DIVISION 200
EARTHWORK
SECTION 201
CLEARING AND GRUBBING

DESCRIPTION

201.01. This work consists of clearing, grubbing, removing, and disposing of vegetation and debris within the limits of the right of way, easement areas, borrow pits, and other areas shown in the Contract or required by the work. Vegetation and objects designated to remain shall be preserved free from injury or defacement.

CONSTRUCTION REQUIREMENTS

201.02. The Engineer will designate all trees, shrubs, plants, and other objects to remain. Every object that is designated to remain and is damaged shall be repaired or replaced as directed at the Contractor's expense.

Clearing and grubbing shall extend to the toe of fill or the top of cut slopes, unless otherwise designated.

All surface objects, trees, stumps, roots, and other protruding obstructions not designated to remain shall be cleared and grubbed. In areas to be rounded at the tops of backslopes, stumps shall be removed to at least 2 feet below the surface of the final slope line.

Except in areas to be excavated, all holes resulting from the removal of obstructions shall be backfilled with suitable material and compacted per subsection 203.06.

Burning of perishable material will not be permitted without the written approval of the Engineer. If permitted, perishable material shall be burned under the constant care of the Contractor, at times and in a manner that will not endanger the surrounding vegetation, adjacent property, or objects designated to remain. Burning shall be done per applicable laws and ordinances.

No material or debris shall be disposed of within the project limits without the written permission of the Engineer. Material or debris that is disposed of within the project limits shall be buried to a depth of at least 2 feet and the surface shall be reshaped to match the adjacent ground line. The Contractor shall make all arrangements to obtain written permission from property owners for disposal locations outside the limits and view of the project. Copies of this written agreement shall be furnished to the Engineer before the disposal area is used.

All cleared merchantable timber shall be removed from the project and shall become the property of the Contractor.
Branches on trees or shrubs shall be removed as directed. Branches of trees extending over the roadbed shall be trimmed to give a clear height of 20 feet above the roadbed surface. All trimming shall be done per good tree surgery practices.

The Contractor shall clear and grub the areas within the excavation or embankment grading limits and shall include the removal from the ground of brush, roots, sod, grass, residue of agricultural crops, sawdust, and other vegetable matter. See subsection 208.04(e) for disturbed area limits.

METHOD OF MEASUREMENT

201.03. Measurement will be by one of the following methods:

Area Basis. The work to be paid for will be the number of acres acceptably cleared and grubbed, including scalping, within the limits shown on the plans or staked by the Engineer.

Lump Sum Basis. When the Contract contains a clearing and grubbing lump sum item, no measurement will be made.

BASIS OF PAYMENT

201.04. The accepted quantities of clearing and grubbing will be paid for at the contract unit prices as follows:

Area Basis. The quantities will be paid for at the contract unit price bid per acre for each pay item that appears in the bid schedule.

Lump Sum Basis. When the bid schedule contains a lump sum item, the lump sum price so bid will be paid and shall be full compensation for clearing and grubbing the entire project.

Clearing and grubbing beyond the limits designated under this item will be paid for as Extra Work per subsection 104.03.

Payment will be made under:

Pay Item	Pay Unit
Clearing	Acre, Lump Sum
Grubbing	Acre, Lump Sum
Clearing and Grubbing	Acre, Lump Sum

Exclusions. When the bid schedule does not contain an estimated quantity or a lump sum item for clearing and grubbing, the work will not be paid for separately, but shall be included in the work.

SECTION 202
REMOVAL OF STRUCTURES AND OBSTRUCTIONS

DESCRIPTION

202.01. This work consists of the removal and disposal of trees, slope and ditch protection, abandoned utility services, curb, gutter, pipes, sidewalk, structures, bridges or parts of bridges, railroad appurtenances, traffic control devices, impact attenuators, guardrail, fences, foundations, detours, pavements, pavement markings, and all other obstructions that are not designated or permitted to remain. It shall also include salvaging, stockpiling and loading salvable materials, sandblasting, plugging structures, cleaning culverts, and sawing and cutting to facilitate controlled breaking and removal of concrete and asphalt to a neat line. Except in areas to be excavated, the resulting trenches, holes, and pits shall be backfilled. This work also consists of plugging and abandoning water wells as designated in the Contract.
Materials removed and not designated in the Contract to be salvaged or incorporated into the work shall become the property of the Contractor.

This work consists of removal of the existing bridge(s) at the locations shown in the plans. Bridge removal shall consist of the complete removal of all superstructure and substructure elements including caissons and piling to a depth of at least two (2) feet below finished grade unless otherwise shown on the plans. Time limitations for the work shall be as shown in the contract and/or plans.

CONSTRUCTION REQUIREMENTS

202.02 General. The Contractor shall raze, remove, and dispose of all structures and obstructions that are identified on the project, except utilities, structures and obstructions removed under other contractual agreements, and salvable material designated to remain the property of the Department.

Basements and other cavities left by structure removal shall be filled to the level of the surrounding ground with suitable material and, if within the construction limits, shall be compacted per subsection 203.06.

Bridges, culverts, and other drainage structures shall not be removed until satisfactory arrangements have been made to accommodate traffic and drainage.

Blasting or other operations used to remove existing structures or obstructions, which may damage new construction, shall be completed before placing the new work.

Where portions of structures are to be removed, the portions designated to remain shall be prepared to fit the new construction and shall be protected from damage. All damage to structures designated to remain in place shall be repaired at the Contractor's expense. Method of repair shall be approved by the Engineer.

Sawing of concrete shall be done to a true line, with a vertical face, unless otherwise specified. The minimum depth of a saw cut in concrete shall be 2 inches or to the depth of the reinforcing steel, whichever occurs first.

Removed concrete and asphalt material may be used to construct embankments per subsection 203.07.

Where culverts or sewers are to be left in place and plugged, the ends of concrete or

masonry culverts shall be filled with suitable material. The ends of corrugated metal pipe culverts shall be crushed. Culvert and sewer ends are to be sufficiently filled or crushed to prevent future settlement of embankments. Plugging of culverts shall include removal of headwalls and other appurtenances where necessary to accommodate the work.

Procedures for abandoning water wells shall conform to the Revised and Amended Rules and Regulations of the State of Colorado, Division of Water Resources, Board of Examiners of Water Well Construction and Pump Installation Contractors, (Board). The State Engineer who acts for the Board is located at 818 Centennial Bldg., 1313 Sherman St., Denver, CO 80203 (Phone 303-866-3587).

The Contractor shall properly plug and abandon the designated wells and file an abandonment report for each. An abandonment report shall be prepared using Form GWS-9 obtained from the Board at the above address. The report shall describe the well location and how it was plugged. This report shall be submitted to the Board, with a copy given to the Project Engineer, within 60 days after performing the work.

Existing guardrail shall not be removed unless the need for the guardrail has been eliminated or the hazard has been protected or delineated. The duration and manner of protection or delineation shall be submitted in writing for approval by the Engineer.
Perform the removal of the existing bridges per the requirements in this specification and Standard Specification 107.06. The Construction Plan requirements shown in Revision of Section 107-Performance of Safety Critical Work shall be included in the Bridge Removal Plan.

When removal operations are located over or in proximity to a railroad or any live water way, additional coordination including potential incident emergency/risk management notifications with the railroad or other agency (United States Army Corps of Engineers (USACE), US Fish and Wildlife Service, US Forest Service, etc.) shall be required.

The Contractor shall submit a Bridge Removal Plan to the Engineer for review and acceptance at least 2 weeks prior to the Pre-removal Conference. This Plan shall detail procedures, sequences, and all features required to perform the removal in a safe and controlled manner. The Bridge Removal Plan shall be prepared by the Contractor's Engineer and contain the Seal of a Professional Engineer registered in the State of Colorado. The Contractor's Engineer shall stamp and sign the Bridge Removal Plan "Approved for Construction". Submit the Bridge Removal Plan to the Engineer of Record, the corresponding CDOT Region Bridge Unit Leader and the Engineer for review and concurrence with general specification compliance, but it will not be approved. Submit comments from the referenced reviewers of the Bridge Removal Plan in writing to the Contractor within seven calendar days from receipt of the plan and prior to the Pre-removal Conference. Acceptance of the Bridge Removal Plan will be contingent upon the Contractor adequately addressing all written comments to the satisfaction of the Engineer.

The Bridge Removal Plan shall provide complete details of the bridge removal process, including:

(1) The removal sequence corresponding to the construction phasing shown on the plans, including calculations and analysis of the Contractor's removal equipment as related to loading capacity and any crane bearing during the removal operations. Sequence of operation shall include a detailed schedule that complies with the working hour limitations.

(2) Equipment descriptions including size, number, type, capacity, backup/standby need, and location of equipment during removal operations.

(3) Roles, responsibilities, and positioning of all CDOT project management, construction supervision, and critical workers during removal activities. Include instructions for communicating and managing a 'safe-all stop' scenario in this section, if unexpected hazards are discovered during the activity.

(4) Shoring that exceeds 5 feet in height, all falsework and bracing. Shoring design shall follow the AASHTO Guide Design Specifications for Bridge Temporary Works, or other design standard as approved by the Engineer.

(5) Shoring construction, including verification and proof testing shall be per Section 206. Shoring will not be measured and paid for separately but shall be included in the cost of item 202 – Removal of Bridge, unless otherwise provided on the plans or as directed by the Engineer.

(6) Details, locations, and types of protective coverings to be used. The protective covering shall prevent materials, equipment, and debris from falling onto the property below. When removal operations are located over or in proximity to a live waterway, railroad, or pedestrian/bicycle path, additional width of protective covering sufficient to protect these facilities shall be required. Include detailed methods of protection of the existing roadway facilities, including measures to assure that people, property, utilities, and improvements will not be endangered. Consider a catastrophic, unplanned failure of the structure during demolition as worst-case scenario.

(7) Detailed methods for protection of live waterways including minimization of turbidity and sedimentation, and protection of existing wetlands.

(8) Detailed methods for mitigation of fugitive dust resulting from the demolition.

(9) Details for dismantling, removing, loading, and hauling steel elements.

(10) Locations of railroad tracks, roadways, utilities (overhead and underground), structures or facilities located within the area of the bridge removal operations.

(11) Detailed methods of fire suppression.

(12) Methods of Handling Traffic, including bicycles and pedestrians, in a safe and controlled manner.

(13) Details for managing project communications, media, and on-looking public during demolition as needed.

(14) Contingency planning for unexpected weather.

(15) Details for emergency and post-incident management in a catastrophic failure or other serious incident or worker injury.

The Contractor's Engineer shall be responsible for the stability of the existing "in service"

structure for any deviation from the bridge removal limits shown on the construction phasing plans. The Contractor is also responsible for the protection of any portion of the structure to remain in place for later phases, including protection from the Contractor's construction activities.

Use the more stringent criteria of the design guidelines, when a temporary works or demolition guideline is provided by a railroad or local agency.

Hold a Pre-removal Conference at least seven days prior to the beginning of removal of the bridge. The Engineer, Staff Bridge, the Contractor, the subcontractor performing the removal(s), the Contractor's Engineer, the Traffic Control Supervisor (TCS), and CDOT/Project Communications Staff shall attend the Pre-removal Conference. Finalize the Bridge Removal Plan at this Conference. Record meeting minutes and the attendance list.

The Contractor's Engineer shall seal items (1) and (4) listed above in the final Bridge Removal Plan. Demonstrate with adequate calculations that the loads and impact of the Contractor's demolition equipment do not impose detrimental effects on the stability of the structure remaining after the end of each phase of removal. Review these calculations before traffic is allowed to resume in its normal configuration.

The final Bridge Removal Plan shall be stamped "Approved for Construction" and sealed by the Contractor's Engineer. The Contractor shall address all written comments from the Engineer and submit a final Bridge Removal Plan to the Engineer. The Contractor shall not begin the removal operations without the Engineer's written acceptance of the final Bridge Removal Plan.

Submittal of the final Bridge Removal Plan to the Engineer, and field inspection performed by the Engineer, will in no way relieve the Contractor and the Contractor's Engineer of full responsibility for the removal plan and procedures.

Work within Railroad right-of-way shall be per Section 107. For bridge removal over railroads, including overhead wires, tunnels and underground facilities, approval of the bridge removal plans will be contingent upon the drawings being satisfactory to the railroad company involved.

The Contractor's Engineer shall be onsite during safety critical removal operations considered to have a high degree of safety risk. At or before the Pre-removal Conference, the Contractor and the Engineer shall agree if the Bridge removal operations are of high safety risk. Document said agreement in writing. The Contractor's Engineer shall inspect and provide written approval of each phase of the removal operations corresponding to the construction phasing shown on the plans prior to allowing vehicles or pedestrians on, below, or adjacent to the structure. The Contractor's Engineer shall certify in writing that the falsework, bracing, and shoring conform to the details of the final Bridge Removal Plan. Submit a copy of the certification to the Engineer. If any part of the adjacent structure designated to remain in place is damaged during removal operations, the Contractor's Engineer shall perform a full and complete engineering evaluation of the structure and submit a written report to the Engineer. This evaluation, as well as any additional costs to stabilize the structure due to or resulting from the Contractor's actions or inactions, shall be borne solely by the Contractor. Do not permit further work involving the bridge until the report and any subsequent remedial stability measures are complete and satisfactory to the Engineer and Staff Bridge.

The Contractor shall have all necessary workers, materials, and equipment at the site prior to

closing any lanes to traffic to accommodate bridge removal operations. Pursue work promptly and without interruption until reopening the roadway to traffic.

Removal of hazardous material shall be per Section 250.

The Contractor shall take all necessary steps to avoid contaminating state waters, per subsection 107.25.

If an unplanned event occurs or the bridge removal operation deviate from the submitted Bridge Removal Plan, the bridge removal operations shall immediately cease. Perform all necessary work to ensure worksite safety. The Contractor shall submit to the Engineer the procedure or operation proposed by the Contractor's Engineer to correct or remedy the occurrence of this unplanned event or to revise the final Bridge Removal Plan. The Contractor's Engineer shall submit a written report to the Engineer within 24 hours of the event summarizing the details of the event and the procedure for correction. The Engineer shall review the information submitted regarding the unplanned event and provide written acceptance of the corrective action or remedy procedure prior to resuming operations.

Before removal of the protective covering, the Contractor shall clean the protective covering of all debris and fine material.

The Engineer may suspend bridge removal for the following reasons:

(1) Final Bridge Removal Plan has not been submitted, or written acceptance has not been provided by the Engineer to begin the removal.

(2) The Contractor is not proceeding per the final Bridge Removal Plan, procedures, or sequence.

(3) The Contractor's Engineer is not onsite to conduct inspection for the written approval of the work.

(4) Safety precautions are deemed to be inadequate.

(5) Existing neighboring facilities are damaged because of bridge removal.

Suspension of bridge removal operations shall in no way relieve the Contractor of their responsibility under the terms of the Contract. A suspension ordered as a direct result of (1) through (5) above, shall be considered a non-excusable delay. Bridge removal operations shall not resume until modifications have been made to correct the conditions that resulted in the suspension, as approved in writing by the Engineer.

The Contractor shall notify all emergency response agencies of the proposed removal work and any detours a minimum of three days in advance of the work. This shall include the Colorado State Patrol, local Police Department, local Fire Department, all local ambulance services, and the Sheriff's Department, as appropriate.

All required traffic control devices, nighttime flagging stations, barricades and VMS signs

shall be in place, with detours in operation, prior to the beginning of removal operations each day. Night work shall conform to the requirements of the MUTCD, Parts 1, 5, and 6.

Prior to reopening the roadway to public traffic, remove all debris, protective pads, materials, and devices and sweep the roadways clean. The Contractor shall install any restriping necessary to achieve full compliance pavement markings prior to reopening. All costs related to pavement marking replacement shall be included in the work.

Do not use explosives for removal work without the written approval of the Engineer.

Removal shall include the superstructure, the substructure, which includes the piers, abutments and wingwalls, the bridge rail, and any approach slabs and sleeper slabs.

During removal of the substructure, take it down to at least 2 feet below the natural existing or future ground surface at the lowest point of interface with the abutment, unless otherwise approved by the Engineer. Holes resulting from substructure removal shall be backfilled with Structure Backfill (Class 2) to the adjacent existing grades.

All other materials removed from the existing structure shall become the property of the Contractor and shall be properly disposed of offsite at the Contractor's expense, unless otherwise stated on the plans.

The Contractor shall not damage the existing structures, facilities, and surrounding roadways during the removal operations. Repair damage that occurs immediately, at the Contractor's expense.

202.03 Salvable Material. All salvable material designated in the Contract to remain the property of the Department shall be removed without damage, in sections or pieces that may be readily transported and shall be stockpiled by the Contractor at specified locations within the project limits. The Contractor shall safeguard salvable materials and shall be responsible for the expense of repairing or replacing damaged or missing material until it is incorporated into the work or is loaded onto Department equipment by the Contractor.

Protect and remove all brass bridge plaques prior to demolition of the bridge. Deliver plaques to the Region Environmental group or Staff Bridge.

202.04 Signs and Traffic. Removal of signs shall include removal of posts, footings, pedestals, sign panels, and brackets. Concrete adhering to salvable signposts shall be removed.

Removal of sign panel shall include removal of the panel and its attachment hardware from the existing installation and adjusting the spacing of the remaining panels.

The removal of traffic signal items shall include poles, mast arms, signal heads, span wires, footings, all attachment hardware, and other incidental materials. Removal of signal pole or pedestal pole shall include pole, span wire, cable, signal heads, overhead sign support wire, footings, and pedestrian push buttons. Removal of traffic signal controller and cabinet shall include removal of the footing and all auxiliary equipment contained within the cabinet.

202.05 Pavement Markings. Pavement markings shall be removed from the pavement to the maximum extent possible, by methods that do not materially alter or damage the surface or texture of the pavement, to the satisfaction of the Engineer. The proposed method of pavement marking removal shall be designated by the Contractor at the Pre-construction Conference and approved by the Engineer. Operations that do not produce the desired result, damage the pavement, or may constitute a hazard to the traveling public will not be permitted. Materials deposited on the pavement because of removal of pavement markings shall be promptly removed so as not to interfere with traffic or roadway drainage.

Pavement markings, designated to be removed, shall be removed before any change is made in traffic patterns. Temporary marking tape sections longer than one foot shall be removed before placement of the final pavement course. All tape shall be removed on sections where tape conflicts with revised traffic lanes before opening of new lanes to traffic.

Removal of Temporary Pavement Marking on Final Alignment. Temporary pavement marking paint on the approved final alignment shall be removed completely from the roadway surface at locations of permanent pavement markings as shown on the plans. The removal location shall be clean, dry and free of laitance, oil, dirt, grease, paint, and other foreign contaminants before application of final pavement marking.

The Contractor shall not remove more pavement marking paint than what can be replaced with permanent pavement marking during the same working day or working period. If a storm or other event prevents the Contractor from completing the placement of permanent marking, the Contractor shall halt the removal operation and place raised flexible pavement markers where temporary pavement markings have been removed but the permanent markings have not been placed. Raised flexible pavement markers shall be installed with one marker at 40-foot centers. Raised flexible pavement markers shall remain in place while the pavement is drying before the permanent marking application. Permanent marking application shall resume when the pavement is dry and has had no moisture for a minimum of 24 hours.

Removal of Temporary Pavement Marking on Transitions. Removal of pavement marking paint on temporary transitional alignments shall be performed by grinding or water blasting. The removal shall result in 100 percent removal of the paint and a wide swath of ground pavement surrounding the former location of the temporary paint. The width of the swath shall be as follows; the center of the swath shall be the location of the paint line:

Table 202-1

REMOVAL OF TEMPORARY PAVEMENT MARKING - SWATH SIZE

Width of Pavement Marking to be Removed	Width of Swath
less than 8 inches	12 inches
more than 8 inches	15 inches

202.06 Detours. The Contractor shall completely remove the detour and dispose of the materials per the Contract.

202.07 Pavements, Sidewalks, Curbs. All concrete pavement, sidewalks, structures, curbs, gutters, designated for removal, shall be disposed of per subsection 201.02. Concrete pavement to be broken and left in place shall be broken so the largest fragment does not exceed 1 square yard in surface.

202.08 Portions of Structures. Unless otherwise directed, remove the substructures of removed structures to 2 feet below the natural stream bottom and remove those parts outside of the stream down 2 feet below natural ground or finished surface. Remove such portions of existing structures, which lie wholly or in part within the limits of a new structure, as necessary to accommodate the construction of the proposed structure.

Reinforcing steel projecting from the structure, designated to remain, shall be cleaned and aligned to the new construction.
Required dowels shall be securely grouted with approved grout. When concrete is removed, all exposed reinforcing steel designated to remain in place shall be cleaned by sandblasting to sound steel free of oil, dirt, concrete fragments or laitance, loose rust scale, and other coatings that would destroy or inhibit the bond with the new concrete.

Adequate measures shall be taken by the Contractor to protect the steel from contamination or corrosion. Reinforcing steel, contaminated because of the Contractor's failure to provide adequate protection, shall be re-sandblasted at the Contractor's expense with no allowance for contract time extension.

A protective device shall be placed between the sandblasting operations and the traveling public.

202.09 Removal of Asphalt Mat (Planing). The Contractor shall not commence planing operations until the hot mix asphalt, (HMA) Mix Design (CDOT Form 43) has been approved and signed.

Before beginning planing operations, the Contractor shall submit a planing plan for approval by the Engineer. This plan shall include as a minimum:

The number and types of planers to be used.

The width and location of each planing pass.

The number and types of brooms to be used, and their locations with respect to the planers. The Contractor shall have at least one back up broom on the project at all times in case one of the operating brooms breaks down.

Each planer shall conform to the following:

The planer shall have sufficient power, traction, and stability to maintain an accurate depth of cut. The propulsion and guidance system of the planer shall be maintained in such condition that the planer may be operated to straight and true lines.

Operation with broken or missing teeth will not be allowed. Worn teeth shall be replaced if the planer does not produce a uniform surface.

The planer shall be capable of picking up the removed asphalt in a single operation.

A self-loading conveyer shall be an integral part of the planer. Windrows will not be allowed.

All planed areas shall be broomed with a pickup broom, unless otherwise specified, before being opened to traffic. A sufficient number of brooms shall be used immediately after planing to remove all planed material remaining on the roadway.

If the Contractor fails to adequately clean the roadway, work shall cease until the Engineer has approved the Contractor's revised written proposal to adequately clean the roadway.

At the completion of each day's work, vertical edges caused by planing that are greater than 1 inch in height shall be: Longitudinal - tapered to not less than a 3:1 slope, Transverse - tapered to not less than a 50:1 slope.

The roadway shall be left in a safe and usable condition at the end of each workday. All required pavement markings, removed by the planing, shall be restored before the roadway is opened to traffic.

All planing shall be completed parallel to the travel lanes unless otherwise directed by the Engineer.

All planing shall be completed full width before resurfacing commences.

202.10 Clean Culvert. Culverts designated in the Contract to be cleaned shall be cleaned by removing all sedimentation and debris from within the culvert and all appurtenant structures.

METHOD OF MEASUREMENT

202.11. When the Contract provides payment for removal of obstructions on a lump sum basis, this payment will include all stipulated structures and obstructions encountered within the right of way per this section. When the Contract provides payment for the removal of specific items on a unit basis, measurement will be by the unit.

Removal of pavement marking will be measured in square feet, completed and accepted. Sandblasting of pavement that is to be covered with pavement marking material will be measured as the same area as measured for the pavement marking where the sandblasting is required.

Removal of asphalt mat (planing) will be measured by the area in square yards, completed to the required depth, and accepted.

Sandblasting reinforcing steel will be measured by the square yard of deck surface. Multiple layers of reinforcing steel within a common area of the deck exposed and requiring sandblasting will not be measured separately.

Clean culvert will be measured by the number of culverts acceptably cleaned as designated on the plans, irrespective of the kind or size involved.

Abandon well will be measured by the actual number plugged, abandoned, and the abandonment report submitted.

Removal of temporary pavement marking on transitions will be measured by the actual square feet of the swath that is removed for the required width. Removal of pavement marking for the permanent alignment will be measured as the actual in square feet of pavement marking that is removed.

BASIS OF PAYMENT

202.12 The accepted quantities will be paid for at the contract unit price for each of the pay items listed below that appear in the bid schedule. Payment shall be full compensation for sawing, removing, disposal, excavation and subsequent backfill, and salvage of materials removed, their custody, preservation, storage, and disposal as provided.

Payment will be made under:

Pay Item	Pay Unit
Removal of Bridge	Each
Removal of Structures and Obstructions	Lump Sum
Removal of Asphalt Mat (Planing)	Square Yard
Removal of Pavement Marking	Square Foot
Removal of Pavement Marking (12 Inch)	Square Foot
Removal of Pavement Marking (15 Inch)	Square Foot
Plug	Each
Clean Culvert	Each
Abandon Well	Each
Sandblasting	Square Foot
Sandblasting (Reinforcing Steel)	Square Yard

When the Contract does not include pay items for removal of structures and obstructions, the removal will not be paid for separately but shall be included in the work.

Payment for abandon well will be full compensation for all labor and materials required to complete the work, including preparing and submitting the abandonment report.

Temporary raised flexible pavement markers used per subsection 202.05(a) will not be measured and paid for separately but shall be included in the work.

Payment for Removal of Bridge will be full compensation for all labor and materials required to complete the work, including, preparation and implementation of the Bridge Removal Plan, Engineering work, inspection, equipment, debris handling and disposal, salvaging, handling and storage of salvable materials, handling and disposal of all hazardous materials and disposal of non-salvable materials.

Lighting required for nighttime operations will not be measured and paid for separately but shall be included in the work.

DIAMOND GRINDING
CONCRETE PAVEMENT

DESCRIPTION

202.13 Diamond Grinding Concrete Pavement. This work consists of rehabilitating existing concrete pavement by diamond grinding to restore smoothness and texture at the locations indicated on the plans such that the surface area has a minimum average macrotexture depth of 0.05 inches when tested per Colorado Procedure 77B. The maximum grinding depth shall be 0.25 inches unless approved by the Engineer.

MATERIALS

202.14. A hardness of approximately 7 is anticipated for the existing concrete pavement based on the Mohs hardness scale. For bidding purposes, the Contractor shall be responsible for verifying the hardness of the existing concrete pavement.

CONSTRUCTION REQUIREMENTS

202.15. Before beginning work on the project, the Contractor shall submit to the Engineer for approval a detailed plan for accomplishing the grinding. The plan shall include a sequence for grinding that produces the desired surface ride qualities with a minimum macrotexture depth throughout the project. Grinding shall be performed in the longitudinal direction. The entire surface width of the driving and passing lane pavement shall be ground until the pavement surfaces on both sides of all transverse joints and random cracks are in the same plane and meet the smoothness requirements specified. Grinding shall begin and end at lines normal to the pavement centerline.

The Contractor shall grind driving and passing lane pavement surfaces within designated limits as shown on the plans. The finished grinding shall maintain the existing cross slope of the roadway in the driving and passing lanes. A feather pass shall be ground at the edge of traveled way as indicated on the plans or as directed by the Engineer. No adverse drainage conditions shall be caused by the grinding operations. The sequence of work shall not allow for ponding of water in the travel lanes due to a weather event. Shoulders that require grinding will be designated on the plans.

Approach slabs and bridge decks shall not be ground and textured. Grinding depth shall transition to 0 inches before the approach slab interface.

One stratified random acceptance test for texture per 2,500 linear feet or fraction thereof in each lane and shoulder shall be taken with a minimum of one test per day.

Smoothness for this project will be measured by the Department per subsection 105.08. The MRI after grinding for each 0.10-mile section or fraction thereof shall have an MRI of 95 in/mile or less. Sections with an MRI greater than 95 in/mile shall be corrected by further diamond grinding.

At various locations within the driving and passing lanes, miscellaneous tie bars may be exposed due to wearing of the pavement surface. Removal of these tie bars will be incidental to the grinding and texturing work.

All grinding shall be parallel to the longitudinal joints. Adjacent passes shall be overlapped by a maximum of 2 inches.

Grinding shall be performed using diamond blades mounted on a self-propelled machine designed for grinding and texturing concrete pavement. The equipment shall weigh a minimum 35,000 pounds including the grinding head and be of a size that will grind a strip at least 3 feet wide in a single pass. The effective wheelbase of the machine shall be at least 12 feet. Grinding equipment that causes raveling, aggregate fractures or disturbance to the joints shall not be permitted. The equipment shall be maintained to ensure it is in proper working order, including the roundness of the match and depth of control wheels. Any wheels found to be out of round shall be immediately replaced. The Engineer may approve smaller equipment for areas that the above equipment cannot reach.

The grinding process shall produce a pavement surface that is true to grade and uniform in appearance. Grooves shall be evenly spaced. Ridges on the outside edge next to the shoulder, auxiliary, or ramp lanes greater than 3/16 inch shall be feathered out to the satisfaction of the Engineer in a separate, feather pass operation. No adverse drainage conditions shall be caused by the grinding operations.

The pavement surface after grinding shall have no depressions or misalignment of slope in the longitudinal direction exceeding 1/8 inch in 10 feet when measured with a 10-foot straightedge placed parallel to the centerline. The grinding coverage shall be at least 95 percent of the pavement surface area. All areas of deviation shall be reground at no additional cost.

When the texture depth is below the lower specified limit, the Contractor shall determine the area represented by this test. The area shall be determined by taking additional tests at 15-foot intervals parallel to the centerline in each direction from the affected location until two consecutive tests are found to be within the specified limits. Any surface with unacceptable texturing exceeding 25 linear feet in any lane or shoulder shall be reground (full width). After the Engineer approves the limits, the Contractor shall correct the deficient surface texture by grinding full width at no additional cost to the project. The corrected surface texture will be retested for acceptance. Correcting surface texture deficiencies shall occur before pavement smoothness testing. Upon the second unacceptable test result, the Contractor shall notify the Engineer, in writing, the action taken to provide an acceptable surface macrotexture. Upon the project's third unacceptable test result from the Department, the Engineer will notify the Contractor, in writing, and the pay estimate will be withheld until diamond grinding is taken to provide an acceptable surface macrotexture.

The slurry and residue, including joint sealant, resulting from the grinding operation shall not be allowed to flow across lanes occupied by traffic and shall be continuously removed during the grinding operation, leaving the pavement in a clean condition.

The Contractor shall haul the grinding residue to an approved suitable location at no additional cost. The Contractor shall obtain approval of the disposal method from the Engineer before beginning the grinding operation.

METHOD OF MEASUREMENT

202.16. Diamond Grinding Concrete Pavement will be measured by the square yard of acceptable finished surface regardless of the number of passes required. The quantity of grinding and texturing will be determined by measuring the finished area ground within the limits indicated on the plans or as directed by the Engineer.

BASIS OF PAYMENT

202.17. Diamond Grinding Concrete Pavement will be paid for at the contract unit bid price per square yard. Payment will be considered full compensation for all labor, materials, supplies, tools, water, equipment, and incidentals necessary for completing the work as specified. Payment will be made under:

Pay Item	Pay Unit
Diamond Grinding Concrete Pavement	Square Yard

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SECTION 203
EXCAVATION AND EMBANKMENT

DESCRIPTION

203.01 General. This work consists of excavation, hauling, disposal, placement, and compaction of all material encountered within the limits of the work, including construction of dikes and excavation for ditches and channels, necessary for the construction of the roadway per the Contract.

MATERIALS

203.02 Excavation Definitions. All excavation will be defined as, "unclassified excavation", "stripping", "removal of unsuitable material", "rock excavation", "borrow", or "potholing" as described below:

(a) Unclassified Excavation. Unclassified excavation shall consist of the excavation of all materials of whatever character required for the work, obtained within the right of way, including surface boulders and excavation for ditches and channels that is not removed under some other item.

(b) Stripping. Stripping shall consist of removing overburden or other specified material from borrow pits, and the replacement of overburden or other specified material over the disturbed area of the site or pit after the underlying material has been removed.

(c) Removal of Unsuitable Material. Removal of unsuitable material shall consist of the removal of soils or mixtures of soil and organic matter identified in the Contract or as directed by the Engineer that would be detrimental to the roadway or embankment if left in place in its existing condition.

(d) Rock Excavation. Rock excavation shall consist of removal of igneous, metamorphic, and sedimentary rock that cannot be excavated without blasting or with the use of rippers, including all boulders or other detached stones having a volume of 1/2 cubic yard or more. Unless specified in the Contract, rock excavation is material that meets one of the following field test criteria to be conducted by the Contractor:

1. Ripping Test: Material that cannot be broken down by one pass with a single tooth ripper mounted on a crawler type tractor in low gear with a minimum net flywheel power rating of 235 horsepower; or material that cannot be broken down with a 48,000-pound tracked excavator using a bucket with rock teeth.

2. Seismic Test: Material that has a seismic velocity of 6,000 feet per second or greater. The Contractor shall submit the qualifications of the individual performing or interpreting the seismic testing to the Engineer a minimum of 14 days before testing. The ripping test will be used to resolve differences if seismic velocities fall below 6,000 feet per second.

3. Handling Test: Any boulder or detached stone having a volume of ½-cubic yard or more that cannot be readily broken down with the excavation equipment described above in 1.

(e) Borrow. Borrow shall consist of approved material obtained from outside the right of way required for the construction of the project.

(f) Potholing. Potholing shall consist of exposing and verifying the location of existing utilities at locations as directed.

203.03 Embankment Material. Embankment material shall consist of approved material acquired from excavations or borrow pits and hauled and placed in embankments. Approval of embankment material is contingent on the material meeting the Atterberg Limit and gradation requirements specified in the Contract. Approval of the embankment material in the upper 2 feet of embankment below the subgrade elevation is contingent on the material meeting one of the following as specified in the Contract:

(1) The specified resistance value when tested by the Hveem Stabilometer or the equivalent resilient modulus.

(2) The specified Atterberg Limit and gradation requirements.

(3) The specified resistance value when tested by the Hveem Stabilometer or equivalent resilient modulus, and the specified Atterberg Limit and gradation requirements.

Embankment material shall be classified into one of the material groups listed below and placed and compacted per the appropriate methods specified in subsection 203.07. If any material does not meet the criteria for one of the following classifications, it shall be processed on site to meet the requirements for one of the material groups listed below or disposed of at the Contractor's expense.

