~ATTAPULGITE

- A. ~~Attapulgitite Sepiolite~~ used in preparing slurry shall be pulverized ~~(powder or granular)~~ premium grade ~~attapulgitite sepiolite~~ and shall meet the most current API Standard 13A specifications. ~~Attapulgitite Sepiolite~~ shall be ~~Florigel-HY Sea Mud~~ available from ~~Active Minerals International, LLC originating from mines located near Quincy, Florida. IMV Nevada located at 498 E. Invite Rd., Amargosa Valley, Nevada.~~ Alternate sources will not be permitted without additional compatibility testing of the design mix by the Contractor.
- B. ~~Attapulgitite Sepiolite shall be graded so that a minimum of 70 percent will pass a No. 200 mesh sieve and shall~~ meet the requirements set forth in Table 1.

2.03 SLAG-CEMENT

- A. Slag-cement shall be New Cem Grade 100, a ground granulated blast furnace slag (GGBFS) per ASTM C989 available from LaFarge of Seattle, Washington and located at 5400 W Marginal Way SW, Seattle, WA. Slag-cement additives and/or replacements or other cementitious additives which produce acceptable material properties will not be allowed without additional compatibility testing of the design mix by the Contractor and written acceptance by the Engineer.

2.04 WATER

- A. Potable water available from City of Tacoma water systems near the site shall be used to manufacture slurry and shall be free of excessive amounts of deleterious substances (e.g., soil, oils, acids, salts, and organic matter) or harsh properties (e.g., hardness, pH, and total dissolved solids) that may adversely affect slurry properties.
- B. It is the responsibility of the Contractor that the slurry resulting from the mix water shall always meet the standards of this specification and requirements shown in Table 1.

2.05 ADDITIVES

- A. Admixtures such as softening agents, dispersants, retarder, plugging, or bridging agents may be added to the water or the slurries to permit efficient use of materials and proper workability, provided these additives do not adversely affect the long- or short-term performance of the containment wall. Additives, if approved and used in the slurry mix(es) shall be incorporated in proportions similar to that used in Contractor design mix testing and long-term compatibility testing performed prior to containment wall construction to evaluate impact of said additive(s).
- B. The Contractor shall advise the Engineer of any and all additives used in production of the slurry for containment wall construction and document quantities used in each batch.
- C. Laboratory and field testing will be required of the Contractor by the Engineer to demonstrate that additives do not adversely affect performance of the Containment Wall.

2.06 SELF-HARDENING SLURRY

- [1] A. Self-hardening slurry shall consist of a stable colloidal suspension of attapulgitesepiolite and GGBFS in water and shall be controlled in accordance with the most current API Recommended Practice 13B-1. Minimum mix ratio shall be 5% clay (attapulgitesepiolite) and 18% slag (GGBFS) from the sources specified herein.
- B. The Contractor shall select and produce a unit weight for the self-hardening slurry mixture needed to maintain stable panels during construction of the containment wall. The slurry shall exhibit properties in accordance with Table 1. (Marsh funnel >40 seconds and unit weight in range of 70 to 75 pcf)
- [1] C. Additional attapulgitesepiolite, GGBFS or admixtures may be required depending on the hardness, temperature, or other water quality parameters, and the quality of the sepiolite-attapulgitesepiolite and GGBFS.
- [1] D. Self-hardening slurry shall be prepared by mixing potable water, attapulgitesepiolite and GGBFS with high shear mixing equipment until the granular particles are fully hydrated and the resulting slurry appears homogeneous. Particles of attapulgitesepiolite and GGBFS shall be fully dispersed with no clods present. The Contractor shall note that during design mix testing in the laboratory, more success was achieved by mixing attapulgitesepiolite and GGBFS in dry form prior to introduction of water; however, the Contractor is responsible for all means and methods during the mixing process.
- E. The self-hardening slurry shall be constantly circulated to maintain homogeneity until introduced into the trench.
- F. The in-trench self-hardening slurry mixture shall be tested at the intervals and meet the requirements for permeability and unconfined compressive strength (UCS) set forth in Table 1, Containment Wall Quality Control Testing Plan or as approved by the Engineer.
- G. The self-hardening slurry shall be protected from any loading (including foot traffic) and shall not be covered until it has cured for a minimum of 3 days or has achieved a green color and a

minimum unconfined compressive strength of 20 psi (undrained shear strength of 10 psi).

