

Appendix B

Technical Specifications

US STEEL
CHERRYVALE, KANSAS
TECHNICAL SPECIFICATIONS

for the construction of the

WASTE DEPOSITION AREA
NATIONAL ZINC SITE

JACOBS

Phoenix, Arizona

November 2018

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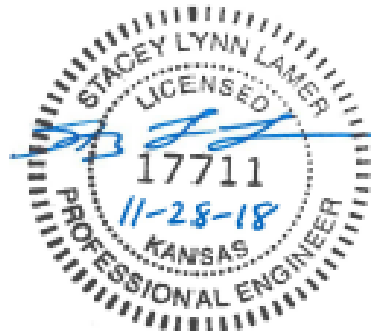
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Project No. 698945

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**SECTION 00 01 07
SEALS PAGE**

SPECIFICATIONS



Signed on

November 28, 2018

Stacey Lynn Lamer

END OF SECTION

TABLE OF CONTENTS

	<u>Pages</u>
<u>SPECIFICATIONS</u>	
DIVISION 01—GENERAL REQUIREMENTS	
01 57 13 Temporary Erosion and Sediment Control	1- 17
DIVISION 02—EXISTING CONDITIONS	
02 61 00 Staging and Disposal of Contaminated Soil	1- 8
DIVISIONS 03 THROUGH 30—NOT USED	
DIVISION 31—EARTHWORK	
31 10 00 Site Clearing	1- 3
31 23 23 Fill and Backfill	1- 11
31 32 00 Soil Stabilization.....	1- 7
DIVISIONS 32 THROUGH 49—NOT USED	

END OF SECTION

**OSECTION 01 57 13
TEMPORARY EROSION AND SEDIMENT CONTROL****PART 1 GENERAL****1.01 SUMMARY**

- A. This section covers Work to implement Best Management Practices (BMP) to control soil erosion by wind or water and keep eroded sediments and other construction-generated pollutants from moving off the Site. Requirements described in this specification and shown on the Waste Deposition Area (WDA) Drawings are part of the project Temporary Erosion and Sediment Control Plan (TESC Plan) and are the minimum for all Site conditions. This specification covers all Site activities related to the WDA unless specific project activities are excluded elsewhere in this specification or in other Contract Documents controlling the Work.
- B. National Pollutant Discharge Elimination System: Comply with Federal, state, and local laws, rules and regulations, and the National Pollutant Discharge Elimination System (NPDES) Construction Stormwater Discharge Permit or Permits applicable to the project. NPDES General Construction permits are required on projects that involve disturbance of 1 acre or more with potential to discharge stormwater to surface waters.
- C. Other Regulations: A local government erosion and sediment control permit may apply and some local agency requirements may be more stringent than this specification.

1.02 REFERENCES

- A. Activities shall conform to the Standard Specifications and Drawings. In the event of a conflict, the more stringent requirement shall apply.
- B. The following is a list of standards that may be referenced in this section:
 - 1. ASTM International (ASTM):
 - a. D4355, Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.
 - b. D4397, Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.
 - c. D4491, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.

- d. D4533, Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
 - e. D4632/D4632M, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
 - f. D4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile
 - g. D6241, Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe.
 - h. D6459, Standard Test Method for Determination of Rolled Erosion Control Product (RECP) Performance in Protecting Hillslopes from Rainfall-Induced Erosion.
 - i. D6460, Standard Test Method for Determination of Rolled Erosion Control Product (RECP) Performance in Protecting Earthen Channels from Stormwater-Induced Erosion.
 - j. D6475, Standard Test Method for Measuring Mass Per Unit Area of Erosion Control Blankets.
 - k. D7322, Standard Test Method for Determination of Rolled Erosion Control Product (RECP) Ability to Encourage Seed Germination and Plant Growth Under Bench-Scale Conditions.
2. National Weather Service:
 - a. Precipitation-Frequency of the United States by State/Territory, 2012.
 - b. Precipitation Frequency Data Server, 2012.
 3. North American Weed Management Association (NAWMA).
 4. U.S. Department of Agriculture, Natural Resources Conservation Service: *Urban Hydrology for Small Watersheds*; 1986. Technical Release 55.
 5. U.S. Environmental Protection Agency:
 - a. Developing Your Stormwater Pollution Prevention Plan: A Guide for Construction Sites, 2007. EPA-833-R-06-004.
 - b. National Menu of BMPs, 2012.
 6. The sections of the standards referenced above which apply to this Project include, but are not limited to:

Detail No.	Title
4/C-5	Check Dam
3/C-5	Erosion Control Blanket
2/C-5	Plastic Covering
1/C-6	Stormwater Control Ditch
1/C-5	Sediment Fence

Detail No.	Title
5/C-5	Stabilized Construction Entrance

1.03 DEFINITIONS

- A. Drawings: The WDA Drawings dated November 2018.
- B. Project: The Work within the Site as referenced in these Specifications and Drawings.
- C. Site: The Site is defined as the WDA as shown on the Drawings and within these specifications.
- D. Specifications: The technical specifications for the construction of the WDA National Zinc Site dated November 2018.

1.04 SYSTEM DESCRIPTION

- A. Erosion and Sediment Control:
 - 1. Provide, maintain, and operate temporary facilities to control erosion and sediment releases during construction period.
 - 2. Design erosion and sediment controls to handle peak runoff resulting from 25-year, 24-hour storm event based on National Weather Service: Precipitation Frequency Data Server.
 - 3. Size temporary stormwater conveyances based on procedures presented in U.S. Department of Agriculture, Natural Resources Conservation Service: Urban Hydrology for Small Watersheds, 1986. Technical Release 55.
- B. Erosion and Sediment Control (ESC) Lead:
 - 1. Identify the ESC Lead at the preconstruction discussions and in the TESC Plan. The ESC Lead shall have certification in construction site erosion and sediment control.
 - 2. The ESC Lead shall implement the TESC Plan, including, but not limited to:
 - a. Installing and maintaining all temporary erosion and sediment control Best Management Practices (BMPs) included in the TESC Plan to assure continued performance of their intended function. Damaged or inadequate TESC BMPs shall be corrected immediately.

- b. Updating TESC Plan to reflect current field conditions.
 - c. Terminating TESC Plan.
 3. ESC Lead shall inspect all areas disturbed by construction activities, all onsite erosion and sediment control BMPs, all stormwater discharge points, and all temporarily stabilized inactive sites per schedule in the Construction Stormwater Discharge Permit(s). Complete erosion and sediment control inspection form provided by water resource agency for each inspection.
- C. Personnel Training: Prior to commencement of construction, applicable personnel must have an understanding of the Construction Stormwater Discharge Permit's requirements and their specific responsibilities under the permit. At a minimum, personnel must be trained to understand the following as it relates to the scope of their job duties:
 1. The location of all stormwater controls and how to maintain them.
 2. Procedures for complying with the pollution prevention requirements.
 3. Procedures for conducting inspections, recording findings, and taking corrective action.
- D. Temporary Erosion and Sediment Control Plan (Stormwater Pollution Prevention Plan):
 1. A TESC Plan showing minimum TESC control measures is furnished as part of the Drawings (Sheet C-1), which helps fulfill part of the plan requirement of the NPDES Permit. This initial TESC Plan, when adopted by Contractor, may be used as the basis of the construction TESC Plan. Additional or revised erosion and sediment control features, not shown on the initial TESC Plan, may be required depending on Contractor's methods of operation and schedule.
 2. For each phase of the scheduled work, indicate on the TESC Plan all the BMPs proposed and installed for erosion and sediment control to minimize clearing, stabilize exposed soil, divert or temporarily store flows, limit runoff from exposed areas, and filter transported sediment. Include all temporary slopes, constructed for staging or other reasons, which may not have been identified in the original Contract plans. Refer to the current local jurisdiction's erosion and sediment control manual.
 3. TESC Plan Elements Typically Required by NPDES Permits:
 - a. Narrative Site Description:
 - 1) Nature of construction activity planned for the Site.
 - 2) Estimates of total site area and the areas of the Site expected to be disturbed.
 - 3) Soil types found onsite and their erosion potential.
 - 4) The types of fill materials to be used.