1. Soil Embankment: Soil embankment shall have all particle sizes less than 6 inches. The material shall be classified per AASHTO M 145 and placed and compacted per subsection 203.07(a).

2. Rock Embankment: Rock embankment shall meet all of the following requirements:

   A. A minimum of 50 percent of the material shall be retained on the 4.75 mm (No. 4) sieve.

   B. More than 30 percent of the material shall be retained on the 19.0 mm (3/4-inch) sieve.

   C. The material shall meet the classification of an AASHTO A-1 soil type.

   D. All particle sizes shall be less than 6 inches.

   E. Particles retained on the 4.75mm (No. 4) sieve shall not be composed of non-durable bedrock types.

   Rock embankment may be placed without moisture density control as described in subsection 203.07(b).

3. Rock Fill: Rock fill shall meet all of the following requirements:

   A. A minimum of 50 percent of the material shall be retained on a 100 mm (4-inch) sieve.

   B. The maximum dimension of any particle shall not exceed 36 inches.

   C. The material shall be well-graded as determined on visual inspection.

   D. The material shall contain less than 20 percent by volume of material passing the 75 µm (No. 200) sieve based on visual inspection.

E. Particles retained on the 4.75 mm (No. 4) sieve shall not be composed of non-durable bedrock types.

Rock fill can be placed without moisture density control as described in subsection 203.07(b).

Non-durable bedrock shall be identified and classified using Colorado Procedure - Laboratory (CP-L) 3104. Any material classified as Soil-like Non-durable (S-N) as defined in the procedure shall be pulverized, broken down and processed to 6-inch maximum particle sizes before incorporation into embankment fill. These materials shall be placed and compacted as "soil embankment" per subsection 203.07(a). Non-durable bedrock particles in excess of 6 inches shall not be placed into embankment fill.

If recycled concrete or asphalt are to be incorporated into embankment fill, the maximum dimension permitted for concrete is 24 inches and the maximum dimension permitted for asphalt is 12 inches. Embankment material imported onto the project will be tested for water soluble sulfates using CP-L 2103 Method B. The average of three consecutive tests shall show that the sulfate content is not greater than that corresponding to the sulfate exposure level specified in the Contract. No single test shall have a sulfate content more than 20 percent greater than that corresponding to the sulfate exposure level specified in the Contract. When there is a single failing test, the remaining sample shall be split into four equal portions. The CDOT Region Lab shall receive one portion, the Contractor shall receive one portion, and the remaining two portions shall go to the CDOT Central Lab. The CDOT Region Lab, the CDOT Central Lab, and the Contractor's Lab shall retest the sample. If the results from the three labs are within 10 percent of each other, the results will be averaged. The averaged result will be used for determining Contract compliance. If the results from the labs are not within 10 percent of each other, the remaining split sample shall be sent to an independent laboratory for testing using CP-L 2103. The independent laboratory shall be mutually agreed upon by the Department and the Contractor. The independent lab's test result will be used for determining Contract compliance.

If the water-soluble sulfate content is less than that corresponding to the sulfate exposure level specified in the Contract, CDOT will bear all costs associated with the independent lab test. If the soluble sulfate content is greater than that corresponding to the sulfate exposure level specified in the Contract, all costs associated with independent lab testing shall be at the Contractor's expense. Embankment represented by failing tests shall be removed from the project and replaced at the Contractor's expense.

Imported material used for backfilling pipes (storm sewer, cross culverts, side drains, etc.) shall be tested for compatibility with the selected pipe material. When non-reinforced concrete pipe or reinforced concrete pipe is used, the imported material shall be tested for sulfate and pH. When corrugated steel pipe, bituminous-coated corrugated steel pipe or pre-coated corrugated steel pipe is used, the imported material shall be tested for sulfates, chlorides, pH and resistivity. When aramid fiber bonded corrugated steel pipe or corrugated aluminum pipe is used, the imported material shall be tested for pH and resistivity. When plastic pipe is selected, the imported material does not need to be tested for sulfates, chlorides, pH or resistivity.

Sulfates, chlorides, pH and resistivity shall be determined by the following procedures:

(1) Water soluble sulfates using CP-L 2103 Method B
(2) Chlorides using CPL 2104
(3) Resistivity using ASTM G57
(4) pH using ASTM G51

The average of three consecutive tests shall show the imported material's sulfate, chloride, pH and resistivity is not greater than the limits corresponding to the Pipe Class in Table 203-1 or 203-2 for the pipe class specified in the Contract. No single test shall have a result more than 20 percent greater than that corresponding to the limit in Table 203-1 or Table 203-2 for sulfates, chlorides and resistivity. No single test shall have a result more than 5 percent outside the limit in Table 203-1 for pH. The remaining sample material from a single failing test shall be split into three equal portions. CDOT shall receive one portion, the Contractor shall receive one portion and the remaining portion shall be retained by the Project. CDOT and the Contractor's Lab shall retest the failed sample; if the results from those tests are within 10 percent of each other, the results will be averaged. The averaged result will be used for Contract compliance. If the results from the Labs are not within 10 percent of each other, the remaining sample portion shall be sent to an independent laboratory for testing using the testing requirements specified above. The independent laboratory shall be mutually agreed upon by the Department and the Contractor. The Independent Lab's test result will be used for Contract compliance.

If the imported material's sulfates, chlorides, and resistivity are less than the limits and the pH is within the limits in Table 203-1 or 203-2, CDOT will bear all costs associated with the independent lab test. If the imported material's sulfates, chlorides, and resistivity is greater than the limits and the pH is outside the limits in Table 203-1 or 203-2, all costs associated with independent lab testing shall be at the Contractor's expense.

Embankment represented by failing tests shall be removed from the project and replaced at the Contractor's expense.

Table 203-1
SULFATE, CHLORIDE AND pH OF IMPORTED MATERIAL

Pipe Class	Soil Sulfate (SO4) % max.	Soil Chloride (Cl) % max.	Soil pH
0, 7	0.05	0.05	6.0-8.5
1, 7	0.1	0.1	6.0-8.5
2, 8	0.2	0.2	6.0-8.5
3, 9	0.5	0.5	6.0-8.5
4, 9	1	1	5.0-9.0
5, 10	2	2	5.0-9.0
6, 10	>2.00	>2.00	<5 or >9

Table 203-2

RESISTIVITY AND pH OF IMPORTED MATERIAL

SOIL SIDE Resistivity R (Ohm – cm)	SOIL SIDE pH
≥ 1500	5.0-9.0
≥ 250	3.0-12.0

CONSTRUCTION REQUIREMENTS

203.04 General. The excavations and embankments shall be finished to smooth and uniform surfaces conforming to the typical sections specified. Variation from the subgrade plan elevations specified shall not be more than 0.08 foot. Where asphalt or concrete surfacing materials are to be placed directly on the subgrade, the subgrade plane shall not vary more than 0.04 foot. Materials shall not be wasted without written permission of the Engineer. Excavation operations shall be conducted so material outside of the slope limits will not be disturbed. Before beginning grading operations, all necessary clearing and grubbing in that area shall have been performed per Section 201.

The Contractor shall notify the Engineer at least five workdays before beginning excavation. The Contractor shall not excavate beyond the dimensions and elevations shown in the Contract.

Archaeological and paleontological materials encountered during the work shall be handled per subsection 107.23.

All excavation activities in areas where asbestos is encountered or expected to be encountered shall conform to the Colorado Department of Public Health and Environment's Asbestos-Contaminated Soil Guidance Document or the State of Colorado's Asbestos Contaminated Soil Statewide Management Plan (ACS), whichever is more recent at the time of advertisement and per subsection 250.07(d) and the Air Quality Control Commission Regulation No. 8 Part B or Section 5.5 of the solid Waste Regulation 6 CCR 1007-2, as applicable.

203.05 Excavation. Excavation shall be one or more of the following:

(a) Rock. Unless otherwise specified, rock shall be excavated to a minimum depth of 0.5 foot and a maximum depth of 1 foot below subgrade, within the limits of the roadbed. Rock removed in excess of 1 foot below subgrade will not be paid for. Backfilling of the depth in excess of 1 foot below subgrade shall be at the Contractor's expense. Approved embankment material shall be used to bring the rock-excavated areas to subgrade elevations within the tolerances specified in subsection 203.04.

Undrained pockets shall not be left in the rock surface and depressions shall be drained at the Contractor's expense.

When required for rock excavation, controlled blasting shall be conducted per the Contract.

(b) Unclassified. Excess or unsuitable excavated material, including rock and boulders, that cannot be used in embankments may be placed on the side slopes of the nearest fill if approved.

Unless otherwise specified by the Engineer, intercepting ditches shall be made above the top of cut slopes and carried to outlets near the ends of the cuts. In order to blend the intersection of cut slopes with the slope of the adjacent natural ground surfaces in a uniform manner, the tops of all cut slopes, except those in solid rock, shall be flattened and rounded per typical sections and details specified. Earth overburden lying above solid rock cuts shall be treated in the same manner as earth cuts.

The Department reserves the right to change cut slopes during the progress of excavation.

(c) *Unsuitable Material*. Unsuitable materials encountered in the subgrade, roadway, or embankment foundation that are determined to be detrimental to the roadway or embankment shall be removed to the depth and extents directed by the Engineer. The excavated area shall be backfilled to the finished graded section with approved material. Materials that contain organics or that cannot be dried or moisture conditioned, then compacted to the required density shall be disposed of and shall not be reused as embankment fill. Materials that do not contain organics and that can be dried or moisture conditioned and compacted to the required density may be reused as embankment fill as approved by the Engineer.

(d) *Borrow*. If the Contractor places more borrow than is specified or approved and causes a waste of roadway excavation, the quantity of waste will be deducted from the borrow volume. All borrow areas shall be bladed and shaped to permit accurate measurements after excavation is completed. The finished borrow areas shall be graded to a smooth and uniform surface and shall be finished so water will not collect or stand, unless otherwise specified.

(e) *Stripping*. Overburden shall be removed to the depth required for the production of acceptable material, and at least 5 feet beyond area being excavated.

(f) *Potholing*. All necessary potholing as determined by the Contractor and agreed to by the Engineer shall be completed under this item with appropriate equipment as approved.

The Contractor shall acquire necessary permits, locate utilities, excavate all materials of whatever character required to expose the utilities, survey the location of the utilities, and backfill the excavation to existing grade lines with the excavated or other approved materials. Backfilling shall be accomplished per subsection 206.03.

The Contractor shall use extreme caution during this work. All damage to existing utility lines or adjacent facilities shall be repaired promptly at the Contractor's expense.

203.06 General Embankment Construction Requirements. When Contractor Process Control is required, the Contractor's Process Control Representative shall be certified with Western Alliance for Quality Transportation Construction (WAQTC) Embankment and Base Testing and CDOT's Excavation, Embankment, and Soil Inspection certification course.

Embankment construction shall include preparation of the areas where embankments are to be placed, construction of dikes, and placing and compacting approved material within roadway areas including holes, pits, and other depressions within the roadway area. Only approved materials shall be used in the construction of embankments and fills.

All sod, vegetable and other organic matter, stumps, and roots shall be removed from the surface where the embankment is to be placed per Section 201. Unless a thickness is otherwise specified in the Contract, the upper 4 inches of the ground surface will be considered topsoil and shall be removed per Section 207 before placement of embankment fill.

The cleared surface shall be completely broken up by plowing or scarifying to a minimum depth of 6 inches or as specified in the Contract, the moisture content increased or reduced as necessary, and compacted to the specified embankment density for the material type present.

When embankment is placed on a slope that is steeper than 4H:1V, as measured in the steepest direction, the existing slope shall be benched as the embankment is placed in layers. A 2-foot-deep key shall be excavated at the base of the existing slope and backfilled with approved and compacted material. The embankment shall be placed in layers from that key. Each horizontal cut shall begin at the intersection of the original ground and the vertical sides of the previous bench. Excavated material from benching may be placed and compacted with the embankment material at the Contractor's expense.

During the course of construction, embankment side slopes shall be built a minimum of 12 inches wider than the final grade indicated in the Contract to allow for compaction equipment to compact the full width of the embankment. Once the specified level of compaction is achieved, the side slopes shall be trimmed back to final grade. Excess material placement and removal to satisfy this requirement shall be at the Contractor's expense.

If embankment can be placed on only one side of structures such as retaining walls, abutments, wing walls, piers, or culvert headwalls, compaction shall be accomplished without initiating movement or deformation of the structure and without placing excessive pressure against the structure. When noted in the Contract, the fill adjacent to the abutment of a bridge shall not be placed higher than the bottom of the backwall until the superstructure is in place. When embankment is placed on both sides of a concrete wall or box type structure, the embankment shall be brought up equally on both sides of the structure.

Where embankment is to be placed and compacted and end dumping is used, the slopes of the original ground or embankment shall be deeply plowed or scarified before starting end dumping.

Embankment fill other than A-1 soil types shall not be placed within standing water, unless otherwise noted in the Contract. During the construction of the embankment, the top surface shall be maintained so that it is well drained at all times.

Frozen materials shall not be used in construction of embankments. Frozen material will be identified by the visual observation of ice crystals within the foundation or embankment material, or by measuring the temperature of the ground surface.

203.07 Embankment Placement and Compaction Requirements. Materials incorporated into embankment fill shall be placed and compacted according to the following requirements:

(a) Soil Embankment. All soil embankment shall be placed in horizontal layers not to exceed 8 inches in loose lift thickness. Each layer shall be compacted before the placement of subsequent layers. Spreading equipment shall be used to obtain uniform thickness before compaction. As the compaction progresses, continuous mixing, leveling, and manipulating shall be done to assure uniform moisture and density. Additional work involved in drying soil embankment to the required moisture content shall be included in the contract price paid for excavating or furnishing the material with no additional compensation.

Soil embankment that is classified as A-1 material may be used to bridge across standing water or swampy ground within the embankment foundation and may be placed in lift thicknesses greater than 8 inches when used for this purpose if approved by the Engineer.

Soil embankment with less than or equal to 30 percent retained on the 3/4-inch sieve shall be tested for compaction using CP 80. Materials classified as AASHTO A-1, A-2-4, A-2-5, and A-3 soils shall be compacted at plus or minus 2 percent of Optimum Moisture Content (OMC) and to at least 95 percent of maximum dry density determined per AASHTO T 180 as modified by CP 23. All other soil types shall be compacted to 95 percent of the maximum dry density determined per AASHTO T 99 as modified by CP 23. Soils with 35 percent fines or less shall be compacted at plus or minus 2 percent of OMC. Soils with greater than 35 percent fines shall be compacted at a moisture content equal to or above OMC to achieve stability of the compacted lift. Stability is defined as the absence of rutting or pumping as observed and documented by the Contractor's Process Control Representative and as approved by the Engineer. If the soils cannot be compacted and prove to be unstable at a moisture content equal to or above OMC, then the required moisture content for compaction may be reduced below OMC if approved by the Engineer.

Before placing any soil embankment with greater than 30 percent retained on the 3/4-inch sieve, the Contractor shall construct a test strip to the dimensions specified in the Contract or as directed by the Engineer. The test strip may be incorporated into the final embankment. The Contractor shall determine the moisture conditioning necessary to achieve compaction and shall determine the equipment and number of passes necessary to achieve adequate compaction. The Contractor shall use compression-type or vibratory rollers on granular materials and sheepsfoot rollers on cohesive soils. Adequate compaction shall be demonstrated by the absence of rutting, pumping, or deflection following a proof roll of the test strip using any piece of construction equipment that exerts a minimum 18-kip per axle load. The proof roll will be observed and accepted by the Engineer. Once the test strip passes a proof roll, the Contractor may resume embankment construction using the same moisture conditioning and compaction methods that were used to construct the test strip.

Placement, moisture conditioning, and compaction of every lift of soil embankment with greater than 30 percent retained on the 3/4-inch sieve shall be observed by the Contractor's Process Control Representative and accepted by the Engineer. Adequate compaction of each lift shall be demonstrated as the absence of rutting, pumping, or deflection as construction equipment is routed over a lift following the compactive efforts that were used and accepted for the respective test strip. The Engineer may request a proof roll at any time to document the condition of a lift.

Significant changes in the material being hauled for soil embankment with greater than 30 percent retained on the 3/4-inch sieve will require construction of a new test strip, and demonstration of adequate compaction methods using a proof roll.

Non-durable bedrock shall be watered to promote slaking and break down and pulverized or processed to a maximum particle size of 6 inches. These materials shall be placed and compacted as soil embankment; except they shall be compacted with a heavy tamping foot roller weighing at least 30 tons. Each tamping foot shall protrude from the drum a minimum of 4 inches. Each embankment layer shall receive a minimum of four passes with the tamping foot roller.

The roller shall be operated at a uniform speed not exceeding 3 miles per hour. No additional compensation will be made for additional roller passes to achieve specified density requirements.

Non-durable Bedrock shall not be used to bridge over standing water or swampy ground within an embankment foundation. Non-durable bedrock shall also not be placed within 2 feet of the final subgrade elevation.

(b) Rock Embankment and Rock Fill.

Rock embankment shall be placed in horizontal layers not to exceed 8 inches in loose lift thickness. The lift thickness can be increased when bridging over standing water or swampy ground in the embankment foundation as directed by the Engineer. Each layer shall be compacted before the placement of subsequent layers. Spreading equipment shall be used to obtain uniform thickness before compaction.

Rock fill shall be placed in horizontal layers not to exceed a loose lift thickness equivalent to the average particle size up to a maximum permitted lift thickness of 18 inches. Particles with a maximum dimension of 36 inches are permitted; however, rocks larger than the lift thickness shall be separated enough to allow compaction equipment to operate in between. Material shall be placed to fill in voids between larger stones with finer particle sizes and to avoid nesting. Spreading equipment shall be used to obtain uniform thickness before compaction. If the use of leveling equipment is not practical, the Engineer may permit rock fill material to be cast or end dumped. In such cases sufficient hand or machine work will be required to construct a compact, stable fill and to finish the slopes to a neat and smooth appearance. Rock fill shall not be placed within 2 feet of the final subgrade elevation. When a rock fill is placed over any structure, the structure shall be covered with a minimum of 2 feet of compacted soil embankment or rock embankment material before the rock fill is placed.

The Contractor shall determine the moisture conditioning necessary to achieve compaction for rock embankment or rock fill. Vibratory or compression-type rollers shall be used to compact these materials. At a minimum, compression-type rollers weighing 20 tons shall complete four passes over the entire width of a lift at a speed not to exceed 3 miles per hour. Vibratory rollers shall exert a minimum dynamic force of 30,000 pounds of impact per vibration and achieve a minimum 1,000 vibrations per minute. Vibratory rollers shall complete a minimum of four passes over the entire width of a lift at a speed not to exceed 1.5 miles per hour.

Before placing rock embankment or rock fill, the Contractor shall construct a test strip to the dimensions specified in the Contract, or as directed by the Engineer. The test strip may be incorporated into the final embankment. Adequate compaction of the rock embankment or rock fill test strip shall be demonstrated by the absence of rutting, pumping, or deflection following a proof roll of the test strip using any piece of construction equipment that exerts a minimum 18-kip per axle load. The proof roll will be observed and accepted by the Engineer. Once the test strip passes a proof roll, the Contractor can resume rock embankment or rock fill construction with the same moisture conditioning and compaction methods as the test strip was constructed. Placement, moisture conditioning, and compaction of every lift of rock embankment and rock fill shall be observed by the Contractor's Process Control Representative and accepted by the Engineer. Adequate compaction of each lift shall be demonstrated as the absence of rutting, pumping, or

deflection as construction equipment is routed over a lift following the compactive efforts that were used and accepted for the respective test strip. The Engineer may request a proof roll at any time to document the condition of a lift.

Significant changes in the characteristics of material being hauled for rock embankment or rock fill will require construction of a new test strip, and demonstration of adequate compaction methods using a proof roll.

If the Contractor wishes to deviate from the minimum equipment and compactive efforts specified above for rock embankment or rock fill, the Contractor must first demonstrate the adequacy of the proposed methods with a test strip and passing proof roll. In addition, proof rolls are required for every lift placed for the first 2,000 cubic yards of rock embankment or rock fill placed. The proof rolls used to demonstrate adequate compaction of the first 2,000 cubic yards placed will not be measured and paid for separately but shall be performed at the Contractor's expense.

(c) *Use of Recycled Concrete and Asphalt*. Recycled concrete and asphalt may be incorporated into embankment material, and shall be processed, placed, and compacted per subsection 203.07(a) or (b), depending on the overall classification of the embankment material once the recycled material is incorporated. Rebar shall not extend more than one inch beyond the edges of recycled concrete particles. Recycled concrete or asphalt shall not be placed in the upper 2 feet of the final subgrade elevation or within 2 feet of the final finished side slopes unless otherwise noted in the Contract.

203.08 Proof Rolling. Proof rolling with pneumatic tire equipment shall be performed using a minimum axle load of 18 kips per axle. A weigh ticket from an approved scale shall be furnished by the Contractor to substantiate this weight.

The subgrade shall be proof rolled after the required compaction has been obtained and the subgrade has been shaped to the required cross section.

The proof roller shall be operated in a systematic manner so that a record may be readily kept of the area tested and the working time required for the testing. Areas that are observed to have soft spots in the subgrade, where deflection is not uniform or is excessive as determined by the Engineer, shall be ripped, scarified, dried or wetted as necessary, and re-compacted to the requirements for density and moisture at the Contractor's expense. After re-compaction, these areas shall be proof rolled again and all failures again corrected at the Contractor's expense.

Upon approval of the proof rolling, the subbase, base course, or initial pavement course shall be placed within 48 hours. If the Contractor fails to place the subbase, base course, or initial pavement course within 48 hours or the condition of the subgrade changes due to weather or other conditions, proof rolling, and correction shall be performed again at the Contractor's expense.

203.09 Blading. Blading shall consist of furnishing motor graders of the specified horsepower rating, with operators, for shaping roadway, shoulders, or other areas as designated by the Engineer.

When scarifying is specified, the motor grader shall be equipped with an independently operated "V" type scarifier and attachments.

203.10 Dozing. Dozing shall consist of furnishing crawler-type tractors of the specified horsepower rating, complete with operators and bulldozer blades. Rippers, if specified, will not be measured and paid for separately, but shall be included in the work.

METHOD OF MEASUREMENT

203.11. Items paid for by volume be the quantities designated in the Contract. Exceptions will be made when field changes are ordered or when it is determined that there are discrepancies in the Contract in an amount of at least plus or minus two percent of the plan quantity.

(a) Excavation. The original cross-sections will be used for determination of volumes of excavated material removed, unless changes have been directed. These measurements will include authorized excavation of rock, shale, or other unsuitable material. All accepted stripping will be measured in stockpiled locations by cross-sectioning.

When the excavation conforms to the staked lines and grades, the original cross-sections and the staked sections shall be used for the determination of volumes excavated. Volumes will be computed from the cross-sections by the average end area or other acceptable method.

When topsoil or wetland topsoil is included as a separate pay item and is specified, the measured volume of excavation will be reduced by the volume of topsoil or wetland topsoil removed from the area shown as excavation in the Contract.

Measurements will include over-breakage in rock excavation from the back slopes to an amount not to exceed, in any half station of 50 feet, 10 percent of the actual quantity required for that half station.

(b) Embankment. If provided in the Contract, embankment material will be measured in its final compacted position in the roadway. Measurement will be made upward from the original ground line without any allowance for subsidence due to compaction of the base under the embankment. The original cross-sections will be used for determination of volumes of embankment material placed, unless changes have been directed.

The measured volume of embankment material will be increased by the volume of topsoil or wetland topsoil removed from the area below the original ground line and under the embankment.

(c) Rock Fill. Rock fill will be measured as the volume in cubic yards in its final position, unless otherwise specified, and shall be limited to the elevations specified.

(d) Blading and Dozing. The quantity measured for blading and dozing will be the number of hours that each motor grader or bulldozer is actually used as ordered. A minimum of four hours for any half shift or part thereof will be paid for unless the equipment is inoperative due to breakdown or other causes determined to be the Contractor's responsibility. Time involved in moving onto or off the project will not be measured and paid for.

Time will be paid for moving motor graders or bulldozers from one location on the project to another, if directed; but time will not be allowed for moves that are made for the convenience of the Contractor.

Payment for a minimum of four hours will not be allowed in cases where the motor grader, bulldozer, or operator is assigned to work on other pay items connected with the project.

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(e) Potholing. Potholing will be measured by the total number of hours that excavation and backfilling equipment is actually used as directed. All other related work, including removal of existing pavement, backfilling, shoring, and labor will not be measured and paid for separately, but shall be included in the work.

(f) Proof Rolling. Proof rolling will be measured by the actual number of hours that the pneumatic equipment is used as a proof roller.

The time to be measured under this item will be the number of hours that each piece of equipment is actually used as ordered.

Proof rolling will be measured and paid for only once for each test strip required during construction; for final verification of subgrade before placement of subbase, base coarse, or pavement; or for each incident where the Engineer directs it through the course of construction. Additional proof rolling that is required due to failure of embankment fill; due to the Contractor's failure to place subbase, base course, or initial pavement course within 48 hours of the initial proof roll; or due to the condition of the subgrade changing due to weather; or additional proof rolls deemed necessary due to the Contractor's choice to deviate from minimum equipment and compaction efforts specified, shall be at the Contractor's expense.

BASIS OF PAYMENT

203.12 The accepted quantities will be paid for at the contract unit price for each of the pay items listed below that appear in the bid schedule.

Payment will be made under:

Pay Item	Unit
Rock Excavation	Cubic Yard
Rock Fill	Cubic Yard
Unclassified Excavation	Cubic Yard
Unclassified Excavation (Complete in Place)	Cubic Yard
Unsuitable Materials	Cubic Yard
Borrow	Cubic Yard
Borrow (Complete in Place)	Cubic Yard
Embankment Material (Complete in Place)	Cubic Yard
Stripping	Cubic Yard
Blading	Hour
Dozing	Hour
Potholing	Hour
Proof Rolling	Hour

Water will not be measured and paid for separately but shall be included in the work.

Compaction will not be measured and paid for separately but shall be included in the work.

Payment for replacement of unsuitable material shall be as follows: If excavated material can be re-used as embankment fill by moisture conditioning and compaction, replacement shall be included in the cost for Unsuitable Material. If the material cannot be re-used as embankment fill, payment for replacement of unsuitable material shall be for the volume that is placed in the excavated area at the respective unit price for the material that is approved by the Engineer and used.

Payment for Unclassified Excavation (Complete in Place), Embankment Material (Complete in Place), or Borrow (Complete in Place) shall be full compensation for all work necessary to complete the item including construction of embankments, reworking of existing materials to satisfy benching requirements, unclassified excavation, borrow, compaction, compaction of bases of cuts and fills, all work in available materials pits, and disposal of excess excavated material.

Reducing the size of the claystone particles, removing the oversized particles, and disposal of the oversized particles will not be measured and paid for separately but shall be included in the work.

Ripping tests or seismic tests used to evaluate whether a material meets the criteria for Rock Excavation will not be measured and paid for separately but shall be included in the work.

Pavement replacement if required due to potholing, shall be accomplished, measured, and paid for per appropriate sections of the specifications.

Pneumatic tire equipment and load required to achieve the desired weight of proof rolling equipment will not be measured and paid for separately but shall be included in the work.

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SECTION 206
EXCAVATION AND BACKFILL
FOR STRUCTURES

DESCRIPTION

206.01. This work consists of the excavation and backfill, or disposal of all material required for the construction of structures.

The excavation and disposal of excavated material for ditches and channels shall be accomplished per Section 203.

All excavation and backfill for structures below the designed slope or subgrade line provided in the Contract shall be included under this item.

Unless otherwise specified, structure excavation shall include all pumping, bailing, draining, and incidentals required for proper execution of the work.

MATERIALS

206.02 General. All structure backfill, bed course material, and filter material will be accepted in place.

(a) Structure Backfill.

1. Structure Backfill (Class 1), (Class 2), and (Class 3). Class 1, Class 2, and Class 3 structure backfill shall be composed of non-organic mineral aggregates and soil from excavations, borrow pits, or other sources. Material shall conform to the requirements of subsection 703.08. Class of material shall be as specified in the Contract or as designated.

   Structure Backfill (Class 1) with mechanical reinforcement shall be used to backfill bridge abutments, unless otherwise shown on the Plans.

   Imported material used as structure backfill for pipes (storm sewer, cross culverts, side drains, etc.) shall meet the requirements of the Class specified and the requirements of subsection 206.02(a)3.

   The Contractor may substitute Structure Backfill (Flow-Fill) conforming to subsection 206.02(a)2 for Structure Backfill (Class 1) or Structure Backfill (Class 2) to backfill culverts and sewer pipes.

   The Contractor may also substitute Structure Backfill (Class 3) as backfill for culverts and sewer pipes.

2. Structure Backfill (Flow-Fill). Flow-Fill shall be a self-leveling low strength concrete material composed of cement, fly ash, aggregates, water, chemical admixtures or cellular foam for air-entrainment. Flow-fill shall have a slump of 7 to 10 inches, when tested per ASTM C143 or a minimum flow consistency of 6 inches when tested per ASTM D6103. Flow-Fill shall have a minimum compressive strength of 50 psi at 28 days when tested per ASTM D4832. Flash fill is a rapid setting Flow-Fill that may be used when approved by the Engineer and will be tested, accepted, and paid for as Flow-Fill.

   Flow-Fill placed in areas that require future excavation, such as utility backfill shall have

a Removability Modulus (RM) of 1.5 or less.

Removability Modulus, RM, is calculated as follows:

$$RM = \frac{W^{1.5} \times 104 \times C^{0.5}}{10^6}$$

where: W = unit weight (pcf)

C = 28-day compressive strength (psi)

Materials for Structure Backfill (Flow-Fill) shall meet the requirements specified in the following subsections:

Fine Aggregate*, ▸ 703.01

Coarse Aggregate#, ▸ 703.02

Portland Cement 701.01

Fly Ash ◂ , ▸ 701.02

Water 712.01

Air-Entraining Admixture 711.02

Chemical Admixtures 711.03

*Fine aggregate not meeting the requirements of subsection 703.01 may be used if testing indicates acceptable results for strength and air content.

#Coarse aggregate not meeting the requirements of subsection 703.02 may be used if testing indicates acceptable results for strength and air content.

◂ Fly ash not meeting the requirements of subsection 701.02 may be used if testing indicates acceptable results for strength and air content.

▸ For industrial by-product aggregates (foundry sand, bottom ash, etc.) and fly ash not meeting the requirements of subsection 701.02 the Contractor shall submit a report from the supplier documenting the results of testing per the Toxicity Characteristic Leaching Procedure (TCLP) described in 40 CFR 261. The report shall include the results of TCLP testing for heavy metals and other contaminants. Materials shall not exceed the TCLP limits of 40 CFR 261.24 for heavy metals.

Cellular foam shall conform to ASTM C869 and ASTM C796.

Recycled broken glass (glass cullet) is acceptable as part or all of the aggregate. Aggregate including glass must conform to the required gradations. All containers used to produce the cullet shall be empty before processing. Chemical, pharmaceutical, insecticide, pesticide, or other glass containers containing or having contained toxic or hazardous substances shall not be allowed and shall be grounds for rejecting the glass cullet. The maximum debris level in the cullet shall be 10 percent. Debris is defined as any deleterious material that impacts the performance of the Structure Backfill (Flow-

Fill) including all non-glass constituents.

The Contractor may use aggregate that does not meet the above specifications if the aggregate conforms to the following gradation:

Sieve Size	Percent Passing
25.0 mm (1 inch)	100
75 µm (No. 200)	0-10

[1]The amount of material passing the 75 µm (No. 200) screen may exceed 10 percent if testing indicates acceptable results for strength and air content.

The Contractor shall submit a Structure Backfill (Flow-Fill) mix design for approval before placement. The mix design shall include the following laboratory test data:

(1)ASTM C231, Air content.
(2)ASTM D6023, Unit Weight.
(3)ASTM C143, Slump or ASTM D6103 flow consistency.
(4)ASTM D4832 28-day Compressive Strength.
(5)Removability Modulus (RM).

The Contractor shall submit a Process Control (PC) Plan with the mix design to the Engineer. The PC Plan shall address the batching, mixing, testing, and placement of the Structure Backfill (Flow-Fill).

3. Imported Structure Backfill for Pipes. Imported Material used as structure backfill for pipes (storm sewer, cross culverts, side drains, etc.) shall be tested for compatibility with the selected pipe material.

When nonreinforced concrete pipe or reinforced concrete pipe is used, the imported material shall be tested for sulfate and pH.

When corrugated steel pipe, bituminous coated corrugated steel pipe or precoated corrugated steel pipe is used, the imported material shall be tested for sulfates, chlorides, pH and resistivity.

When aramid fiber bonded corrugated steel pipe or corrugated aluminum pipe is used, the imported material shall be tested for pH and resistivity.

When plastic pipe is selected, the imported material does not need to be tested for sulfates, chlorides, pH and resistivity.

Sulfates, chlorides, pH and resistivity shall be determined by the following procedures:

(1) Water soluble sulfates using CP-L 2103 Method B.

(2) Chlorides using CPL 2104.

(3) Resistivity using ASTM G57.

(4) pH using ASTM G51.

The average of three consecutive tests shall show the imported material's sulfate, chloride, pH and resistivity is not greater than the limits corresponding to the Pipe Class

in Table 206-1 or 206-2 for the pipe class specified on the plans.

No single test shall have a result more than 20 percent greater than that corresponding to the limit in Table 206-1 or Table 206-2 for sulfates, chlorides and resistivity. No single test shall have a result more than 5 percent outside the limit in Table 206-1 for pH. The remaining sample material from a single failing test shall be split into three equal portions. CDOT shall receive one portion, the Contractor shall receive one portion, and the remaining portion shall be retained by the Project. CDOT and the Contractor's Lab shall retest the failed sample; if the results from those tests are within 10 percent of each other, the results will be averaged. The averaged result will be used for Contract compliance. If the results from the Labs are not within 10 percent of each other, the remaining sample portion will be sent to an independent laboratory for testing using the testing requirements specified above. The independent laboratory shall be mutually agreed upon by the Department and the Contractor. The Independent Lab's test result will be used for Contract compliance.