- H. After initial curing has occurred as described in Item G, the Containment Wall shall be protected with the cover shown on the Contract Drawings and shall not be crossed with construction traffic except at designated crossings and then only following installation of the upgraded cover at crossings shown on the Contract Drawings. Temporary equipment crossings may be used by the Contractor provided they completely bridge over the installed containment wall and are acceptable to the Engineer.

2.07 EQUIPMENT

A. GENERAL

1. The Containment Wall shall be constructed using suitable equipment capable of producing a finished product, as specified.
2. All equipment shall be free of fluid leaks that discharge substances onto the ground. All broken or leaking lines, hoses, valves, pistons, pipes, tanks, and other equipment components shall be immediately repaired or removed.
3. Equipment shall be maintained in such a condition so as to deliver the manufacturer's rated output. If inadequate quality of production is obtained, larger and/or different equipment shall be provided by the Contractor.

B. SLURRY MIXING AND PLACING EQUIPMENT

1. The self-hardening slurry shall be mixed in a mixing plant which shall include a high-speed/high shear colloidal mixer, or other equipment that achieves complete dispersion of the components and produces a stable, homogenous slurry mix. The plant shall be capable of providing a continuous supply of slurry to the vertical barrier during construction. The necessary pumps, sumps, hoses, valves, supply lines, mixers, and tools shall be provided by the Contractor.

C. VIBRATED BEAM

1. The vibrated beam shall be an approximately 33-inch wide flange beam, plus an approximately 14- inch fin with appropriate slurry nozzles affixed to the bottom of the beam.
2. The thickness of the driving shoe, as measured perpendicularly to the web shall be at least 6 inches. The web of the beam may be built-up depending on soil conditions.
3. Attached to the wide flange beam shall be slurry pipes for the injection of slurry. Each beam must be of sufficient length to penetrate the maximum expected depth, plus some margin.
4. The vibrated beam shall be marked so that the depth of the bottom of the beam can be readily observed from the surface.

D. QUALITY CONTROL EQUIPMENT

1. The Contractor shall provide all equipment necessary for quality control testing.
2. Minimum quality control testing by the Contractor is specified herein.
3. All equipment shall be maintained in good working order and shall meet the requirements of the applicable test standards cited herein.

PART 3 – EXECUTION

3.01 GENERAL

- A. All Containment Wall construction activities shall be conducted in the presence of the Engineer or a coordinated representative.
- B. All work performed in this section shall comply with the Safety, Health, and Emergency Response Requirements set forth in the Contractor's HASP.
- C. All work performed in this section shall comply with the Environmental Protection Procedure in Section 01 57 13 - TESC and CSWPP.

3.02 LAYOUT AND SURVEY CONTROL

- A. Contractor shall provide a Surveyor licensed in the State of Washington to establish a survey control grid which shall be utilized for location in the field.
- B. For each 20-foot length of the Containment Wall, Contractor shall survey the location and provide markings clearly showing the Station, existing grade and design top and bottom elevations of the Containment Wall using real-time transit survey from established control points. Survey shall be performed during each day of wall construction to ensure accurate location.
- C. For containment wall depth control, Contractor may use kinematic (RTK) global positioning system (GPS) that provides real time base elevations of the vibrated beam to supplement field survey control. GPS systems may only be used upon field demonstration of its accuracy and upon written approval of the Engineer.
- D. Do not deviate more than 6 inches from the horizontal alignment shown on the Contract Drawings without prior written approval of the Engineer.

3.03 SITE PREPARATION

- A. Prepare the work pad, as needed, and staging areas as shown on the Contract Drawings and described in this paragraph.
- B. Perform demolition and remove all existing structures, utilities, foundations and other obstructions and debris within the lateral limits of the Containment Wall installation area.
- C. Install and maintain survey stakes in appropriate locations along the alignment to identify the 20-foot station locations along the alignment. These stakes will be referenced for quality control and quality assurance measurements during barrier wall construction.

3.04 OPERATIONAL CONDITIONS

- A. Weather Conditions
 - 1. Construction shall not take place in an ambient temperature below 32 degrees Fahrenheit (F) or above 105 degrees F without approval by the Engineer.
 - 2. Excavation shall not be performed during periods of heavy rainfall or stormwater run-on if it results in water being added to the slurry which will adversely impact the ability to meet required properties.
- B. Obstructions

1. If unidentified obstructions including boulders, unknown subsurface structures, or unknown abandoned utilities are encountered that were not cleared during Demolition, the Contractor shall stop construction at that location until the nature of the obstruction is known. Develop a plan to remove obstruction for Engineer's review and acceptance before continuing work in the obstruction vicinity.
2. The Contractor may by-pass an obstruction and continue Containment Wall installation in another location along the wall alignment until the obstruction is cleared or modifications to the alignment are in place.