- 5) Timetable for sequence of major construction events.
- b. Site Map:
- 1) All areas of development.
 - 2) Drainage patterns.
 - 3) Areas of soil disturbance, including pre-development and post-development elevation contours.
 - 4) Areas used for storage of soils or wastes.
 - 5) Areas where vegetative practices are to be implemented.
 - 6) Location of all erosion and sediment control BMP or structures.
 - 7) Location of all impervious structures and surfaces after project is completed.
 - 8) Springs, wetlands, and other surface waters located onsite.
 - 9) Boundaries of the 100-year floodplain, if determined.
 - 10) Ordinary High Water line, if determined.
 - 11) Location of storm drainage outfalls to receiving waters, if applicable.
 - 12) Details of sediment and erosion controls.
 - 13) Details of detention ponds, storm drain piping, inflow and outflow details.
- c. Required BMPs and Procedures for Erosion Prevention, Runoff Control, and Sediment Control:
- 1) Construction entrances and parking areas.
 - 2) Unpaved site roads such as haul roads.
 - 3) Hauling saturated soils from the Site.
 - 4) Water washed from concrete trucks.
 - 5) Correct installation of erosion and sediment control BMPs.
 - 6) Prompt maintenance and repair of BMPs.
 - 7) Clearing and grading practices to minimize area of exposed soil throughout life of the Project.
 - 8) Schedule of phased clearing operations to limit soils to what can be stabilized.
 - 9) Vegetative practices, including preservation of existing vegetation, seeding, mulching, and buffer strips.
 - 10) Preventing erosion of exposed areas.
 - 11) Diverting flows from exposed slopes.
 - 12) Limiting runoff from exposed areas.
 - 13) Limiting sediment transport within work sites and keeping it from moving off of project areas.
 - 14) Perimeter controls for all clearing and grubbing, both planned and installed.
 - 15) Additional controls for wet season work and temporary work suspensions.
 - 16) Sensitive areas such as wetlands.

- 17) Offsite material source and waste areas.
 - 18) Dust.
 - 19) Emergency materials stockpiled onsite.
 - 20) Storing flows and filtering sediment.
 - 21) Soil stockpiles.
4. Contractor's construction TESC Plan and implementation schedules must be prepared by a competent individual. Furnish a signed copy of the TESC Plan with individual's name, title, state certifications, and employing firm if different than Contractor's firm.
 5. Do not begin any Site activities that have potential to cause erosion or sediment movement until the TESC Plan and implementation schedules are reviewed by the ESC Lead.
 6. Keep a copy of the approved TESC Plan with updated changes onsite during all construction activities. During inactive periods longer than 7 calendar days, keep the TESC Plan onsite or provide a copy to ESC Lead to retain.
 7. Continually update the TESC Plan and schedules as needed for unexpected storm or other events to ensure that sediment-laden water does not leave the construction site. Add changes to the TESC Plan no later than 24 hours after implementation.
- E. Install high visibility fence along the Site preservation lines as required. Space posts and attach fence fabric to posts as specified. Do not fasten fence to trees. Throughout the life of the Project, preserve and protect delineated area, acting immediately to repair or restore any fencing damaged or removed.
- F. Preventing erosion, and controlling runoff, sedimentation, and nonstormwater pollution, requires Contractor to perform temporary Work items including, but not limited to:
1. Providing ditches, berms, culverts, and other measures to control surface water.
 2. Building dams, settling basins, energy dissipaters, and other measures, to control downstream flows.
 3. Controlling underground water found during construction.
 4. Covering or otherwise protecting slopes until permanent erosion control measures are working.
- G. To the degree possible, coordinate this temporary Work with permanent drainage and erosion control work the Project requires.
- H. Additional temporary control measures may be required if it appears pollution or erosion may result from weather, nature of materials, or progress on the Work.

- I. When natural elements rut or erode the slope, restore and repair damage with eroded material where possible, and remove and dispose of any remaining material found in ditches and culverts.
- J. Install all sediment control devices including, but not limited to, sediment ponds, perimeter sediment fencing, or other sediment trapping BMPs prior to any ground disturbing activity. Do not expose more erodible earth than necessary during clearing, grubbing, excavation, borrow, or fill activities. ESC Lead may increase or decrease the limits based on project conditions. Erodible earth is defined as any surface where soils, grindings, or other materials may be capable of being displaced and transported by rain, wind, or surface water runoff. Cover inactive areas of erodible earth, whether at final grade or not, within specified time period (see [NPDES] Erosion and Sediment Control Permit), using an approved soil covering practice. Phase clearing and grading to maximum extent practical to prevent exposed inactive areas from becoming a source of erosion.
- K. Water Management: Manage site water in accordance with the conditions of the waste discharge permit from a local permitting authority.
- L. Dispersion/Infiltration: Convey water only to dispersion or infiltration areas designated in the TESC Plan. Water shall be conveyed to designated dispersion areas at a rate such that, when runoff leaves the area and enters surrounding drainageways, turbidity standards are achieved. Convey water to designated infiltration areas at a rate that does not produce surface runoff.
- M. Detention/Retention Pond Construction: Whether permanent or temporary, construct before beginning other grading and excavation Work in the area that drains into that pond. Install temporary conveyances concurrently with grading in accordance with the TESC Plan so that newly graded areas drain to the pond as they are exposed.
- N. Pollution Control: Use BMPs to prevent or minimize stormwater exposure to pollutants from spills; vehicle and equipment fueling, maintenance, and storage; other cleaning and maintenance activities; and waste handling activities. These pollutants include fuel, hydraulic fluid, and other oils from vehicles and machinery, as well as debris, leftover paints, solvents, and glues from construction operations. Implement the following BMPs when applicable:
 - 1. Written spill prevention and response procedures.
 - 2. Employee training on spill prevention and proper disposal procedures.
 - 3. Spill kits in all vehicles.
 - 4. Regular maintenance schedule for vehicles and machinery.

- 5. Material delivery and storage controls.
- 6. Training and signage.
- 7. Covered storage areas for waste and supplies.

- O. If the Work is suspended, continue to control erosion, pollution, and runoff during the shutdown.

- P. Nothing in this section shall relieve Contractor from complying with other Contract requirements.

- Q. Provide a schedule for TESC Plan implementation and incorporate it into Contractor's progress schedule.

- R. Modified TESC Plans shall meet all requirements of the applicable jurisdictions.

- S. The TESC Plan shall cover all areas that may be affected inside and outside the limits of the Project (including all disposal sites haul roads, and all nearby land, streams, and other bodies of water).

PART 2 PRODUCTS

2.01 CHECK DAMS

- A. As shown in the Standard Details on Drawings.

2.02 EROSION CONTROL BLANKET (MATTING), BIODEGRADABLE

- A. Temporary erosion control blanket (ECB) shall be made of natural plant fibers meeting the following independent test results:

Properties	ASTM Test Method	Requirements
Protecting Slopes from Rainfall-Induced Erosion	D6459: Test in one soil type. Soil tested shall be sandy loam as defined by the NRCS Soil Texture Triangle.	Maximum C factor of 0.15 using Revised Universal Soil Loss Equation (RUSLE)
Dry Weight per Unit Area	D6475	0.36 lb/sq. yd. minimum
Performance in Protecting Earthen Channels from Stormwater-Induced Erosion	D6460: Test in one soil type. Soil tested shall be loam as defined by the NRCS Soil Texture Triangle.	1.0 lb/sq. ft. minimum

Properties	ASTM Test Method	Requirements
Seed Germination Enhancement	D7322	200 percent minimum
Netting, if present, shall be biodegradable with a life span not to exceed 1 year.		

- B. For permanent erosion control blanket, see Section 31 32 00, Soil Stabilization.

2.03 GEOTEXTILE

- A. Geotextiles shall consist only of long chain polymeric fibers or yarns formed into a stable network such that the fibers or yarns retain their position relative to each other during handling, placement, and design service life. At least 95 percent by weight of the material shall be polyolefins or polyesters. The material shall be free from defects or tears. Geotextile shall also be free of any treatment or coating which might adversely alter its hydraulic or physical properties after installation. Geotextile properties shall be described in Table 1 through Table 3.

Table 1 Geotextile for Permanent Erosion Control							
Geotextile Property	ASTM Test Method	Geotextile Property Requirements					
		Permanent Erosion Control				Ditch Lining	
		Moderate Survivability		High Survivability			
		Woven	Nonwoven	Woven	Nonwoven	Woven	Nonwoven
AOS	D4751	See Table 2		See Table 2		U.S. No. 30 max.	
Water Permittivity	D4491	See Table 2		See Table 2		0.02 sec ⁻¹ min.	
Grab Tensile Strength, in machine and x-machine direction	D4632/ D4632M	250 lb min.	160 lb min.	315 lb min.	200 lb min.	250 lb min.	160 lb min.
Grab Failure Strain, in machine and x-machine direction	D4632/ D4632M	15% -50%	≥50%	15% -50%	≥50%	<50%	≥50%
Seam Breaking Strength	D4632/ D4632M	220 lb min.	140 lb min.	270 lb min.	180 lb min.	220 lb min.	140 lb min.
Puncture Resistance	D6241	495 lb min.	310 lb min.	620 lb min.	430 lb min.	495 lb min.	310 lb min.

Table 1 Geotextile for Permanent Erosion Control							
Geotextile Property	ASTM Test Method	Geotextile Property Requirements					
		Permanent Erosion Control				Ditch Lining	
		Moderate Survivability		High Survivability			
		Woven	Nonwoven	Woven	Nonwoven	Woven	Nonwoven
Tear Strength, in machine and x-machine direction	D4533	80 lb min.	50 lb min.	112 lb min.	79 lb min.	80 lb min.	50 lb min.
Ultraviolet (UV) Radiation Stability	D4355	70% strength retained min., after 500 hours in xenon arc device					

Table 2 Filtration Properties for Geotextile for Permanent Erosion Control				
Geotextile Property	ASTM Test Method	Geotextile Property Requirements		
		Class A	Class B	Class C
AOS	D4751	U.S. No. 40 max.	U.S. No. 60 max.	U.S. No. 70 max.
Water Permittivity	D4491	0.7 sec ⁻¹ min.	0.4 sec ⁻¹ min.	0.2 sec ⁻¹ min.