If the imported material's sulfates, chlorides, and resistivity are less than the limits and the pH is within the limits in Table 206-1 or 206-2, CDOT will bear all costs associated with the independent lab test. If the imported material's sulfates, chlorides, and resistivity is greater than the limits and the pH is outside the limits in Table 206-1 or 206-2, all costs associated with independent lab testing shall be at the Contractor's expense.

Structure backfill represented by failing tests shall be removed from the project and replaced at the Contractor's expense.

Table 206-1
SULFATE, CHLORIDE AND pH OF IMPORTED MATERIAL

Pipe Class	Soil Sulfate (SO4) % max.	Soil Chloride (Cl) % max.	Soil pH
0, 7	0.05	0.05	6.0-8.5
1, 7	0.1	0.1	6.0-8.5
2, 8	0.2	0.2	6.0-8.5
3, 9	0.5	0.5	6.0-8.5
4, 9	1	1	5.0-9.0
5, 10	2	2	5.0-9.0
6, 10	>2.00	>2.00	<5 or >9

Table 206-2
RESISTIVITY AND pH OF IMPORTED MATERIAL

SOIL SIDE Resistivity R (Ohm – cm)	**SOIL SIDE** pH
≥ 1500	5.0-9.0
≥ 250	3.0-12.0

(b) Bed Course Material. Material shall conform to the requirements of subsection 703.07. Upon approval, aggregate base course conforming to the requirements of subsection 703.03 may be used in lieu of bed course material.

(c) Filter Material. Class A, Class B, and Class C Filter Material shall conform to the requirements of subsection 703.09. Class of material shall be as specified or designated.

CONSTRUCTION REQUIREMENTS

206.03 Structure Excavation and Structure Backfill. Unsuitable foundation material shall be removed and wasted in a manner acceptable to the Engineer, and the excavated material will be paid for as structure excavation. Excavation and backfill for areas in excess of 3 feet below designed elevation will be paid for as provided in subsections 104.03 and 109.04. Unsuitable foundation material that is suitable for embankments and suitable surplus excavated material shall be used in the construction of embankments. Unsuitable material removed below designed elevation shall be replaced with approved material.

If asbestos containing material (ACM) is suspected or found, the ACM and the suspected ACM shall be managed per the Air Quality Control Commission Regulation No. 8 Part B or Section 5.5 of the solid Waste Regulation 6 CCR 1007-2, whichever applies. All work conducted on site shall be per the Colorado Department of Public Health and Environment's Asbestos-Contaminated Soil Guidance Document or the State of Colorado's Asbestos Contaminated Soil Statewide Management Plan (ACS), whichever is more recent at the time of advertisement, and per subsection 250.07(d).

Rock, hardpan, or other unyielding material encountered in trenches for culvert pipe or conduit shall be removed below the designed grade for a minimum depth of 12 inches. This extra depth excavation shall be backfilled with loose Structure Backfill (Class 1) or other approved material. The base of structure backfill shall be scarified to a depth of 6 inches and compacted with moisture and density control before placement of any structural element or structure backfill. The type of compaction shall be the same as that required for Structure Backfill (Class 2), as specified below.

Backfill shall consist of approved materials uniformly distributed in layers brought up equally on all sides of the structure. Each layer of backfill shall not exceed 6 inches and shall be compacted to the required density before successive layers are placed.

Structure Backfill (Class 1) shall be compacted to a density of at least 95 percent of maximum dry density determined per AASHTO T 180 as modified by CP 23. Backfill shall be compacted at plus or minus 2 percent of Optimum Moisture Content (OMC).

Structure Backfill (Class 2) shall be compacted to a density of at least 95 percent of maximum dry density. The maximum dry density and OMC for A-1, A-2-4. A-2-5 and A-3 materials will be determined per AASHTO T 180 as modified by CP 23. The maximum dry density and OMC for all other materials will be determined per AASHTO T 99 as modified by CP 23. Materials shall be compacted at plus or minus 2percent of Optimum Moisture Content (OMC). Materials having greater than 35 percent passing the 75 µm (No. 200) sieve shall be compacted at 0 to 3 percent above OMC.

Pipes, culverts, sewers, and other miscellaneous structures outside the roadway prism and not subjected to traffic loads shall be backfilled in layers as described above but shall be compacted to the density of the surrounding earth.

The excessive use of water during backfilling operations will not be permitted.

Compaction equipment or methods that produce horizontal or vertical earth pressures, which may cause excessive displacement or overturning, or may damage structures, shall not be used.

Backfill material shall not be deposited against newly constructed masonry or concrete structures, until the concrete has developed a compressive strength of 0.8f'c, except in cases where the structures support lateral earth pressure. Concrete compressive strength for structures supporting lateral earth pressure shall conform to subsection 601.12(o). Concrete compressive strength shall be determined by maturity meters.

Backfill at the inside of bridge wingwalls and abutments shall be placed before curbs or sidewalks are constructed over the backfill and before railings on the wingwalls are constructed.

Unless otherwise indicated in the Contract or directed, all sheeting and bracing used in making structure excavation shall be removed by the Contractor before backfilling.

Structure backfill placed at bridge piers in waterways and water channels, that does not support embankments, pavements, or slope protection, will not require compaction.

Structure Backfill (Flow-Fill) shall not be compacted.

The maximum layer thickness for Structure Backfill (Flow-Fill) shall be 3 feet unless otherwise approved by the Engineer. The Contractor shall not place Structure Backfill (Flow-Fill) in layers that are so thick that they cause damage to culverts, pipes, and other structures or that they cause formwork or soil failures during placement. Structure Backfill (Flow-Fill) shall have an indention diameter less than 3 inches and the indention shall be free of visible water when tested per

ASTM D6024 by the Contractor before placing additional layers of Structure Backfill (Flow-Fill). Testing Structure Backfill (Flow-Fill) per ASTM D6024 will be witnessed by the Engineer. Damage resulting from placing Structure Backfill (FlowFill) in layers that are too thick or from not allowing sufficient time between placements of layers shall be repaired at the Contractor’s expense.

The Contractor shall secure culverts, pipes and other structures to prevent floating and displacement of these items during the placement of the Structure Backfill (Flow-Fill).

When Flash Fill is used, it shall be batched with a volumetric mixing truck. Volumetric mixing trucks used to produce Flow-Fill and Flash Fill shall have a computer batching system, capable of producing the approved mix design and printing tickets. For Flash Fill, the batch weights of cement and fly ash per cubic yard shall be within 2 percent of the mix design batch weights and the batch weight of water per cubic yard shall be within 2 percent of the mix design batch weight.

Before the placement of structure backfill (Flow-Fill), the Contractor shall sample the structure backfill (Flow-Fill) per ASTM D5971. The Contractor shall test the structure backfill (Flow-Fill) unit weight per ASTM D6023. For Flash Fill, the measured unit weight shall be within 5.0 percent or 5.0 pounds per cubic foot, whichever is larger, of the approved mix design unit weight. The Contractor shall test the structure backfill (Flow-Fill) for slump per ASTM C143 or flow consistency according to ASTM D6103.

The Contractor shall sample and test the first three loads of Structure Backfill (Flow-Fill) for each placement and then randomly once every 50 cubic yards. Sampling and testing will be witnessed by the Engineer.

When Structure Backfill (Flow-Fill) is placed in areas that require future excavation, the unit weight of the placed Structure Backfill (Flow-Fill) shall not exceed the unit weight of the approved mix design by more than 2.0 pounds per cubic foot.

Structure Backfill (Flow-Fill) shall not be allowed to freeze during placement and until it has set sufficiently according to ASTM D6024. Frozen Structure Backfill (Flow-Fill) shall be removed and replaced at the Contractor's expense.

When the Contractor substitutes Structure Backfill (Flow-Fill) for Structure Backfill (Class 1) or (Class 2), the trench width may be reduced to provide a minimum 6-inch clearance between the outside diameter of the culvert and the trench wall.

206.04 Bed Course Material. Construction requirements for bed course material for sidewalks and curbing shall conform to the applicable requirements of Sections 608 and 609.

206.05 Filter Material. Construction requirements for filter material for subsurface drains shall conform to the applicable requirements of Section 605.

Filter material shall be placed behind bridge abutments, wingwalls, and retaining walls as provided in the Contract and per the following requirements:

When provided in the Contract, wall drain outlets shall be backed with sacked filter material conforming to the gradation requirements for coarse aggregate No. 3 or No. 4 set forth in Table 703-2.

Filter material shall be placed in horizontal layers along with and by the same methods specified for structure backfill.

METHOD OF MEASUREMENT

206.06. Structure excavation, structure backfill, and bed course material will not be measured but will be the quantities designated in the Contract. When field changes are ordered or when there are errors on the plans, quantities will be measured as follows:

(a) For bridges and irregular shaped structures, quantities will be computed to neat lines 18 inches outside and parallel to the outline of the revised foundation plan or as shown on the plans.

(b) For pipes, a profile will be made along the bottom of the center line extending 18 inches beyond the end of the structure, including end sections. Material excavated between this profile and a profile 1 foot above the top of the pipe will not be measured for payment but shall be included in the bid price for the pipe. In excavation sections the area above the profile 1 foot above the top of the pipe and below the limits of roadway excavation will be multiplied by the width shown on the plans to obtain the volume of structure excavation measured for payment. In embankment sections the area above the profile 1 foot above the top of the pipe and below the natural ground will be multiplied by the width shown on the plans to obtain the volume of structure excavation measured for payment.

(c) Backfill and filter material will be the calculated volume of material lying within the prism shown on the plans, from which shall be deducted the volume occupied by the structure.

(d) Bed course material will be the calculated volume of material lying within the prism shown on the plans.

BASIS OF PAYMENT

206.07 The accepted quantities will be paid for at the contract unit price for each of the pay items listed below that appear in the bid schedule.
Payment will be made under:

Pay Item	Pay Unit
Structure Excavation	Cubic Yard
Structure Backfill (Class)	Cubic Yard
Structure Backfill (Flow-fill)	Cubic Yard
Bed Course Material	Cubic Yard
Filter Material (Class)	Cubic Yard

Compaction, water, and all other work necessary to complete the above items will not be measured and paid for separately but shall be included in the work.

Structure backfill, including bed course material, for pipes and end sections will not be measured and paid for separately, but shall be included in the work. Where only end section work is required the structure excavation quantity and the structure backfill quantity will not be measured and paid for separately but shall be included in the work.

When the Contractor substitutes Structure Backfill (Flow Fill) for Structure Backfill (Class 1) or (Class 2), there will be no adjustment in the price or the quantity paid for structure excavation or structure backfill as a result of reducing the trench width.

SHORING

DESCRIPTION

206.08. This work consists of shoring specific areas designated in the Contract.

MATERIALS AND CONSTRUCTION REQUIREMENTS

206.09. The Contractor shall locate, size, design, and construct shoring that provides all necessary rigidity, and supports the loads imposed to facilitate construction as shown on the plans. Shoring used to facilitate construction is considered temporary and shall have a design life 1-1/2 times the expected construction service life, with a maximum design life of three years.

When the height of shoring exceeds 5 feet above the base of the excavation, the Contractor shall submit working drawings per subsection 105.02. The drawings shall be submitted to the Engineer for information only. The drawings shall be electronically sealed by the Contractor's Engineer. The Contractor shall design for internal and external stability of temporary shoring such as but not limited to bearing capacity, settlement, sliding, overturning, internal compound stability, and global stability. All proof and verification testing of the shoring elements shall be the responsibility of the Contractor and results shall be reported to the Engineer the day after the testing was performed.

All proof and verification testing of the shoring elements shall be the responsibility of the Contractor. For soil nail walls, a minimum of one proof test shall be performed per the Revision of Section 504 Soil Nail Wall, and test results shall be reported to the Engineer the day after the testing was performed.

The Contractor shall conduct additional proof and verification testing at the Engineer's request. Sufficient corrosion protection shall be provided in consideration of the temporary shoring design life and is the responsibility of the Contractor. Temporary shoring shall be designed for actual construction-related loads, such as phasing, stockpiles, and operation of large cranes or other large equipment near the area of the shoring. These drawings shall be signed by the Contractor and provided to the Engineer at least 10 days before start of work. Shoring construction shall conform with the shoring drawings provided to the Engineer. The Contractor shall conduct any necessary site-specific evaluation necessary to ensure shoring design, construction and performance.

The Contractor shall have performed and documented an independent review of their shoring design and drawings at designated areas before submittal. The Contractor's Engineer shall electronically seal the independent review shoring design and drawings.

The shoring plans shall detail the methods to control site drainage during the life of the shoring. The Contractor shall actively control drainage and surface runoff during the duration of construction to direct run off away from the shoring areas above and behind the shoring. A shoring site drainage quality control plan shall be included as part of the Contractor's Engineer's shoring plans and shall be part of the submittal to the Engineer. The plan shall include measures to prevent ponding water near the shoring area and maintenance of drainage to convey water away from and around the shoring excavation vicinity.

If the embankment, construction, traffic, or any other surcharge is in excess of what the original shoring was designed for and is to be placed adjacent to the shoring, the Contractor shall provide a signed letter from the Contractor's Engineer before the load placement stating that the shoring will support the additional load.

Shoring shall be designed and constructed per the requirements listed in this specification along with requirements in current AASHSTO and FHWA design manuals including, but not limited to:

(1) AASHTO Construction Handbook for Bridge Temporary Works including Division I.

(2) Section 5 of the AASHTO LRFD Bridge Design Specifications for allowable stress or load factor design; or

(3) AASHTO LRFD Bridge Design Specifications including current interims for load and resistance factor design.

If a shoring type is to be used that is not detailed in these three documents, the shoring type design method will need to be submitted to the Engineer. The Contractor's Engineer shall be on-site and perform construction inspection of the shoring during the first two days of active shoring construction, during any shoring element verification testing, and at the completion of shoring construction. Shoring drawings shall include the following information:

(1) The size and grade of all structural materials

(2) Design notes, including design assumptions, including loading, and construction details.

(3) Detailed plans for managing and maintaining shoring surface and subsurface drainage conditions for the project duration.

(4) Where applicable, restrictions on heavy equipment placement at specific locations adjacent to the shoring

(5) Areas determined by the Contractor's Engineer where dewatering of the shored excavation will be required, and a description of the requirements (i.e., head added by the pump, flow rate, minimum pump size, etc.) and methods to be used for dewatering.

(6) All other information determined by the Contractor's Engineer to be pertinent to the design and successful construction of the shoring.

Drawings for temporary shoring that requires structural designs shall include the following information:

(1) Individual site-specific geotechnical properties for each shoring location based on the plan, review of the Geotechnical Report per subsection 102.05, or from a geotechnical evaluation performed by the Contractor at their own expense.

(2) Global stability analysis showing that the shoring will be stable under the loads placed on it and construction conditions encountered during construction.

The Contractor's Engineer may assign an on-site representative, to perform construction field oversight, by submitting documentation of experience to the Engineer 10 days before starting shoring construction for review and the Engineer's acceptance. Before placing construction or traffic loads on or immediately adjacent to the supported earth, the Contractor's Engineer for the shoring shall certify in an electronically sealed letter that shoring materials and construction have been inspected and that all shoring, materials, and construction are in conformity with the shoring drawings. A copy of this certification shall be submitted to the Engineer.

METHOD OF MEASUREMENT

206.10 Shoring will not be measured but will be paid for as a single lump sum for each Area described on the plans. Incidental shoring work or shoring in locations other than those described on the plans will be as determined by the Contractor and will not be measured and paid for separately but shall be included in the work.

BASIS OF PAYMENT

206.11 The accepted quantities of shoring measured as provided above will be paid for at the contract unit price bid.
Payment will be made under:

Pay Item	Pay Unit
Shoring (Area ___)	Lump Sum

Payment for shoring will be full compensation for all labor, materials, and equipment required to design, construct, test, maintain, and dewatering.

Removal of the shoring shall include removal of all shoring elements. The removal area shall be specified in the plans.

Removal of shoring will not be measured and paid for separately but shall be included in the work.

The Department will pay for additional proof and verification testing, as requested by the Engineer, per subsection 109.04.

Other incidental shoring that is not included as a pay item will not be measured and paid for separately but shall be included in the work.

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SECTION 207
TOPSOIL

DESCRIPTION

207.01. This work consists of salvaging and stockpiling topsoil, and excavating suitable topsoil from stockpiles, contractor sources, available sources, or from the approved natural ground cover to place on designated areas. Placing of topsoil upon constructed cut and fill slopes after grading operations are completed is included.

MATERIALS

207.02. Topsoil shall consist of loose friable soil from the zone of major root development free of subsoil, refuse, stumps, woody roots, rocks, brush, noxious weed seed and reproductive plant parts from current state and county weed lists, heavy clay, hard clods, toxic substances, or other material that would be detrimental to its use on the project.
Wetland topsoil material shall consist of the moist, organic soil, including any existing wetland vegetation and seeds, to be excavated from areas as shown on the plans or as directed.

CONSTRUCTION REQUIREMENTS

207.03. Wetland topsoil material shall be excavated from the designated area to a maximum depth of 12 inches, or as otherwise designated, and placed within 24 hours in the specified area. The Contractor shall prepare the relocation site to elevations specified and approved by the Engineer before excavating the wetlands. If the Engineer determines that this is not possible, then the Contractor shall stockpile the material in an approved area, to remain undisturbed until the relocation site has been prepared. Storage time within the stockpile shall be as short as possible. Wetland topsoil material shall be placed over the prepared relocation areas to a depth of 12 inches, or as otherwise designated.
Topsoil within the limits of the roadway shall be salvaged before beginning hauling, excavating, or fill operations by excavating and stockpiling the material at designated locations in a manner that will facilitate measurement, minimize sediment damage, and not obstruct natural drainage. Topsoil shall be placed directly upon completed cut and fill slopes whenever conditions and the progress of construction will permit.

Topsoil shall be placed at locations and to the thickness provided in the Contract and shall be keyed and tracked to the underlying material without creating a compacted surface by the use of harrows, bulldozers, rollers, or other equipment suitable for the purpose.

Salvaged topsoil exceeding the quantity required under the Contract shall be disposed of at locations acceptable to the Engineer.

METHOD OF MEASUREMENT

207.04. Topsoil salvaged from the roadway and placed in stockpiles shall be measured in the stockpile in cubic yards by the method of average end areas and paid for as Stockpile Topsoil.
Topsoil salvaged from the roadway, taken from stockpiles or from approved pits, hauled and placed directly upon completed cut and fill slopes shall be measured at its source in cubic yards, as described in subsection 203.11, and paid for as Topsoil.

Topsoil generated from the roadway and placed in windrows will be measured at its source in cubic yards, as described in subsection 203.11, and paid for as Stockpile Topsoil. When it is subsequently placed upon the completed cut and fill slopes, the same quantity will be paid for as Topsoil, except that adjustment in quantity shall be made if the total windrowed quantity is not utilized.

Wetland topsoil material excavated from areas within the right of way and placed in stockpiles will be measured in the stockpile by the method of average end areas and paid for as Stockpile Wetland Topsoil.

Wetland topsoil material excavated from areas within the right of way or from stockpiles, hauled and placed directly on a relocated site will be measured at its source in cubic yards, as described in subsection 203.11, and paid for as Wetland Topsoil.

Topsoil secured from the Contractor's source will be measured in place by measuring random depths of topsoil and computing the volume by multiplying the area times the average depth.

BASIS OF PAYMENT

207.05. The accepted quantities measured as provided above will be paid for at the contract unit price per cubic yard for each of the pay items listed below that appear in the bid schedule.
Payment will be made under:

Pay Item	Pay Unit
Stockpile Topsoil	Cubic Yard
Topsoil	Cubic Yard
Stockpile Wetland Topsoil	Cubic Yard
Wetland Topsoil	Cubic Yard

SECTION 208
EROSION CONTROL

DESCRIPTION

208.01. This work consists of constructing, installing, maintaining, and removing when required, control measures during the life of the Contract to prevent or minimize erosion, sedimentation, and pollution of any State waters as defined in subsection 107.25, including wetlands.

Stormwater runoff from all disturbed areas and soil storage areas where permanent or interim stabilization is not implemented, must flow to at least one control measure to minimize sediment in the discharge. This shall be accomplished through filtering, settling, or straining. The control measure shall be selected, designed, installed, and adequately sized per good engineering, hydrologic, and pollution control practices. The control measures shall contain or filter flows in order to prevent the bypass of flows without treatment and shall be appropriate for stormwater runoff from disturbed areas and for the expected flow rate, duration, and flow conditions (i.e., sheet or concentrated flow).

The Contractor shall coordinate the construction of temporary control measures with the construction of permanent control measures to assure economical, effective, and continuous erosion and sediment control throughout the construction period.

When a provision of Section 208 or an order by the Engineer requires that an action be immediate or taken immediately, it shall be understood that the Contractor shall at once begin affecting completion of the action and pursue it to completion in a manner acceptable to the Engineer, and per the Colorado Discharge Permit System Stormwater Construction Permit (CDPS-SCP) requirements.

MATERIALS

208.02 Erosion control materials are subject to acceptance per subsection 106.01. Erosion control materials shall be subject to the following approval process:

Table 208-1

APPROVAL PROCESS FOR EROSION CONTROL MATERIALS

Material	Approval Process	Notes
Erosion Bales (Weed Free)	COC	The Contractor shall provide a transit certificate number, or a copy of the transit certificate as supplied from the producer.
Silt Fence	COC	
Silt Berm	APL	
Erosion Log (Type 1, Type 2, and Type 3)	COC	
Silt Dikes	COC	
Prefabricated Concrete Washout Structures (above ground)	APL	
Prefabricated Vehicle Tracking Pad	APL	
Aggregate Bag	COC	
Storm Drain Inlet Protection (Type I, II, and III)	APL	

Table 208-1 Notes: COC = Certificate of Compliance; APL= Approved Product List

The material for control measures shall conform to the following:

(a) *Erosion Bales*: Material for erosion bales shall consist of Certified Weed Free hay or straw. The hay or straw shall be certified under the Colorado Department of Agriculture Weed Free Forage Certification Program and inspected as regulated by the Weed Free Forage Act, Title 35, Article 27.5, CRS. Each certified weed free erosion bale shall be identified by blue and orange twine binding the bales.

The Contractor shall not place certified weed free erosion bales or remove their identifying twine until the Engineer has inspected them.

The Contractor may obtain a current list of Colorado Weed Free Forage Crop Producers who have completed certification by contacting the Colorado Department of Agriculture, Weed Free Forage Program, 305 Interlocken Pkwy, Broomfield, CO 80021, Contact: Weed Free Forage Coordinator at (303) 869-9038. Also available at www.colorado.gov/ag/csd.

Bales shall be approximately 5 cubic feet of material and weigh at least 35 pounds. Stakes shall be wood and shall be 2 inch by 2 inch nominal.

(b) Silt Fence. Silt fence posts shall be wood with a minimum length of 46 inches. Wood posts shall be 1.5-inch width by 1.5-inch thickness actual dimensions with 1/8-inch tolerance. Geotextile shall be attached to wood posts with three or more staples per post.

Silt fence geotextile shall conform to the following requirements:

Table 208-2

PHYSICAL REQUIREMENTS FOR SILT FENCE GEOTEXTILES

Property	**Wire Fence Supported Requirements**	**Self-Supported Requirements Geotextile Elongation <50%**	**Test Method**
Grab Strength, lbs.	90 minimum	124 minimum	ASTM D4632
Permittivity sec-1	0.05	0.05	ASTM D4491
Ultraviolet Stability	Minimum 70% Strength Retained	Minimum 70% Strength Retained	ASTM D4355

(c) Silt Fence (Reinforced). Silt fence posts shall be metal "studded tee" T-post with a minimum length of 66 inches. Metal posts shall be “studded tee” with .095-inch minimum wall thickness. Wire fabric reinforcement for the silt fence geotextile shall be a minimum of 14 gauge with a maximum mesh spacing of 6 inches. Geotextile shall be attached to welded wire fabric with ties or nylon cable ties at 12 inches on center at top, middle, and bottom wire. Welded wire fabric shall be attached to the post with a minimum three 12-gauge wire ties per post. Vinyl or rubber safety caps shall be installed on all T-post.

(d) Temporary Berms. Temporary berms shall be constructed out of embankment (subsoil) and not out of salvaged topsoil.

(e) Temporary Slope Drains. Temporary slope drains shall consist of fiber mats, plastic sheets, stone, concrete or asphalt gutters, half-round pipe, metal or plastic pipe, wood flume, flexible rubber, or other materials suitable to carry accumulated water down the slopes. Outlet protection riprap shall conform to Section 506. Erosion control geotextile shall be a minimum Class 2, conforming to subsection 712.08.

(f) Silt Berm. Silt berm shall consist of permeable multi-use material consisting of ultraviolet (UV) stabilized high-density polyethylene or other approved material effective in reducing water velocity. Designed and tested system shall be installed on a Turf Reinforcement Mat or Soil Retention Blanket per Section 216. The segment shall be secured to the ground with either metal or wood stakes. Minimum requirements for securing stakes shall be per the plans. Dimensions of individual segments shall meet the following criteria:

Table 208-3

SILT BERM DIMENSIONS

Width	6 - 11 inches
Height	6 - 10 inches
Weight	> 0.25 lbs./sq. ft.
Percent Open Area	20% – 50%

(g) Rock Check Dam. Rock Check dams shall be constructed of stone. Stone shall meet the requirements of Section 506.

(h) Sediment Trap. In constructing an excavated sediment trap, excavated soil may be used to construct the dam embankment, provided the soil meets the requirements of subsection 203.03. Outlet protection riprap shall be the size specified in the Contract and shall conform to Section 506. Erosion control geotextile shall be a minimum Class 1, conforming to subsection 712.08.

(i) Erosion Logs. Erosion logs shall be one of the following types unless otherwise shown on the plans:

1. Erosion Log (Type 1) shall consist of cylinder casings filled with curled aspen wood excelsior with a consistent width of fibers evenly distributed throughout the log. The casing shall be seamless, photodegradable tube netting. The curled aspen wood excelsior shall be fungus free, resin free, and free of growth or germination inhibiting substances.

2. Erosion Log (Type 2) shall consist of cylinder casings filled with Erosion Log (Type 2) Compost per subsection 212.02. The compost-wood chip blend may be pneumatically shot into a geotextile cylindrical casing or be pre-manufactured. The geotextile casing shall consist of high density polyethylene (HDPE) or polypropylene mesh (knitted, not extruded) with openings of 1/8 to 3/8 inch and contain the compost-wood chip material while not limiting water infiltration.

3. Erosion Log (Type 3) shall consist of cylinder casings filled with curled aspen wood excelsior with a consistent width of fibers evenly distributed throughout the log. The casing shall be seamless, 100 percent natural fiber cylinder netting (compostable) and shall have minimum dimensions as shown in Table 208-4, based on the diameter of the log shown on the plans. Netting shall be a woven cotton or cellulose base mesh that has an approval to compost certification with a maximum mesh size of 0.075 inches and index values as shown in Table 208-5. The curled aspen wood excelsior shall be fungus free, resin free, and free of growth or germination inhibiting substances.

   Natural compostable fiber netting shall not contain any synthetic material woven into the netting such as polypropylene, nylon, polyethylene, or polyester dyes. Oxo-degradable or oxo-biodegradable petrochemical-based fiber shall not be part of the netting material. Burlap netting material shall not be used for Erosion Log (Type 3).

   Erosion Log (Type 1, Type 2, and Type 3) shall have minimum dimensions as shown in Table 208-4, based on the specified diameter of the log.

Table 208-4

EROSION LOG DIMENSIONS

Diameter Type 1 and 3 (Inches)	Diameter Type 2 (Inches)	Min. Length (feet)	Max. Length (feet)	Min. Weight (lb/ft)	Stake Dimensions (Inches)
9	8	10	180	1.6	0.75 thickness by 0.75 width by 18 long
12	12	10	180	2.5	1.5 thickness by 1.25 width by 24 long
20	18	10	180	4	1.5 thickness by 1.25 width by 30 long

Table 208-4 Notes: Wood stake acceptable tolerance +/- 1/8 inch.

Table 208-5

Index Values for Natural Fiber Netting

Property	Requirement	Test Method
Fabric Tensile Strength	>70 lbs.	ASTM D3822
Biodegradable	100%	ASTM D5988
Mesh Pattern	Rib	

Stakes to secure erosion logs shall consist of pinewood or hardwood.

(j) Silt Dikes. Silt dikes shall be pre-manufactured flexible sediment barrier that will fully rebound when driven over by heavy equipment. Material shall consist of outer geotextile fabric covering closed cell urethane or polyethylene foam core. The geotextile fabric aprons shall extend beyond the foam core a minimum of 8 inches on both sides.

Table 208-6

GEOTEXTILE REQUIREMENTS

Property	Requirement	Test Method
Water Flow Rate	100 - 150 gallons per minute/square foot	ASTM D4491
Grab Breaking Load	200 lbs. minimum in each direction	ASTM D4632
Ultraviolet Degradation	70% of original unexposed grab breaking load after 500 hours	ASTM D4595

Each silt dike segment shall have the following dimensions:

Dimension Length

Vertical height after installation >5 inches

Geotextile sleeve section to interlock segments	>8 inches

Silt dike segments shall be anchored down using the minimum requirements shown in Table 208-7.

Table 208-7

SILT DIKE SEGMENT REQUIREMENTS

Surface	Nail	Washers
Soil Surface	Installed in 4-inch-deep trench with 6-inch nails no more than 4 feet O.C. (on center)	1-inch washers
Hard Surface	1-inch concrete nails no more than 4 feet O.C.	1-inch washers and solvent-free adhesive

(k) Concrete Washout Structure. The Contractor shall construct a washout structure that will contain washout from concrete placement, construction equipment cleaning operations, and residue from cutting, coring, grinding, grooving, and hydroconcrete demolition. Embankment required for the concrete washout structure may be excavated material, if this material meets the requirements of Section 203 for embankment. If the bottom of the excavated structure is within 5 feet of anticipated high ground water elevation or the soil does not have adequate buffering capacity to meet water quality standards, an impermeable synthetic liner shall be installed with the minimum properties shown in Table 208-8.

Table 208-8

IMPERMEABLE SYNTHETIC LINER REQUIREMENTS

Tested Property	Test Method	Units	Value
Thickness	ASTM D5199	mil	>30 +/- 1.5
Tear Strength	ASTM D1004	lbs.	>8
Low Temperature Impact	ASTM D1790	°F	Pass at -20

(l) Prefabricated Concrete Washout Structure. Prefabricated Concrete Washout Structures shall be one of the following types unless otherwise shown on the plans:

1. Prefabricated Concrete Washout Structure (Type 1). Type 1 portable bins shall be used only when specified in the Contract. It shall consist of a watertight multi-use container designed to contain liquid concrete washout wastewater, solid residual concrete waste from washout operations, and residue from saw cutting, coring, grinding, grooving, and hydro-concrete demolition. Minimum capacity including freeboard shall be 440 gallons. Prefabricated Concrete Washout Structure (Type 2). Type 2 portable bins shall be used only when specified in the Contract. It shall consist of a watertight one-time use container designed to contain liquid concrete washout wastewater, solid residual concrete waste from washout operations, and residue from saw cutting, coring, grinding, grooving, and hydro-concrete demolition. The structure shall have a system to secure to the ground. Minimum capacity including freeboard shall be 50 gallons.

(m)Vehicle Tracking Pad (VTP). Aggregate for the vehicle-tracking pad shall be crushed natural aggregate with at least two fractured faces that meets the following gradation requirements:

Table 208-9

AGGREGATE GRADATION

FOR VEHICLE TRACKING PAD

Sieve size	Percent by weight Passing Square Mesh Sieves
75 mm (3 inch)	100
50 mm (2 inch)	0-25
19.0 mm (3/4 inch)	0-15

Recycled crushed concrete or asphalt shall not be used for vehicle tracking pads.

Erosion control geotextile shall be a minimum Class 2, conforming to subsection 712.08.

Prefabricated or manufactured vehicle tracking pads shall only be used if specified in the Contract. Multi-use pads shall consist of industrial grade materials and shall be designed to minimize sediment leaving the project.

Minimum dimensions of the modular systems shall be:

Table 208-10

MINIMUM DIMENSIONS FOR VEHICLE TRACKING PAD

Width	12 feet
Length of pad	35 feet
Weight (min.) (lbs./sq. ft.)	8
Crush strength (min.) (psi)	400

To accommodate construction traffic turning radii between the tracking pad and a stabilized surface, additional flared sections of approved pads or aggregate per this specification shall be used at no additional cost to CDOT.

If pads weigh less than 8 pounds per square foot, an anchoring system approved by the manufacturer shall be used for pads placed on soil and hard surfaces.

A thin layer of stone, geotextile, or other stable surface may be required to stop rutting under the pad or area where the vehicles mount or dismount the manufactured trackout control device.

(n) Aggregate Bag. Aggregate bags shall consist of crushed stone or recycled rubber filled fabric with the following properties:

Table 208-11

AGGREGATE BAG PROPERTIES

Diameter (inches)	Weight (minimum) (lb/ft)
6-8	6
10	10
12	15

Rubber used in bags shall be clean, 95 percent free of metal and particulates.

Crushed stone contained in the aggregate bags shall conform to Table 703-1 for Coarse Aggregate No. 6.

The aggregate bag shall consist of a woven geotextile fabric with the following properties:

Table 208-12

GEOTEXTILE PROPERTIES FOR AGGREGATE BAG

Property	Requirement	Test Method
Grab Tensile Strength	90 lbs. min.	ASTM D4632
Trapezoid Tear Strength	25 lbs. min.	ASTM D4533
Mullen Burst	300 psi	ASTM D3786
Ultraviolet Resistance	70%	ASTM D4355

(o) Storm Drain Inlet Protection. Storm drain inlet protection shall consist of aggregate filled fabric with the following dimensions:

Table 208-13

AGGREGATE BAG DIMENSIONS FOR STORM DRAIN INLET PROTECTION

Storm Drain Inlet Protection Properties	*Protection Type I	#Protection Type II	^Protection Type III
Diameter	4 in.	4 in.	N/A
Minimum Section Length	7 ft.	5 ft.	5 ft.
Apron Insert	---	30 in. or sized to grate	30 in. or sized to grate

Table 208-13 Notes: *****Type I protection shall be used with Inlet Type R.

#Type II protection shall be used with Combination Inlet. Option A or B

^Type III protection shall be used with Vane Grate Inlet only. Option A or B Note: Options A and B are shown on Standard Plan M-208-1.