3.05 EQUIPMENT

- A. Contractor shall have suitable equipment so that the containment wall can be installed to its final depth continuously along the Containment Wall alignment. Additional equipment required shall be provided by the Contractor.
- B. The vibrated beam crane shall have guide leads to assist in control of verticality to full depth during construction of Containment Wall panels. It shall have the capacity to safely handle all loads from the pile driving operations
- C. The length of the beam shall reach at least 8 ft longer than the maximum depth to the base of the containment wall shown on the Contract Drawings.
- D. The vibratory pile hammer shall be sized to allow efficient penetration of the vibrated beam to full depth considering the soil and groundwater conditions at the site.
- [1] E. The slurry batching plant shall include the necessary equipment including a high shear mixer capable of producing a colloidal suspension of ~~attapulgit~~ ~~sepiolite~~ and GGBFS in water, as well as tanks, hoppers, power supply, pumps, valves, hoses, supply lines, and all other equipment required to adequately produce and continuously supply slurry to the containment wall during construction.

3.06 CONTAINMENT WALL INSTALLATION

A. Slurry Mixing

1. Produce slurry by gradually adding components to water and thoroughly mixing until complete homogenous slurry is achieved. The resulting slurry shall display the slurry properties specified herein before introduction to the vertical barrier panels.
2. All slurry shall be mixing plant mixed.
3. The Contractor shall provide a full-time slurry specialist who shall regularly test and control the mixing and placing of the slurry in accordance with the Contractor's Construction Quality Control Plan in order to maintain the specified properties of the slurry.
4. The Contractor's Construction Quality Control Plan shall include methods and procedures for mixing the slurry, delivering it to the vertical barrier panels and producing a functioning Containment Wall meeting the requirements of these specifications. See Section 1.08.C.
5. The Contractor shall handle the slag-cement and clay in a manner that does not allow fugitive dust particles to be released.
6. Keep the self-hardening slurry in constant circulation until introduced into the Containment Wall.

B. Driving and Slurry Placement

1. The Contractor is responsible for using the construction staking and control points provided by the Contractor's Surveyor.

2. The beam shall be controlled by guide leads ensuring installation within 1% of vertical. Each insertion shall overlap the previous insertion by a minimum of 3 inches, in addition to the 14-inch fin that inserts into the previous panel.
3. The beam shall be inserted to the required depth by a vibratory pile driver vibrating at its optimum rate and shall be extracted at a rate suitable for the proper injection of slurry. The pumping pressure and rate of slurry injection shall be such that a full reservoir trench level is maintained around the beam during extraction.
4. The completed containment wall shall be continuous with no gaps and shall have an average thickness of 6 inches.
5. The Contractor shall arrange its work activities and constantly take care to avoid spillage or accidental discharge of slurries, water, or other liquids into uncontained areas on the site.

[1]

5-6. Acceptance criteria shall be based on Section 3.07 Test Section requirements below. If slurry mix meets all strength, permeability, and viscosity criteria during test section and mix properties remain consistent, wall installation will be continuous. Longer duration UCS tests (e.g. 56-day) will not impede wall installation and will be used for confirmation purposes.

C. Depth of Containment Wall Panels

1. Provide penetration of the vibrated beam to the elevations shown on the Contract Drawings, or as determined in the field by the Engineer.
2. Obstructions that prevent the vibrated beam from achieving the required depth shall be broken or moved by drilling methods, driving piles, excavation, or other means deemed acceptable to the Contractor. If the obstacle cannot be penetrated or moved by these means, the alignment of the barrier wall shall be modified to go around the obstacle subject to approval of the Engineer. Refer to Section 3.04.B.
3. Should the beam reach refusal prior to design depth, the actual recorded depth of that panel will be determined by the Engineer.

D. Tolerances

1. Alignment of the containment wall shall be within 1 foot of the alignment staked in the field. Request for greater variations shall be submitted to the Engineer for review at least 48 hours prior to the installation in the area of the proposed change.
2. The completed top of the containment wall shall be within 0.2 feet of the design top of wall elevation at the end of construction.
3. The containment wall shall be plumb within 1% of vertical.