Table 3 Geotextile for Temporary Silt Fence			
Geotextile Property	ASTM Test Method	Geotextile Property Requirements	
		Unsupported Between Posts	Supported Between Posts with Wire or Polymeric Mesh
AOS	D4751	U.S. No. 30 max. for silt wovens, U.S. No. 50 for all other geotextile types, U.S. No. 100 min.	
Water Permittivity	D4491	0.2 sec ⁻¹ min.	
Grab Tensile Strength, in machine and x-machine direction	D4632/ D4632M	180 lb min. in machine direction, 100 lb min. in x-machine direction	100 lb min.
Grab Failure Strain, in machine and x-machine direction	D4632/ D4632M	30% max. at 180 lb or more	
Ultraviolet (UV) Radiation Stability	D4355	70% strength retained min., after 500 hours in xenon arc device	

2.04 HIGH VISIBILITY FENCING (PERIMETER FENCING)

- A. High Visibility Fence: UV stabilized, orange, high-density polyethylene or polypropylene mesh.
- B. Height: 4 feet minimum.
- C. Support Posts: Wood or steel with sufficient strength and durability to support the fence through the life of the Project.

2.05 OUTLET PROTECTION

- A. Size riprap or quarry spall to resist movement under design flows. Install at least 8 inches deep. Provide riprap or quarry spall material free of extraneous material.

2.06 PLASTIC COVERING

- A. Plastic meeting requirements of ASTM D4397 for polyethylene sheeting having a minimum thickness of 6 mils.

2.07 SEEDING

- A. See Section 31 32 00, Soil Stabilization.

2.08 SEDIMENT FENCE

- A. Geotextile: As specified in Article Geotextile.
- B. Welded wire fabric, 14-gauge minimum with 2-inch by 4-inch mesh.
- C. Support Posts: As recommended by manufacturer of geotextile.
- D. Fasteners: Heavy-duty wire staples at least 1-inch long, tie wires, or hog rings, as recommended by manufacturer of geotextile.

2.09 STABILIZED CONSTRUCTION ENTRANCE

- A. Construct a pad from stone 3 inches to 6 inches in size, placed at least 8 inches deep and not less than 50 feet long.
- B. Provide aggregate free of extraneous materials that may cause or contribute to track out.
- C. Place separation geotextile under the rock to prevent fine sediment from pumping up into the rock pad.

- D. Use of constructed or constructed/manufactured steel plates with ribs (such as, shaker/rumble plates or corrugated steel plates) for entrance/exit access is allowable.

2.10 STREET CLEANING

- A. If debris is tracked onto public streets, remove immediately. Mechanical broom sweepers are not allowed where environmental concerns exist about stormwater pollution or air quality.

2.11 TEMPORARY SEDIMENT TRAP

- A. Temporary ponding area with a rock weir or perforated riser pipe at the outlet, formed by excavation or constructing a weir. Specified by Contractor.

2.12 WHEEL WASH FACILITY

- A. Specified by Contractor.

PART 3 EXECUTION

3.01 PREPARATION

- A. The TESC Plan is required prior to starting earth disturbing activities.
- B. Include proposed stockpile areas and installation of temporary erosion control devices, ditches, or other facilities in Work phasing plans.
- C. Areas designated for Contractor's use during Project may be temporarily developed as specified to provide working, staging, and administrative areas. Include control of sediment from these areas in the TESC Plan.
- D. Check Dams: Install check dams as soon as construction will allow. Check dam is a temporary or permanent structure, built across a minor channel. Construct check dams to create a ponding area upstream of dam to allow pollutants to settle, with water from increased flows channeled over a spillway in check dam. Construct check dam to prevent erosion in area below spillway. Place check dams perpendicular to flow of water and install in accordance with the Drawings. Extend outer edges up sides of conveyance to prevent water from going around check dam. Provide check dams of sufficient height to maximize detention, without causing water to leave ditch. Place sandbags so that initial row makes tight contact with ditch line for length of dam. Stagger subsequent rows so center of bag is placed over space between bags on previous lift.

- E. Erosion Control Blanket (Matting), Biodegradable: Temporary ECBs are used as an erosion prevention device and to enhance establishment of vegetation. Install ECBs according to manufacturer's recommendations.
1. ECBs with an open area of 60 percent or greater may be installed prior to seeding and fertilizing. Install blankets with less than 60 percent open space immediately following seeding and fertilizing operation.
 2. Select ECB material for an area based on the intended function; slope or ditch stabilization and Site-specific factors including soil, slope gradient, rainfall, and flow exposure. Do not use ECBs on slopes or in ditches that exceed manufacturer's recommendations.
 3. For permanent ECB, see Section 31 32 00, Soil Stabilization.
- F. High Visibility Fencing: Install high visibility fencing along the Site preservation lines as required.
- G. Outlet Protection: Provide outlet protection to prevent scour at outlets of ponds, pipes, ditches, or other conveyances.
- H. Plastic Covering: Use plastic covering for stockpiles or other areas where vegetative growth is unwanted. Place plastic with at least a 12-inch overlap of all seams. Install and maintain plastic cover to prevent water from cutting under the plastic and to prevent cover from blowing open in the wind.
- I. Sediment Control Barriers: Install sediment control barriers in accordance with TESC Plan or manufacturer's recommendations in the areas of clearing, grubbing, earthwork, or drainage prior to starting those activities. Maintain sediment control barriers until soils are stabilized.
- J. Seeding: See Section 31 32 00, Soil Stabilization.
- K. Sediment Fence:
1. Sediment fence shall be installed in accordance with the Drawings. When backup support is used, use steel wire with a maximum mesh spacing of 2 inches by 4 inches, or plastic mesh as resistant to ultraviolet radiation as the geotextile it supports. Provide wire or plastic mesh with strength equivalent to or greater than as required for unsupported geotextile (for example, 180 pounds grab tensile strength in the machine direction).
 2. Attach geotextile to posts and support system using staples, wire, or in accordance with manufacturer's recommendations. Geotextile shall be sewn together at the point of manufacture to form geotextile lengths as required.

3. Provide wood or steel support posts at sewn seams and overlaps and as shown on the Drawings and necessary to support fence.
 4. Wood Posts: Minimum dimensions of 1-1/4-inch by 1-1/4-inch by the minimum length shown on Drawings.
 5. Steel Posts: Minimum weight of 0.90 pound per foot.
 6. When sediment deposits reach approximately one-third the height of the sediment fence, remove and stabilize deposits.
- L. Stabilized Construction Entrance: Construct temporary stabilized construction entrance in accordance with the Drawings, prior to beginning any clearing, grubbing, earthwork, or excavation. When stabilized entrance no longer prevents track out of sediment or debris, either rehabilitate existing entrance to original condition or construct a new entrance.
- M. Temporary Sediment Trap: Form trap by constructing a berm or by partial or complete excavation. Direct the discharge flow to a stabilized conveyance outlet or level spreader.
- N. Wheel Wash Facility: Include details for wheel wash and method for containing and treating sediment-laden runoff as part of the TESC Plan. All vehicles leaving the Site shall stop and wash sediment from their tires. Change wash water a minimum of once per day. Polymers may be used to promote coagulation and flocculation in a closed-loop system.

3.02 ADDITIONAL REQUIREMENTS

- A. Natural Buffer, or Equivalent:
1. Unless natural buffer between the Project Site and receiving waters has previously been eliminated by pre-existing development disturbances, comply with one of the following alternatives if stormwater from construction will discharge to surface water:
 - a. Provide a 50-foot, undisturbed natural buffer between construction disturbances and surface water.
 - b. Provide an undisturbed natural buffer that is less than 50 feet supplemented by additional erosion and sediment controls, which in combination, achieve a sediment load reduction that is equivalent to a 50-foot buffer.
 - c. If it is infeasible to provide an undisturbed natural buffer of any size, implement erosion and sediment controls that achieve a sediment load reduction that is equivalent to a 50-foot buffer.