The Storm Drain Inlet Protection (Type I, II, and III) shall consist of a woven geotextile fabric with the following properties:

Table 208-14

WOVEN GEOTEXTILE FABRIC FOR STORM DRAIN INLET PROTECTION

Property	Test Method	Unit	Requirement
Grab tensile strength	ASTM D4632	lbs.	minimum 150x200
Mullen Burst Strength	ASTM D3786	lbs.	400
Trapezoid Tear Strength	ASTM D4533	lbs.	minimum 60x60
Percent Open Area	COE-22125-86	%	≥20
Water Flow Rate	ASTM D4491	gal./min./sq. ft.	≥100
Ultraviolet Resistance	ASTM D4355	%	≥70

Curb roll for Storm Drain Inlet Protection (Type I and II) shall have a weight greater than 4 pounds per linear foot of device. The device shall be capable of conforming to the shape of the curb. Aggregate contained in the storm drain inlet device shall consist of gravel or crushed stone conforming Table 703-1 for Coarse Aggregate No. 6.

CONSTRUCTION REQUIREMENTS

208.03 Project Review, Schedule, and Erosion Control Management. Before construction, an on-site Environmental Preconstruction conference shall be held. The conference shall be attended by:

(1) The Engineer.

(2) The Superintendent.

(3) The Contractor's Stormwater Management Plan (SWMP) Administrator. The SWMP Administrator is equivalent to the CDPS-SCP Qualified Stormwater Manager.

(4) Supervisors or Foremen of subcontractors working on the project.

(5) The Region Water Pollution Control Manager (RWPCM).

(6) CDOT personnel (e.g., CDOT Landscape Architect) who prepared or reviewed the Stormwater Management Plan (SWMP).

At this Conference, the attendees shall discuss the SWMP, CDPS-SCP, sensitive habitats on-site, wetlands, other vegetation to be protected, and the enforcement mechanisms for not meeting the requirements of this specification.

Before beginning construction, the Contractor shall evaluate the project site for stormwater draining into or through the site. When such drainage is identified, control measures shall be used if possible, to divert stormwater from running on-site and becoming contaminated with sediment or other pollutants. The diversion may be accomplished with a temporary pipe or other conveyance to prevent water contamination or contact with pollutants. Run-on water that cannot be diverted shall be treated as construction runoff and adequate control measures shall be employed.

The SWMP Administrator shall evaluate all non-stormwater coming onto the site, such as springs, seeps, and landscape irrigation return flow. If such flow is identified, control measures shall be used to protect off-site water from becoming contaminated with sediment or other pollutants.

The SWMP Administrator shall review existing inlets and culverts to determine if inlet protection is needed due to water flow patterns. Before beginning construction, inlets and culverts needing protection shall be protected and the location of the implemented control measure added to the SWMP Site Map.

Before construction, the Contractor shall implement appropriate control measures for protection of wetlands, sensitive habitat, and existing vegetation from ground disturbance and other pollutant sources, per the approved project schedule as described in subsection 208.03(b).

When additional control measures are required and approved by the Engineer, the Contractor shall implement the additional control measures and the SWMP Administrator shall record and describe them on the SWMP Site Map. The approved control measures will be measured and paid for per subsections 208.11 and 208.12.

(a) *Project Review*. The Contractor may submit modifications to the Contract's control measures in a written proposal to the Engineer. The written proposal shall include the following information:

1. Reasons for changing the control measures.
2. Diagrams showing details and locations of all proposed changes.
3. List of appropriate pay items indicating new and revised quantities.
4. Schedules for accomplishing all erosion and sediment control work.
5. Effects on permits or certifications caused by the proposed changes.

The Engineer will approve or reject the written proposal in writing within seven days after receipt of the submittal. The Engineer may require additional control measures before approving the proposed modifications. Additional modifications and additional control measures will be paid for at the Contract Unit Price for the specific items involved. If no items exist, they will be paid for as extra work per subsection 109.04.

(b) *Erosion and Sediment Control Activities*. The erosion and sediment control activities shall be included in the weekly meeting update. The project schedule shall specifically indicate the sequence of clearing and grubbing, earthwork operations, and construction of temporary and permanent erosion control features and stabilization. The project schedule shall include erosion and sediment control work for haul roads, borrow pits, storage and asphalt or concrete batch sites, and all areas within the project limits. If during construction the Contractor proposes changes that would affect the Contract's control measures, the Contractor shall propose revised control measures to the Engineer for approval in writing. If necessary, the SWMP Administrator shall update proposed sequencing of major activities in the SWMP. Revisions shall not be implemented until the proposed measures have been approved in writing by the Engineer.

(c) *Erosion Control Management* (ECM). Erosion Control Management for this project shall consist of SWMP Administration and Erosion Control Inspection. All ECM staff shall have working knowledge and experience in construction, and shall have successfully completed the Transportation Erosion Control Supervisory Certificate Training (TECS) as provided by the Department. The Superintendent cannot serve in an ECM role. The Erosion Control Inspector (ECI) and the SWMP Administrator may be the same person in projects with not more than 40 acres of disturbed area. The ECI and the SWMP Administrator are equivalent to the CDPS-SCP Qualified Stormwater Manager.

1. SWMP Administration. The SWMP Administrator shall maintain the SWMP. Record the name of the SWMP Administrator on the SWMP Section 3.B. The SWMP Administrator shall have full responsibility to maintain and update the SWMP and identify to the Superintendent critical action items needed to conform to the CDPS-SCP as follows:

   A. Complete the SWMP as described in subsection 208.03(d).
   B. Participate in the Environmental Pre-construction Conference.
   C. Attend weekly erosion and sediment control meetings.
   D. Attend all Headquarters and Region water quality control inspections. The Contractor and the Contractor's SWMP Administrator will be notified a minimum of five days in advance of each inspection by Headquarters or Region water quality staff.

E. Coordinate with the Superintendent to implement necessary actions to reduce anticipated or presently existing water quality or erosion problems resulting from construction activities.

F. Coordinate with the Superintendent to ensure that all labor, material, and equipment needed to install, maintain, and remove control measures are available as needed.

G. During construction, update the SWMP Site Map to reflect current field conditions and include, at a minimum, the following:

(1) Limits of Construction (LOC).

(2) Areas of disturbance (AD), including areas of borrow and fill.

(3) Limits of Disturbance (LDA).

(4) Areas used for storage of construction materials, equipment, soils, or wastes.

(5) Location of dedicated asphalt, concrete batch plants, and masonry mixing machines.

(6) Location of construction offices and staging areas.

(7) Location of work access routes during construction.

(8) Location of waste accumulation areas, including areas for liquid, concrete, masonry, and asphalt.

(9) Location of temporary, interim, and permanent stabilization.

(10) Location of outfalls.

(11) Flow arrows that depict stormwater flow directions on-site and runoff direction.

(12) Location of structural and non-structural control measures.

(13) Location of springs, streams, wetlands, and other State waters, including areas that require pre-existing vegetation be maintained within 50 horizontal feet of a receiving water, unless infeasible.

(14) Location of stream crossings located within the construction site boundary.

H. The SWMP shall reflect the field conditions and shall be amended to reflect control measures, including the following:

(1) A change in design, construction, operation, or maintenance of the site that would require the implementation of new or revised control measures; or

(2) Changes when the SWMP proves to be ineffective in achieving the general objectives of controlling pollutants in stormwater discharges associated with construction activity.

(3) Changes when control measures are no longer necessary and are removed.

I. Complete vegetative survey transects when required per CDOT Erosion Control and Stormwater Quality Guide.

J. Start a new site map before the current one becomes illegible. All site maps shall remain as part of the SWMP.

K. Document all inspection and maintenance activities. Keep the SWMP and documentation on the project site.

L. When adding or revising control measures in the SWMP, add a narrative explaining what, when, where, why, and how the control measure is being used, and add a detail to the SWMP.

(1) How to install and inspect the control measure.

(2) Where to install the control measure.

(3) When to maintain the control measure.

M. If using existing topography, vegetation, etc. as a control measure, label it as such on the SWMP Site Map; add a narrative as to when, where, why, and how the control measure is being used.

N. Indicate control measures in use or not in use by recording them on Standard Plans M-208-1, M-216-1, and M-6151 in the SWMP.

O. Record on the SWMP, the approved Method Statement for Containing Pollutant Byproducts.

P. Update the potential pollutants list in the SWMP and Spill Response Plan throughout construction.

Q. Do not use vegetative buffers as a sole control measure. Use them only as the final stage of a treatment train.

2. Erosion Control Inspector.

One ECI is required for every 40 acres of total disturbed area that is currently receiving temporary and interim stabilization measures as defined in subsection 208.04(e). An ECI shall not be responsible for more than 40 acres in the project. Accepted permanent stabilization methods as defined in subsection 208.04(e) will not be included in the 40 acres.

A. ECI duties shall be as follows:

(1) Coordinate with the SWMP Administrator on reporting the results of inspections and how to install and inspect the control measure.

(2) Review the construction site for compliance with the Stormwater Construction Permit.

(3) Inspect with the Superintendent and the Engineer (or their designated representatives) the stormwater management system at least every seven calendar days. Conduct post-storm event inspections within 24 hours after the end of any precipitation or snowmelt event that may cause surface erosion. If no construction activities will occur following a storm event, post-storm event

inspections shall be conducted before commencing construction activities, but no later than 72 hours following the storm event. Document delay in inspections in the inspection report. Form 1176 (Stormwater Field Inspection Report – Active Construction) shall be used for all seven-day inspections and inspections following storm events. The Contractor shall notify the ECI when a storm event occurs.

Inspections are not required at sites when construction activities are temporarily halted, when snow cover exists over the entire site for an extended period and melting conditions do not pose a risk of surface erosion. This exception shall be applicable only during the period where melting conditions do not exist, and applies to the routine seven-day, Headquarters and Region inspections, as well as the post-storm event inspections. Document the following information on Form 1176 for use of this exclusion: dates when snow cover occurred, date when construction activities ceased, and date melting conditions began.

B. The order of precedence for required inspections shall be as follows:

(1) Headquarters or Region water quality routine audits

(2) Post-storm event inspections

(3) Seven-day inspections

When one of the listed inspections is performed, the inspections listed below it need not be performed on that day if the required CDOT and Contractor personnel participated in the inspection.

A seven-day inspection is not required on the same day a Headquarters or Region water quality routine audit is conducted, as long as all of the inspection scope requirements for a seven-day and post-storm event inspection are met. A sheet shall be placed in the inspections area of the SWMP to refer to the date the inspection was performed.

C. Seven-day inspections and post-storm inspections shall include inspection of the following areas, if applicable, for evidence of, or the potential for, pollutants leaving the construction site boundaries, entering the stormwater drainage system, or discharging to State waters:

(1) Construction site perimeter
(2) Disturbed areas
(3) Designated haul routes
(4) Material and waste storage areas exposed to precipitation.
(5) Locations where stormwater has the potential to discharge offsite.
(6) Locations where vehicles exit the site.

D. Inspections shall include the following:

(1) Visually verify whether all implemented control measures are in effective operational condition and are working as designed in their specifications to minimize pollutant discharges.
(2) Determine if there are new potential sources of pollutants.
(3) Assess the adequacy of control measures at the site to identify areas requiring new or modified control measures to minimize pollutant discharges.

(4) Identify all areas of non-compliance with the permit requirements and, if necessary, implement corrective action per the CDPS-SCP.

Follow all other agency Stormwater requirements and inspections unless a waiver or other agreement has been made.

E. The Contractor shall report the following circumstances orally to CDOT, CDPHE, the Contractor's Superintendent, and the SWMP Administrator within 24 hours from the time the permittee becomes aware of the circumstances, and shall mail to the Division a written report containing the information requested within five working days after becoming aware of the following circumstances:

(1) Noncompliance that may endanger health or the environment, regardless of the cause of the incident.
(2) Unanticipated bypass that exceeds any effluent limitations per the CDPS-SCP.
(3) Upset conditions that causes an exceedance of any effluent limitation per the CDPS-SCP.
(4) Daily maximum violations for any of the pollutants limited by the permit. This includes any toxic pollutant or hazardous substance, or any pollutant specifically identified as the method to control any toxic pollutant or hazardous substance.

F. Document spills, leaks, or overflows that result in the discharge of pollutants on the Form 1176. The ECI shall record the time and date, weather conditions, reasons for spill, and how it was remediated.

(d) Documentation Available on the Project. The following Contract documents and references will be made available for reference at the CDOT field office during construction:

1. SWMP. The Engineer will provide an approved SWMP design at the Pre-construction Conference, which is and shall remain the property of CDOT. Before construction, CDOT will provide the documentation for items (1) through (4), and (18) as listed below, when available. The Contractor shall provide the contents required for items (5) through (17). The SWMP shall be stored in the CDOT field office or at another on-site location approved by the Division. The SWMP Administrator shall modify and update the SWMP as needed to reflect actual site conditions before the change or as soon as practicable, but in no case more than 72 hours after the change. The following Contract documents and reports shall be kept, maintained, and updated in the SWMP under the appropriate items by the SWMP Administrator:

A. SWMP Plan Sheets – Notes, tabulation, site description. The SWMP site description shall include, at a minimum, the following:

(1) The nature of the construction activity at the site.
(2) The proposed schedule for the sequence for major construction activities and the planned implementation of control measures for each phase. (clearing, grading, utilities, vertical, etc.)
(3) Estimates of the total acreage of the site, and the acreage expected to be disturbed by clearing, excavation, grading, or any other construction activities.
(4) A summary of any existing data used in the development of the construction site plans or SWMP that describe the soil or existing potential for soil erosion.
(5) A description of the percent of existing vegetative ground cover relative to the

entire site and the method for determining the percentage, per CDOT Erosion Control and Stormwater Quality Guide.

(6) A description of any allowable non-stormwater discharges at the site, including those being discharged under a division low risk discharge guidance policy.

(7) A description of areas receiving discharge from the site. Including a description of the immediate source receiving the discharge. If the stormwater discharge is to a municipal separate storm sewer system (MS4), the name of the entity owning the system, the location of the storm sewer discharge, and the ultimate receiving water(s).

(8) A description of all stream crossings located within the construction site boundary.

B. SWMP Site Maps and Project Plan Title Sheet.

C. Specifications – Standard and project special provisions related to stormwater and erosion control.

D. Standard Plans M-208-1, M-216-1 and M-615-1.

E. Control Measure Details not in Standard Plan M-208-1 – Non-standard details.

F. Weekly meeting sign-in sheet and weekly meeting notes.

G. Calendar of Inspections – Calendar of inspections marking when all inspections take place.

H. Contractor Stormwater Field Inspection Reports (Forms 1176, 1177, 1388).

I. All Water Quality Audit Reports and Form 105(s) relating to Water Quality.

J. Description of Inspection and Maintenance Methods – Description of inspection and maintenance methods implemented at the site to maintain all control measures identified in the SWMP and items not addressed in the design.

K. Spill Response Plan – Reports of reportable spills submitted to CDPHE.

L. List and Evaluation of Potential Pollutants – List of potential pollutants as described in subsection 107.25 and approved Method Statement for Containing Pollutant Byproducts.

M. Other Correspondence including agreements with other MS4s, approved deferral request, CDPHE audit documentation, Water Quality Permit Transfer to Maintenance Punch List, and other miscellaneous documentation such as documented use agreements for areas outside of the permitted area.

N. TECS Certifications of the SWMP Administrator and all ECIs, kept current through the life of the project.

O. Environmental Pre-construction Conference – Conference agenda with a certification of understanding of the terms and conditions of the CDPS-SCP and SWMP. All attendees shall sign the certification. A certification shall also be signed by all attendees of meetings held for new subcontractors beginning work on the project that could adversely affect water quality after the Environmental Pre-construction Conference has been held.

P. Project Environmental Permits – All project environmental permits and associated applications and certifications, including: CDPS-SCP, Senate Bill 40, USACE 404, temporary stream crossings, dewatering, biological opinions, and all other permits applicable to the project, including any separate CDPS-SCP obtained by the Contractor for staging area on private property, asphalt or concrete batch plant.

Q. Photographs Documenting Existing Vegetation – Project photographs shall include the following information with the record: project number, project code, name of the person who took the picture, date and time the picture was taken, and location and approximate station number or mile marker. The Contractor shall submit photographs documenting existing vegetation, before construction commencing, on paper with a maximum of four colored images per side of 8 1/2 inch by 11-inch sheet or a digital copy on CD-ROM/Flash Drive (JPG format) as directed by the Engineer.

R. Permanent Water Quality Plan Sheets – Plan sheets and specifications for permanent water quality structures and riprap.

The Engineer will incorporate the documents and reports available at the time of award. The Contractor shall provide and insert all other documents and reports as they become available during construction. The SWMP Administrator shall finalize the SWMP for CDOT Maintenance use upon completion of the project. The Engineer shall approve SWMP completeness. Corrections to the SWMP shall be made at the Contractor's expense.

2. Reference Materials. The following Reference materials shall be used:

(1) CDOT Erosion Control and Stormwater Quality Guide.

(2) CDOT Erosion Control and Stormwater Quality Field Guide.

(e) Weekly Meetings: The Engineer, the Superintendent, and the SWMP Administrator shall conduct a weekly meeting with supervisors involved in construction activities that could adversely affect water quality. The meeting shall follow an agenda prepared by the Engineer, or a designated representative, and have a sign-in sheet recording the names of all attendees. The SWMP Administrator shall take notes of water quality comments and action items at each weekly meeting and place the agenda and sign-in sheet in the SWMP. At this meeting the following shall be discussed and recorded in tab 6 of the SWMP:

(1) Recalcitrant, chronic, and severe inspection findings.
(2) Unresolved issues from previous inspections.
(3) Requirements of the SWMP.
(4) Problems that may have arisen in implementing the site specific SWMP or maintaining control measures.
(5) Control measures that are to be installed, removed, modified, or maintained, and associated SWMP modifications.
(6) Planned activities that will affect stormwater in order to proactively phase control measures.

All subcontractors not in attendance at the Environmental Pre-construction Conference shall be briefed on the project by the Engineer, Superintendent, and the SWMP Administrator before start of work. The SWMP Administrator shall record the names of these subcontractors as an addendum to the list of attendees and add it to the SWMP.

208.04 Control Measures for Stormwater. The SWMP Administrator shall modify the SWMP to clearly describe and locate all control measures implemented at the site to control potential sediment discharges.

Vehicle tracking pads shall be used at all vehicle and equipment exit points from the site to prevent sediment exiting the limits of construction (LOC) of the project site. Access shall be provided only at locations approved by the Engineer. The SWMP Administrator shall record vehicle tracking pad locations on the SWMP Site Map.

New inlets and culverts shall be protected during their construction. Appropriate protection of each culvert and inlet shall be installed immediately. When riprap is called for at the outlet of a culvert, it shall be installed within 24 hours of completion of each pipe. The Contractor shall remove sediment, millings, debris, and other pollutants from within the newly constructed drainage system per the CDPS-SCP, before use, at the Contractor's expense. All removed sediment shall be disposed of outside the project limits per all applicable regulations.

Concrete products wasted on the ground during construction including, but not limited to, excess concrete removed from forms, spills, slop, and all other unused concrete are potential pollutants that shall be removed from the site or contained at a preapproved containment area that has been identified in the SWMP. The concrete shall be picked up and recycled per 6 CCR 1007-2 (CDPHE Regulations Pertaining to Solid Waste Sites and Facilities) at regular intervals, as needed, or as directed by the Engineer. The uses of recycled concrete from permitted recycling facilities shall be per Section 203.

(a) Unforeseen Conditions. The Contractor shall design and implement erosion and sediment control measures for correcting conditions unforeseen during the design of the project, or for emergency situations, that develop during construction. The Department's Erosion Control and Stormwater Quality Guide shall be used as a reference document for the purpose of designing erosion and sediment control measures. Measures and methods proposed by the Contractor shall be reviewed and approved in writing by the Engineer before installation.

(b) Other Agencies. If CDPHE, US Army Corps of Engineers (USACE), the Environmental Protection Agency (EPA), or a Local Agency reviews the project site and requires additional measures to prevent and control erosion, sediment, or pollutants, the Contractor shall cease and desist activities resulting in pollutant discharge and immediately implement these measures. If the work may negatively affect another MS4, the Contractor shall cease and desist activities resulting in the discharge and shall implement appropriate measures to protect the neighboring MS4, including installing additional measures. Implementation of these additional measures will be paid for at contract unit prices.

(c) Work Outside the Right of Way. Disturbed areas, including staging areas, that are outside CDOT ROW and outside easements acquired by CDOT for construction, are the responsibility of the Contractor. These areas shall be subject to a separate CDPS-SCP and all other necessary permits, as they are considered a common plan of development if within a 1/4 mile of the construction site. The Contractor shall acquire these permits and submit copies to the Engineer before any disturbance. These permits shall be acquired, and all erosion and sediment control work performed at the Contractor's expense. These areas are subject to inspections by CDOT or any other agency, as agreed upon in writing. A documented use agreement between the permittee and the owner or operator of any control measures located outside of the permitted area that are utilized by the permittee's construction site for compliance with the CDPS-SCP, but not under the direct control of the permittee shall be placed in the project's SWMP.

(d) Construction Implementation. The Contractor shall incorporate control measures into the

project as outlined in the accepted schedule.

(e) Stabilization. Once earthwork has started, the Contractor shall maintain erosion control measures until permanent stabilization of the area has been completed and accepted. Clearing, grubbing and slope stabilization measures shall be performed regularly to ensure final stabilization. Failure to properly maintain erosion control and stabilization methods, either through improper phasing or sequencing will require the Contractor to repair or replace sections of earthwork at the Contractor's expense. The Contractor shall schedule and implement the following stabilization measures during the course of the project:

1. Temporary Stabilization. At the end of each day, the Contractor shall stabilize disturbed areas by surface roughening, vertical tracking, or a combination thereof. Disturbed areas are locations where actions have been taken to alter the existing vegetation or underlying soil of a site, such as clearing, grading, roadbed preparation, soil compaction, and movement and stockpiling of sediment and materials. Designated topsoil distributed on the surface or in stockpiles shall not receive temporary stabilization. Other stabilization measures may be implemented, as approved. The maximum area of temporary stabilization (excluding areas of designated topsoil) shall not exceed 20 acres.

2. Interim Stabilization. As soon as it is known with reasonable certainty that work will be temporarily halted for 14 days or more, sediment and material stockpiles and disturbed areas shall be stabilized using one or more of the following methods:

   A. Application of 1.5 tons per acre of mechanically crimped certified weed free hay or straw in combination with an approved organic mulch tackifier.

   B. Placement of bonded fiber matrix per Section 213.

   C. Placement of mulching (hydraulic) wood cellulose fiber mulch with tackifier, per Section 213.

   D. Application of spray-on mulch blanket per Section 213. Magnesium Chloride, Potassium Chloride, and Sodium Chloride or other salt products shall not be used as a stabilization method.

   E. Topsoil stockpiles shall receive interim stabilization unless specified per Section 207 as a different material than the other disturbed areas on-site.

3. Summer and Winter Stabilization. Summer and winter stabilization is defined as stabilization during months when seeding is not permitted. As soon as the Contractor knows shutdown is to occur, interim stabilization shall be applied to the disturbed area. Protection of the interim stabilization method is required. Reapplication of interim stabilization may be required as directed.

4. Permanent Stabilization. Permanent stabilization is defined as the covering of disturbed areas with topsoil, seeding, mulching with tackifier, soil retention coverings, and such non-erodible methods as riprap, road shouldering, etc., or a combination as required by the Contract. Other permanent stabilization techniques may be proposed by the Contractor, in writing, and shall be used if approved in writing by the Engineer. Permanent stabilization requirements shown on the plans shall be completed within four working days of the placement of the topsoil per Section 207.

5. Final Stabilization. Final stabilization is achieved when all ground-disturbing activities at the site have been completed, and uniform vegetative cover has been established with an individual plant density of at least 70 percent of predisturbance levels, or equivalent permanent physical erosion reduction methods have been employed.

(f) Maintenance. Erosion and sediment control practices and other protective measures identified in the SWMP as control measures for stormwater pollution prevention shall be maintained in effective operating condition until the CDPS-SCP has been transferred to CDOT. Control measures shall be continuously maintained per good engineering, hydrologic, and pollution control practices, including removal of collected sediment when silt depth is 50 percent or more of the effective height of the erosion control device. When possible, the Contractor shall use equipment with an operator rather than labor alone to remove the sediment.

Maintenance of erosion and sediment control devices shall include replacement of such devices upon the end of their useful service life as recommended by the Contractor and approved by the Engineer. Maintenance of rock check dams and vehicle tracking pads shall be limited to removal and disposal of sediment or addition of aggregate. Damages resulting from failure to maintain control measures shall be repaired at the Contactor's expense.

Complete site assessment shall be performed as part of comprehensive inspection and maintenance procedures to assess the adequacy of control measures at the site and the necessity of changes to those control measures to ensure continued effective performance. Where site assessment results in the determination that new or replacement control measures are necessary, the control measures shall be installed to ensure continuous effectiveness. When identified, control measures shall be maintained, added, modified or replaced as soon as possible, immediately in most cases.

Approved new or replaced control measures will be measured and paid for per subsections 208.11 and 208.12. Devices damaged due to the Contractor's negligence shall be replaced at the Contractor's expense.

From the time seeding and mulching work begins until project acceptance the Contractor shall maintain all seeded areas. Damage to seeded areas or to mulch materials shall be immediately restored. Damage to seeded areas or to mulch materials due to Contractor negligence shall be immediately restored at the Contractor's expense. Restoration of other damaged areas will be measured and paid for under the appropriate bid item.

Temporary control measures may be removed upon completion of the project, as determined by the Water Quality Partial Acceptance walk-through. If removed, the area where these control measures were constructed shall be returned to a condition similar to what existed before its disturbance. Removed control measures shall become the property of the Contractor.

If the Contractor fails to complete construction within the approved contract time, the Contractor shall continue erosion and sediment control operations at its expense until acceptance of the work.

Sediment removed during maintenance of control measures and material from street sweeping may be used in or on embankment, provided it meets the requirements of Section 203 and is distributed evenly across the embankment.

Whenever sediment collects on the paved surface, the surface shall be cleaned. Street washing will not be allowed. Storm drain inlet protection shall be in place before shoveling, sweeping, or vacuuming. Sweeping shall be completed with a pickup broom or equipment capable of collecting sediment. Sweeping with a kick broom will not be allowed.

Material from pavement saw cutting operations shall be cleaned from the roadway surface during operations using a vacuum. A control measure, such as a berm, shall be placed to contain slurry from joint flushing operations until the residue can be removed from the soil surface. Aggregate bags, erosion logs or other permeable control measures shall not be used. Residue shall not flow into driving lanes. It shall be removed and disposed of per subsection 107.25(b). Material containment and removal will not be paid for separately but shall be included in the work.

208.05 Construction of Control Measures. Control measures shall be constructed per Standard Plans M-208-1 and M-216-1, and with the following:

(a) Seeding, Mulching, Sodding, Soil Retention Blanket. Seeding, mulching, sodding, and soil retention blanket installation shall be performed per Sections 212, 213, and 216.

(b) Erosion Bales. The bales shall be anchored securely to the ground with wood stakes.

(c) Silt Fence. Silt fence shall be installed in locations specified in the Contract.

(d) Temporary Berms. Berms shall be constructed to the dimensions shown in the Contract, and sufficiently compacted to prevent erosion or failure. If the berm erodes or fails, it shall be immediately repaired or replaced at the Contractor's expense.

(e) Temporary Diversion. Diversions shall be constructed to the dimensions shown in the Contract and graded to drain to a designated outlet. The berm shall be sufficiently compacted to prevent erosion or failure. If the diversion erodes or fails, it shall be immediately repaired or replaced at the Contractor's expense.

(f) Temporary Slope Drains. Temporary slope drains shall be installed before installation of permanent facilities or growth of adequate ground cover on the slopes. Temporary slope drains shall be securely anchored to the slope. The inlets and outlets of temporary slope drains shall be protected to prevent erosion.

(g) Silt Berm. Before installation of silt berms, the Contractor shall prepare the surface of the areas where the berms are to be installed such that are they free of materials greater than 2 inches in diameter and are suitably smooth for the installation of the silt berms, as approved. Silt berms shall be secured with spikes. The Contractor shall install the silt berm in a manner that will prevent water from going around or under the silt berm. Silt berms shall be installed on top of soil retention blanket or turf reinforcement blanket.

(h) Rock Check Dam. Rock shall be installed at locations shown on the plans. Rock check dams shall conform to the dimensions shown on the plans.

(i) Rip rap Outlet Protection. Geotextile used shall be protected from cutting or tearing. Overlaps between two pieces of geotextile shall be 1-foot minimum. Riprap size shall be as shown on the plans.

(j) Storm Drain Inlet Protection. Before installation, the Contractor shall sweep the surface of the area where the storm drain inlet protection devices are to be installed such that the pavement is free of sediment and debris. The ends of the inlet protection Type 1 and Type 2 shall extend a minimum of 1 foot past each end of the inlet.

The Contractor shall remove all accumulated sediment and debris from the surface surrounding all storm drain inlet protection devices after each rain event or as directed. The Contractor shall remove accumulated sediment from each Type II and III containment area when it is more than one third full of sediment, or as directed.

The Contractor shall protect storm drain facilities adjacent to locations where pavement cutting operations involving wheel cutting, saw cutting, sand blasting, or abrasive water jet blasting are to take place.

(k) Sediment Trap. Sediment traps shall be installed to collect sediment-laden water and to minimize the potential of pollutants leaving the project site. Locations shall be as shown on the plans or as directed.

Sediment traps shall be constructed before disturbance of upslope areas and shall be placed in locations where runoff from disturbed areas can be diverted into the trap.

The area under the embankment shall be cleared, grubbed, and stripped of any vegetation and roots.

Fill material for the embankment shall be free of roots or other vegetation, organic material, large stones, and other objectionable material.

Sediment shall be removed from the trap when it has accumulated to one half of the wet storage depth of the trap and shall be disposed of per subsection 208.04(f).

(l) Erosion Logs. Erosion logs shall be embedded 2 inches into the soil. Stakes shall be embedded so that the top of the stake does not extend past the top erosion log more than 2 inches, at the discretion of the Engineer, a shallower stake depth may be permitted if adverse site conditions are encountered, such as rock or frozen ground.

The Contractor shall maintain the erosion logs during construction to prevent sediment from passing over or under the logs.

(m)Silt Dikes. Before installation of silt dikes, the Contractor shall prepare the surface of the areas where the silt dikes are to be installed such that they are free of materials greater than 2 inches in diameter and are suitably smooth for the installation of the silt dikes, as approved by the Engineer.

(n) Concrete Washout Structure. The concrete washout structure shall meet or exceed the dimensions shown on the plans. Work on this structure shall not begin until the Engineer provides written acceptance of location.

Implement control measures designed for concrete washout waste. If the bottom of the excavated structure is within 5 feet of anticipated high ground water elevation or the soil does not have adequate buffering capacity to meet water quality standards, an impermeable synthetic liner shall be installed with the minimum properties shown in Table 208-8 or use a prefabricated washout.

Meet the following requirements:

1. The structure shall contain all washout water.
2. Stormwater shall not carry wastes from washout and disposal locations.
3. The site shall be located a minimum of 50 horizontal feet away from State waters and shall meet all requirements for containment and disposal as defined in subsection 107.25.
4. The site shall be signed as “Concrete Washout.”
5. The site shall be accessible to appropriate vehicles.
6. Freeboard capacity shall be included in the structure design to reasonably ensure the structure will not overtop during or because of a precipitation event.
7. The Contractor shall prevent tracking of washout material out of the washout structure.
8. Do not add solvents, flocculants, and acid to wash water.
9. Surround the structure on three sides by a compacted berm.
10. The structure shall be fenced with orange plastic construction fencing to provide a barrier to construction equipment and to aid in identification of the concrete washout area.
11. Concrete waste, liquid and solid, shall not exceed 2/3 the storage capacity of the washout structure.

(o) Prefabricated concrete washout structures (Type 1 and Type 2). Structures and sites shall meet the following requirements:

1. Structure shall contain all washout water. If bins are determined to be leaking, the Contractor shall replace the bin onsite and clean up the spilled material.
2. Structure shall be located a minimum of 50 horizontal feet away from State waters and shall be confined so that no potential pollutants will enter State waters and other sensitive areas as defined in the Contract. Locations shall be as approved by the Engineer. Sign the prefabricated structure as “Concrete Washout”. Sign can be on portable bin.
3. The site shall be accessible to appropriate vehicles.
4. Washout bins shall be covered with a tarp tied down to the structure or staked to the ground when a storm event is anticipated.
5. Do not add solvents, flocculants, and acid to wash water.
6. Concrete waste, liquid and solid, shall not exceed ⅔ the storage capacity of the washout structure.
7. Do not move prefabricated structures when they contain liquid, unless otherwise approved.
8. The concrete washout structure shall be installed and ready for use before concrete placement operations.
9. Check and maintain washout areas as required. Do not allow on-site permanent disposal of concrete washout waste.

10. All liquid and solid wastes, including contaminated sediment and soils generated from concrete washout shall be hauled away from the site and disposed of properly at the Contractor's expense.

11. Delivery to the site shall not occur until written acceptance is provided by the Engineer for both the product and the concrete waste disposal facility.

(p) Vehicle Tracking Pad (VTP). Vehicle tracking pads shall be constructed to the minimum dimensions shown in the Contract, unless otherwise directed by the Engineer. Construction of approved vehicle tracking pads shall be completed before any disturbance of the area.

The Contractor shall maintain each vehicle tracking pad during the entire time that it is in use for the project. The vehicle tracking pad shall be removed at the completion of the project unless otherwise directed by the Engineer. Additional aggregate may be required for maintenance and will be paid for under Pay Item, Maintenance Aggregate (Vehicle Tracking Pad).

(q) Detention Pond. Permanent detention ponds shown on the plans may be used as temporary control measures if the following conditions are met:

1. The pond is designated as a construction control measure in the SWMP.

2. The pond outfall and outlet are designed and implemented for use as a control measure during construction per good engineering, hydrologic, and pollution control practices. The stormwater discharges from the outfall shall not cause degradation or pollution of State waters and shall have control measures as appropriate.