E. Treatment to Top of Vertical Barrier

1. A temporary cover shall be constructed above the vertical barrier for protection following installation. Construction of the temporary cover shall begin after the slurry has adequately cured. Placement of a cloth cover or other means for protection from the elements may be applied at the Contractor's discretion, if needed until soil cover can be placed.
2. Material excavated from the containment wall reservoir trench or excess material from the containment wall operations may be used for the temporary cover provided it is uncontaminated and is approved by the Engineer. Other excess material from the operations shall be stockpiled in the appropriate stockpile area and handled similarly to other native materials encountered at the site.

3. The wall may be overbuilt in elevation during installation and cut back to design elevation prior to the self-hardening slurry achieving an unconfined compressive strength of 100 psi.
4. Upon completion of containment wall curing to a minimum set strength of approximately 100 psi, the containment wall protective cap shall be installed as indicated on the Contract Drawings.

F. Containment Wall Penetrations

1. Penetrations through the containment wall shall be sealed using a low permeability grout or other similar methods using means acceptable to the Engineer.
2. Submit a plan for sealing containment wall penetrations to the Engineer for review and approval a minimum of 2 weeks prior to application.

3.07 TEST SECTION

- A. Prior to starting full scale construction of the containment wall, a test section shall be constructed along a 30-foot length of the containment wall alignment in an area selected by the Contractor.
- B. The purpose of the Test Section is to verify that equipment and means provided by the Contractor will produce a containment wall with the required physical characteristics and specified properties described in these Contract Drawings and Specifications.
- C. Allow for a 40-day period for sample curing and laboratory testing of self-hardening slurry prior to commencement of full-scale containment wall production. Schedule containment wall installation activities accordingly.
- D. The Test Section shall be installed using the same means and methods proposed to construct full-scale production sections of the containment wall.
- E. Additional test sections may be required by the Engineer at no additional cost to the Owner or Contractor if the original Test Section does not successfully meet the following criteria. Specifically:
 1. Test Section panels continuously overlap and are successfully installed to the design depth of the containment wall.
 2. Adjacent panels are demonstrated to be continuous using a guide plate (as described in Section 3.08.E.2) inserted into overlapping containment wall panels to the full depth of the installed panels.
 3. Self-hardening slurry is consistently produced at the mixing plant meeting the viscosity and unit weight requirements of these Specifications.
 4. Quality control samples obtained from in-trench slurry and tested by the Contractor meet the strength and permeability requirements of these Specifications. Since the self-hardening slurry strength increases with time and the permeability reduces with time, the Engineer will examine the physical property trends from Contractor laboratory testing for comparison to trends at early stages of curing during the mix design program to determine acceptability, e.g. 14-day and 28-day UCS. Refer to Appendix A, sub-appendix C for Barrier Wall Slurry Mix Design Testing Report.
- F. Quality Control testing for the Test Section will be performed similarly to that for full production as described in Section 3.08 - FIELD QUALITY CONTROL but at an increased frequency as described in Table 1 of that Section.
- G. Construction of the Test Section may be slowed or discontinued as determined by the Engineer based on quality control testing, visual observations, or other available information.

- H. Once the Test Section is complete the Engineer will review the available data and evaluate suitability of the proposed means and methods. The Engineer will communicate conclusions of this evaluation to the Contractor and Owner as soon as possible. The Engineer reserves 3 working days to evaluate test section data in which work may be paused.

3.08 FIELD QUALITY CONTROL

A. GENERAL.

1. The Contractor shall be responsible to ensure that work is performed to the standards established herein subject to review and inspection of the Engineer.
2. Quality control records, routine test observations, and measurements shall be made available for inspection by the Engineer.

B. TEST AND FREQUENCY - MINIMUM REQUIREMENTS

1. Quality control testing shall be performed in accordance with the approved Construction Quality Control Plan. Minimum requirements are specified below.
2. Perform the sampling and control testing as indicated, according to the methods specified below and at the frequencies specified below. 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.
3. Equipment for sampling and testing shall be in good condition. Equipment shall be set up for on-site testing and testing shall be performed on-site, unless otherwise specified or accepted in writing by the Engineer. Test results shall become the property of the Owner. The Contractor shall be responsible for representative, quality and accurate sampling, and testing. Mathematical calculations shall be checked by someone other than the person performing the original calculations.