3.03 MAINTENANCE

- A. The ESCP measures described in this specification are minimum requirements for anticipated Site conditions. During the construction period, upgrade these measures as needed to comply with all applicable local, state, and federal erosion and sediment control regulations.
- B. Maintain erosion and sediment control BMPs so they properly perform their function until they are no longer needed.
- C. Construction activities must avoid or minimize excavation and creation of bare ground during wet weather.
- D. The intentional washing of sediment into storm sewers or drainage ways must not occur. Vacuuming or dry sweeping and material pickup must be used to cleanup released sediments.
- E. Inspect BMPs in accordance with the schedule in the Construction Stormwater Discharge Permit(s).
- F. Complete an inspection report within 24 hours of an inspection. Each inspection report shall be signed and identify corrective actions. Document that corrective actions are performed within 7 days of identification. Keep a copy of all inspection reports at the Site or at an easily accessible location.
- G. Unless otherwise specified, remove deposits before the depth of accumulated sediment and debris reaches approximately height of BMP. Dispose of debris or contaminated sediment at approved locations. Clean sediments may be stabilized onsite using BMPs.
- H. Sediment Fence: Remove trapped sediment before it reaches one-third of the above ground fence height and before fence removal.
- I. Other Sediment Barriers (such as biobags): Remove sediment before it reaches 2 inches depth above ground height and before BMP removal.
- J. Catch Basins: Clean before retention capacity has been reduced by 50 percent.
- K. Sediment Basins and Sediment Traps: Remove trapped sediments before design capacity has been reduced by 50 percent and at completion of Project.
- L. Initiate repair or replacement of damaged erosion and sediment control BMPs immediately, and work completed by end of next work day. Significant replacement or repair must be completed within 7 days, unless infeasible.

- M. Within 24 hours, remediate any significant sediment that has left construction site. Investigate cause of the sediment release and implement steps to prevent a recurrence of discharge within same 24 hours. Perform in-stream cleanup of sediment according to applicable regulations.
- N. At end of each work day, stabilize or cover soil stockpiles or implement other BMPs to prevent discharges to surface waters or conveyance systems leading to surface waters.
- O. Temporarily stabilize soils at end of shift before holidays and weekends, if needed. Ensure soils are stable during rain events at all times of year.
- P. Initiate stabilization by no later than end of next work day after construction work in an area has stopped permanently or temporarily.
- Q. Within 14 days of initiating stabilization or as specified in permit, either seed or plant stabilized area (see Section 31 32 00, Soil Stabilization); or apply non-vegetative measures and cover all areas of exposed soil. Seed dry areas as soon as Site conditions allow. Ensure that vegetation covers at least 70 percent of stabilized area. In areas where Contractor's activities have compromised erosion control functions of existing grasses, overseed existing grass. Complete initial stabilization within 7 days if storm water discharges to surface waters impaired for sediment or nutrients, or high quality waters.
- R. Provide permanent erosion control measures on all exposed areas. Do not remove temporary sediment control practices until permanent vegetation or other cover of exposed areas is established. However, do remove all temporary erosion control measures as exposed areas become stabilized, unless doing so conflicts with local requirements. Properly dispose of construction materials and waste, including sediment retained by temporary BMPs.

3.04 EMERGENCY MATERIALS

- A. Provide, stockpile, and protect emergency erosion and sediment control materials on the Project Site for unknown weather or erosion conditions. Emergency materials are in addition to other erosion control materials required to implement and maintain the TESC Plan. Replenish emergency materials as they are used. Remove all unused emergency materials from the Project Site at completion of the Project.

3.05 REMOVAL

- A. When an erosion control BMP is no longer required, remove BMP and all associated hardware from the Project limits. When materials are biodegradable, it may be appropriate leaving temporary BMP in place.
- B. Permanently stabilize all bare and disturbed soil after removal of erosion and sediment control BMPs. Dress sediment deposits remaining after BMPs have been removed to conform to existing grade. Prepare and seed graded area. If installation and use of erosion control BMPs have compacted or otherwise rendered soil inhospitable to plant growth, such as construction entrances, take measures to rehabilitate soil to facilitate plant growth. This may include, but is not limited to, ripping the soil, incorporating soil amendments, or seeding with specified seed.

END OF SECTION

SECTION 02 61 00
STAGING AND DISPOSAL OF CONTAMINATED SOIL**PART 1 GENERAL**

1.01 SUMMARY

- A. This section describes the Work involved in handling and disposal of excavated waste and incidental debris brought onto the WDA site from other excavations.

1.02 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. U.S. Code of Federal Regulations (CFR):
 - a. Title 29, Labor, Chapter XVII Occupational Safety and Health Administration (OSHA), Part 1910, Occupational Safety and Health Standards: Part 1910.120, Hazardous Waste Operations and Emergency Response.
 2. ASTM International (ASTM):
 - a. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - b. D6938, Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.03 DEFINITIONS

- A. Completed Course: A course or layer that is ready for next layer or next phase of Work.
- B. Drawings: The WDA Drawings dated November 2018.
- C. Excavated Waste: Buried soil contaminated with smelter residue material brought onto the WDA site from other excavations. Excavated waste does not include demolition debris, solid waste, refuse, construction waste, or special waste created by Contractor incidental to the Work.
- D. Incidental Debris: Debris in contact with excavated waste that is incidental to the removal action, such as brick, concrete, and wood.
- E. Lift: Loose (uncompacted) layer of material.

- F. Prepared Ground Surface: Ground surface after completion of required demolition, clearing and grubbing, scalping of sod, stripping of topsoil, excavation to grade, and subgrade preparation.
- G. Project: The Work within the Site as referenced in these Specifications and Drawings.
- H. Relative Compaction:
 - 1. Ratio, in percent, of as-compacted field dry density to laboratory maximum dry density as determined in accordance with ASTM D1557.
 - 2. Apply corrections for oversize material to either as-compacted field dry density or maximum dry density.
- I. Select Waste Material: Excavated waste material from required excavations free from rocks larger than 1/2 inch, from roots and other organic matter, ashes, cinders, trash, debris, and other deleterious materials.
- J. Site: The Site is defined as the WDA as shown on Drawings and within these Specifications.
- K. Specifications: The technical specifications for the construction of the WDA National Zinc Site dated November 2018.

1.04 REQUIREMENTS

- A. Prior to commencement of the Work obtain or complete the following:
 - 1. Documentation that personnel proposed for Work with contaminated materials have been 40-hour trained in accordance with 29 CFR 1910.120.
 - 2. Inspection reports, including photographs, and other items from offsite excavations.
 - 3. Disposal Plan demonstrating controls for migration of water into active disposal areas.
 - 4. Site-specific Health and Safety Plan:
 - a. In accordance with 29 CFR 1910.120.
 - b. Include Contractor-proposed monitoring, personnel protective gear, worker training and certifications, and emergency procedures.
 - c. State criteria or measures when air monitoring and work by HAZWOPER-trained personnel are no longer necessary.
 - 5. Emergency Response Plan: Details how to handle an emergency during execution of the Work (for example, encountering drums with unknown contents; encountering pockets of hazardous atmospheres; response to

- spills caused by excavation of materials by Contractor or Contractor's equipment; response to fire or injured personnel).
6. Manufacturer's data sheets for compaction equipment.
 7. Qualifications for Contractor's independent testing agency/laboratory.
- B. During disposal activities obtain or complete the following:
1. Daily job progress log detailing information on review of progress with respect to previously established milestones and schedules, major problems, corrective actions, injury reports, equipment breakdown, and sampling results.
 2. Weekly disposal (fill) and staging plans.

1.05 QUALITY ASSURANCE

- A. Qualifications:
1. Contractor: Proper equipment and personnel experienced in similar work.
 - a. Personnel shall be formally trained in procedures for contaminated soil and water removal (for example, HAZWOPER training).
 2. Waste Transporter: Licensed waste haulers with trucks equipped with containment and cover systems to transport solid and liquid waste materials on public streets and roads without spillage.
 3. Contractor's Construction Quality Control (CQC) Testing Agency/Laboratory: Minimum 10 years' experience on related types of projects (size and complexity) working with local soils in the area. Laboratory shall be certified and maintain calibrated instruments, equipment, and document standard procedures for performing specified testing. All field testing shall be documented in terms of testing result and test/sampling location.
- B. Codes and Regulations:
1. Comply with federal, state, and local regulations in handling, transporting, and disposing materials and in performing the Work.
 2. Prior to commencing removal operations, obtain applicable local, state, and federal permits and licenses that directly impact Contractor's ability to perform the Work.

1.06 SEQUENCING AND SCHEDULING

- A. Repository disposal and staging plan shall be completed prior to commencing waste filling.

- B. Backfill around buried structures only after structures are set in position, securely anchored, and ready to be backfilled.
- C. Do not place waste fill until after applicable Work specified in Section 31 10 00, Site Clearing has been completed.
- D. Sequence waste placement in the repository such that area of exposed waste material is limited keep contact stormwater at a minimum.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Plastic Sheeting:
 - 1. Nylon-reinforced polyethylene sheeting, opaque/frosted.
 - 2. Thickness: Minimum 10 mils.
- B. Tape and Glue: Capable of sealing joints of adjacent sheets of plastic and capable of adhering under wet conditions.
- C. Ballast: Sandbags or other ballast materials of sufficient weight and quantity to maintain polyethylene sheeting securely in place.

2.02 WATER FOR MOISTURE CONDITIONING

- A. Free of hazardous or toxic contaminants, or contaminants deleterious to proper compaction.