3. All silt shall be removed, and the pond returned to the design grade and contour, before project acceptance.

(r) Aggregate Bag. Aggregate bags shall be placed on a stable surface, consisting of hardscape or compacted gravel. If approved by the Engineer, the aggregate bag may be placed on compacted dirt areas, where bags conform to the surface and can effectively minimize sediment transport. Aggregate bags shall not be placed in concentrated flow areas. Aggregate bags shall be placed to conform to the surface without gaps to ensure that discharge water does not cause erosion.

(s) Surface roughening. Surface roughening creates horizontal grooves along the contour of the slope. Roughening may be accomplished by furrowing, scarifying, ripping, or disking the soil surface to create a 2 to 4-inch minimum variation in soil surface.

(t) Vertical Tracking. Vertical tracking involves driving a tracked vehicle up and down the soil surface and creating horizontal grooves and ridges along the contour of the slope. Sandy soils or soils that are primarily rock need not be tracked.

208.06 Materials Handling and Spill Prevention. The SWMP Administrator shall clearly describe and record on the SWMP, all practices implemented at the site to minimize impacts from procedures or significant material that could contribute pollutants to runoff. Areas or procedures where potential spills can occur shall have a Spill Response Plan in place as specified in subsections 107.25(b) or 208.06(c). Construction equipment, fuels, lubricants, and other petroleum distillates shall not be stored or stockpiled within 50 horizontal feet of any State waters or more if the Contractor determines necessary. Equipment fueling and servicing shall occur only within approved designated areas.

(a) Bulk Storage Structures. Bulk storage structures for petroleum products and other chemicals shall have impervious secondary containment or equivalent adequate protection to contain all spills and prevent any spilled material from entering State waters. Secondary containment shall be capable of containing the combined volume of all the storage containers plus at least 10 percent freeboard. For secondary containment that is used and may result in accumulation of stormwater within the containment, a plan shall be implemented to properly manage and dispose of all accumulated stormwater deemed to be contaminated (has an unusual odor or sheen).

(b) Lubricant Leaks. The Contractor shall inspect equipment, vehicles, and repair areas daily to ensure petroleum, oils, and lubricants (POL) are not leaking onto the soil or pavement. Absorbent material or containers approved by the Engineer shall be used to prevent leaking POL from reaching the soil or pavement. The Contractor shall have onsite approved absorbent material or containers of sufficient capacity to contain any POL leak that can reasonably be foreseen. The Contractor shall inform all Spill Response Coordinators per the Spill Response Plan if unforeseen leakage is encountered. All materials resulting from POL leakage control and cleanup shall become the property of the Contractor and shall be removed from the site. Control, cleanup, and removal of by-products resulting from POL leaks shall be performed at the Contractor's expense.

(c) Spill Response Plan. A Spill Response Plan shall be developed and implemented to establish operating procedures for handling potential pollutants and preventing spills.

1. The Response Plan shall contain the following information:
2. Identification and contact information of each Spill Response Coordinator.
3. Locations of areas on the project site where equipment fueling and servicing operations are permitted.
4. Location of clean-up kits.
5. Quantities of chemicals and locations stored on-site.
6. Label system for chemicals and Safety Data Sheets (SDS) for products.
7. Clean-up procedures to be implemented in the event of a spill that does not enter State waters or ground water.
8. Procedures for spills of any size that enter surface waters or ground water or have the potential to do so. CDOT’s Erosion Control and Stormwater Quality Guide contains spill notification contacts and phone numbers required in the Spill Response Plan.
9. A summary of the employee training provided.

Information in items (1) through (8) shall be updated in the SWMP when they change.

208.07 Stockpile Management. Material stockpiles shall be located 50 horizontal feet away from State waters and shall be confined so that no potential pollutants will enter State waters and other sensitive areas as defined in the Contract. Locations shall be approved by the Engineer.

Erodible stockpiles (including topsoil) shall be contained with acceptable control measures at the toe (or within 20 feet of the toe) throughout construction. Control measures shall be approved by the Engineer. The SWMP Administrator shall describe, detail, and record the sediment control devices on the SWMP.

208.08 Limits of Disturbance. The Contractor shall limit construction activities to those areas within the limits of disturbance shown on the plans and cross-sections. Construction activities, in addition to the Contract work, shall include the on-site parking of vehicles or equipment, on-site staging, on-site batch plants, haul roads or work access, and all other activities that would disturb existing soil conditions. Staging areas within the LDA shall be as approved by the Engineer. Construction activities beyond the limits of disturbance due to Contractor negligence shall be restored to the original condition by the Contractor at the Contractor's expense. The SWMP Administrator shall tabulate additional disturbances not identified in the CDPS-SCP application and indicate changes to locations and quantities on the SWMP. The Contractor shall report the changes and additional disturbances to the Engineer, Water Quality Control Division of CDPHE, and all other involved agencies.

The Contractor shall pursue stabilization of all disturbances to completion.

208.09 Regulatory Mechanism for Water Quality The Department will identify and document findings not in compliance with the Water Quality Specifications, as specified in subsection 208.09(a)7, during Headquarters and Region water quality control inspections or observation by the Engineer. The Engineer will immediately notify the Contractor of these findings by issuing Form 105, which will be tracked in ESCAN/CARL software. Failure by the Contractor to clarify a finding location with the Engineer shall not interrupt the timelines noted in subsection 208.09(b).

Timelines noted in subsection 208.09(b) do not indemnify the Contractor from failing to comply with CDPS-SCP timelines for corrective actions. The CDPS-SCP (Part I.D.8) states corrective actions "…must be addressed as soon as possible, immediately in most cases, to minimize the discharge of pollutants."

(a) Definitions.

1. Compliance Assistance. A low-risk event as determined by the Region Water Pollution Control Manager (RWPCM). Compliance assistance events are not considered Findings and not subject to the Regulatory Mechanism noted in subsection 208.09(b).
2. Deferment. A request from the Contractor to the Engineer to delay implementation of corrective actions for Regular Findings pertaining to Water Quality Specifications. Deferments may only be granted due to extraordinary circumstances. However, it is at the Department's discretion to approve or reject these requests.

3. Finding. An incident discovered through inspection by the Department or by Engineer observation, which is noncompliant with the Water Quality Specifications. A Finding will be classified as one of the following:

   A. Regular Finding. A situation upon inspection that is in noncompliance with the Water Quality Specifications.

   B. Severe Finding. A discharge outside the project's Limits of Construction (LOC), subsection 107.25(a), to State waters or to a live inlet where the pollutant cannot be reclaimed.

   C. Chronic Finding. A Chronic Finding is assessed when the same Regular Finding at the same location is documented twice in the last three Headquarters or Region water quality control inspections. Engineer observed findings outside these inspections will not apply.

4. Inspection Form 105. The Form 105 issued by the Engineer documenting findings from Headquarters or Region led water quality inspection per subsection 208.03(c).

5. Location. The place where the finding was observed; can be a document (Stormwater Management Plan [SWMP]) or physical location. A physical location must be described with enough detail to guide an independent party to the spot of the finding. Physical locations must be supported with at least one photograph.

6. Recalcitrance. Contractor has shown willful negligence or misrepresentation or unwillingness to adhere to the Water Quality Specifications.

7. Water Quality Specifications. Subsection 107.25, Sections 208, 213 and 216, and Standard Plans M-208-1 and M-216-1.

(b) Liquidated Damages and Stop Work Orders. The Contractor will be subject to Liquidated Damages for incidents of failure to comply with the Water Quality Specifications and implement corrective actions to resolve noncompliance in the time frame established in subsection 208.09(b and c). Liquidated damages will not be considered a penalty but will be assessed to recover costs associated with environmental damages, and engineering and administrative expenses incurred by the Department for the Contractor's failure to comply with the Water Quality Specifications. Liquidated damages will accumulate for each finding, for each cumulative day that the finding remains uncorrected. Liquidated damages associated with incidents pertaining to this subsection do not indemnify the Contractor of other Liquidated Damages associated with this project.

In addition to Liquidated Damages, the Contractor will be subject to a project-wide Stop Work Order for recalcitrance and the Engineer may, in writing, issue a Stop Work Order for Chronic and Severe Findings per subsection 105.01.

Findings are closed when the corrective action is complete, reported to ESCAN and accepted by the Department. The Department will notify the Contractor through ESCAN when the corrective action is accepted or denied. Liquidated damages will be assessed by the type of finding as follows and will continue until the corrective action is approved by the Department.

1. Regular Finding. The time required to repair a Regular Finding shall begin at 11:59 PM on the date the Inspection Form 105 is issued. The Contractor shall have no more than a seven-day grace period to correct the Regular Finding before Liquidated Damages are assessed. The grace period extends until 11:59 PM on the seventh day after the Inspection Form 105 was issued.

   The Engineer will issue a Form 105 notifying the Contractor that Liquidated Damages are accruing at $1,500 per day for each full or partial calendar day a Regular Finding remains uncorrected after the seven-day grace period. At 11:59 PM on the 14th day after the Form 105 was issued, each uncorrected, undeferred Regular Finding will be assessed as recalcitrant and the Engineer will issue a project-wide stop work order. The Contractor shall fix each recalcitrant finding and submit a plan to avoid future instances of each recalcitrance to the Department for approval. The recalcitrance plan shall be in writing, signed by the Superintendent and shall include:

   A. Each Recalcitrant Finding.

   B. Why the corrective action for each Recalcitrant Finding was not implemented within 14 days.

   C. How the Contractor will avoid future recalcitrance.

   The Department will discuss the recalcitrance plan and may meet with the Superintendent to recommend modifications, if needed. The Engineer will issue a Form 105 accepting or rejecting the recalcitrance plan within 24 hours of the Contractor submitting a plan or resubmitting a modified plan.

   The Contractor will neither be reimbursed for costs incurred to fix each Recalcitrant Finding pertaining to a control measure in the SWMP plan nor costs to prepare the recalcitrance plan. The Contractor shall propose additional control measures, if needed, according to subsection 208.04(a). The project-wide Stop Work Order and Liquidated Damages will be assessed until approval of the corrective action for each Recalcitrant Finding and approval of the Contractor's recalcitrance plan by the Department is given. After written approval by the Engineer, the project-wide Stop Work Order will be lifted, and accrual of Liquidated Damages will cease.

2. Severe Finding. In response to a Severe Finding, the Engineer will issue Inspection Form 105 and immediately assess Liquidated Damages of $3,500 per Severe Finding. Severe Findings shall not be eligible for the seven-day grace period (subsection 208.09(b)1). Liquidated damages will accrue at $3,500 per Severe Finding per calendar day beginning at 11:59 PM of day the Inspection Form 105 is issued.

   A. If the Severe Finding is a discharge to State waters, the Contractor shall prevent any further discharge and shall reclaim discharge that has not yet entered State waters. The Contractor shall report the discharge to CDPHE per CDPS-SCP requirements.

   B. If the Severe Finding is a discharge outside the LOC that does not enter State waters, the Contractor shall fully reclaim the discharge before it enters State waters and implement relevant CDPS-SCP noncompliance notification procedures.

The Engineer may require the Contractor to submit a plan for permanent stabilization of disturbed areas outside the LOC per 208.04(e)4 for approval. Permanent stabilization plans pertaining to Severe Findings and subsequent stabilization activities are not subject to 208.09(b).

The Contractor shall not be reimbursed for activities undertaken to reclaim the discharge, stabilize areas outside the LOC and implement relevant CDPS-SCP noncompliance notification procedures.

3. Chronic Finding. In response to a Chronic Finding, the Engineer will issue Inspection Form 105 and immediately assess Liquidated Damages of $1,500 per Chronic Finding. Chronic Findings shall not be eligible for the seven-day grace period (subsection 208.09(b)). Liquidated damages will accrue at $1,500 per Chronic Finding per day beginning at 11:59 PM of day the Inspection Form 105 is issued.

   When the Chronic Finding is comprised of two Severe Findings, the Department will assess Liquidated Damages per this specification.

(c) Deferment. If the Contractor seeks deferment, the Superintendent shall submit a deferment request to the Engineer by 11:59 PM of the day after the issuance of Inspection Form 105. Chronic and Severe Findings are not eligible for deferment. The deferment request shall be in writing, signed by the Superintendent and shall include:

1. Regular Findings to be deferred.
2. The reasons why the Findings cannot be corrected in seven days.
3. An action plan containing:

   A. Methodology to protect water quality until each deferred Finding is corrected and accepted.

   B. Milestones to measure progress toward completion.

   C. Additional control measures to be implemented until each deferred Finding is corrected and accepted.

   D. Corrective completion dates for each Finding

The Department will discuss the deferment request and may meet with the Superintendent to recommend modifications to the action plan. The Engineer will issue a Form 105 accepting or rejecting the deferment request by 11:59 PM of the third day after the Inspection Form 105 documenting the Regular Finding is issued. The Department will not accept a deferment for operational error, lack of resources, improperly installed control measures, inadequate control measures, lack of preventative maintenance, careless or improper operation, or other non-proactive reason.

Preparation of deferment documentation and additional materials, including additional control measures, required to complete the action plan shall be at the Contractor's expense. Time frames noted in subsection 208.09(b)1 will not be stopped during the deferment review period, therefore, Liquidated Damages will be assessed beginning 11:59 PM on calendar day seven if the deferment request is rejected and, furthermore, a rejected deferment plan (subsection 208.09(c)) shall not absolve the Contractor from recalcitrance.

The Engineer will assess Liquidated Damages of $1,500 per calendar day, and partial day, for each uncorrected Deferred Finding. These Liquidated Damages will start on the date the uncorrected work was deferred to be completed (subsection 208.09(c)(3)). In addition, Liquidated Damages of $1,500 per calendar day will be assessed retroactively to 11:59 PM of the day the finding was originally noted on the Inspection Form 105.

(d) Conflict Resolution. Subsections 105.22, 105.23, and 105.24 detail the process through which the parties (CDOT and the Contractor) agree to resolve any issue that may result in a dispute.

(e) Exemptions. The Engineer will exempt from subsection 208.09(b) situations of Compliance Assistance, Documented Upset Conditions, Documented Reportable Spills and Documented Winter Exemptions. Release from subsection 208.09(b) does not exempt the Contractor from compliance with CDPS-SCP, Part I.D.8.

1. Documented Upset Condition. The Contractor shall report, both verbally and in writing, the Upset Condition to CDPHE per CDPS-SCP Part II.A.6 and subsection 208.03(c) and provide written documentation to the Engineer. The Engineer will issue a Form 105 and recognize the exemption to the Regulatory Mechanism. The Contractor shall also update the SWMP with the Form 105 and the documented Upset Condition.

2. Documented Reportable Spills. The Contractor shall report, both verbally and in writing, the Reportable Spill to CDPHE per subsection 107.25(b) and provide written documentation to the Engineer. The Engineer will issue a Form 105 and recognize the exemption to the Regulatory Mechanism. The Contractor shall also update the SWMP with the Form 105 and the documented Reportable Spill.

3. Winter Exemptions. The Contractor is unable to address findings noted on the Headquarters or Region led water quality control inspection due to:

   A. Snow covers the entire site for an extended period,

   B. No construction activity, and

   C. Melting conditions posing a risk of surface erosion do not exist.

   The Contractor shall request a Winter Exemption to the Department. If approved, the Engineer will issue a Form 105 and recognize the exemption to subsection 208.09(b). The Contractor shall also update the SWMP with the Form 105 and the documented Winter Exemption. Liquidated Damages, if assessed, will only accrue up to the point where the Winter Exemptions are approved.

4. Compliance assistance during Headquarters or Region led water quality control inspections. The RWPCM will record compliance assistance in ESCAN/CARL software.

208.10 Items to Be Completed Before Requesting Partial Acceptance of Water Quality Work.

(a) Reclamation of Washout Areas. After concrete operations are complete, washout areas shall be reclaimed per subsection 208.05(n) at the Contractor's expense.

(b) Survey. When Permanent Water Quality (PWQ) control measures are required on the project and once built, the Contractor shall survey the control measures to confirm that the PWQ control measures conform to the configuration, grade, and volume shown on the plans. The survey shall conform to Section 625. The results of the survey shall be submitted per CDOT's Survey Manual (MicroStation to GIS and TMOSS Codes), or GIS with attribute tables, showing both designed and final elevations and configurations. The Contractor's Surveyor shall submit electronically sealed control measure drawings.

PWQ control measures that do not meet the Contract requirements will be identified in writing by the Engineer and shall be repaired or replaced at the Contractor's expense. Correction surveys shall be performed at the Contractor's expense to confirm the locations, dimensions, and volume certification (for water quality capture volume structures only) of each PWQ control measure. The Engineer, CDOT Hydraulics Engineer for the region, Headquarters Permanent Water Quality Manager, and Headquarters Maintenance staff will perform a walkthrough of the PWQ control measures to confirm conformance to material requirements, locations, and dimensions. Before the walkthrough, the Contractor shall provide the corrected survey to the Engineer, Regional, and Headquarters Permanent Water Quality Managers.

(c) Locations of Temporary Control Measures. The Engineer will identify locations where modification, cleaning, or removal of temporary control measures are required and will provide these in writing to the Contractor. Upon completion of work required, the SWMP Administrator shall modify the SWMP to provide an accurate depiction of control measures to remain on the project site.

Complete and approve all punch list and walkthrough items by the Engineer and Maintenance.

METHOD OF MEASUREMENT

208.11. Erosion Control Management will be measured as the actual number of days of ECM work performed, regardless of the number of personnel required for SWMP Administration and Erosion Control Inspection, including erosion control inspections, documentation, meeting participation, SWMP Administration, and the preparation of the SWMP. If the combined hours of SWMP Administration and Erosion Control Inspection is four hours or less in a day, the work will be measured as a half day. If the combined hours of SWMP Administration and Erosion Control Inspection is more than four hours in a day, the work will be measured as one day. Pay the total combined hours of ECM work exceeding eight hours in a day as one day.

Erosion bales and rock check dams will be measured by the actual number installed and accepted.

Silt fence, silt berms, erosion logs, aggregate bags, silt dikes, temporary berms, temporary diversions, and temporary slope drains, will be measured by the actual number of linear feet that are installed and accepted. Measured length will not include required overlap.

Concrete washout structure will be measured by the actual number of structures that are installed and accepted.

Prefabricated concrete washout structures will be measured by the actual number of structures delivered to the site. It shall not include structures moved on-site.

Storm drain inlet protection will be measured by linear foot or actual number of devices that are installed and accepted.

Sediment trap quantities will be measured by the actual number installed and accepted.

Removal of trash that is not generated by construction activities will be measured by the actual number of hours that Contractor workers actively remove trash from the project. Each week the Contractor shall submit to the Engineer a list of workers and the hours spent collecting such trash.

Removal of accumulated sediment from traps, basins, areas adjacent to silt fences and erosion bales, and other clean out excavation of accumulated sediment, and the disposal of such sediment, will be measured by the number of hours that equipment, labor, or both are used for sediment removal.

Vehicle tracking pads will be measured by the actual number constructed and accepted.

Additional aggregate required for maintaining vehicle-tracking pads will be measured as the actual number of cubic yards installed and accepted.

Prefabricated vehicle-tracking pads will be measured by the actual number of pads delivered to the site and set up to the minimum dimensions. It shall not include pads moved on-site.

BASIS OF PAYMENT

208.12. Pay for ECM and control measures at the Contract unit price for each of the items listed below that appear in the bid schedule.

Pay under:

Pay Item	Pay Unit
Aggregate Bag	Linear foot
Concrete Washout Structure	Each
Erosion Bales (Weed Free)	Each
Erosion Control Management	Day
Erosion Log (Type 1) (____ Inch)	Linear foot
Erosion Log (Type 2) (____ Inch)	Linear foot
Erosion Log (Type 3) (____ Inch)	Linear foot
Prefabrctd. Concrete Washout Struc.(Type 1)	Each
Prefabrctd. Concrete Washout Struc.(Type 2)	Each
Prefabricated Veh.Tracking Pad	Each
Mtce. Aggregate (Veh. Tracking Pad)	Cubic Yard
Removal & Disposal of Sediment (Equip.)	Hour
Removal and Disposal of Sediment (Labor)	Hour
Removal of Trash	Hour
Rock Check Dam	Each
Sediment Basin	Each
Sediment Trap	Each
Silt Berm	Linear Foot
Silt Dike	Linear Foot
Silt Fence	Linear Foot
Silt Fence (Reinforced)	Linear Foot
Storm Drain Inlet Protection (Type__)	Linear Foot
Storm Drain Inlet Protection (Type__)	Each
Sweeping (Sediment Removal)	Hour
Temporary Berm	Linear Foot
Temporary Diversion	Linear Foot
Temporary Slope Drain	Linear Foot
Vehicle Tracking Pad	Each

Payment for Erosion Control Management (ECM) will be full compensation for all labor, materials and equipment necessary for the SWMP Administrator and Erosion Control Inspectors to perform all the work described in this specification. This includes assembling items (5) to (18) in subsection 208.03(d)1 and required updates to the SWMP.

The SWMP Administrator and ECI's commute times will not be measured and paid for separately but shall be included in the work.

Modifications to the SWMP due to construction errors or survey errors by the Contractor shall be made at the Contractor’s expense.

Surface roughening and vertical tracking (temporary stabilization) will not be measured and paid for separately but shall be included in the work. Payment for each control measure item will be full compensation for all work and materials required to furnish, install, maintain, and remove the control measure when directed.

Payment for Removal and Disposal of Sediment (Equipment) will be full compensation for use of the equipment, including the operator. Payment for Removal and Disposal of Sediment (Labor) will be full compensation for use of the labor.

Payment for concrete washout structure, whether constructed or prefabricated, will be full compensation for all work and materials required to install, maintain, and remove the item. Maintenance and relocation, as required, of these structures throughout the duration of the project will not be measured and paid for separately but shall be included in the work.

Silt berm spikes and wood spikes will not be measured and paid for separately but shall be included in the work. When required, soil retention blankets will be measured and paid for per Section 216.

Compost and wood stakes for Erosion Log (Type 2) will not be measured and paid for separately but shall be included in the work.

Spray-on mulch blankets required by the Contract, including those used in both interim and final stabilization, will be measured and paid for per Section 213.

Payment for storm drain inlet protection will be full compensation for all work, materials, and equipment required to complete the item, including surface preparation, maintenance throughout the project, and removal upon completion of the work. Aggregate will not be measured and paid for separately but shall be included in the work.

Sweeping, when used as a control measure as shown in the Contract, will be measured by the number of hours that a pickup broom or equipment capable of collecting sediment, authorized by the Engineer, is used to remove sediment from the roadway or other paved surfaces. Each week the Contractor shall submit to the Engineer a statement detailing the type of sweeping equipment used and the number of hours it was used to pick up sediment. The operator will not be measured and paid for separately but shall be included in the work.

Stakes, anchors, connections, geotextile, riprap, and tie downs used for temporary slope drains will not be measured and paid for separately but shall be included in the work.

Payment for vehicle tracking pad will be full compensation for all work, materials and equipment required to construct, maintain, and remove the entrance upon completion of the work. Aggregate and geotextile will not be measured and paid for separately but shall be included in the work. If additional aggregate for maintenance of vehicle tracking pads is required, it will be measured by the cubic yard per Section 304 and will be paid for under this Section as Maintenance Aggregate (Vehicle Tracking Pad).

Seeding, sod, mulching, soil retention blanket, and riprap will be measured and paid for per Sections 212, 213, 216, and 506.

All work and materials required to perform the permanent control measure survey and furnish the electronic files shall be included in the original unit price bid for surveying. Surveying will be measured and paid for per Section 625.

Payment will be made for control measures replaced as approved by the Engineer. Temporary erosion and sediment control measures required due to the Contractor’s negligence, carelessness, or failure to install permanent controls as a part of the work as scheduled or ordered by the Engineer or for the Contractor's convenience, shall be performed at the Contractor’s expense. If the Contractor fails to complete construction within the contract time, payment will not be made for Section 208 pay items for the period of time after expiration of the contract time. These items shall be provided at the Contractor's expense.

SECTION 209
WATERING AND DUST PALLIATIVES

DESCRIPTION

209.01. This work consists of applying water to soils or aggregates for moisture and density control, landscaping, prewetting an excavation area, and dust palliatives. It also includes applying magnesium chloride dust palliative for the control of dust and the stabilization of soil and aggregate surfaced roads.

MATERIALS

209.02 Water applied for moisture and density control, as dust palliative, and for prewetting shall be free from injurious matter. Water for landscaping shall be free from oil, acids, alkalis, salts, or any substance injurious to plant life.

When the water source proposed for use by the Contractor is not of known quality and chemical content, submit samples of the water for approval before use.

Magnesium chloride dust palliative shall consist of a magnesium chloride base agent, water, and other enhancing or nondetrimental ions. The chemical analysis shall conform to the following:

Table 209-1

MAGNESIUM CHLORIDE DUST PALLIATIVE

CHEMICAL CONSTITUENTS PERCENT BY WEIGHT

Magnesium Chloride (MgCl2)	28 to 35
Enhancing or Non-detrimental Ions	0 to 5
Water	65 to 72

CONSTRUCTION REQUIREMENTS

209.03 Moisture and Density Control. Sprinkling equipment shall deliver uniform and controlled distribution of water without ponding or washing. Apply uniformly water for finishing operations by spraying across the full width of the course.

209.04 Prewetting. Prewetting material in excavation areas before its removal for placement in embankments will be allowed when approved. The Contractor shall furnish a prewetting layout for each area to be prewetted including nozzle size, spacing, number of lines, and other equipment to be used. The Contractor shall obtain the approval of the Engineer for each prewetting layout before each prewetting operation.

209.05 Dust Palliative. The Contractor shall furnish and apply a dust palliative on portions of the roadway and on haul roads at the locations and in the amounts as provided in the Contract.

Dust palliative shall consist of water. Apply water with acceptable sprinkling equipment at an appropriate rate as approved by the Engineer.

Apply Magnesium Chloride dust palliative as follows:

Scarify the top 2 inches of the existing road surface and wet with water to approximately four percent moisture content, or as directed.

Apply the magnesium chloride dust palliative in two applications of 0.25 gallon per square yard in each application.

Allow to soak for 30 minutes after each application.

Roll the surface with a pneumatic tire roller, as specified in the Contract.

Do not permit traffic on the treated surface until approved.

209.06 Landscaping. The Contractor shall furnish water for seeding, mulching, planting, transplanting, sodding, herbicide treatment, and any other landscaping work when called for on the plans or when designated.

METHOD OF MEASUREMENT

209.07 Water will be measured by the number of thousand gallons (M Gallon) used and accepted. Measurement of water may be made in the vehicle at point of delivery or by meter. When water is to be metered for measurement, the Contractor shall provide and use an approved metering device.

Magnesium Chloride dust palliative will be measured by the number of gallons applied and accepted.

BASIS OF PAYMENT

209.08 The accepted quantities of water measured as provided above will be paid for at the contract unit price per M Gallon. The accepted quantities of Magnesium Chloride dust palliative measured as provided above will be paid for at the contract unit price per Gallon. Pay under:

Pay Item	Pay Unit
Water	(M Gallon)
Water (Landscaping)	(M Gallon)
Dust Palliative (Magnesium Chloride)	Gallon

Water required for all items of work will not be measured and paid for separately but shall be included in the work, except that water for dust palliative, and water ordered for the benefit or safety of the public will be measured and paid for separately per the Contract.

If the area for landscape work is irrigated by a Department-owned system, the Contractor may use the water from this source. Water used from a Department source will not be measured and paid for.

SECTION 210
RESET STRUCTURES

DESCRIPTION

210.01 This work consists of removing, relaying, resetting, or adjusting structures and related materials. All designated items shall be carefully removed, and stored, reinstalled, or adjusted, in a manner that will avoid loss or damage.

CONSTRUCTION REQUIREMENTS

210.02 General. Relaid pipe and conduit and reset structures shall be cleaned of foreign material before reinstallation.

Except in areas to be excavated, all holes resulting from the removal of structures shall be neatly backfilled. Methods shall conform to those required in the specifications for the various types of construction involved.

Materials in good condition from removed structures may be re-used. Salvable material, as designated in the Contract, that is not re-used shall remain the property of the Department, and the Contractor shall be held responsible for safekeeping of all materials until receipted by the Department. Materials damaged, stolen, or lost before receipt by the Department shall be repaired or replaced, as determined by the Engineer, at no cost to the Department.

Unserviceable material, as determined by the Engineer, shall be replaced with new material of similar dimensions, and the material costs will be paid for per subsection 109.04(b), except as otherwise provided in this section. All new materials and replacement parts shall conform to the requirements of the Contract for the appropriate items.

210.03 Light Standard. Light standards shall be reset on new concrete foundation pads complete with conduit and wiring per the Department's Standard Plans at locations indicated in the Contract.

210.04 Fences and Gates. Where fences (except snow fence) are reset, the Contractor shall supply and install any new materials required to restore the fence to acceptable condition except for new posts. The Contractor shall supply new posts as needed for the reset fence per Section 607. Wire in the old fence shall be salvaged and used in the reset fence.

Where snow fences are reset, panels shall be removed from their existing location and reset at the new location.

Gates designated to be reset shall be removed and restored for service at the new locations.

Right-of-way fence shall be reset approximately six inches inside the boundary of the highway right of way shown on the plans. Anchorages, footings, or fence appurtenances shall not extend beyond the limits of the highway right of way without the written consent of the abutting property owner.

210.05 Guardrail. Where guardrail is reset, the Contractor shall supply and install any new materials needed to restore the guardrail to acceptable condition. New materials shall include additional posts, blocks, and hardware needed to complete the intermediate post installations as shown on the Department's Standard Plans. Posts with similar tops shall be installed in groups as directed. Installation of fiat-top posts alternately with other top shapes will not be permitted. Posts may be cut, rotated, or turned upside down to eliminate unacceptable tops. If the posts are cut, the Contractor shall treat the exposed surface with two coats of an approved preservative.

Adjust guardrail shall be the work necessary to adjust the height to the standard per Standard Plan M-606-1 and filling the resulting voids under the posts with a lean concrete mixture consisting of 1 part cement and 10 parts sand.

210.06 Mailbox. Mailboxes complete with supporting structures are to be removed and temporarily reset at points near their original location to be accessible for mail delivery service. Upon completion of surfacing operations, the boxes shall again be reset at the locations designated. A supporting structure may contain one or more mailboxes. New permanent mailbox support posts and mounting brackets shall be furnished and installed per the Department's Standard Plans.

210.07 Ground Sign. Signs and posts designated to be reset shall be removed, cleaned, and reset at designated locations, including all work necessary to provide the existing posts with break-away devices, where required.

210.08 Sign Structure Sign structures shall be sandblasted and repainted before reinstallation.

210.09 Traffic Signal Traffic signals designated to be reset shall be removed along with existing poles and electrical equipment. New concrete footings shall be installed along with any new electrical equipment necessary to restore the structure to service at the new location. Equipment and materials shall be cleaned before being reset.

210.10 Adjust Structure. Adjusting structures shall apply, but not be limited to, manhole rings and covers, inlet gratings and frames, water valve boxes, water meters, gate posts, and other structures and facilities. Construction operations shall consist of raising, lowering, moving, or removing masonry or concrete; adding brickwork, masonry, or concrete; and resetting grates, frames, or rings and covers to fit the new construction. Structures in the traveled roadway shall be adjusted to a tolerance of 1/4 inch to 1/2 inch below the surface of the roadway. Work on water services shall be subject to inspection and testing by the owners. Damage to any fire hydrant or any part of the water system by the Contractor shall be repaired at the Contractor's expense.

210.11 Flashing Beacon. Reset flashing beacon shall consist of providing a new concrete foundation or footing, adjustments of post and breakaway device as required, and providing all electrical equipment and materials necessary to restore the installation to service at the new location. The Contractor shall provide necessary connections from the nearest power source or from the source designated on the plans to the new location.

METHOD OF MEASUREMENT

210.12 The quantity to be measured where items are reset or adjusted on an “each” basis shall be the actual number of those items restored for service at new location, completed and accepted.

Concrete foundation pads will be measured and paid for as “Concrete Foundation Pad” per Section 613.

Concrete footings for ground signs and overhead sign structures, if required, will be measured and paid for per Section 614.

Steel post extensions, if required, will be measured and paid for as “Steel Signpost” per Section 614, of the type shown on the plans.

The quantity to be measured where items are reset or adjusted on a “linear foot” basis shall be the actual number of linear feet of the items completed and accepted, measured end to end, except guardrail and snow fence. Guardrail will be measured as the actual number of linear feet completed and accepted, as shown on the Department's Standard Plans. Snow fence shall be measured end to end of the anchor posts.

The quantity to be measured for “Relay Pipe” shall be the number of linear feet of re-laid pipe including end sections, measured end to end, in place, completed and accepted.

The quantity to be measured for “Reset Mailbox Structure” shall be the number of supporting structures, complete with mailboxes, restored at new locations and accepted. Moving the mailbox structures for temporary mail service during construction, and installing new support post, base, mounting brackets, and hardware will not be measured or paid for separately but shall be included in the work.

Resetting of structures, fences, and related materials shall include all work necessary to remove the items from their existing location to the new location, and shall include all mounting hardware, footings, and all other work necessary to complete the reset item, except for new fence posts. Fence posts required and approved will be measured and paid for per Section 607.

Resetting of traffic signals, poles, controllers, cabinets, preemption units, coordination and interconnection equipment, and related equipment and materials shall include all work necessary to remove the items from their existing location and reset them at the new location, and shall include all mounting hardware, footings, other electrical equipment and service, and all other materials and work necessary to complete the reset item in service at the new location.

BASIS OF PAYMENT

210.13 The accepted quantities, measured as provided above, will be paid for at the contract price for each of the pay items listed below that appear in the bid schedule.

Payment will be made under:

Pay Item	Pay Unit
Reset	Each, Linear Foot, Square Yard, Lump Sum
Relay Pipe ( )	Linear Foot
Adjust	Each, Linear Foot
Modify	Each
Reset Mailbox Structure (Type)	Each

Adjust Guardrail Linear Foot

Structure excavation and structure backfill required for “Relay Pipe” will be measured and paid for per Section 206. Any void in the structure excavation prism created by the removal of pipe will be excluded from measurement and payment of structure excavation.