Table 1			
Item	Sampling & Testing	Criteria	Frequency
Slurry-As Mixed	Sampled immediately before entering the trench:		Every 10,000 gallons or twice daily (whichever is greater)
	Unit Weight	70 pcf to 75 pcf	Minimum 20 tests during Test Section
	Viscosity	> 40 seconds	
Slurry-In Wall (in panel during day of placement)	Sample from panel at varied depths		One grab sample each shift
	Unit Weight	70 pcf to 75 pcf	
	Viscosity	> 40 seconds	

[1]

Table 1			
Slurry-In Wall (after curing)	Hydraulic Conductivity (2 ea. event)	> 1x10-8 cm/sec	Min. 7 cylinder samples every shift. Store samples and test one set for every 200 linear feet of containment wall installed with a minimum of one set of tests per week
	Strength (UCS) (5 ea. event)	<u>>20 psi @ 28 days</u> <u>and</u> <u>> 100 psi at 100 days</u>	Minimum 21 samples and 3 sets of tests during Test Section
Barrier Verticality	Measured with hand level	Plumb within 1% of vertical	Each beam insertion
Barrier Continuity	Insert guide at specified frequency before slurry has cured	Extends to full depth of panel or acceptable to Engineer	Every panel for the first 30 feet of the Test Section and, with approval of the Engineer, every 10th panel thereafter

C. TESTING SCHEDULE

- Tests shall conform to the following:

Table 2	
Test	Standard
Unit Weight of Slurry	API RP 13B-1, ASTM D4380
Viscosity, Marsh (seconds)	API RP 13B-1, ASTM D6910
Hydraulic Conductivity	ASTM D 5084
Unconfined Compressive Strength	ASTM D2166 or ASTM D4832

D. RECORD KEEPING

- The Contractor shall keep detailed and accurate records of the mixing plant and vertical panel production during installation of the containment wall.
 - Mixing plant record keeping shall include maintaining an accurate record of slurry ingredients, including any additives used for slurry production, mixing time for each batch, and the volume of slurry produced for each batch.
 - Production records during driving of the vibrated beam shall include an accurate record of the total penetration depth of each beam drive, top and bottom elevation of each completed panel, a record of the driving pressure, and changes in slurry pressure

versus depth for each beam.

- c. Any obstructions encountered or deviations from design.
- d. Copies of these records shall be provided to the Engineer on a daily basis. Electronic versions prepared in Microsoft Excel or equivalent of field documentation to be provided to Engineer no later than 3 days from generation unless approved by the Engineer.

E. WALL CONTINUITY AND THICKNESS

- 1. The Contractor shall maintain a rigorous quality control program for the penetration of each beam to help ensure wall continuity. The Contractor shall also compare the square foot production in relation to the volume of slurry produced to give an average wall thickness estimate for that day.
- 2. The Contractor shall introduce a guide plate into the trench before the self-hardening slurry has cured to verify containment wall continuity. The guide plate may be rectangular or circular and shall have external dimensions that are at least 2.5 inches thick and 42 inches long (or 42-inch dia.). The guide plate shall be inserted to the full depth of the panel. The guide plate shall be inserted for each panel over the first 30 feet of barrier wall constructed. If no problems are identified during the first 30 feet of construction, the test frequency may be reduced to every 10th panel or once per production day at the discretion of the Engineer.
- 3. Alternative means of documenting containment wall continuity may be proposed by the Contractor, should the guide plate fail to readily provide barrier wall continuity information, subject to approval by the Engineer.
- 4. The Contractor shall help the Engineer in any possible way for other tests, as long as this participation does NOT interfere with wall production.

F. Quality Control Testing

- 1. Quality control activities will be the responsibility of the Contractor.
- 2. The parameters of the self-hardening slurry after mixing and in-trench slurry must meet the requirements shown on Table 1.
- 3. Water
 - a. Collect a sample of potable water from the selected source prior to commencement of slurry mixing activities (minimum 2 weeks).
 - b. Measure and record the level of dissolved solids, hardness, and pH of water proposed for use in preparing slurry.
 - c. Provide results to the Engineer for approval.
- 4. Mix Tank Slurry Sampling and Testing
 - a. A grab sample of the slurry shall be collected from the mix tank each day prior to the commencement of slurry panel construction and tested for compliance with the required slurry material properties. If test results are not satisfactory, Contractor will adjust the mixing operation or add supplemental reagents (subject to prior approval by Engineer) and conduct additional quality control sampling and testing until quality control requirements are met. Collect and test a second sample during afternoon shift (minimum two samples per day).