2.03 MOISTURE CONTROL EQUIPMENT

- A. Equipment for water application shall be of a type and quality adequate to achieve the Work. It shall not leak and shall be equipped with a distributor bar or other approved device to ensure uniform application.
- B. Equipment used for mixing and/or drying of soil material, if necessary, shall consist of blades, disks, or other agricultural implement suitable for the Work.

2.04 COMPACTION EQUIPMENT

- A. Compaction equipment shall be suitable and adequate to obtain the specified densities, and shall provide satisfactory breakdown of materials, as needed, to form a dense and unyielding fill.
- B. Compaction equipment shall be operated in strict conformance with manufacturer's instructions and recommendations. Equipment shall be

maintained such that it will deliver the manufacturer's rated compaction effort. If inadequate densities are obtained, larger and/or different types of additional equipment shall be provided by the Contractor. Hand-operated equipment shall also be capable of achieving the specified relative compaction levels.

PART 3 EXECUTION

3.01 GENERAL

- A. Contractor shall be responsible for the following:
 - 1. Providing means, methods, and equipment necessary for collecting, handling, processing, loading, and disposing of excavated waste and incidental debris in the repository.
 - 2. Complying with all applicable federal, state, and local requirements.
- B. Disposal (Fill) Plan:
 - 1. Plan shall include, but not be limited to, the following:
 - a. Means and sequencing of disposal.
 - b. Proposed locations, layout, and controls for materials stockpile areas.
 - c. Numbers and types of proposed equipment.
 - d. Methods of handling, segregating, and stockpiling excavated materials.
 - e. Methods of controlling water and sediment in proposed stockpile areas.
 - f. Proposed locations, types, and capacities of temporary water storage facilities, if required.
- C. Provide qualified professional with appropriate training to accomplish the Work to oversee and supervise waste handling operations at Site.
- D. Keep placement surfaces free of water, debris, and foreign material during placement and compaction of waste materials.

3.02 ONSITE WASTE EXCAVATION

- A. Waste (excavated waste and incidental debris) shall be removed, handled, and disposed in accordance with the specifications.

3.03 WASTE HANDLING AND DISPOSAL

- A. To extent possible, schedule and coordinate Work such that excavated waste and wastewater can be loaded and hauled to the repository with minimal handling or storage requirements.
- B. Where temporary storage or stockpiling is necessary, provide and maintain adequate containment and environmental controls, including but not limited to containers, dikes, linings, covers, erosion and sediment controls, and other measures of sufficient capacity to store materials without unauthorized release of contaminants into ground, air, or surface water.
 - 1. Temporary Stockpile:
 - a. Provide with perimeter dike at least 12 inches high and lined with plastic sheeting.
 - b. Anchor plastic sheeting with sandbags or other approved ballast over stockpile(s) at end of working day.
 - 2. Liquid Container Storage:
 - a. Provide with perimeter dike and plastic lining.
 - b. Volume of lined storage area shall be at least the volume of the largest container within the area plus a minimum of 1 foot of freeboard.
 - 3. Seams for diked area linings shall be appropriately sealed to prevent release of contaminated materials or liquids within containment area.
 - 4. Cover systems shall be lapped or sealed as required to prevent leakage of rainwater into stockpiled materials.
 - 5. Inspect containment areas daily, or after each rainfall event, and remove standing water.
- C. Transportation:
 - 1. Provide vehicles and other measures necessary to prevent spillage or tracking of waste materials, mud, or other debris on local streets or roads.
 - 2. Inspect and document vehicles and containers for proper operation and covering.
 - 3. Inspect vehicles and containers for proper markings, manifests, and other requirements for waste shipment.
 - 4. Perform and document decontamination procedures prior to leaving removal location and again before leaving repository.

3.04 WASTE MATERIAL PLACEMENT IN REPOSITORY

- A. Keep placement surfaces free of ponded water during placement and compaction of fill materials inside the repository. Manage stormwater in such

a manner to minimize contact water discharge from the repository. Cover the repository with clean fill and/or tarps during inclement weather or interim periods of shutdown.

- B. Place and spread waste fill materials in horizontal lifts of uniform thickness of no more than 1-foot thick loose lifts and compact each lift prior to placing succeeding lifts. Compaction shall be done by several passes with suitable equipment designed for the purpose of compacting soil. Relative compaction shall be no less than 90 percent in accordance with ASTM D1557 in areas where it can be measured.
- C. Slope lifts only where necessary to conform to final grades or as necessary to keep placement surfaces drained of water.
- D. Spread incidental debris within the excavated waste fill. Incidental debris is not permitted within 2 feet of the bottom or top of the waste fill surfaces. Do not allow debris materials to be concentrated together. These materials shall be broken and crushed as necessary as to not segregate and bridge. Maximum length of debris shall be no more than 2 feet. Any material "processing" shall utilize caution for dust and airborne particles.
- E. During filling, keep fill level relatively even. Fill placement should be done in accordance with the disposal plan and done sequentially.
- F. Do not place fill, if fill material is frozen, or if surface upon which fill is to be placed is frozen.

3.05 CONTRACTOR'S CONSTRUCTION QUALITY CONTROL (CQC)

- A. Disposal of anything other than waste characterized in this section is strictly prohibited.
- B. Reevaluate Fill Plan when:
 - 1. Soft or loose subgrade materials are encountered wherever embankment or site fill is to be placed.
 - 2. Fill material appears to be deviating from Specifications.

3.06 SITE TESTING

- A. In-Place Density Tests: In accordance with ASTM D6938. During placement of materials, test top of waste surface 2 per acre per lift.

3.07 EQUIPMENT DECONTAMINATION

- A. Decontaminate equipment that has come into contact with waste or impacted water.
- B. Decontaminate materials and equipment before leaving the site. Minimize wastewater and sediment generated by decontamination activities. Such materials shall be contained and disposed of in the repository in accordance with provisions stated in this section. No liquids are permitted for direct disposal in the repository.

END OF SECTION

**SECTION 31 10 00
SITE CLEARING****PART 1 GENERAL**

1.01 DEFINITIONS

- A. Clearing: Removal of interfering or objectionable material lying on or protruding above ground surface.
- B. Drawings: The WDA Drawings dated November 2018.
- C. Grubbing: Removal of vegetation and other organic matter including stumps, buried logs, and roots greater than 2-inch caliper to a depth of 6 inches below subgrade.
- D. Interfering or Objectionable Material: Trash, rubbish, and junk; vegetation and other organic matter, whether alive, dead, or decaying; topsoil.
- E. Project: The Work within the Site as referenced in these Specifications and Drawings.
- F. Project Limits: Areas, as shown or specified, within which Work is to be performed.
- G. Scalping: Removal of sod without removing more than upper 3 inches of topsoil.
- H. Site: The Site is defined as the WDA as shown on Drawings and within these Specifications.
- I. Specifications: The technical specifications for the construction of the WDA National Zinc Site dated November 2018.
- J. Stripping: Removal of topsoil remaining after applicable scalping is completed.

1.02 SCHEDULING AND SEQUENCING

- A. Prepare Site only after adequate erosion and sediment controls are in place. Limit areas exposed uncontrolled to erosion during installation of temporary erosion and sediment controls in accordance with the Contractor's TESC Plan.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

- A. Clear, grub, and strip areas actually needed for Work activities within limits shown or specified.
- B. Do not injure or deface vegetation that is not designated for removal.

3.02 LIMITS

- A. As follows, but not to extend beyond Project limits:
 - 1. Excavation: 5 feet beyond top of cut slopes.
 - 2. Trench Excavation: Minimize disturbance to the trench excavation 4 feet from trench centerline, regardless of actual trench width.
 - 3. Fill: 5 feet beyond toe of permanent fill.
 - 4. Other Areas: As shown on Drawings.
- B. Remove rubbish, trash, and junk from entire area within Project limits.

3.03 CLEARING

- A. Clear areas within limits shown or specified.
- B. Fell trees so that they fall away from facilities and vegetation not designated for removal.
- C. Cut stumps not designated for grubbing flush with ground surface.
- D. Cut off shrubs, brush, weeds, and grasses to within 2 inches of ground surface.

3.04 GRUBBING

- A. Grub areas within limits shown or specified.

3.05 SCALPING

- A. Do not remove sod until after clearing and grubbing is completed and resulting debris is removed.
- B. Scalp areas within limits shown or specified.

3.06 STRIPPING

- A. Do not remove topsoil until after scalping is completed.
- B. Strip areas within limits to minimum depths shown or specified. Do not remove subsoil with topsoil.
- C. Stockpile strippings, meeting requirements of Section 31 23 23, Fill and Backfill, for topsoil, separately from other excavated material.

3.07 DISPOSAL

- A. Clearing and Grubbing Debris:
 - 1. Utilize clearing and grubbing debris in onsite soil stabilization or dispose onsite.
 - 2. Burning of debris onsite is not permitted.
 - 3. Limit offsite disposal of clearing and grubbing debris to locations that are approved by federal, state, and local authorities.
- B. Scalpings: As specified for clearing and grubbing debris.
- C. Strippings:
 - 1. Dispose of strippings that are unsuitable for topsoil or that exceed quantity required for topsoil in the onsite repository.
 - 2. Stockpile topsoil in sufficient quantity to meet Project needs. Dispose of excess strippings as specified for clearing and grubbing.