Except as otherwise provided in the Contract, collars and connecting devices will not be measured and paid for separately but shall be included in the work.

SECTION 212
SEEDING, FERTILIZER, SOIL CONDITIONER, AND SODDING

DESCRIPTION

212.01 This work consists of soil preparation, application of fertilizer, soil conditioners, or both, and furnishing and placing seed and sod. The work shall be per the Contract and accepted horticultural practices.

MATERIALS

212.02 Seed, Soil Conditioners, Fertilizers, and Sod.

(a) Seed. All seed shall be furnished in bags or containers clearly labeled to show the name and address of the supplier, the seed name, the lot number, net weight, origin, the percent of weed seed content, the guaranteed percentage of purity and germination, pounds of pure live seed (PLS) of each seed species, and the total pounds of PLS in the container. All seeds shall be free from noxious weed seeds per current state and local lists and as indicated in Section 213. The Contractor shall furnish to the Engineer a signed statement certifying that the seed is from a lot that has been tested by a recognized laboratory for seed testing within thirteen months before the date of seeding. The Engineer may obtain seed samples from the seed equipment, furnished bags, or containers to test seed for species identification, purity, and germination. Seed tested and found to be less than 10 percent of the labeled certified PLS and different than the specified species will not be accepted. Seed that has become wet, moldy, or damaged in transit or in storage will not be accepted.

Seed types and amount of PLS required per acre shall be provided per the Contract.

Seed and seed labels shall conform to all current State and Federal regulations and will be subject to the testing provisions of the Association of Official Seed Analysis. Computations for quantity of seed required on the project shall include the percent of purity and percent of germination.

The formula used for determining the quantity of PLS shall be:

Bulk Pounds of Seed Species • (Percent Purity • Percent Germination) = Pounds of PLS

(b) Soil Conditioners and Fertilizer.

1. Fertilizer: Fertilizer (plant nutrients) shall conform to the applicable State fertilizer laws. It shall be uniform in composition, dry, and free flowing, and shall be delivered to the site in the original, unopened containers, each bearing the manufacturer's guaranteed analysis. Fertilizer that becomes caked or damaged will not be accepted.

2. Soil Conditioner: Soil conditioner shall consist of compost, biological nutrient, biological culture or humic acid-based material.

   Humic acid-based material (Humate) shall include the following:

   A. A pH of 3 to 5.

   B. Maximum 20 percent inert ingredient.

   C. Minimum 80 percent organic matter with 40 percent minimum humic acid.

   Compost shall be weed–free, organic compost derived from a variety of feed stocks including agricultural, biosolids, forestry, food, leaf and yard trimmings, manure, tree wood with no substances toxic to plants. Material shall be aerobically composted in a facility permitted by the Colorado Department of Public Health and Environment (CDPHE) to produce or sell compost per House Bill (HB) 1181. The Contractor shall submit a copy of this permit to the Engineer for approval and the project records. The compost shall be tested per the U.S. Composting Council's Test Methods for Examining of Composting and Compost (TMECC) manual.

   The compost manufacturer shall be a participating member of in the U.S. Composting Council's Seal of Testing

   Assurance Program (STA). The Contractor shall provide a participation certificate and test data on a Compost Technical Data Sheet.

Compost shall have the following physical properties:

Table 212-1
COMPOST PHYSICAL PROPERTIES

Compost Parameters	Reported as	Requirement	Test Method
pH	pH units	6.0 – 8.5	TMECC 04.11-A
Soluble Salts (Electrical Conductivity)	dS m-1 or mmhos cm-1	Maximum 10 dS/m	TMECC 04.10-A
Moisture Content	%, wet weight basis	30 – 60%	TMECC 03.09-A
Organic Matter Content	%, dry weight basis	30 – 65%	TMECC 05.07-A
Particle Size (sieve sizes)	%, dry weight basis for each sieve fraction	Passing 1 inch – 100% 1/2 inch – 95%	TMECC 02.02-B
Man-made Inert Contamination	%, dry weight basis	< 1%	TMECC 03.08-A
Stability (Respirometry)	mg CO2-C per g TS per day mg CO2-C per g OM per day	8 or below	TMECC 05.08-B
Select Pathogens	(PASS/FAIL) Limits: Salmonella <3 MPN/4grams of TS, or Coliform Bacteria <1000 MPN/gram	Pass	TMECC 07.01-B Fecal Coliforms, or 07.02 Salmonella
Trace Metals	(PASS/FAIL) Limits (mg kg-1, dw basis): As 41, Cd 39, Cu 1500, Pb 300, Hg 17, Ni 420, Se 100, Zn 2800	Pass	TMECC 04.06
Maturity (Bioassay)			
Percent Emergence	%, (average)	> 80%	TMECC 05.05-A
Relative Seedling Vigor	%, (average)	> 80%	

Table 212-1 Notes: The Contractor shall provide a CTR per subsection 106.13 confirming the material has been tested per TMECC.

(c) Sod. Sod shall be nursery grown and 99 percent weed free. Species shall be as shown on the plans. Other sod types may be used only if approved in writing by the Engineer. The one percent allowable weeds shall not include any undesirable perennial or annual grasses, or plants defined as noxious by current State statute. Soil thickness of sod cuts shall not be less than 3/4 inch nor more than 1 inch. Sod shall be cut in uniform strips with minimum dimensions of 18 inches in width and 48 inches in length. The Contractor shall submit a sample of the sod proposed for use, which shall serve as a standard. Any sod furnished, whether in place or not, that is not up to the standard of the sample may be rejected. Sod that was cut more than 24 hours before installation shall not be used.

Each load of sod shall be accompanied by a certificate from the grower stating the type of sod and the date and time of cutting.

CONSTRUCTION REQUIREMENTS

212.03 Seeding Seasons. Seeding in areas that are not irrigated shall be restricted according to the following timetable and requirements.

Table 212-2

SEEDING SEASON TIMETABLE AND REQUIREMENTS

Areas other than the Western Slope

Zone	Spring Seeding	Fall Seeding
Below 6000 feet	Spring thaw to June 1	September 15 until consistent ground freeze
6000 to 7000 feet	Spring thaw to June 1	September 1 until consistent ground freeze
7000 to 8000 feet	Spring thaw to July 15	August 1 until consistent ground freeze
Above 8000 feet	Spring thaw to consistent ground freeze	

Western Slope

Zone	Spring Seeding	Fall Seeding
Below 6000 feet	Spring thaw to May 1	August 1 until consistent ground freeze
6000 to 7000 feet	Spring thaw to June 1	September 1 until consistent ground freeze

(1) “Spring thaw” shall be defined as the earliest date in a new calendar year that seed can be buried 1/2 inch into the surface soil (topsoil) thru normal drill seeding methods.

(2) “Consistent ground freeze” shall be defined as that time during the fall months that the surface soil (topsoil), due to freeze conditions, prevents burying the seed 1/2 inch thru normal drill seeding operations. Seed shall not be sown, drilled, or planted when the surface soil or topsoil is in a frozen or crusted state.

Seeding accomplished outside the time periods listed above will be allowed only when ordered by the Engineer or when the Contractor's request is approved in writing. When requested by the Contractor, the Contractor must agree to perform the following work at no cost to the Department: reseed, remulch, and repair areas that fail to produce species indicated in the Contract.

When seeding is ordered by the Engineer outside the time periods listed above, the cost of additional material will be paid for by the Department. The Contractor will not be responsible for failure of the seeded area to produce species indicated in the Contract due to reasons beyond the control of the Contractor.

The seeding, the soil conditioning, and the fertilizing application rate shall be as specified. The Engineer may establish test sections for adjusting the seeding and the fertilizing equipment to assure the specified rate. The Engineer may order equipment readjustment at any time.

Seed, soil conditioner and fertilizer shall not be applied during inclement weather including rain and high winds, or when soil is frozen or soil moisture is too high to evenly incorporate seed, soil conditioner or fertilizer.

212.04 Lawn Grass Seeding. Lawn grass seeding shall be accomplished in the seeding seasons described in subsection 212.03.

(a) Soil Preparation. Preparatory to seeding lawn grass, irregularities in the ground surface, except the saucers for trees and shrubs, shall be removed. Measures shall be taken to prevent the formation of low places and pockets where water will stand.

Immediately before seeding, the ground surface shall be tilled or hand worked into an even and loose seedbed to a depth of 4 inches, free of clods, sticks, stones, debris, concrete, and asphalt in excess of 2 inches in any dimension and brought to the desired line and grade.

(b) Fertilizing and Soil Conditioning. The first application of fertilizer, soil conditioner, or both shall be incorporated into the soil before seeding, and shall consist of a soil conditioner, commercial fertilizer, or both as designated in the Contract. Fertilizer called for on the plans shall be worked into the top 4 inches of soil at the rate specified in the contract. Biological nutrient, culture or humic acid-based material called for on the plans shall be applied in a uniform application onto the soil service. Organic amendments shall be applied uniformly over the soil surface and incorporated into the top 6 inches of soil.

The second application of fertilizer shall consist of a fertilizer having an available nutrient analysis of 20-10-5 applied at the rate of 100 lbs. per acre. It shall be uniformly broadcast over the seeded area three weeks after germination or emergence. The area shall then be thoroughly soaked with water to a depth of 1 inch.

Fertilizer shall not be applied when the application will damage the new lawn.

(c) Seeding. After the surface is raked and rolled, the seed shall be drilled or broadcast and raked into the top 1/4 inch of soil. Seeding shall be accomplished by mechanical landscape type drills. Broadcast type seeders or hydraulic seeding will be permitted only on small areas not accessible to drills. Seed shall not be drilled or broadcast during windy weather or when the ground is frozen or untillable. All loose exposed rock larger than 2 inches shall be removed from slopes that are to be seeded by drilling.

Hydraulic seeding equipment shall include a pump capable of being operated at 100 gallons per minute and at 100 pounds per square inch pressure, unless otherwise directed. The equipment shall have a nozzle adaptable to hydraulic seeding requirements. Storage tanks shall have a means of estimating the volume used or remaining in the tank.

212.05 Sodding.

(a) Soil Preparation. Preparatory to sodding, the ground shall be tilled or hand worked into an even and loose sod bed to a depth of 4 inches, and irregularities in the ground surface shall be removed. Sticks, stones, debris, clods, asphalt, concrete, and other material more than 2 inches in any dimension shall be removed. Any depressions or variances from a smooth grade shall be corrected. Areas to be sodded shall be smooth before any sodding is done.

(b) Sodding. The sod shall be laid by staggering joints with all edges touching. On slopes, the sod shall run approximately parallel to the slope contours. Where the sod abuts a drop inlet, the subgrade shall be adjusted so that the sod shall be 1 1/2 inch below the top of the inlet.

Within one hour after the sod is laid and fertilized it shall be watered. After watering the sod shall be permitted to dry to the point where it is still wet enough for effective rolling. It shall then be rolled in two directions with a lawn roller weighing at least 150 pounds.

(c) Fertilizing and Soil Conditioning. Before laying sod, the 4 inches of subsoil underlying the sod shall be treated by tilling in fertilizer, soil conditioner, or both. The rate of application shall be as designated in the Contract. Fertilizer called for on the plans shall be worked into the top 4 inches of soil at the rate specified in the contract. Biological nutrient, culture or humic acid-based material called for on the plans shall be applied uniformly onto the soil surface. Organic amendments shall be applied uniformly over the soil surface and incorporated into the top 6 inches of soil.

After laying, the sod shall be fertilized with a fertilizer having an available nutrient analysis of 20-10-5 at the rate of 200 pounds per acre. Fertilizer shall not be applied when the application will damage the sod.

212.06 Native Seeding. Areas that are unirrigated shall be seeded per subsection 212.03.

(a) Soil Preparation. Slopes flatter than 2:1, shall be tilled into an even and loose seed bed 4 inches deep. Slopes 2:1 or steeper shall be left in a roughened condition. Slopes shall be free of clods, sticks, stones, debris, concrete, and asphalt in excess of 4 inches in any dimension and brought to the desired line and grade.

(b) Fertilizing and Soil Conditioning. Before seeding, fertilizer, soil conditioner, or both shall be applied. The fertilizer and soil conditioner type and rate of application shall be as designated in the Contract. Fertilizer called for on the plans shall be worked into the top 4 inches of soil at the rate specified in the contract. Biological nutrient, culture or humic

acid-based material called for on the plans shall be applied in a uniform application onto the soil service. Organic amendments shall be applied uniformly over the soil surface and incorporated into the top 6 inches of soil. No measurable quantity of organic amendment shall be present on the surface after incorporation.

(c) Seeding. Seeding shall be accomplished within 24 hours of tilling or scarifying to make special seed bed preparation unnecessary. The seeding application rate shall be as designated in the Contract. All slopes flatter than 2:1 shall be seeded by mechanical power drawn drills followed by packer wheels or drag chains. Mechanical power drawn drills shall have depth bands set to maintain a planting depth of at least 1/4 inch and shall be set to space the rows not more than 7 inches apart. Seed that is extremely small shall be sowed from a separate hopper adjusted to the proper rate of application.

If strips greater than 7 inches between the rows have been left unplanted or other areas skipped, the Engineer will require additional seeding at the Contractor's expense.

When requested by the Contractor and approved by the Engineer, seeding may be accomplished by broadcast or hydraulic type seeders at twice the rate specified in the Contract at no additional cost to the project.

All seed sown by broadcast-type seeders shall be "raked in" or covered with soil to a depth of at least 1/4 inch. Broadcasting seed will be permitted only on small areas not accessible to machine methods.

Hydraulic seeding equipment and accessories shall conform to the equipment and accessories described in subsection 212.04(c).

Seeded areas damaged due to circumstances beyond the Contractor's control shall be repaired and reseeded as ordered. Payment for this corrective work, when ordered, shall be at the contract prices.

Multiple seeding operations shall be anticipated as portions of job are completed to take advantage of growing conditions and to comply with Section 208 and subsection 212.03.

METHOD OF MEASUREMENT

212.07 The quantities of lawn seeding and native seeding will not be measured but shall be the quantities designated in the Contract, except that measurements will be made for revisions requested by the Engineer, or for discrepancies of plus or minus five percent of the total quantity designated in the Contract. The quantity of lawn seeding shall include soil preparation, water, fertilizer, and seed, completed, and accepted. The quantity of native seeding shall include soil preparation, fertilizer, soil conditioner, and seed applied, completed, and accepted.

The quantity of sod to be measured will be the actual number of square feet, including soil preparation, water, fertilizer, and sod, completed, and accepted.

When soil conditioner is measured and paid for separately, it will be measured by the actual number of acres where soil conditioner is applied and will be paid for as Soil Conditioning.

The Contractor shall furnish the Engineer with seed certifications and analysis, fertilizer analysis, and bag weight tickers before placing any seed or fertilizer. Any seed or fertilizer placed by the Contractor without the Engineer’s approval will not be paid for.

Measurement for acres will be by slope distances.

BASIS OF PAYMENT

212.08 The accepted quantities of lawn seeding, native seeding, soil conditioning, and sod will be paid for at the contract unit price for each of the pay items listed below that appear in the bid schedule.

Payment will be made under:

Pay Item	Pay Unit
Seeding (Lawn)	Acre
Seeding (Native)	Acre
Sod	Square Foot
Soil Conditioning	Acre

Soil preparation, water, seed, fertilizer, and soil conditioner, incorporated into the seeding sodding or soil conditioning will not be paid for separately but shall be included in the work.

Adjusting or readjusting seeding or fertilizing equipment will not be paid for separately but shall be included in the work.

SECTION 213
MULCHING

DESCRIPTION

213.01 This work consists of mulching the seeded areas, furnishing and placing wood chip mulch in the planting beds and plant saucers, furnishing and applying hydromulch with tackifier on roadway ditches and slopes, furnishing and placing tackifier on mulch or soil on roadway ditches or slopes, and furnishing and installing metal landscape border for the separation of planting beds, per the Contract or as directed. Mulching may be accomplished by the crimping method using straw or hay, by the hydraulic method using wood cellulose fiber mulch, or by other approved methods with approved materials. When a specific mulching method is required, it will be designated in the Contract.

This work includes furnishing and applying spray-on mulch blanket or bonded fiber matrix on top of rock cuts and slopes after seeding or as temporary stabilization as shown on the plans or as directed by the Engineer.

MATERIALS

213.02 Materials shall conform to the following requirements.

(a) Mulching. Materials for mulching shall consist of Certified Weed Free field or marsh hay or straw of oats, barley, wheat, rye, or triticale certified under the Colorado Department of Agriculture Weed Free Forage Certification Program and inspected as regulated by the Weed Free Forage Act, Title 35, Article 27.5, CRS. Each certified weed free mulch bale shall be identified by one of the following:

(1) One of the ties binding the bale shall consist of blue and orange twine, or

(2) The bale shall have a regional Forage Certification Program tag indicating the Regional Forage Certification Program Number.

Mulch shall be inspected for and Regionally Certified as weed free based on the Regionally Designated Noxious Weed and Undesirable Plant List for Colorado, Wyoming, Montana, Nebraska, Utah, Idaho, Kansas, and South Dakota.

The Contractor shall not unload certified weed free mulch bales or remove their identifying twine, wire, or tags until the Engineer has inspected and accepted them.

The Contractor shall provide a transit certificate that has been filled out and signed by the grower and by the Department of Agriculture inspector.

The Contractor may obtain a current list of Colorado Weed Free Forage Crop Producers who have completed certification by contacting the Colorado Department of Agriculture, Division of Plant Industry.

Straw or hay in a stage of decomposition (discolored, brittle, rotten, or moldy) or old, dry mulch that breaks in the crimping process will not be accepted.

The type and application rate of mulch material shall be as designated in the Contract.

(b) Wood Cellulose Fiber Mulch. Wood cellulose fiber mulch shall consist of virgin wood fibers manufactured expressly from clean whole wood chips. The chips shall be processed in such a manner as to contain no growth or germination inhibiting factors. Fiber shall not be produced from recycled materials such as sawdust, paper, cardboard, or residue from pulp and paper plants. The wood cellulose fibers of the mulch must maintain uniform suspension in water under agitation. Upon application, the mulch material shall form a blotter like mat covering the ground. This mat shall have the characteristics of moisture absorption and percolation and shall cover and hold seed in contact with the soil. The Contractor shall obtain certifications from suppliers that laboratory and field testing of their product has been accomplished, and that it meets all of the foregoing requirements pertaining to wood cellulose fiber mulch.

The wood cellulose fiber mulch shall conform to the following requirements:

Table 213-1

WOOD CELLULOSE FIBER MULCH REQUIREMENTS

Property	Requirement
Percent moisture content	10.0% ± 3.0%
Percent Organic Matter* (Wood Cellulose Fiber)	99.3% ± 0.2%
Percent Ash Content*	0.7% ± 0.2%
pH	4.9 ± 0.5
Water Holding Capacity*	1200-1600 grams**

Table 213-1 Notes: *Oven Dried Basis
**Per 100 grams of fiber

The wood cellulose fiber mulch shall be packaged in units containing current labels, with the manufacturer's name, the net weight, and certification that the material meets the foregoing requirements for wood cellulose fiber mulch.

(c) Mulch Tackifier. Material for mulch tackifier shall consist of a free-flowing, noncorrosive powder produced either from the natural plant gum of Plantago Insularis (Desert Indianwheat) or pre-gelatinized 100 percent natural corn starch polymer. The powders shall possess the following properties:

Table 213-2

PROPERTIES OF PLANTAGO INSULARIS (DESERT INDIANWHEAT)

Property	Requirement
pH 1% solution	6.5 - 8.0

Table 213-3

PROPERTIES OF PRE-GELATINIZED

100 PERCENT NATURAL CORN STARCH POLYMER

Property	Requirement
Organic Nitrogen as protein	5.5-7%
Ash content	0-2%
Fiber	4-5%
pH 1% solution	6.5 – 8.0
Size	100% thru 850 microns (20 mesh)
Settleable solids	<2%

All fibers shall be colored green or yellow with a biodegradable dye.

The material used for mulch tackifier shall not contain any mineral filler, recycled cellulose fiber, clays, or other substances that may inhibit germination or growth of plants. Water shall conform to subsection 209.02.

(d) Wood Chip Mulch. Wood chip mulch shall consist of fresh, moist pole peelings material having approximate dimensions; Width: 1/4 to 1/2 inch; Length: 3 to 4 inches.

The Contractor shall submit a sample to the Engineer for approval at least 30 days before placing on the project.

(e) Metal Landscape Border. The metal landscape border shall consist of a strip of metal such as steel conforming to ASTM A1011 or approved equal.

(f) Spray-on Mulch Blanket. Spray on mulch blanket shall be one of the following, unless otherwise shown on the plans:

1. Spray-on Mulch Blanket (Type 1) shall be a hydraulically applied matrix conforming to the following:

Table 213-4

PROPERTIES OF MULCH BLANKET (TYPE 1)

Properties	Requirement	Test Method
Organic Fibers	71% Min.	ASTM D2974
Cross Linked Mulch Tackifiers	10% ± 2% Min.	
Reinforcing Fibers	2.5% Min.	
Biodegradability	100%	ASTM D5338
Ground Cover at Application Rate	90% Min.	ASTM D6567
Functional Longevity	12 Months Min.	
Cure Time	< 8 hours	
Application		
Application Rate	3000 lb/acre	

The organic fiber shall not contain lead paint, printing ink, varnish, petroleum products, seed germination inhibitors, or chlorine bleach. The organic fibers and reinforcing interlocking fibers cannot be produced from sawdust, cardboard, paper, or paper by-products.

2. Spray-on Mulch Blanket (Type 2) shall be a hydraulically applied matrix pre-packaged in 50-pound bags containing both a soil and fiber stabilizing compound and thermally processed wood fiber.

   The wood fiber mulch shall be manufactured through a thermo-mechanical defibrating process containing a specific range of fiber lengths averaging 0.25 inches or longer.

Mulch Blanket (Type 2) shall meet the following requirements:

Table 213-5
PROPERTIES OF MULCH BLANKET (TYPE 2)

Property	Requirement	Test Method
Fiber Retention On 28-Mesh Screen	≥ 40%	Tyler Ro-Tap Method
Moisture Content	12% ± 2%	Total Air Dry Weight Basis
Organic Matter	99.2% ± 0.2%	Oven Dry Weight Basis
Ash Content	0.8% ± 0.2%	Oven Dry Weight Basis
pH at 3% Consistency In Water	4.5-7.0 ± 0.5%	
Sterilized Weed-Free	Yes	
Non-Toxic To Plant or Animal Life	Yes	
Application		
Application rate	3,000 lb./acre	

The soil and fiber stabilizing compound shall be composed of linear anionic copolymers of acrylamide pre-packed within the bag having a minimum content of 1.0 percent. The compound shall conform to the following:

Table 213-6
SOIL AND FIBER STABILIZING COMPOUND PROPERTIES

Property	Requirement
Molecular Weight	≥ 12x106
Charge Density	> 25%
Non-Toxic To Plant or Animal Life	Yes

(g) Bonded Fiber Matrices (BFM). BFM shall consist of hydraulically-applied matrix with a minimum of 70 percent non-toxic thermally processed or refined long strand organic fibers and water soluble tackifier to provide erosion control and shall be designed to be functional for a minimum of 9 months. BFMs form an erosion-resistant blanket that promotes vegetation and prevents soil erosion. The BFM shall be 100 percent biodegradable. The binder in the BFM shall also be biodegradable. BFMs shall conform to the following requirements:

Table 213-7

BONDED FIBER MATRICES PROPERTIES

Property	Requirement	Test Method
Ground Cover (%)	95	ASTM D6567
Biodegradability (%)	100	ASTM D5338
functional Longevity (months)	9 months minimum	
Cure Time (hours)	24-48	
Cross-linked Tackifier	10% minimum	
Application		
Application Rate (lbs./Acre)	3000	

The fibers shall not contain lead paint, printing ink, varnish, petroleum products, seed germination inhibitors, or chlorine bleach. Fiber shall not be produced from sawdust, cardboard, paper, or paper by-products.

CONSTRUCTION REQUIREMENTS

213.03

(a) Hay or Straw Mulching. After seeding has been completed or when required for erosion control, hay or straw shall be uniformly applied, with no bare soil showing, at the rate designated in the Contract or as directed. It shall be crimped in with a crimper or other approved equipment. The Engineer may order hand-crimping on areas where mechanical methods cannot be used.

The seeded area shall be mulched and crimped within four hours after seeding. Areas not mulched and crimped within four hours after seeding or before precipitation or damaging winds on site shall be reseeded with the specified seed mix at the Contractor's expense, before mulching and crimping.

When tackifier is required in the Contract it shall be applied in the following order: (1) mulching, (2) mulch tackifier.

(b) Hydraulic Mulching. Wood cellulose fiber mulch and mulch tackifier shall be added to water to form a homogeneous slurry.

The operator shall spray apply the slurry mixture uniformly over the designated seeded area.

Hydraulic mulching shall not be done in the presence of free surface water.

Mixing procedure for the hydraulic mulch and tackifier mixture shall be as follows:

1. Fill tank with water approximately 1/4 full.
2. Continue filling while agitating with engine at full rpm.
3. Pour tackifier, at a moderate rate, directly into area of greatest turbulence.

4. With the recommended amount of tackifier in solution, add wood cellulose fiber mulch. Do not add fertilizer.

   Apply the hydromulch and tackifier mixture at the following rate:

Wood Cellulose Fiber	Mulch Tackifier
2,000 lb/acre	100 lb/acre

(c) Mulch Tackifier. Mixing procedure for mulch tackifier shall be as follows:

1. Fill tank with desired amount of water and run engine at full R.P.M.
2. Add wood cellulose fiber. Agitate until a homogenous, non-lumpy slurry is formed. Do not add fertilizer.
3. Slowly sift powdered tackifier into slurry and continue to agitate for at least five minutes.

   Mulch tackifier shall be sprayed over hay or straw using a nozzle that will disperse the spray into a mist that will uniformly cover the mulch.

   Application Rate: Apply this as an overspray at the following rate or as approved by the Engineer.

Mulch Tackifier Powder	Wood Cellulose Fiber	Water
200 lb/acre	300 lb/acre	2,000 gal acre

(d) General. Mulch shall be tacked simultaneously or immediately upon completion of mulching and crimping to avoid nonuniform coverage. Areas not properly mulched, or areas damaged due to the Contractor's negligence, shall be repaired and remulched as described above, at the Contractor's expense.

Mulch removed by circumstances beyond the Contractor's control shall be repaired and remulched as ordered. Payment for this ordered corrective work shall be at the contract prices.

The Engineer may order test sections be established for adjusting the mulching equipment to assure conformance with the specified application rate. The Engineer may order equipment readjustment at any time.

(e) Wood Chip Mulch. A 4-inch layer, unless otherwise shown in the plans, of wood chip mulch shall be uniformly applied to all planting beds as shown on the plans or as directed. Wood chip mulch shall be placed in all tree and shrub saucers in seeded areas. Wood chip mulch shall be capable of matting together to resist scattering by the wind.

(f) Metal Landscape Border. Metal landscape border shall be installed along the lines and at the grades shown on the plans by an approved method that will not damage the border. Ends of metal landscape border shall overlap the next adjacent section a minimum of 6 inches. Metal landscape border shall be anchored with wire tie-downs at intervals of approximately 2 feet. Wire tie-downs shall be 9-gauge wire at least 14 inches long. Metal landscape border shall be inserted into the ground by driving against the wire tiedowns; ground may be moistened to ease entrance into the ground. Driving on edge of metal landscape border will not be permitted except when the edge is properly shielded. Metal landscape border may be bent for sharp angles and overlapped at closure of perimeter.

(g) Spray-On Mulch Blanket. Spray-on mulch blanket installation shall strictly comply with the Manufacturer's mixing recommendations and installation instructions. No chemical additives with the exception of fertilizer, soil pH modifiers, extended-term dyes and bio nutrients will be permitted. The spray-on mulch blanket shall be mixed and applied as follows:

The hydromulching vessel shall be filled with water to at least 1/3 capacity (high enough to cover agitators) before adding any material. Continue to fill vessel with water and slowly add the fibers while agitators are in motion. Run agitators at 3/4 speed. Continue to mix tank a minimum of 10 minutes before application.

Apply spray-on mulch blanket in a uniform application using a minimum 22-degree arc type nozzle. Apply hydro slurry in two directions (from top of slope down and from toe of the slope up, as well as, be applied at a minimum of two layers).

Co-polymer shall not be used use in channels, swales, or other areas where concentrated flows are anticipated and should not be used on saturated soils that have groundwater seeps.

(h) Bonded Fiber Matrices (BFM). Bonded fiber matrices shall strictly comply with the Manufacturer's mixing recommendations and installation instructions. No chemical additives with the exception of fertilizer, soil pH modifiers, extended-term dyes, and bio stimulant materials shall be permitted. BFMs shall be applied in a uniform application using a minimum 22-degree arc type nozzle. BFMs shall be applied in two directions (from top of slope down and from toe of the slope up, as well as, be applied at a minimum of two layers.

Biodegradable BFMs shall not be applied immediately before, during, or immediately after rainfall if the soil is saturated.

BFMs shall not be used use in channels, swales, or other areas where concentrated flows are anticipated and shall not be used on saturated soils that have groundwater seeps.

Foot traffic, mechanical traffic or grazing shall not be permitted on treated areas until vegetated. Treated areas damaged due to circumstances beyond the Contractor's control shall be repaired or re-applied as ordered. Payment for corrective work, when ordered, shall be at contract unit prices.

METHOD OF MEASUREMENT

213.04 The quantity of hay and straw mulch, wood chip mulch, wood fiber and, spray-on mulch blanket, bonded fiber matrix, and tackifier will not be measured but shall be the quantity designated in the Contract, except that measurements will be made for revisions requested by the Engineer, or for discrepancies of plus or minus five percent of the total quantity designated in the Contract. Measurement for acres will be by slope distances.

The quantity of mulch tackifier to be measured will be the actual number of pounds of dry tackifier powder used.

Metal landscape border will be measured by the linear foot of completed and accepted metal border. Measured length of metal landscape border will not include required overlap splices.

Spray-on mulch blanket and bonded fiber matrix will be measured by the acre or by the actual pounds of product applied, as shown on the plans. The area will be calculated on the basis of actual or computed slope measurements. The Contractor shall verify, before application, weight of spray on mulch blanket and bonded fiber matrix bags for certification of materials and application rate.

BASIS OF PAYMENT

213.05 The accepted quantities will be paid for at the contract unit price for each of the pay items listed below that appear in the bid schedule.
Payment will be made under:

Pay Item	Pay Unit
Mulching ( )	Acre
Mulching (Hydraulic)	Acre
Mulching (Weed Free Hay)	Acre
Mulching (Weed Free Straw)	Acre
Mulching (Wood Chip)	Cubic Foot
Mulch Tackifier	Pound
Metal Landscape Border	Linear Foot
Spray-on Mulch Blanket	Acre
Spray-on Mulch Blanket	Pound
Bonded Fiber Matrix	Acre
Bonded fiber Matrix	Pound

Water, wood fiber, mixing and application for mulch tackifier will not be measured and paid for separately but shall be included in the work.

Adjusting or readjusting mulching equipment will not be paid for separately but shall be included in the work.

Payment for spray–on mulch blanket and bonded fiber matrix will be full compensation for all work and materials necessary to complete the item.

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SECTION 214
PLANTING

DESCRIPTION

214.01 This work consists of furnishing all plants, labor, materials and equipment to install herbaceous and woody plant material, hereinafter referred to as "nursery stock". The work may also consist of obtaining live "unrooted cuttings" from approved donor plants and installing them on the site as shown on the plans.

All approvals and direction required from the Engineer in this specification will involve the Engineer working directly with Region or Headquarters Environmental Staff, as identified in the Contract.

MATERIALS

214.02 Nursery Stock and unrooted cuttings shall be of the minimum sizes and species as designated on the plans, in healthy condition with normal well-developed branch and root systems and shall conform to the requirements of the *American Standard for Nursery Stock* (ANSI Z60.1-2014). For specified deep rooted container stock the container class volume ranges shall be substituted with the requirements of this specification. See subsection 1.1.3.3 of the American Standard for Nursery Stock regarding unclassified containers.

All nursery stock and unrooted cuttings shall be free from plant diseases and insect pests. All shipments of plants shall comply with all nursery inspection and plant quarantine regulations of the State of origin and destination, and the Federal regulations governing Interstate movement of nursery stock. The Contractor shall submit proof of deposit that nursery stock, Contract species and Contract quantity have been secured 30 days post Environmental Pre-Construction Conference. For multi-year projects (two or more continuous years) the contractor shall submit a schedule for approval documenting when proof of deposits on nursery stock will be provided.

The minimum acceptable sizes of all nursery stock, with branches in normal position, shall conform to the measurements specified in the Landscape/Mitigation Plans.

Hardiness zones are defined in U.S. Department of Agriculture (USDA) 2012 Plant Hardiness Zone Map publications. Only Nursery Stock rated for USDA Hardiness Zones 2, 3, 4, and 5 will be accepted.

Other than approved unrooted cuttings or as otherwise approved by the Engineer, plants shall be nursery grown for at least one growing season, or plants that have established themselves in accordance with definitions set forth in the Colorado Nursery Act, Title 35, Article 26, CRS.

Field collected trees and shrubs shall have been root-pruned during their growing period in the nursery in accordance with standard nursery practice outlined in the American Standard for Nursery Stock.

No species substitutions are permitted without written approval. If nursery stock of acceptable quality and specified variety or size are not available, before any species substitutions will be approved the Contractor shall supply to the Engineer three written letters from nurseries verifying that a species or plant size is not available. Once three letters are provided, the Contractor Shall with Engineer's written approval:

(1) Substitute acceptable nursery stock that are larger than specified at no change in Contract price. For deep rooted nursery stock, the minimum depth requirement of the container must be maintained as stated in this specification.
(2) Substitute smaller plants than those specified on the Landscape/Mitigation Plans at the adjusted price or ratio stated in the written approval.
(3) Substitute of plants of different genus, species or variety shall be submitted to the Engineer for approval 30 days prior to installation at the adjusted price stated in the written request.

At the Environmental Pre-construction Conference, the Contractor shall name the nursery stock supplier for all items. Nursery stock will be rejected for not meeting the Contract at any of the four following times and locations:

(1) At the nursery stock supplier's location during inspection. The Engineer will notify the contractor when the nursery stock will be inspected.
(2) On the project site at the time of delivery, prior to planting.
(3) At the time of installation.
(4) At the partial or final acceptance walkthroughs on the project site.