- b. Conduct all slurry tests specified in this Section in accordance with API RP 13B-1 and the requirements of Table 1. If more than one batching plant is being used, the testing frequencies shall apply to each batching plant separately.

5. In-Trench Slurry Sampling and Testing:

- a. As shown in Table 1, take at least one grab sample of the self-hardening slurry for every shift of work. The samples must be taken from different batch times during the week (e.g., morning and afternoon, alternating).
- b. Samples of the in-trench self-hardening slurry should be collected from various locations from the top of trench, mid-height, and bottom of trench. Use sampling device designed to collect isolated sample from target depth. Obtain additional grab samples at any time or location requested by the Engineer. The Contractor must provide personnel who have a working knowledge of API standard test procedures to perform the tests. The Contractor must furnish all the equipment for slurry sampling and testing.
- c. Grab samples must be collected from the trench at various depths to be used for permeability and strength testing. Plastic molds used to cast the test specimens must be cylindrical with dimensions of 3-in. diameter and 6-in. height. From each grab sample collected, cast seven (7) cylinder test specimens. Discard and note clumps not passing 1/4-inch screen. Pour wet grab sample into cylinder molds, rod to remove trapped air pockets, and seal. Store the specimens in a reasonably constant temperature (60 to 80 degrees Fahrenheit) and damp environment until tested or until otherwise directed by the Engineer.
- d. The Engineer will select at least two sets of seven cylinders for testing per week of operation, or one every 200 lf of containment wall, whichever is more. The selected sets of cylinders will be tested by the Contractors Testing Laboratory. Handle, store, and test samples in accordance with ASTM D4832.
- e. Samples for strength testing shall be submitted by the Contractor to a certified independent laboratory approved by the Engineer. One specimen will be tested for strength after curing for 14 days, one after curing for 28 days, and one after curing for 56 days. If the 14-day strength test results indicate the minimum specified strength (20 psi) may not be achieved by 28 days, the 28-day test specimen may be held until 56 days or longer before testing. The Engineer may direct additional strength testing based on results of the testing program.
- f. Select two test specimens from the chosen grab samples for permeability testing (hydraulic conductivity) in a triaxial type permeability cell by a certified independent laboratory approved by the Engineer. The Engineer will designate whether permeability testing should be performed after reviewing results of strength testing of samples from the same set of cylinders. The length of curing prior to the start of permeability testing may be varied but will not be less than 28 days. The Engineer may require additional permeability testing with the need for such additional testing determined based, at least in part, on the results of previous sample testing.
- g. Quality Control requirements for hardened attapulgit~~ite~~ ~~sepiolite~~-GGBFS are presented in Table 1.
- h. Perform permeability tests in accordance with ASTM D 5084 with the following conditions applied:
 - 1) Average Effective Confining Stress = 100 kPa (14.5 psi).

- 2) Hydraulic Gradient: Maximum allowed per ASTM D5084.
- 3) Permeant: Potable water from the site used in mixing operation.
- 4) Backpressure: Sufficient to ensure a Skempton's pore pressure parameter $b \geq 0.95$.
- 5) Continue permeability tests until inflow-outflow measurements or flow rates demonstrate that steady state seepage conditions are evident.
- 6) Size permeameter cell to accommodate the full height of the specimen as cast (i.e., no trimming or cutting of sample).

G. CORRECTIVE ACTION

1. Whenever tests conducted by the Contractor and/or the Engineer indicate material or workmanship are not in accordance with the Contract Drawings and Specifications, work shall be halted and the cause of the discrepancy shall be identified.
2. Work not in accordance with the Contract Drawings and Specifications shall be removed, replaced, or otherwise corrected so as to conform to the Contract Drawings and Specifications.

H. QUALITY ASSURANCE

1. The Engineer may sample and test independently of the Contractor. Sampling and testing performed independently by the Engineer will be in addition to the specified tests and shall not relieve the Contractor of any testing responsibilities.
2. Sampling and testing performed by the Contractor, work necessary to identify the cause of any nonconformance, and remedial work necessary because of construction not in accordance with the Contract Documents shall be at the Contractor's expense.

3.09 CLEAN-UP

- A. After completion of construction operations, remaining material and slurry shall be removed from the ground surface in the construction area, including the mixing areas. The excess slurry shall be spread out on the ground outside of the barrier wall alignment. Location of placement and other necessary clean-up shall be subject to approval of the Engineer.

END OF SECTION