END OF SECTION

**SECTION 31 23 23
FILL AND BACKFILL****PART 1 GENERAL****1.01 REFERENCES**

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
 - a. D75, Standard Practice for Sampling Aggregates.
 - b. D1556, Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
 - c. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - d. D2216, Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
 - e. D2974, Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils.
 - f. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
 - g. D4254, Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
 - h. D4972, Standard Test Methods for pH of Soils.
 - i. D5084, Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
 - j. D5268, Standard Specification for Topsoil Used for Landscaping Purposes.
 - k. D6391, Standard Test Method for Field Measurement of Hydraulic Conductivity Using Borehole Infiltration.
 - l. D6938, Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.02 DEFINITIONS

- A. Compacted Native Soil (Low Permeability): Imported material used in the final cover system as a barrier for moisture infiltration.
- B. Completed Course: A course or layer that is ready for next layer or next phase of Work.
- C. Drawings: The WDA Drawings dated November 2018.

- D. Embankment Material: Fill materials required to raise existing grade in areas other than under structures.
- E. Geosynthetics: Geotextiles, geogrids, or geomembranes.
- F. Imported Material: Materials obtained from sources offsite, suitable for specified use.
- G. Influence Area: Area within planes sloped downward and outward at 60-degree angle from horizontal measured from:
 - 1. 1 foot outside outermost edge at surface of roadways or shoulder.
 - 2. 0.5 foot outside exterior at spring line of pipes or culverts.
- H. Lift: Loose (uncompacted) layer of material.
- I. Optimum Moisture Content:
 - 1. Determined in accordance with ASTM Standard specified to determine maximum dry density for relative compaction.
 - 2. Determine field moisture content on basis of fraction passing 3/4-inch sieve.
- J. Prepared Ground Surface: Ground surface after completion of required demolition, clearing and grubbing, scalping of sod, stripping of topsoil, excavation to grade, and subgrade preparation.
- K. Project: The Work within the Site as referenced in these Specifications and Drawings.
- L. Relative Compaction:
 - 1. Ratio, in percent, of as-compacted field dry density to laboratory maximum dry density as determined in accordance with ASTM D1557.
 - 2. Apply corrections for oversize material to either as-compacted field dry density or maximum dry density.
- M. Relative Density: Calculated in accordance with ASTM D4254 based on maximum index density determined in accordance with ASTM D4253 and minimum index density determined in accordance with ASTM D4254.
- N. Sideslope: Slope in a fill area between the edge of the shoulder and the point where the slope either intersects original ground or a benching/berm.
- O. Site: The Site is defined as the WDA as shown on the Drawings and within these specifications.

- P. Specifications: The technical specifications for the construction of the WDA National Zinc Site dated November 2018.
- Q. Topsoil: Imported material used in the final cover system on top of the Compacted Native Soil (Low Permeability).
- R. Well-Graded:
 - 1. A mixture of particle sizes with no specific concentration or lack thereof of one or more sizes.
 - 2. Does not define numerical value that must be placed on coefficient of uniformity, coefficient of curvature, or other specific grain size distribution parameters.
 - 3. Used to define material type that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids.

1.03 QUALITY ASSURANCE

- A. Independent Soils Testing Agency Qualifications: 10 years' experience in field of soils testing required for this Project, and 2 years' experience in performing specified back pressure saturated permeability tests. Calibrated instruments and equipment, and documented standard procedures for performing specified testing.
- B. Reevaluate Fill Plan when:
 - 1. Soft or loose subgrade materials are encountered wherever material is to be placed.
 - 2. Material appears to be deviating from Specifications.

1.04 SITE CONDITIONS

- A. Contours and spot elevations indicated on Drawings are approximate. Actual grades may vary. Contractor shall confirm all grades prior to starting Work by "before start of construction" topographic survey.

PART 2 PRODUCTS

2.01 SOURCE QUALITY CONTROL

- A. Gradation Tests: As necessary to locate acceptable sources of imported material.
- B. Permeability Tests: As necessary to locate acceptable sources of imported material.

- C. Samples: Collected in accordance with ASTM D75: Clearly mark to show source of material and intended use.
- D. Material containing more than 10 percent gravel, stones, or shale particles is unacceptable.
- E. Topsoil Analysis/Testing: Performed by county or state soil testing service or approved certified independent testing laboratory.

2.02 WATER FOR MOISTURE CONDITIONING

- A. Free of hazardous or toxic contaminants, or contaminants deleterious to proper compaction.

2.03 FINAL COVER SYSTEM

- A. Compacted Native Soil (Low Permeability):
 - 1. Fine-grained, free from rocks and gravels, roots and other organic matter, ashes, cinders, trash, debris, and other deleterious materials.
 - 2. Thoroughly blended to provide homogenous material relatively uniform in gradation and moisture content throughout.
 - 3. Gradation: Material having 100 percent by weight passing 1-inch sieve, 80 percent by weight passing U.S. No. 4 sieve and at least 40 percent by weight passing U.S. No. 200 sieve.
 - 4. Liquid Limit: 30 minimum to 50 maximum.
 - 5. Plasticity Index: 20 to 50.
 - 6. Compacted soil having a permeability of 1×10^{-5} centimeters per second or less (low permeability) when compacted to 90 percent relative compaction.
 - 7. Source: Perform tests as necessary to locate and confirm acceptable source of imported material, chemical constituents, and priority pollutants.
 - 8. Laboratory Permeability Testing:
 - a. Prepare Samples taken from proposed borrow source by compacting test specimens to 90 percent relative compaction at moisture content within range of optimum moisture to 5 percentage points above optimum.
 - b. Use same type and source of water in permeability tests as is added during construction, or as acceptable to Contractor.
 - c. Perform constant head triaxial permeability tests in accordance with ASTM D5084 to measure permeability of natural low permeability material.
 - 1) Trim test specimens to length-to-diameter ratio of 0.5 to 1.3.

- 2) Sheath specimens in latex membrane, placed in a triaxial cell, consolidated under average effective confining pressure of 2 psi to 3 psi, subjected to back pressure sufficient to saturate specimen, and permeated under hydraulic gradient less than 30 across specimen.
- 3) Monitor inflow and outflow volumes and rates. Record the time and flow data for at least 1 day beyond time when inflow rate equals outflow rate, at which time pressures may be relieved and physical measurements of specimens obtained for calculations.

B. Topsoil:

1. Natural, friable, sandy loam, obtained from well-drained areas, free from objects larger than 1-1/2 inches maximum dimension, and free of subsoil, roots, grass, other foreign matter, hazardous or toxic substances, and deleterious material that may be harmful to plant growth or may hinder grading, planting, or maintenance.
2. Composition: In general accordance with ASTM D5268:
 - a. Gravel-Sized Fraction: Maximum 5 percent by weight retained on a No. 10 sieve.
 - b. Sand-Sized Fraction: Minimum 30 percent to 50 percent passing No. 10 sieve.
 - c. Silt and Clay-Sized Fraction: Minimum 40 percent to 75 percent passing No. 200 sieve.
3. Organic Matter: Minimum 1.0 percent by dry weight as determined in accordance with ASTM D2974.
4. pH: Range 6.8 to 7.5 in accordance with ASTM D4972.
5. Textural Amendments: Amend as necessary to conform to required composition by incorporating sand, peat, manure, or sawdust.
6. Source: Imported material.

2.04 COMPACTION EQUIPMENT

- A. Compaction equipment shall be of suitable type and adequate to obtain the densities specified and shall provide satisfactory breakdown of materials to for a dense fill.
- B. Compaction equipment shall be operated in strict accordance with the manufacturer's instructions and recommendations. Equipment shall be maintained in such condition that it will deliver the manufacturer's rated compactive effort. If inadequate densities are obtained, larger and/or different types of additional equipment shall be provided by the Contractor. Hand-operated equipment shall be capable of achieving the specified densities.

2.05 MOISTURE CONTROL EQUIPMENT

- A. Use equipment for applying water of type and quality adequate for Work.
- B. Equipment shall not leak and will be equipped with distributor bar or other device to assure uniform application.
- C. Use equipment for mixing and drying out material consisting of blades, discs, or other equipment.

PART 3 EXECUTION

3.01 BORROW SOURCE FOR COMPACTED NATIVE SOIL (LOW PERMEABILITY)

- A. Excavate low permeability material in orderly manner to avoid inclusion of sand or other unacceptable material and to thoroughly mix natural low permeability material.
- B. Remove rocks, roots, sticks, debris, or other deleterious materials by screening or other method.
- C. Pulverize and screen low permeability material if necessary to produce uniform, homogeneous material that can be compacted to requirements of these Specifications.
- D. Perform moisture-density tests on source materials at a frequency of at least one test per 5,000 cubic yards or portion thereof, of low permeability materials in accordance with ASTM D1557.
- E. During construction, conduct at least one grain size (sieve analysis through No. 200 sieve), natural moisture content, Atterberg Limits, and moisture-density relationship tests on each 5,000 cubic yards or portion thereof, of material obtained from borrow source(s).