Plant materials supplied by the Contractor shall be inspected by the Engineer at the growing site and tagged or otherwise approved for delivery. Inspection at nursery does not preclude right of rejection at construction site. Contractor shall remove rejected materials immediately from the site at Contractors expense. The Contractor shall ensure that all nursery materials meet the requirements of this Section prior to delivery.

Proposed materials shall be flagged at the nurseries by the Contractor prior to viewing by the Engineer. The Contractor shall schedule with the Engineer a time for viewing plant material at the nursery. Trips to nurseries shall be efficiently arranged to allow Engineer to maximize their viewing time. A minimum of two weeks shall be allowed for this viewing prior to time that plants are to be dug. When requested by the Engineer photographs of plant material or representative samples of plants shall be submitted. Viewing of plant materials by the Engineer at the nursery does not preclude their right to reject material at the site of planting.

The Contractor shall notify the Engineer at least three working days in advance of the anticipated delivery date of any plant material. The Contractor shall submit an invoice for each shipment of plants showing the quantities, kinds, and sizes of materials along with the certificate of inspection. Evidence of inadequate protection of plant material following digging, transit, storage or other handling will be cause for rejection. Upon arrival at the temporary storage location or work site, plants shall be inspected for proper handling (including but not limited to shipping procedures) in the presence of the Engineer for damage, including but not limited to dried out roots, broken branches, broken or loosened root balls, or torn bark. The Contractor shall replace the damaged material at their own expense.

Container grown nursery stock shall have a well-established root system reaching the sides and bottom of the container to provide a firm mass of growing medium, but shall not be root bound (i.e., have excessive root growth encircling the inside of the container). Bare root material will not be accepted as a substitution for nursery stock specified as container or balled and burlapped specified nursery stock.

Each species shall be identified by means of grower's label affixed to the plant. The grower's label shall include the data necessary to indicate conformance to specifications. For minimum plant requirements of height, width, minimum multi stems and root ball diameter as appropriate for the specified species type see the Plant Schedule on the Plans.

(a) Nursery stock. Contractor shall file copies of certificates after acceptance of material. Evidence of inadequate protection following digging, carelessness while in transit, or improper handling or storage, will be cause for rejection. When a plant has been rejected, the Contractor shall remove it from the area of the work and replace it with one of the required size and quality conforming to one of the following:

(1) Deep Rooted Containers shall be containers for growing native plants that are narrower in diameter and longer than standard nursery pots of equal volume. Containers must have physical "anti-spiraling" features such as vertical ribs on the inside walls or side slits in the sidewalls that will air-prune roots. Containers that have been treated with compounds such a copper to chemically prune the roots will not be accepted. Deep rooted container classifications shall have the following properties:

Deep Rooted Container Class Specification	Minimum Height (Inches)	Minimum Volume (Cubic Inches)
#10	8	10
#40	9	40
#60	13	60
#180	14	180
#300	29	300

(2) Standard Nursery Containers shall conform to the recommended specification in the *American Standard for Nursery* Stock (ANSI Z60.1-2014). For minimum plant requirements of height or width as appropriate for the specified species type see the Plant List on the drawings. Standard nursery container classifications shall have the following properties:

Standard Nursery Container Class	Acceptable Volume Range (Cubic Inches)
#1	152-251
#5	785-1242
#10	2080-2646
#20	4520-5152

(3) Balled and burlapped or large container shall conform to the recommended specifications in the *American Standard for Nursery Stock* (ANSI Z60.1-2014). Single stem deciduous tree caliper measurements shall be taken six inches above the ground for field grown

stock and from soil line for container grown stock. Multi-stem deciduous tree and evergreen tree height measurement shall be from ground level for field grown and from soil line for container grown stock.

(b) Unrooted Cuttings. Unless otherwise authorized, the Contractor shall notify the Engineer at least five working days in advance of the anticipated start of harvesting cuttings. All cuttings shall be harvested from approved parent material. Approval of parent material shall be in writing from the Engineer. This approval will include a detailed description of the approved locations. The Contractor shall select a site, and if outside of the construction boundary, provide written approval from the Owner, when applicable, for access and harvesting the required number of cuttings. The harvesting site shall be left clean and tidy, to the satisfaction of the Engineer and the Owner, when applicable. Unused material including trimmings shall be cut up to 2 feet in length and evenly distributed around the wetland mitigation site.

Unrooted cuttings shall be harvested and planted in early spring (March 1st to April 15th) while the plants are still dormant. However, the Engineer may authorize an alternative harvesting and planting timeframe based on project timing. Immediately upon harvesting, all cuttings shall be placed in water so that the cut ends are covered in water, and the cuttings shall be stored in a cool location. Plants shall be completely submerged in containers with water if not planted within 24 hours of harvesting. The containers shall be continuously shaded and protected from the wind. Cuttings shall be protected from drying at all times.
During transportation, the cuttings shall be kept completely submerged in containers with water in orderly fashion to prevent damage and to facilitate handling. Cuttings should be bundled using natural twine or flexible staking tape (and not with wire) in uniform groups of 25-100 to allow for easy tracking of quantities.

(1) Live Willow Stakes –Shall be unrooted cuttings approximately 3 feet long and between 1/2 and 1-inch in diameter. All side branches must be trimmed. Willow cuttings shall be cut from branches with smooth undamaged bark. Branches with thick, cracked bark shall not be used because they will not re-sprout effectively. Cuttings shall be cut about one foot from the ground using sharp loppers or pruning tools. Cuts shall be clean, without stripping the bark or splitting the wood. The base cuts shall be at a 45-degree angle to identify the root end of the cutting. The top shall be cut off with a square cut so that the top of the stake is easily distinguishable from the bottom. If willow stakes are to be planted in the second half of the growing season (June 15th to October 15th), then the cut top end shall be dipped into latex paint (covering approximately 1 inch at the top of the stake) to seal and reduce desiccation in hot/dry establishment conditions.

(2) Live Brush Mattress– Live willow unrooted cuttings to be used in brush mattress as a bioengineering application. The primary branch shall be approximately 6 – 15 feet long and between 1/2 and 2 inches in diameter at the base. Side branches are not trimmed unless a side branch is large enough to be used as a primary branch itself. Brush cuttings shall be cut at a height of between six to twelve inches above the ground. Cuts shall be clean, without stripping the bark or splitting the wood. Live brush cuttings should be composed primarily of willow cuttings but may include up to 20% cottonwood branch cuttings.

(3) Live Brush Fascines - Live willow unrooted cuttings to be used in fascines as a bioengineering application. Unrooted cuttings diameter shall vary and shall be a minimum 5 feet long and between 1/4 and 2 inches in diameter. Up to 30 percent of the bundle may be plant material that does not root easily or dead plant material. The remaining 70 percent of the bundle shall consist of younger wood between 1 to 4 years old (at a minimum 25 willow cuttings per fascines). Fascines bundles may be stored submersed in water for no longer than two weeks, if necessary.

(c) Wood Stakes. Wood stakes for deciduous tree support shall be 2 inches' x 2 inches square, or 2 1/2 inch diameter and 6 feet long free from bends. One end of all wood posts shall be pointed. Metal stakes for deciduous tree support shall be studded 6 feet long T-Post with a minimum weight of 1.25 lbs. per linear foot. Metal stakes for evergreen tree support shall be 24 inches long and consist of either minimum weight 1.25 lbs. per linear feet T-Post or #4 or larger rebar. Wood stakes shall be made of untreated wood guaranteed to last in the ground at least two growing seasons.

(d) Backfill. Backfill material consists of topsoil in accordance with the Contract requirements of 207 and additional compost material thoroughly mixed together and reasonably free of rocks and plant material. All other foreign material shall be removed. Do not use subsoil removed from planting pits as backfill unless accepted by CDOT Project Engineer. Compost shall be mixed into the backfill material at a rate of 25 percent by volume.

Live Willow Stake applications do not require additional compost in the backfill material, but holes must be backfilled with topsoil or native fine alluvium (sand or gravel).

Compost for planting pits shall be in accordance with section 212.

(e) Wood Mulch. Mulch shall consist of virgin moist wood product with shavings having approximate dimensions of: Width: 1/4 to 1/2 inch, Length 3 to 4 inches. Mulch shall be free of material injurious to plant growth. Sources of mulch should be free of weeds and invasive plant parts or seeds. Sawdust, dirt, garbage, or other debris mixed in the mulch is not acceptable. Contractor shall submit one pound of proposed mulch for approval.

(f) Flex Pipe Bark Protector. Bark Protector shall be made of flexible UV stabilized plastic that shall be able to push off and separate with tree growth, without harming the bark, stem, wood or any part of the tree.

(g) Wildlife Protection Fencing. When specified on plans fencing shall be made of 20-gage steel with black-vinyl coating, with a maximum opening of 1 inch.

(h) Deciduous Tree Wrapping Materials. Wrapping material shall be horticulturally standard waterproof corrugated cardboard material that allows stretching over time to prevent girdling of the tree.

(i) Tree Straps. Breathable nylon webbing 18 inches long and 1 ½ inches wide with metal grommets at each end.

CONSTRUCTION REQUIREMENTS

214.03 All nursery stock shall be protected from drying out or other injury with acceptable practices within the industry. Broken and damaged roots shall be pruned before planting.

(a) *Planting Seasons.* Nursery stock shall be planted in accordance with the Contract. Areas to be planted shall be brought to the lines and grades designated or approved. The Contractor shall place all plant material according to the approved Landscape/Mitigation Plans to the degree that unsuitable planting locations shall be avoided. Trees shall be planted outside of the clear zone, except when guardrail or vertical curb exists, this distance may be reduced to 20 feet. Shrubs shall not be planted closer than 6 feet from the edge of pavement. Locations of all nursery stock and unrooted cuttings shall be staked in the field prior to planting. Plants and planting locations shall be checked in the field by CDOT Region Biologist or CDOT Landscape Architect and shall be adjusted to the position as approved before planting begins. Planting holes shall not be constructed until written approval has been received from the Engineer.

(b) *Excavation.* Planting pits shall be circular in outline with vertical or sloped sides. The Contractor shall roughen sides of the pit to remove any compacting or glazing. When conditions detrimental to plant growth are encountered, such as over compacted topsoil, rubble fill, debris, or obstructions, notify the Engineer before planting. Use of a tree spade to dig plant pits is prohibited.

(c) *Planting.* Planting shall be done in accordance with good horticultural practices and only after topsoil has been placed. Plants of upright growth shall be set plumb, and plants of prostrate type shall be set normal to the ground surface. Plants with dry, broken, or crumbling roots will not be accepted for planting. When conditions detrimental to plant growth are encountered, such as over compacted topsoil, rubble fill, debris, or obstructions, notify the Engineer before planting. Use of a tree spade to dig plant pits is prohibited. Pits excavated with a backhoe shall be scarified as needed.

For automated irrigated areas planting pits shall be dug 2 to 4 inches shallower than the height of the rootball for trees, and 2 inches shallower for shrubs. In non-irrigated areas, planting pits shall be dug so that the top of the rootball is 2-4 inches depressed from surrounding final grades. The nursery stock shall be set in the center of the planting pit on undisturbed soil.

Trees shall be stabilized and then the top third of the wire basket, any twine and burlap shall be removed before the pit is backfilled. Shrubs shall be planted in the center of the pit. All of the plastic, metal and fabric, containers shall be removed. Peat containers shall be removed if directed by the Engineer. If the nursery stock is root-bound (roots circle the root ball) shallow scores with a sharp knife 1/4 to 1/2 inch deep shall be made along the edges and the bottom of the rootball.

Areas to be planted with ground cover shall be prepared by placing topsoil and a 1/2 inch layer of soil conditioner on the ground surface and rototilling to a depth of 6 inches. Ground cover shall be planted by excavating to a depth sufficient to accommodate the root structure of plant materials without crimping or bending roots. After planting, backfill shall be placed around the ground cover and compacted firmly around the roots. The planted areas shall be brought to a smooth and uniform grade, and then top dressed with a 2-inch-deep wood mulch.

(d) Backfilling. Backfill shall be thoroughly worked and watered-in to eliminate air pockets. For trees backfill 1/2 of the planting pit and saturate to remove air pockets. After settling finish backfilling and saturate again. After the soil has settled, nursery stock must be in the proper position and at the proper depth. Saucers shall be prepared around each plant to the dimensions shown on the planting details. For all nursery stock the excavated area shall be covered with a 4-inch-thick layer of wood mulch. After completion of all planting and before acceptance of the work, the Contractor shall water

nursery stock installed under this Contract, as needed to maintain a moist root zone optimum for plant growth. Nursery stock or prepared surfaces damaged during planting operations by the Contractor's operations shall be replaced at the Contractor's expense.

Surplus soil remaining after backfilling is completed shall be used for constructing water retention berms, or, if not needed for berms, shall be thinly distributed (wasted) in the vicinity, subject to approval of the Engineer.

(e) Wood Mulch. Mulch shall be placed to a minimum of 4-inch depth to cover nursery stock excavated areas, but not touching the trunk of trees.

(f) Pruning. All deciduous trees and shrubs shall be pruned in accordance with standard horticultural practice, preserving the natural character of the plant. Guidelines for pruning are indicated in the planting details. Pruning cuts shall be made with sharp clean tools.

All clippings shall become the property of the Contractor and be removed from the site.

(g) Guying. All deciduous trees 2-inch caliper and greater shall be staked as designated on the plans. Coniferous trees 4 feet or taller shall be staked as designated on the plans.

(h) Deciduous Wrapping Materials. Wrapping shall be applied from the base of the tree upward to the second scaffold branch and secured with arbor tape. Populus species shall be exempt from tree wrap. The Contractor shall submit the manufacturer's certification for the wrapping material requirements. Wrapping shall be done in the fall months prior to freeze and removed in the spring. Wrapping shall not remain on any trees throughout the summer months. Wrapping shall be removed by the Contractor.

All plant tags shall be removed from plants and all packing or other material used by the Contractor shall be removed from the site. Upon completion of work, the Contractor shall remove plant containers, bags and other debris and leave area in clean, acceptable condition.

(i) Unrooted Cuttings. Upon arrival at the construction site, cuttings shall be inspected for acceptability. Only healthy, undamaged material will be accepted. During installation activities, the cuttings shall be kept wet and out of the direct sun light. No cuttings shall be out of water for more than 10 minutes before planting. Water shall be applied to areas around the cuttings until the soil mass is saturated. Cuttings shall be watered thoroughly every day for a period of one month, unless natural soil saturation occurs within 12 inches of soil surface, as verified by the Engineer. Unrooted cuttings shall be used in the following:

1. *Live Willow Stakes.* Using a rock bar or other mechanical method such as a stinger backhoe attachment or trenching equipment, create a vertical hole or trench deep enough to reach a depth at which the water table will be present throughout the growing season, or deep enough to extend below the low summer flow, or groundwater elevation of the adjacent stream channel. Planting zones shall be surveyed and staked in the field for approval by the Engineer prior to planting. Insert 2/3 of the live cutting into the hole/trench, with the 45 degree cut end down, so that the end of the cutting maintains contact with the natural water table throughout the entire growing season;

planting depth must consider the natural fall of the water table that typically occurs in late summer. Planting depth shall be verified by Engineer. The placement of these cuttings shall be in areas shown on the plans and at the spacing specified. Minor adjustments in placement and spacing may be necessary based on field conditions.

The root end of cuttings shall be tamped into the pilot hole or placed in a trench to a minimum depth of 2 feet, or until the root-end of the cutting meets elevation at which groundwater will be present at the driest point of the growing season. Note that some water tables will vary greatly from April to October; the Contractor shall consult with the Engineer and Region environmental staff for proper depth.

The top of the cutting shall protrude a minimum of 4 inches, but no more than 1/3 of its length with at least two live buds showing above ground. Dead blow hammers or rubber mallets shall be used to tamp in the cuttings into holes, in such manner as to not cause the wood to split. Trench planting should not require any tamping.

Live cuttings require direct contact with soil. Soil shall be placed/backfilled in any spaces around the cuttings and tamped into place to remove any air pockets; if necessary, a soil-water slurry should be used to ensure good soil contact with cutting.

Water shall be applied to the planted cutting stakes areas until the soil mass is saturated. Cuttings shall be watered thoroughly every day for a period of one month, unless natural soil saturation occurs within 12 inches of soil surface, as determined by the Engineer, in consultation with the Region environmental representative.

2. Live Brush Mattress. Live unrooted cuttings shall be evenly distributed in the dimensions shown on the plans and laid flat against sloped stream bank to create a continuous mat of brush. The cut-end of the *branches* shall be buried in the toe of the slope. At a minimum, the ends shall be buried 6 inches at the toe of slope or otherwise secured with willow fascines, log and/or rock as specified in plans. The Contractor shall ensure that the lower willow tips are in contact with soil that is saturated during normal low flow stream conditions. The mattress will be secured to the stream embankment with a network of wood stakes and twine. Utilize minimum length 24-inch-long wood stakes and 0.25-inch diameter machine spun bristle coil twine (tensile strength: 140 pounds).

   The Contractor shall cover the mattress with a thin layer of clean topsoil and seed with wetland seed mix. Soil covering should cover 90 percent of the unrooted cuttings. Approximately 10 percent but no more than 20 percent of the cuttings should daylight above the soil covering once soil has settled into the voids of the mattress.

3. Live Brush Fascine. A fascine is a bundle of unrooted cuttings, fastened together with 0.25-inch diameter machine spun bristle coil twine (tensile strength: 140 lbs.) to keep the bundles tightly tied until placed in the ground and buried. Clean topsoil shall be worked over and around the bundles, no compaction is required. The length of the wattle bundle shall be placed parallel with the contour of the ground. Wood stakes shall be placed as shown on the plans centered along bundle. Utilize minimum length 24-inch wood stakes and 0.25-inch diameter machine spun bristle coil twine (tensile strength: 140 pounds). The Contractor shall puddle with water and allow soil to settle, then repeat backfill procedure until wattle bundle is covered to three-quarters

of bundle height. Unrooted cuttings installed above reliable ground water supply shall be watered thoroughly every day for a period of one month. Watering shall be continued after the first month at a minimum of once a week until the completion of the project.

(j) Watering.

1. Watering for nursery stock in irrigated areas (projects with 623 pay items). Irrigation system shall be operating and supplying the correct amount of water to the immediate area prior to any nursery stock being planted. Plants shall be thoroughly watered within 15 minutes of planting.
2. Watering in newly planted nursery stock and unrooted cuttings in non-irrigated areas. The Contractor shall furnish and supply the correct amount of water to the area receiving unrooted cuttings and nursery stock to keep the plants in a healthy and vigorous condition. All plantings shall be watered within four hours of placement. All plant material shown on the plans (excluding seeded areas) shall be watered to ensure successful establishment of the plant. Rate of flow shall allow the water to soak into the soil adjacent to the planting. At no time shall watering operations be applied at a rate or intensity that causes surface run off.

(k) Maintenance of landscape during construction. Maintenance of landscaping shall start immediately upon placement of first permanent landscaping and continue until the Notice of Substantial Landscape Completion has been received. The Contractor shall maintain the seeded areas, nursery stock and unrooted cuttings in a healthy and vigorous growing condition to ensure successful establishment. Maintenance shall consist of the following:

Work Item	Function	Notes
Weed control of areas having native seed	Areas shall be kept free of harmful insects, disease and weeds	Weed management strategies shall be discussed during the Site Pre-Vegetation Conference.
Hand watering trees	All plant material shown on the plans (excluding seeded areas) shall be watered to ensure successful establishment of the tree. Rate of flow must allow the water to soak into the soil adjacent to the planting. At no time shall watering operations be applied at a rate or intensity that causes surface run off.	Trees shall be watered two times a month at a rate of 10 gallons for each diameter inch of the tree for the months of May through October, and one time per month for the months of November through April.

Work Item	Function	Notes
Hand watering trees, shrubs, herbaceous plants and unrooted cuttings	All plant material shown on the plans (excluding seeded areas) shall be watered to ensure successful establishment of the plant. Rate of flow must allow the water to soak into the soil adjacent to the planting. At no time shall watering operations be applied at a rate or intensity that causes surface run off.	All plant material shown on the plans (excluding seeded areas) shall be watered to ensure successful establishment of the plant. Rate of flow must allow the water to soak into the soil adjacent to the planting. At no time shall watering operations be applied at a rate or intensity that causes surface run off.

214.04 Landscape Establishment. From the time of installation, during construction, and throughout the Landscape Establishment period the Contractor shall maintain all plant material and seeded areas in a healthy and vigorous growing condition and ensure the successful establishment of vegetation. This includes performing establishment, replacement work, and landscape maintenance work as described below.

The beginning of the Landscape Establishment period depends upon receipt of the written Notice of Substantial Landscape Completion from the Engineer. Substantial Landscape Completion occurs when all plant materials in the Contract have been planted and all work under Sections 212, 213, 214 and 623 has been performed, except for the Section 214 pay item, Landscape Maintenance. If the Notice of Substantial Landscape Completion is issued during the spring planting season, the Landscape Establishment period begins immediately and lasts for a period of 12 months. If the Notice of Substantial Landscape Completion is issued at any other time, the Landscape Establishment period begins at the start of the next spring planting season and lasts for a period of 12 months.

(a) Establishment and Replacement. After all planting on the project is complete, a plant inspection shall be held including the Contractor, Engineer and CDOT Landscape Architect to determine acceptability of plant material. During the inspection, an inventory of rejected material will be made, and corrective and necessary cleanup measures will be determined.

Dead, dying, or rejected material shall be removed each month during the Landscape Establishment period as directed. Plant replacement shall be performed during the spring planting seasons at the beginning and end of the Landscape Establishment Period. Plant replacement stock shall be planted per the Contract and is subject to all requirements specified for the original material. Plant replacement shall be at the Contractor's expense.

(b) Landscape Maintenance. During the Landscape Establishment period the Contractor shall perform landscape maintenance as described. The Contractor shall maintain all landscaped areas in the condition they were in when first installed and accepted.

Before the Notice of Substantial Landscape Completion, the Contractor shall submit a detailed maintenance plan, which includes a schedule showing the number of hours or days personnel will be present, the type of work to be performed, supervision,

equipment and supplies to be used, emergency program and responsible person to contact for emergency work, and inspection schedule. The detailed maintenance plan is subject to review and approval by the Engineer. The Engineer will not issue the Notice of Substantial Completion until the Engineer has received and approved the maintenance plan.

The proposed types, brand names, material safety data sheets, and rates of application of herbicides, pesticides, and fertilizers to be used shall be submitted for approval with the detailed maintenance plan. Herbicides, pesticides, and fertilizers shall meet all local, state, and federal regulations and shall be applied by a licensed applicator.

The Contractor shall perform start-up, watering, programming, operation, and fall winterization of the irrigation system. The Contractor shall do a spring start-up of the irrigation system before Final Acceptance and perform all irrigation system warranty work as specified in Section 623.

The Contractor shall keep a project diary documenting all landscape and irrigation maintenance activities including work locations and time spent. The Contractor shall provide copies of the diary to the Engineer upon request.

The Contractor shall restore and reseed eroded areas and areas of poor establishment per Sections 212 and 213. The Contractor shall maintain staking and guying until the end of the Landscape Establishment period. The Contractor shall remove all guying wire, straps, and stakes at the end of the Landscape Establishment period.

During the Landscape Establishment period, the Contractor shall water, cultivate, and prune the plants and repair, replace, or readjust guy material, stakes, and posts as required or directed by the Engineer. The Contractor shall reshape plant saucers, repair washouts and gullies, replace lost wood chip mulch, keep all planting sites free from weeds and do other work necessary to maintain the plants in a healthy and vigorous growing condition. This includes seasonal spraying or deep root watering with approved insecticides or fungicides as required.

(1) Watering in Irrigated Areas. Trees planted at all locations on the project shall be watered once per month at the rate of 30 gallons per tree for the months November through April until the Landscape Establishment period ends.

Shrubs planted at all locations on the project shall be watered once per month at the rate of 10 gallons per shrub for the months November through April until the Landscape Establishment period ends.

(2) Watering in Non-irrigated Areas. Trees planted shall be watered twice per month by the Contractor at the rate of 30 gallons per tree per watering for the months May through October, and once per month at the rate of 30 gallons per tree for the months November through April of the 12-month period following planting.

Shrubs planted in upland areas shall be watered twice per month by the Contractor at the rate of 10 gallons per shrub per watering for the months May through October and shall be watered once per month at the rate of 10 gallons per shrub for the months November through April of the 12-month period following planting.

The contract performance bond, required by subsection 103.03, shall guarantee replacement work during the Landscape Establishment period.

If all other work is completed on a project, no contract time will be charged during the plant establishment period.

METHOD OF MEASUREMENT

214.05 The quantity of nursery stock to be measured will be the number of plants, of the types and sizes designated in the Contract that are actually planted and accepted.

Live Willow Stakes will be measured by the number actually installed and accepted.

Live Brush Mattress will be measured by the actual number of linear feet installed and accepted.

Live Brush Fascines will be measured by the actual number of linear feet installed per the detail on the plans and accepted.

Landscape Maintenance will not be measured but will be paid for on a lump sum basis.

BASIS OF PAYMENT

214.06 The accepted quantities of nursery stock and unrooted cuttings will be paid for at the contract unit price for each of the items listed below:

Payment for the total cost of the item will be made at the completion of the installation of each item.

Cost of the performance bond shall be included in the cost of the plant items.
Payment will be made under:

Pay Item	**Pay Unit**
_____ Tree (____Inch Caliper)	Each
_____ Tree (____Foot)	Each
Deep Rooted Container #___ (Deep Rooted # ____ Container)	Each
Standard Nursery Container (#_____ Container)	Each
Live Willow Stakes	Each
Live Willow Fascine	Linear Feet
Live Brush Mattress	Linear Feet
Landscape Maintenance	Lump Sum

Additional slow-release organic fertilizer for nursery stock shall be used as specified in the plans will not be measured and paid for separately but shall be included in the work.

Compost required for backfill of nursery stock will not be paid for separately but shall be included in the work.

All water required for nursery stock and unrooted cuttings in projects without 623 pay items will be measured and paid for in accordance with Section 209 under Pay Item Water (Landscaping), up to the Notice of Substantial Completion.

Water required after the acceptance of the Notice of Substantial Completion will not be measured and paid for separately but shall be included in the work.

Standard waterproof tree wrap and flex pipe bark protector for nursery stock will not be measured and paid for separately but shall be included in the work.

Cleaning or repair of site conditions from equipment used by the Contractor for planting operations will not be measured and paid for separately by shall be included in the work. Wood mulch, stakes, guy wire, PVC protector, safety caps, wrapping, and all other materials required to install a tree will not be measured and paid for separately but shall be included in the work.

Wood stakes and other materials required to secure Live Brush Mattresses and Live Brush Fascines will not be measured and paid for separately but shall be included in the work.

Seeding will be measured and paid for per Section 212 and Topsoil will be measured and paid for per Section 207.

Maintenance of Landscaping during construction will not be measured and paid for separately but shall be included in the work.

For each month that landscape maintenance is performed and accepted during the Landscape Establishment period as specified in subsection 214.04, payment for landscape maintenance will be made in installments as follows:

- Ten percent of the lump sum amount will be paid for each of the eight growing season months, March through October.
- Five percent of the lump sum amount will be paid for each of the winter months, November through February.

Landscape maintenance performed during construction will not be measured and paid for separately but shall be included in the work.

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SECTION 215
TRANSPLANTING

DESCRIPTION

215.01 This work consists of transplanting trees, shrubs, plugs of wetland material including root mats from existing wetlands, and other plant material, referred to as "plants," of the designated species per this specification and accepted standard horticultural practice at the designated locations. Transplanting season is that period when plants are in a dormant condition and can be moved. Dormant means that deciduous material is without leaves and coniferous material is without new candle growth. Transplanting done in periods not considered dormant transplanting season shall require advance approval.

MATERIALS

215.02 Plants to be transplanted shall be those that are flagged on the project site within the right of way, or as directed. Plugs shall be dug from areas noted in the Contract or as directed by the Engineer. Removal shall be dispersed throughout the areas so as not to impact the existing wetland. Plugs shall be taken in early spring when plants are emerging. Plugs shall be a minimum of 4 inches in diameter and 6 inches to 8 inches deep with the root mat to remain intact. Plugs shall not be stockpiled but shall be transplanted directly to wetland mitigation sites as directed. Transplanting shall be accomplished the day they are dug. Plugs shall be kept moist and shall not be placed in holding beds.

CONSTRUCTION REQUIREMENTS

215.03 Plants shall be dug, properly pruned, and prepared for transplanting per standard practice. The root system shall be kept moist, and plants shall be protected from adverse conditions due to climate and transporting from the time they are dug to the actual planting. Before removal for transplanting, all coniferous trees shall be sprayed with an approved anti-desiccant.

The following table represents the minimum diameter of rootballs for collected plants.

Table 215-1

TYPE 6 COLLECTED PINON PINE

MIN. ROOTBALL DIAMETER

Caliper	Min. Ball Dia.
1 to 1 1/2 inch	15 inch
1 1/2 to 2 inch	17 inch
2 to 2 1/2 inch	20 inch
2 1/2 to 3 inch	24 inch
3 to 3 1/2 inch	26 inch
3 1/2 to 4 inch	28 inch
4 to 4 1/2 inch	30 inch
4 1/2 to 5 inch	32 inch

Table 215-2
TYPE 7 ALL COLLECTED PLANTS
OTHER THAN PINON PINE
MIN. ROOTBALL DIAMETER

Caliper	Min. Ball Dia.
1 to 1 1/2 inch	14 inch
1 1/2 to 2 inch	16 inch
2 to 2 1/2 inch	20 inch
2 1/2 to 3 inch	24 inch
3 to 3 1/2 inch	28 inch
3 1/2 to 4 inch	32 inch
4 to 4 1/2 inch	36 inch
4 1/2 to 5 inch	40 inch

For caliper sizes larger than those given under Type 7, the ratio of ball diameter to caliper shall be 8:1.

Planting pits for balled and burlapped trees shall be circular in outline with vertical sides. Pits shall be at least two times greater in diameter than the earth ball. Before a tree is placed in a plant pit, the pit shall be filled half full of water. Backfill shall be thoroughly worked and watered to eliminate air pockets. Unsuitable backfill soils shall be replaced.

Trees shall be machine transplanted with tree spades. The following table represents the minimum size of spade machine equipment to be used for transplanting plants based upon caliper size. The table also represents the minimum diameter of rootballs for machine transplanted plants.

Table 215-3
MINIMUM SPADE MACHINE SIZE
FOR MACHINE TRANSPLANTED PLANTS

Caliper (based on rootball width)	Min. Spade Machine Size
1 to 3 inch	44 inch
3 to 6 inch	65 inch
6 to 9 inch	80 inch
9 to 12 inch	> 90 inch

Each tree shall be transported to the new site using the same spade that it was dug, or several trees may be spade-dug and transported in a pod trailer manufactured specifically for this purpose. Trees shall not be removed from spade or transported in a haul truck. The Contractor shall give the Engineer one-week notice before transplanting trees. At the time of transplanting the Engineer will designate a Department landscape architect to be on the site to oversee all tree planting.

Planting pits for machine-dug trees shall have the same dimension as the machine ball being

placed. Before a tree is placed in a planting pit, the pit shall be filled half full of water and allowed to drain. Once the tree is placed, voids in the pit shall be filled with clean suitable backfill and tamped. If unsuitable soil is encountered in the planting pits, the Contractor shall dispose of said material and backfill with suitable material as determined by the Engineer.

After the tree is planted (collected or machine transplanted), a basin shall be built to hold at least 30 gallons of water. For each inch of trunk diameter greater than 3 inches, the basin capacity shall be increased by 10 gallons. The depth of saucer shall not be below the top of the root system of the tree. The basin shall be filled with water three times and allowed to stand each time until empty before refilling. Saucers shall be covered with a 4-inch-thick layer of fresh moist wood chip mulch as shown on the plans. The size of mulch shall be approximately 1/4 to 1/2 inch wide and 3 to 4 inches long. A sample shall be submitted in advance to the Engineer for approval.

Transplanting shall be accomplished within one day. Trees shall not be placed in holding beds.

All transplanted trees shall be subject to a 180-day maintenance period during one or more growing seasons and shall be watered every seven calendar days. Each watering shall be 100 gallons per tree.

All transplanted trees shall be guyed per Standard Plan M 214-1. Guying material shall be removed at the end of the 180-day maintenance period. All trees damaged by the Contractor's operations shall be replaced and replanted at the Contractor's expense as approved. At the end of the 180-day maintenance period all dead trees shall be replaced and replanted with trees at the Contractor's expense. Further maintenance will not be required.

The Contractor shall not damage existing landscaped areas, including but not limited to turf, irrigation equipment, and other plants, during the transplanting operation. The Contractor may use suitable platform material over existing turf to prevent damage from heavy machinery.

Wetland plugs shall be a minimum of 4 inches in diameter and 6 to 8 inches in depth. Holes left in the existing wetlands from plug removal shall be filled with topsoil and tamped lightly. After tamping, the filled hole shall be at the same elevation as the existing surrounding wetlands.

Transplant plugs shall be placed in containers (one plug per container) after harvesting to facilitate handling and placing of material.

Plugs shall be spaced as directed in the Contract. Plugs shall be planted to match surrounding grade.

Water shall be applied to plugs until soil is saturated. Plugs shall be watered thoroughly every day for a period of one month.

METHOD OF MEASUREMENT

215.04 The quantity of transplanting to be measured will be the actual number of plants of the various types transplanted and accepted.
The quantity of transplanted trees to be measured will be the actual number of trees of the various calipers and types transplanted and accepted in their final location.

Caliper measurement shall conform to the USA Standard for Nursery Stock, sponsored by the American Association of Nurserymen, Inc. (AAN)

Only living plants in healthy condition at the end of the maintenance period will be accepted. If all other work is completed on the project, contract time will not be charged during the maintenance period.

The quantity of transplanted plugs to be measured will be the actual number of plugs transplanted and accepted in their final locations.