3.02 GENERAL

- A. Keep prepared ground surfaces free of water, debris, and foreign material during placement and compaction of fill and backfill materials.
- B. Place and spread fill and backfill materials in horizontal lifts of uniform thickness, in a manner that avoids segregation, and compact each lift to specified densities prior to placing succeeding lifts. Slope lifts only where necessary to conform to final grades or as necessary to keep placement surfaces drained of water.

- C. Do not place fill or backfill material, if fill or backfill material is frozen, or if surface upon which fill or backfill material is to be placed is frozen.
- D. Tolerances:
 - 1. Final Lines and Grades: Within a tolerance of 0.1 foot unless dimensions or grades are shown or specified otherwise.
 - 2. Grade to establish and maintain slopes and drainage as shown. Reverse slopes are not permitted.
- E. Settlement: Correct and repair any subsequent damage to structures, pavements, curbs, slabs, piping, and other facilities, caused by settlement of fill material.

3.03 PLACEMENT OF MATERIALS IN STOCKPILES

- A. Stockpile material in segregated stockpiles as shown on Drawings which is suitable for use as fill or backfill until material is needed.
- B. Confine stockpiles to within easements, rights-of-way, and approved work areas. Do not obstruct roads or streets, and not interfere with site operation or drainage.
- C. Do not stockpile material adjacent to trenches and other excavations, unless excavation sideslopes and excavation support systems are designed, constructed, and maintained for stockpile loads.
- D. Do not stockpile materials near or over existing facilities, adjacent property, or completed Work.
- E. Place material in maximum 6-inch lifts and compact by tracking with spreading equipment to provide a firm and unyielding surface. Keep stockpiles grades to drain and employ erosion control measures as specified.
- F. Stockpiles shall have slopes no steeper than 3H:1V.

3.04 SUBGRADE PREPARATION

- A. Grade existing ground surface to meet designated grades beneath cover system as shown on Drawings.
- B. Compact the surface to a density of at least 90 percent relative compaction.

3.05 TEST FILL FOR COMPACTED NATIVE SOIL (LOW PERMEABILITY)

- A. Construct in accordance with the Contractor generated test fill plan and to demonstrate the following:
 - 1. Subgrade Preparation: For 100-foot by 100-foot test pad.
 - 2. Construct compacted native soil (low permeability) material test pad, thickness as shown for compacted native soil layer.
 - a. Moisture Content: At optimum moisture content to 5 percent above optimum.
 - b. Number of rotovator and compactor passes to achieve specified compaction for each lift per accepted test fill plan.
 - c. Maximum Compacted Lift Thickness: 6 inches.
 - d. Allow sufficient space for compaction equipment to attain full operating speed prior to passing over pad in any direction.
 - 3. Excavate at least four holes, each 3 feet square, through completed pad for observation, sampling, and testing of compacted material.
- B. Demonstrate the following:
 - 1. Soil screening and pulverizing procedures for properly processing compacted native soil (low permeability) prior to compaction.
 - 2. Moisture content of compacted native soil (low permeability) at time of compaction.
 - 3. Lift thicknesses, compaction procedures, and number of passes for proposed compaction equipment.
 - 4. Dry unit weight achieved and measured by field density testing.
 - 5. In-place permeability of compacted test fill material using ASTM D6391 for at least five locations on test fill.
 - 6. Back pressure saturated permeability tests on undisturbed samples obtained with Shelby tubes after compaction is complete and at each location in-place permeability testing is performed.

3.06 PLACEMENT OF COMPACTED NATIVE SOIL (LOW PERMEABILITY)

- A. Start after successful completion of the test fill, using procedures determined optimal based on test fill test results, and after subgrade preparation.
- B. Place compacted native soil (low permeability) after preparation of subgrade in maximum loose 6-inch lifts.
- C. Remove sand or silt inclusions and replace with compacted native soil (low permeability).

- D. Rotovator:
1. Use to condition each lift of compacted native soil (low permeability) prior to compaction.
 2. Break down so that 90 percent of soil clumps are maximum 6-inch size.
 3. Use if required to make moisture content uniform throughout lift, as determined by field testing.
 4. Make as many passes as necessary to achieve specified results.
- E. Compact compacted native soil (low permeability) to a minimum density of 90 percent relative compaction at moisture content range of optimum moisture specified below.
- F. Overlap joints between adjacent compacted low permeability material sections at least 5 feet.
- G. Scarify the surface of each lift or interface with adjacent section with rotovator to depth of 2 inches prior to placing subsequent lift of compacted native soil (low permeability).
- H. Cover areas of compacted native soil (low permeability) layer that are exposed within 24 hours of placement of material.
- I. Exposed Surfaces: Compact to protect the compacted native soil (low permeability) liner from moisture changes, loss, or gain.
- J. If the compacted native soil (low permeability) liner becomes cracked or becomes softened due to moisture changes, scarify full depth of lift with rotovator, adjust moisture content to that specified below, and recompact as previously specified.
- K. Surface of Final Lift: Free from tine or roller marks, holes, depressions more than 1/2-foot deep, or protrusions extending above surface more than 1/2 inch.
- L. Barrier Layer Minimum Thickness: As shown.
- M. Perform in-place field density and moisture content tests at frequency of at least four tests for each lift of the test fill pad and for each 1,000 cubic yards of material placed or portion thereof.
- N. Determine in-place density and moisture content by any one or combination of following methods: ASTM D6938, ASTM D1556, ASTM D2216, or other methods acceptable to Contractor. If nuclear gauge method (ASTM D6938) is used to determine in-place density, moisture content readings shall be

calibrated for compacted native soil (low permeability) with at least two oven-dried moisture content tests each day.

3.07 SAMPLING OF COMPLETED COMPACTED NATIVE SOIL (LOW PERMEABILITY) LAYER

- A. Obtain a minimum of two undisturbed Samples from each sample location for each 5,000 cubic yards or portion thereof, of compacted and completed barrier layer using thin-walled Shelby tube samplers.
- B. Seal and protect each undisturbed Sample to maintain its integrity and moisture content for permeability testing.
- C. Repair sampling locations with compacted low-permeability soil or with compacted soil bentonite mixture to form continuous and watertight barrier.
- D. Label and archive one of the two samples for potential future testing.
- E. Back Pressure Saturated Permeability Tests.
 - 1. Perform at least one on undisturbed Samples obtained with Shelby tube after compaction of barrier layer is complete, at frequency of one test for each 5,000 cubic yards or portion thereof, of lift placement.
 - 2. Test Samples in a flexible wall perimeter using back pressure saturation in accordance with ASTM D5084.
 - 3. If specified permeability is exceeded, excavate defective areas and reconstruct to meet permeability and density requirements.

3.08 MOISTURE CONTROL

- A. Implement Moisture Control Plan.
- B. During compacting operations, maintain the moisture content in each lift of natural low permeability material within range of optimum to plus 5 percentage points above optimum.
- C. If too dry, add water to material by sprinkling fill, then mix to make moisture content uniform throughout lift.
- D. If too wet, aerate material by blading, discing, harrowing, or other methods, to hasten drying process.

3.09 PLACEMENT OF TOPSOIL

- A. Do not place topsoil when subsoil or topsoil is frozen, excessively wet, or otherwise detrimental to the Work.

- B. Mix soil amendments and other soil additives, identified in analysis reports with topsoil before placement and mix thoroughly into entire depth of topsoil before planting or seeding. Delay mixing of fertilizer if planting or seeding will not occur within 3 days.
- C. Uniformly distribute to within 1/2 inch of final grades. Fine grade topsoil eliminating rough or low areas and maintaining levels, profiles, and contours of subgrade.
- D. Remove stones exceeding 1-1/2-inch diameter, roots, sticks, debris, and foreign matter during and after topsoil placement.
- E. Remove surplus subsoil and topsoil from Site. Grade topsoil as necessary and place in condition acceptable for planting or seeding.

3.10 SITE TESTING

- A. Cooperate with the testing agency by leveling and backfilling test areas designated by Contractor.
- B. If compaction tests indicate density or moisture content is not as specified, terminate material placement and take corrective action prior to continuing placement.
- C. If tests conducted indicate that compacted native soil (low permeability) does not meet specified requirements, terminate material placement until corrective measures are taken. Remove and replace material that does not conform to specified requirements.

3.11 REPLACING OVEREXCAVATED MATERIAL

- A. Replace excavation carried below grade lines shown or established as follows:
 - 1. Beneath Fill or Backfill: Same material as specified for overlying fill or backfill.

3.12 FIELD QUALITY CONTROL TESTING

- A. During fill and backfill activities, soil materials shall be verified for gradation and placement thicknesses in conformance with the Specifications and as shown on Drawings.

END OF SECTION

**SECTION 31 32 00
SOIL STABILIZATION****PART 1 GENERAL**

1.01 REFERENCES

A. The following is a list of standards that may be referenced in this section:

1. Official Seed Analysts of North America.

1.02 DEFINITIONS

- A. Drawings: The WDA Drawings dated November 2018.
- B. Maintenance Period: Begin maintenance immediately after each area is planted and continue for a period of 8 weeks after planting under this section is completed.
- C. Project: The Work within the Site as referenced in these Specifications and Drawings.
- D. Satisfactory Stand: Grass or section of grass of 10,000 square feet or larger that has:
1. No bare spots larger than 3 square feet.
 2. Not more than 10 percent of total area with bare spots larger than 1 square foot.
 3. Not more than 15 percent of total area with bare spots larger than 6 square inches.
- E. Site: The Site is defined as the WDA as shown on the Drawings and within these specifications.
- F. Specifications: The technical specifications for the construction of the WDA National Zinc Site dated November 2018.

1.03 DELIVERY, STORAGE, AND PROTECTION

- A. Seed: As specified in this Section.
- B. Hydroseeding Mulch: Mark package of wood fiber mulch to show air dry weight.

1.04 SEQUENCING AND SCHEDULING

- A. Prepare topsoil as specified in this Section.
- B. Complete soil preparation, seeding, liming, fertilizing, mulching within 10 days after final grades have been reached.
- C. Seeding: Perform under favorable weather conditions during seasons that are normal for such Work as determined by accepted local practice.

1.05 MAINTENANCE

- A. Operations: As specified in Article Seed of this Section.
 - 1. Watering: Keep seeded surface moist.
 - 2. Washouts: Repair by filling with topsoil, fertilizing, seeding, and mulching.
 - 3. Reseed unsatisfactory areas or portions thereof immediately at end of maintenance period if a satisfactory stand has not been produced.
- B. Maintenance Service Agreement: Provide for period of 2 years from Substantial Completion.

PART 2 PRODUCTS

2.01 FERTILIZER

- A. Commercial, uniform in composition, free-flowing, suitable for application with equipment designed for that purpose.
- B. Application Rates: Determined by soil analysis results.
- C. Top Dress Type: As recommended by local authority.

2.02 SEED

- A. Fresh, clean new-crop seed that complies with the tolerance for purity and germination established by Official Seed Analysts of North America.

Species	Variety	PLS (lbs/acre) ¹	Percent of Mix (%)	PLS (lbs/acre) ²
Big Bluestem	Kaw	12.0	20	2.40
Little Bluestem	Aldous	8.0	15	1.20
Indiangrass	Osage	12.0	25	3.00

Species	Variety	PLS (lbs/acre) ¹	Percent of Mix (%)	PLS (lbs/acre) ²
Switchgrass	Blackwell	6.0	20	1.20
Sideoats grama	El Reno	12.0	10	1.20
Western Wheatgrass	Barton	20.0	10	2.00
<p>Note: PLS: Pure live seed. lbs/acre: pounds per acre. ¹: Minimum PLS for pure seeding obtained from Specifications. ²: Seeding rate as part of the seeding mixture (PLS multiplied by percent mix).</p>				

2.03 MULCH

A. Wood Cellulose Fiber Mulch:

1. Specially processed wood fiber containing no growth or germination inhibiting factors.
2. Dyed a suitable color to facilitate inspection of material placement.
3. Manufactured such that after addition and agitation in slurry tanks with water, material fibers become uniformly suspended to form homogenous slurry.
4. When hydraulically sprayed on ground, material will allow absorption and percolation of moisture.

2.04 TACKIFIER

- A. Derived from natural organic plant sources containing no growth or germination inhibiting materials.
- B. Capable of hydrating in water, and to readily blend with other slurry materials.
- C. Wood Cellulose Fiber: If tackifier is added as a separate layer, add as tracer, at rate of 150 pounds per acre.
- D. Manufacturers and Products:
 1. Organic Tackifier: Hydrostick, Finn Corp, 9281 LeSaint Dr., Fairfield, OH 45014; (800) 543-7166.
 2. Organic Tackifier: Hydrotack, Finn Corp, 9281 LeSaint Dr., Fairfield, OH 45014; (800) 543-7166.

2.05 EROSION CONTROL MATTING

- A. Excelsior mat or straw blanket; staples as recommended by matting manufacturer.
- B. Manufacturers and Products:
 - 1. Akzo Industries, Asheville, NC; Curlex Mat.
 - 2. North American Green, Evansville, IN; S150 blanket.

2.06 S150 BLANKET TACKIFIER

- A. Derived from natural organic plant sources containing no growth or germination-inhibiting materials.
- B. Capable of hydrating in water, and to readily blend with other slurry materials.
- C. Wood Cellulose Fiber: Add as tracer, at rate of 150 pounds per acre.
- D. Manufacturers and Products:
 - 1. Chevron Asphalt Co.; CSS-1.
 - 2. Terra; Tack AR.
 - 3. J-Tack; Reclamare.

PART 3 EXECUTION

3.01 SOIL PREPARATION

- A. Grade areas to smooth, even surface with loose, uniformly fine texture.
 - 1. Roll and rake, remove ridges, fill depressions to meet finish grades.
 - 2. Limit such Work to areas to be planted within immediate future.
 - 3. Remove debris, and stones larger than 1-1/2-inch diameter, and other objects that may interfere with planting and maintenance operations.
- B. Before start of hydroseeding, and after surface has been shaped and graded, and lightly compacted to uniform grade, scarify soil surface to a depth of 1 inch.
- C. Moisten prepared areas before planting if soil is dry. Water thoroughly and allow surface to dry off before seeding. Do not create muddy soil.
- D. Restore prepared areas to specified condition if eroded or otherwise disturbed after preparation and before planting.

3.02 SEEDING

- A. Start within 2 days of preparation completion.
- B. Seeding shall not be done during windy weather or when the ground is frozen, excessively wet, or otherwise unsuitable. Seed shall be placed at the rate and mix specified herein. Seed shall be sown by an approved hydroseeder that uses water as the carrying agent and maintains continuous agitation through paddle blades. It shall have an operating capacity sufficient to agitate, suspend, and mix into a homogenous slurry the specified amount of seed and water or other material. Distribution and discharge lines shall be large enough to prevent stoppage and shall be equipped with a set or hydraulic discharge spray nozzles that will provide a uniform distribution of the slurry.
- C. Seed and fertilizer may be applied in one application. Apply within 30 minutes of mixing to prevent fertilizer from burning seed.
- D. Apply by hydroseeding method on moist soil, but only after free surface water has drained away. Prevent drift and displacement of mixture into other areas.
- E. Hydroseed all areas disturbed by Contractor, except for areas covered with structures, rock, or pavements.
- F. Upon application, allow absorption and percolation of moisture into ground.
- G. Application:
 - 1. Prepare and apply slurry as follows:
 - a. Seed Mix: 30 pounds per acre.
 - b. Fertilizer: 200 pounds per acre.
 - c. Wood Cellulose Fiber Mulch: 1,500 pounds per acre.
 - d. Water: As necessary.
 - e. Tackifier: 40 pounds to 60 pounds per acre.

3.03 MULCHING

- A. Apply uniformly on seeded areas that will remain undisturbed for 7 days or more, as prescribed by the Contractor's Erosion Control Plan. Do not apply mulch on seeded areas that will be immediately covered with erosion control matting.

- B. Application: Sufficiently loose to permit penetration of sunlight and air circulation, and sufficiently dense to shade ground, reduce evaporation rate, and prevent or materially reduce erosion of underlying soil.

- 1. Wood Cellulose Fiber: 1,500 pounds per acre.

3.04 EROSION CONTROL MATTING

- A. Place in ditches and on seeded slopes 3H:1V and steeper, staple/stake in place and with the appropriate overlap in accordance with manufacturer's instruction. Overlap matting such that the uphill mat overlaps on top of the downhill mat. Matting shall be placed in areas requiring additional stabilization.

3.05 TACKIFIER

- A. Can be applied with mulch or after mulch is in place.

3.06 HYDROSEED MAINTENANCE

- A. Contractor shall apply a second application of the specified fertilizer to each hydroseeded area during the growing season that follows the growing season in which each area was seeded.
- B. Damaged or washed out areas shall be filled and repaired at no additional expense to the Owner.
- C. Hydroseeded areas that do not properly germinate or grow shall be reseeded in accordance with the specifications for the original seeding. Hand broadcasting will not be allowed.
- D. Upon completion of maintenance period, determine if a satisfactory stand has been established.
- E. If a satisfactory stand has not been established, make another determination following the next growing season.

3.07 STOCKPILES

- A. The Contractor shall limit the amount of silt carried away in stormwater runoff from temporary stockpiles by installing sediment fences around the base of each stockpile, as prescribed by the Contractor's Erosion Control Plan.
- B. When the Contractor removes material from the stockpiles, the Contractor shall replace and repair erosion control measures.

- C. Control erosion from temporary stockpiles by covering per Detail 2/C-5.

END OF SECTION