BASIS OF PAYMENT

215.05 The accepted quantities of transplanting measured as provided above will be paid for at the contract unit price each.
Payment will be made under:

Pay Item	Pay Unit
Transplant Tree	Each
Transplant Shrub	Each
Transplant Plug	Each

Water required will not be measured and paid for separately but shall be included in the work.

Hauling plants to their new location, removing unsuitable backfill, and providing clean suitable backfill for planting pit voids will not be measured and paid for separately but shall be included in the work.

SECTION 216
SOIL RETENTION COVERING

DESCRIPTION

216.01 This work consists of furnishing, preparing, applying, placing, and securing soil retention blankets and turf reinforcement mats for erosion control on roadway slopes or channels as designated in the Contract.

MATERIALS

216.02 Soil retention covering shall be either a soil retention blanket or a turf reinforcement mat as specified in the Contract. It shall be one of the products listed on CDOT's Approved Products List and shall conform to the following:

(a) Soil Retention Blanket. Soil retention blanket shall be composed of degradable natural fibers mechanically bound together between two slowly degrading synthetic or natural fiber nettings to form a continuous matrix and shall conform to the requirements of Tables 216-1 and 216-2. The blanket shall be of consistent thickness with the fiber evenly distributed over the entire area of the mat.

When specified, lightweight polypropylene netting shall be 1.5 pounds per 1,000 square feet; heavyweight netting shall be 2.9 pounds per 1,000 square feet.

When biodegradable blanket is specified, the thread shall be 100 percent biodegradable; polypropylene thread is not allowed.

When photodegradable netting is specified, the thread shall be polyester, biodegradable or photodegradable.

Blankets and nettings shall be non-toxic to vegetation and shall not inhibit germination of native seed mix as specified in the Contract. The materials shall not be toxic or injurious to humans. Class 1 blanket shall be an extended term blanket with a typical 24-month functional longevity. Class 2 blanket shall be a long-term blanket with a typical 36-month functional longevity. The class of blanket is defined by the physical and performance characteristics.

(b) Soil Retention Blanket (Straw-Coconut). Soil Retention Blanket (Straw-Coconut) shall be a machine-produced mat consisting of 70 percent certified weed free agricultural straw or Colorado native grass straw and 30 percent coconut fiber. The blanket shall be either biodegradable or photodegradable. Blankets shall be sewn together on a maximum 2-inch centers.

Netting shall be as follows:

When biodegradable netting is specified, the top and bottom netting shall be 100 percent biodegradable organic jute fiber. Netting shall be constructed using a weave unattached at intersections, which allows the strands of the net to move independently of each other.

When photodegradable netting is specified, the bottom side shall be lightweight polypropylene. The top side shall be heavyweight or lightweight polypropylene.

(c) Soil Retention Blanket (Excelsior). Soil Retention Blanket (Excelsior) shall consist of a machine-produced mat of 100 percent curled wood excelsior, 80 percent of which shall be 6 inches or longer in fiber length. It shall be either biodegradable or photodegradable. Blankets shall be sewn together at a maximum of 4-inch centers.

Netting shall be as follows:

When biodegradable netting is specified, the top and bottom netting shall be 100 percent biodegradable organic jute fiber. Netting shall be constructed using a weave unattached at intersections, which allows the strands of the net to move independently of each other.

When photodegradable netting is specified, the bottom side shall be lightweight polypropylene. The top side shall be heavyweight or lightweight polypropylene.

(d) Soil Retention Blanket (Coconut). Soil Retention Blanket (Coconut) shall be a machine-produced mat consisting of 100 percent coconut fiber. It shall be either biodegradable or photodegradable.

Netting shall be as follows:

When biodegradable netting is specified, the top and bottom netting shall be 100 percent biodegradable organic jute fiber. Netting shall be constructed using a weave that is unattached at the intersections, and which allows the strands of the net to move independently of each other.

When photodegradable netting is specified, the bottom and top side shall be heavyweight polypropylene.

Table 216-1
PHYSICAL REQUIREMENTS
FOR SOIL RETENTION BLANKET –
PHOTODEGRADABLE OR BIODEGRADABLE BLANKETS

Photo/Bio Degradable Class	Minimum Roll Width	Minimum Thickness ASTM D6525	Acceptable Matrix Fill Material	Min. Mass per Unit Area ASTM 6475	Size of Net Opening Photodegradable	Size of Net Opening Bio-degradable
1	6.5 ft	250 mils	Straw/ Coconut	8 oz/sy	Min. 0.50"x0.50" Max 0.75"x0.75"	Min. 0.50"x0.50" Max 0.50"x1.0"
1	6.5 ft	250 mils	Excelsior	8 oz/sy	Min. 0.50"x0.50" Max 1.0"x2.0"	NONE
2	6.5 ft	200 mils	Coconut	8 oz/sy	Min. 0.50"x0.50" Max 0.75"x0.75"	Min. 0.50"x0.50" Max 0.50"x1.0"

Table 216-2
PERFORMANCE REQUIREMENTS
FOR SOIL RETENTION BLANKET –
PHOTODEGRADABLE OR BIODEGRADABLE BLANKETS

Photo/Bio Degradable Class	Slope Application "C" Factor1 ASTM D6459	Minimum Tensile Strength MD2 ASTM D6818
1	< 0.10 at 3:1	8.33 lbs./in
2	< 0.10 at 3:1	10.42 lbs./in

Table 216-2 Notes:
"C" Factor is calculated as ratio of soil loss from soil retention blanket protected slope (tested at specified or greater gradient, 3H:1V) to ratio of soil loss from unprotected (control) plot in large-scale testing.
MD is for machine direction testing (along the length of the roll).

Blankets shall be tested for physical properties and have published data from an independent testing facility.

Large scale testing of Slope Erosion Protection ("C" factor) shall be performed by an independent testing facility.

(e) Turf Reinforcement Mat. Turf reinforcement mat (TRM) shall be a rolled mat consisting of UV stabilized, corrosion resistant, non-degradable synthetic fibers, filaments, or nets processed into a permanent three-dimensional matrix of the thickness specified in Tables 216-3 and 216-4. TRMs shall provide sufficient thickness, strength, and void space to permit soil filling and retention, and the development of vegetation within the matrix. The class of TRM is defined by the physical and performance characteristics as specified in the following tables.

Table 216-3
PHYSICAL REQUIREMENTS
FOR TURF REINFORCEMENT MAT

Product Class	Minimum Roll Width	Minimum Thickness ASTM D6525	Acceptable Matrix Fill Material2	Size of Net Opening2
1	6.5 ft	250 mils	Excelsior, Straw/Coconut, Coconut, or Polymer fibers	Minimum: 0.50"x0.50" Maximum: 0.75"x0.75"
2	6.5 ft	250 mils	100% UV Stabilized Synthetic or Coconut Fibers	Maximum 0.50"x 0.50"
3	6.5 ft	250 mils	100% UV Stabilized Synthetic Fibers	Maximum 0.50"x 0.50"

Table 216-3 Notes:

For TRMs containing degradable components, all property values shall be obtained on the non-degradable portion of the matting alone.

For TRMs with nets and fill material. Netted TRMs shall be sewn together on a maximum 2-inch centers.

Table 216-4
PERFORMANCE REQUIREMENTS
FOR TURF REINFORCEMENT MAT

Product Class	Tensile Strength MD ASTM D6818	Minimum UV Stability at 500 Hours ASTM D4355	Minimum Permissible Shear Stress* (Unvegetated) ASTM D6460
1	125 lb/ft	80%	1.8 lb/sf
2	150 lb/ft	80%	2.5 lb/sf
3	175 lb/ft	80%	3.1 lb/sf

Table 216-4 Notes: *****Permissible shear stress is the minimum shear stress that a product must be able to sustain when placed on a channel un-vegetated without physical damage or excess soil loss. Failure is defined as 1/2 inch of soil loss during a 30-minute flow event in large scale testing.

TRMs shall be tested for physical properties and have published data from an independent testing facility.

Large scale testing of Permissible Shear Stress shall be performed by an independent testing facility.

(f) Staples. Staples shall be made of ductile steel wire, 0.165 inches in diameter, 8 inches long and have a 1-inch crown. "T" shaped staples will not be permitted.

A sample of the staples and a Certificate of Compliance (COC) including the manufacturer's product data showing that the product meets the Contract requirements shall be submitted for approval at the Environmental Pre-construction Conference. Installation of the blanket will not begin until approval has been received from the Engineer in writing.

(g) Earth Anchors. The mechanical earth anchor shall be composed of a load bearing face plate, a tendon rod or wire rope, and a locking head or percussion anchor. Each element of the anchor shall be composed of corrosion resistant materials. The anchor and wire rope shall have a breaking strength of 9,500 pounds utilizing standard tensile testing and ASTM A1007-07. The anchor shall have a minimum 1,000 pounds' ultimate holding strength in normal soil and a manufacturer's recommended 216.03 minimum driven depth of 3.5 feet.

A sample of the anchors and a Certificate of Compliance (COC) including the manufacturer's product data showing that the product meets the Contract requirements shall be submitted for approval at the Environmental Pre-construction Conference. Installation of the blanket will not begin until approval has been received from the Engineer in writing.

CONSTRUCTION REQUIREMENTS

216.03 The Contractor shall install soil retention coverings per Standard Plan M-216-1 and the following procedure:

(1) Prepare soil per subsection 212.06(a).

(2) Apply topsoil or soil conditioning as directed in the Contract to prepare seed bed.

(3) Place seed per the Contract.

(4) Unroll the covering parallel to the primary direction of flow.

(5) Ensure that the covering maintains direct contact with the soil surface over the entirety of the installation area.

(6) Do not stretch the material or allow it to bridge over surface inconsistencies.

(7) Staple the covering to the soil such that each staple is flush with the underlying soil.

(8) Ensure that staples or earth anchors are installed full depth to resist pull out. No bent over staples will be allowed. Install anchor trenches, seams, and terminal ends as shown on the plans.

The Contractor shall install TRMs using the following procedure:

1. Place 3 inches of topsoil or soil amended with soil conditioning.
2. Apply half of the specified seed at the broadcast rate and rake it into the soil.
3. Install TRM.
4. Place 1 inch of topsoil or soil amended with soil conditioning into the matrix to fill the product thickness.

5. Apply the remaining half of the specified seed at the broadcast rate and rake it into the soil.
6. Install soil retention blanket (Photodegradable or Biodegradable Class 1) over the seeded area and TRM.

   When applicable, the covering shall be unrolled with the heavyweight polypropylene netting on top and the lightweight polypropylene netting in contact with the soil.

216.04 Slope Application. Soil retention coverings shall be installed on slopes as follows:

The upslope end shall be buried in a trench 3 feet beyond the crest of the slope if possible. Trench depth shall be a minimum of 6 inches unless required by the manufacture to be deeper. Before backfilling begins, staples shall be placed across the width of the trench. The trench shall then be backfilled to grade with soil amended with soil conditioning or topsoil, compacted by foot tamping, and seeded. Fabric shall be brought back over trench and secured with staples or earth anchors at 1 foot on center.

There shall be an overlap wherever one roll of fabric ends and another begins, with the uphill covering placed on top of the downhill covering. Staples shall be installed in the overlap.

There shall be an overlap wherever two widths of covering are applied side by side. Staples shall be installed in the overlap.

Staple checks shall be installed on the slope length at a maximum of every 35 feet. Each staple check shall consist of two rows of staggered staples.

The down slope end shall be buried in a trench 3 feet beyond the toe of slope. Before backfilling begins, staples shall be placed across the width of the trench. The trench shall then be backfilled to grade with soil amended with soil conditioning or topsoil, compacted by foot tamping, and seeded. Fabric shall be brought back over the trench and secured with staples or earth anchors. If a slope runs into State waters or cannot be extended 3 feet beyond the toe of slope, the end of covering shall be secured using a staple check as described above.

Coverings shall be securely fastened to the soil by installing staples or earth anchors at the minimum rate shown on the Standard Plan M-216-1. Staple or earth anchor spacing shall be reduced where required due to soil type or steepness of slope.

216.05 Channel Application. Soil retention coverings shall be installed as follows on a channel application:

Coverings shall be anchored at the beginning and end of the channel across its entire width by burying the end in a trench. Trench depth shall be a minimum of 6 inches, unless a larger depth is specified by the manufacturer’s recommendations. Before backfilling begins, staples shall be placed across the width of the trench. The trench shall then be backfilled to grade with soil amended with soil conditioning or topsoil and compacted by foot tamping and seeded. Fabric shall be brought back over the trench and stapled.

Covering shall be unrolled in the direction of flow and placed in the bottom of the channel first. Seams shall not be placed down the center of the channel bottom or in areas of concentrated flows when placing rolls side by side.

There shall be an overlap wherever one roll of covering ends and another begins with the upstream covering placed on top of the downstream covering. Two rows of staggered staples shall be placed.

There shall be an overlap wherever two widths of covering are applied side by side. Staples shall be placed in the overlap.

The covering shall have a channel check slot every 30 feet along the gradient of the flowline. Check slots shall extend the entire width of the channel. The covering shall be buried in a trench. Before backfilling begins, staples shall be placed across the width of the trench. The trench shall then be backfilled to grade with soil amended with soil conditioning or topsoil, compacted by foot tamping, and seeded. Fabric shall be brought back over the trench and continued down the channel.

Coverings shall be securely fastened to the soil by installing staples at the minimum rate shown on the plans. Staple spacing shall be reduced where needed due to soil type or high flows.

216.06 Maintenance. The Contractor shall maintain the soil retention coverings until all work on the Contract has been completed and accepted. Maintenance shall consist of the repair of areas where damage is due to the Contractor's operations. Maintenance shall be performed at the Contractor's expense. Repair of those areas damaged by causes not attributable to the Contractor's operations shall be repaired by the Contractor and will be paid for at the contract unit price. Areas shall be repaired to reestablish the condition and grade of the soil and seeding before application of the covering.

METHOD OF MEASUREMENT

216.07 Soil retention coverings, including staples, complete in place and accepted, will be measured by the square yard of finished surface, excluding overlap, which is installed and accepted. Earth anchors will be measured by the actual number of earth anchors complete in place and accepted.

BASIS OF PAYMENT

216.08 The accepted quantities of soil retention coverings will be paid for at the contract unit price per square yard. The accepted quantities of earth anchors will be paid for at the contract unit price for each installed.

Payment will be made under:

Pay Item	Pay Unit
Soil Retention Blanket (_) (Photodegradable Class _)	Square Yard
Soil Retention Blanket (_) (Biodegradable Class _)	Square Yard
Turf Reinforcement Mat (Class _)	Square Yard
Earth Anchors	Each

Preparation of seedbed, fertilizing, and seeding will be measured and paid for per Section 212.

Placing and preparation of seedbed, fertilizing, and seeding of soil under the TRM layer will be measured and paid for per Section 212.

Topsoil or amended soil and seed placed on the TRM will be measured and paid for per Sections 207 and 212.

Staples will not be measured and paid for separately but shall be included in the work.

SECTION 217
HERBICIDE TREATMENT

DESCRIPTION

217.01 This work consists of furnishing and applying herbicides to prevent or control plant growth in areas shown on the plans or designated.

MATERIALS

217.02 Herbicides shall be designated in the contract.
All herbicide labels shall be currently registered with the Colorado Department of Agriculture and the U.S. Environmental Protection Agency. All herbicides shall be supplied to the project in labeled containers. The labels shall show the product name, chemical composition, expiration date, and directions for use.

CONSTRUCTION REQUIREMENTS

217.03 All herbicides shall be applied by commercial pesticide applicators licensed by the Colorado Department of Agriculture as qualified applicators. The Contractor shall furnish documentation of such licensing before herbicide application. Herbicide mixing and application shall be done per instructions on the registered product label. The Engineer shall be furnished such label information before mixing and application.
The Contractor shall notify the Engineer at least 24 hours before each herbicide application and shall indicate the time and location application will begin. Application will not be allowed on Saturdays, Sundays, or holidays unless otherwise approved by the Engineer.

Herbicides shall not be applied when weather conditions, including wind conditions, are unsuitable for such work. Herbicides shall not be applied when soil is extremely dry.

Herbicide application method shall be such that plant growth outside the designated treatment areas will not be damaged. All damage caused by improper herbicide application shall be repaired at the Contractor's expense.

Herbicides shall not be used on areas that are to be topsoil sources unless otherwise approved by the Engineer.

METHOD OF MEASUREMENT

217.04 The quantity of herbicide treatment to be measured will be the actual number of square yards treated per the foregoing requirements or the actual number of hours the Contractor spends applying the herbicide and accepted by the Engineer. Areas designated to receive herbicide treatment will be measured once for each designated application. Reapplication of herbicide required due to inappropriate timing of the original application will not be measured or paid for.

BASIS OF PAYMENT

217.05 The accepted quantities of herbicide treatment will be paid for at the contract unit price per square yard or per hour.

Payment will be made under:

Pay Item	Pay Unit
Herbicide Treatment	Square Yard
Herbicide Treatment	Hour

Water will not be measured and paid for separately but shall be included in the work.

SECTION 250
ENVIRONMENTAL, HEALTH AND SAFETY MANAGEMENT

DESCRIPTION

250.01 This work consists of protection of the environment, persons, and property from contaminants that may be encountered on the Project. This includes monitoring the work for encounters with contaminants or suspected soil and groundwater contaminants; the management of solid, special, and hazardous waste; and management of visual emissions associated with hazardous waste, when encountered on the project.

250.02 The Contractor shall furnish all personnel, materials, equipment, laboratory services, and traffic control necessary to perform the contamination monitoring, testing, and site remediation when required. Traffic control shall be per the requirements of Section 630.

Monitoring equipment used to detect flammable gas, oxygen level, and toxic gas shall be capable of detection to meet the following standards:

Table 250-1
DETECTION STANDARDS FOR MONITORING GASES

Instrument Detection

Constituent	Threshold Limit	Increments
Flammable Gas	1% LEL	1%
Oxygen	19%	0.1%
Toxic Gas	1 PPM	1 PPM

Table 250-1 Notes: LEL = lower explosive limit

PPM = parts per million

CONSTRUCTION REQUIREMENTS

250.03 General. Prospective bidders, including subcontractors, are required to review the environmental documents available for this project. These documents are listed in subsection 102.05 as revised for this project.

This project may be in the vicinity of property associated with petroleum products, heavy metal-based paint, landfill, buried foundations, abandoned utility lines, industrial area or other sites that can yield hazardous substances or produce dangerous gases. These hazardous substances or gases can migrate within or into the construction area and could create hazardous conditions. The Contractor shall use appropriate methods to reduce, and control known landfill, industrial gases, and visible emissions from asbestos encounters and hazardous substances that exist or migrate into the construction area. The Contractor shall follow CDOT's Regulated *Asbestos-Contaminated Soil Management Standard Operating Procedure, dated October 18, 2016,* for proper handling of asbestos-contaminated soil, and follow all applicable Solid and Hazardous Waste Regulations for proper handling of soils encountered that contain any other substance mentioned above.

Encountering suspected contaminated material, including groundwater, old foundations,

building materials, demolition debris, or utility lines that may contain asbestos or be contaminated by asbestos, is possible at some point during the construction of this project. When suspected contaminated material, including groundwater, is encountered, or brought to the surface, the procedures under subsection 250.03(d) and 250.05 shall be followed.

Transportation of waste materials on public highways, streets and roadways shall be done per Title 49, Code of Federal Regulations (CFR). All labeling, manifesting, transportation, etc., of waste materials generated on this project shall be coordinated with the Engineer. All hazardous waste manifests for waste materials generated on this project shall list the Colorado Department of Transportation as the generator of the waste materials except as otherwise noted. If the Contractor contaminates the site, the Contractor shall be listed as the generator on the hazardous waste manifests, permits, and other documents for such material. If the project is not on a State Highway or frontage road, then the appropriate local governmental entity having jurisdiction over the transportation system facility shall be listed as the hazardous waste generator.

If waste materials must be handled in a permitted treatment, storage and disposal (TSD) facility, the facility shall be designated in writing by the Engineer. If the waste materials are the result of the Contractor's actions, the Contractor shall designate the facility.

The hazardous waste transportation phase of the work involves insurance required by law and regulations. If the waste materials are determined to be hazardous, the Contractor must submit proof that the transportation company is covered by the appropriate type and amount of insurance required by laws and regulations governing the transportation of hazardous waste.

The Contractor alone bears the responsibility for determining that the work is accomplished in strict accordance with all applicable federal, state, and local laws, regulations, standards, and codes governing special waste, petroleum, and hazardous substance encounters and releases.

The Contract will list known or suspected areas of contamination. Health and Safety Officer, Monitoring Technician, and Health and Safety Plan shall be required when so stated in the Contract.

(a) Health and Safety Officer (HSO). The Contractor shall designate an HSO, not the Project Superintendent, who shall have at least two years of field experience in chemical related health and safety. The HSO shall be either a certified industrial hygienist (CIH), certified hazardous materials manager (CHMM), professional engineer (PE) licensed in the State of Colorado, certified safety professional (CSP), or registered environmental manager (REM) meeting the criteria set forth in 29 CFR 1926. When asbestos is present or is suspected to be present, the HSO shall have additional training and certification per the Air Quality Control Commission Regulation No. 8 Part B. The HSO shall meet the minimum training and medical surveillance requirements established by the Occupational Safety and Health Association. When regulated asbestos contaminated soil (RACS) is present or is suspected to be present on or near a project, the HSO shall have knowledge of RACS regulations. The HSO shall meet the minimum training and medical surveillance requirements established by the Occupational Safety and Health Administration (OSHA) and the Environmental Protection Agency (EPA) for a supervisory Site Safety Official per 29 CFR 1962.65. The Contractor shall furnish documentation to the Engineer, at the Pre-construction Conference, that the above requirements have been met. Certification as an Asbestos Building Inspector per subsection 250.03(b) is recommended.

The HSO shall be equipped with the following:

1. Communication equipment as required in subsection 250.03(d)2A and a vehicle.
2. Monitoring and detection equipment for flammable gas, oxygen sufficiency, toxic gas, radiological screening, and other hazards. This includes, as required, a combustible gas indicator, flame ionization or photo ionization detector, oxygen meter, radiation monitor with Geiger Mueller detector, and other foreseeable equipment.
3. Depth gauging equipment, sampling equipment, and sampling containers.
4. Personal protective equipment (levels C and D) when required.

The HSO shall recommend and supervise those actions that will minimize the risk of hazardous substance related injury to the workers, Department personnel, the general public, property, and the environment. Hazardous substance is defined in 29 CFR 1926.32. The HSO shall prepare written procedures for the monitoring of confined space entry and working in or near excavations, including but not limited to trenches and drill holes associated with this project. The HSO shall conduct or supervise all hazardous substance and solid waste related testing, sampling, monitoring, and handling for this project to ensure compliance with applicable statutes and regulations, and other applicable environmental requirements under subsections 107.01 and 107.02.

The HSO shall be available for consultation and assistance with contaminated materials related testing, sampling, and field monitoring as required by the Engineer.

The HSO shall prepare and submit a bound and indexed final site report to the Engineer at the end of the project. This site report shall include a detailed summary of all contaminated materials and contaminated water that were encountered and their final disposition.

During each week the HSO is utilized, the HSO shall prepare a daily diary that shall be submitted to the Contractor and the Engineer. This diary shall be submitted at the end of the week and shall become a part of the Department's records. The diary shall contain a chronological log of activities on the project including dates and times on site, equipment used and calibrations, field monitoring results, visual observations, conversations, directives both given and received, and disposition of suspected hazardous substances. The Engineer will review this submittal and approve the actual number of hours to be paid.

(b) Monitoring Technician (MT). The Contractor shall designate a monitoring technician to be responsible for monitoring of hazardous substances during work on the project. The MT shall have a minimum of two years of actual field experience in assessment and remediation of hazardous substances that may be encountered during highway construction projects. When asbestos is present or is suspected to be present on or near a project, the MT shall have additional 40 hours' experience in RACS project management and certification as an Asbestos Building Inspector per the Colorado Air Quality Control Commission Regulation No. 8 Part B. The MT shall be experienced in the operation of monitoring devices, identifying substances based upon experience and observation, and field sampling (for testing) of all media that may be found on the site. Completion of the 40-hour hazardous waste and 8-hour supervisory training required by OSHA and U.S. EPA rules and regulations that complies with the accreditation criteria under the provisions of the proposed 29 CFR 1910.121 is required before beginning work. The Contractor shall furnish documentation at the Pre-construction Conference that demonstrates these requirements have been met.

The MT shall be equipped with the following:

(1) Communication equipment as required in subsection 250.03(d)2A and a vehicle.

(2) Monitoring and detection equipment for flammable gas, oxygen sufficiency, toxic gas, radiological screening, and other hazards. This includes, as required, a combustible gas indicator, flame ionization or photo ionization detector, oxygen meter, radiation monitor with Geiger Mueller detector, and other foreseeable equipment.

(3) Depth gauging equipment, sampling equipment, and sampling containers.

(4) Personal protective equipment (levels C and D) when required.

The MT shall be present on site and perform monitoring as required by 250.03(d) when work is being performed in areas of suspected contamination and on a predetermined basis throughout other work on the project.

The MT shall monitor for compliance with regulations, the project Health and Safety Plan and the Materials Management Plan (if they exist for the project), the Contract, and the environmental documents for the project. The MT shall immediately notify the Contractor, the Engineer, and the HSO of any hazardous condition.

During each week the MT is utilized, the MT shall prepare a daily monitoring diary, which shall be submitted to the Contractor, HSO and the Engineer. This diary shall be submitted at the end of the week and shall become a part of the Department's records. The diary shall contain a chronological log of activities on the project including dates and times on site, equipment used and calibrations, field monitoring results, visual observations, conversations, directives both given and received, and disposition of suspected hazardous substances. The Engineer will review this submittal and approve the actual number of hours to be paid.

(c) Health and Safety Plan (HASP). The HSO shall prepare a written HASP for the project, formatted as shown in Appendix B, Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, DHHS (NIOSH) Publication No. 85-115, available from the Superintendent of Documents, U.S. Government Printing Office. The Contractor and the HSO shall review the environmental documents listed before preparation of the HASP.

The Contractor shall submit a signed (or electronically sealed when HSO is a Professional Engineer) electronic HASP to the Engineer for acceptance. The Engineer shall have seven calendar days to review and accept or reject the proposed HASP. Within five calendar days after acceptance, the HSO shall distribute the accepted HASP to each emergency response agency servicing the project area, the HASP designated emergency hospital, and the Engineer. Earth or demolition work shall not occur until after the HASP is accepted distributed. The HASP shall also be available to the Contractor's employees, their representatives, and officials of OSHA, EPA, Colorado Department of Public Health and Environment (CDPHE), local government health department, Federal Highway Administration (FHWA), and as determined by the Engineer. The Engineer will distribute the accepted HASP to appropriate Department personnel. The HSO shall revise and update the HASP as warranted by changes in the field conditions.

All on-site workers (Contractor's, Department's, Utilities', and others) shall be briefed by the HSO on the contents of the HASP and any revisions thereof. The HSO shall conduct briefings (group or individual) to inform new employees, subcontractors, utility companies, and other on-site workers of the HASP contents before their entry on site. All

personnel involved in excavation or other soil disturbing activities shall receive the required two-hour Asbestos Awareness training by a Certified Asbestos Inspector, when asbestos discoveries are anticipated, or discoveries are made. A signature log of all briefing attendees shall be kept and furnished to the Engineer. The. Contractor shall provide, as required, eyewash equipment and stations, emergency showers, hand and face washing facilities, and first aid equipment.

The Contractor shall provide, as required, decontamination facilities for personnel and equipment employed in the work. The exact procedure for decontamination and frequency shall be included in the accepted HASP. Decontamination facilities shall meet the criteria set forth in the Code of Federal Regulations (29 CFR and 40 CFR).

(d) Precautions and Procedures. The following minimum precautions and procedures shall be followed during the construction of the project:

1. General construction precautions:

   A. All monitoring and piezometer wells and test borings shall be established or abandoned by the Contractor as regulated by the State Engineer's Office. Copies of all required permits, notification, and abandonment documents shall be submitted to the Engineer before payment approval.

   B. Hazardous substance related activities shall have a work plan for each work phase, which shall be coordinated with the Engineer at least three workdays before commencement of each phase of the work.

   C. The Contractor shall properly handle all investigation-derived waste generated by this project. Documentation shall be submitted to the Engineer of all tests performed for Treatment, Storage, and Disposal (TSD) determination; classification of waste; hauling records; TSD acceptance; manifest (if required); per applicable laws and regulations.

   D. When the work may involve air emissions, the Contractor shall contact the Colorado Department of Public Health and Environment (CDPHE), Air Pollution Control Division to ascertain if an air pollution emission notice (APEN) or permit is required for this operation. The Contractor shall be responsible for filing the APEN and obtaining said permit, if required. The processing of air pollution permits, if required, in non-attainment areas or where public hearings are required, likely will take more than 90 days.

2. For construction on a known or potentially contaminated site, the following conditions shall apply, in addition to those listed in subsection 250.03(d)1:

   A. The HSO shall be on site or readily available by radio, telephone or pager at all times during the work. When on site, the HSO shall have an operational portable or mobile cellular telephone available for immediate use in areas where such service is available. When on site in cellular telephone non-service areas, the HSO shall have available, for immediate use, radio access to a site with telephone service. The HSO shall be notified at least 24 hours before the start of confined space entry, storage tank removal, drilling, excavation, trenching, or dewatering operations.

B. The HSO shall designate the onsite monitoring equipment for flammable gases, oxygen deficient or enriched atmosphere, and toxic gases, such as but not limited to, a flame ionization detector, photoionization detector, combustible gas indicator, and oxygen meter. This designated equipment shall be on site during all construction operations and be utilized during trenching, drilling, excavating, confined space entry, underground storage tank removal, and other appropriate construction operations. The exact equipment to fulfill this requirement shall be specified in the accepted HASP. The HSO shall conduct or supervise the monitoring. The monitoring equipment shall be calibrated as recommended by the manufacturer.

C. When drilling, trenching, or excavating in the presence of detectable concentrations of explosive gases, the soil shall be wetted, and the operating equipment shall be provided with spark proof exhausts.

D. The Contractor, through the HSO, is responsible for ensuring that 29 CFR 1926 is fully complied with during the construction of the project.

E. Affected excavation operations shall be discontinued and personnel shall be removed from the affected excavation sites where any of the following levels are detected:

(1) 20.0 percent or more LEL flammable gas, or 10.0 percent in an underground or confined space,

(2) Permissible Exposure Limit (PEL) of any toxic gas,

(3) 19.5 percent or less oxygen,

(4) 25.0 percent or more oxygen,

(5) Greater than 2 mrem/hr. (Beta particle and photon radioactivity),

(6) Greater than 15 pCi/L (Gross alpha particle activity), or

(7) Other action levels as determined by the HSO.

(8) Uncovering of suspect Asbestos Containing Material (ACM), including but not limited to, buried facility components, active or abandoned utility lines, buried foundations and demolition debris, or miscellaneous ACM dispersed in the soil. The Contractor shall follow the procedures outlined in the HASP and 29 CFR 1926 to address these conditions. Work shall resume in these areas when approved by the Engineer.

F. Personnel shall be issued and utilize appropriate health and safety equipment as determined by the HSO, who shall provide the Engineer with a written explanation of what personal protective equipment (PPE) shall be worn, when, and by which personnel. Except in emergency cases, the Engineer shall be advised by the HSO of changes in the degree of PPE before implementation.

G. Personnel shall avoid the area immediately downwind of any excavation unless the excavation is monitored and declared safe.

H. The operators of excavating, trenching, or drilling equipment shall wear appropriate PPE as required in the HASP.

I. Exhaust blowers shall be present at the location where required in the accepted HASP.

J. The Contractor shall accomplish the work with employees who have been trained and equipped as required by the HASP and applicable provisions of 29 CFR 1910 and 29 CFR 1926.

K. Fire extinguishers, electrical equipment and wiring shall conform to the applicable requirements of 29 CFR 1926 and 49 CFR.

L. Smoking shall not be permitted within 50 feet of any excavation.

3. For construction within 1,000 feet of a known or potentially contaminated site, the following conditions, in addition to those listed in subsection 250.03(d)1. shall apply:

A. The areas under construction shall be checked with a combustible gas indicator before excavation begins to determine if flammable or combustible gas is in the area.

B. Excavations, trenches, and drill holes shall be monitored by the HSO for flammable gas, toxic gas and oxygen deficiency or enrichment. This shall be carried out continuously unless the presence of flammable, combustible, or toxic gas or oxygen deficiency or enrichment in the area can be ruled out by the HSO. The recommendation to discontinue monitoring must be agreed to by the Engineer and the Contractor. Before implementation, this agreement shall be written, and shall contain specific conditions that will require re-evaluation of the area.

C. When flammable or toxic gas is found in the area, those precautions and procedures in subsection 250.03(d)2 shall apply.

4. The following procedures shall be followed if the level of contamination as documented in the environmental documents referenced in subsection 102.05 as revised for this project is exceeded, or if previously unidentified contaminated air, soil, or water, is encountered during the construction of the project:

A. Work in the immediate area of the release or discovery of contamination shall cease. The Engineer shall be immediately notified.

B. If no HSO is required by the Contract, the Contractor shall designate an HSO as directed, per subsection 250.03(a).

C. The Engineer may direct the HSO to evaluate the material for potential hazardous substance or other contamination or unsafe conditions. This evaluation may include, but is not limited to, on-site field monitoring, on-site testing, and on or off-site laboratory analysis. Removal of storage tanks and surrounding contaminated soils shall be per applicable laws, regulations and established procedures. If the contaminated material cannot be placed in the embankment or remediated on site, it must be removed to an appropriate TSD facility, as designated in writing by the Engineer. The HSO shall supervise the necessary testing required to make appropriate TSD determinations. Disposal of the unsuitable material shall be considered as remediation work as described in subsection 250.03(d)4. D and 250.03(d)4. E.

D. If this site is determined to be contaminated with petroleum products, hazardous substances, or other solid waste in excess of that indicated in the above listed site investigation documents, a thorough Site Investigation and Waste Management Plan shall be accomplished under the supervision of the HSO. The Site Investigation and Waste Management Plan shall be submitted to the Engineer for approval and shall determine the extent of contamination and propose at least three types of remedial action for the contaminated area as required by applicable statutes and regulations. The HSO shall be available to assist the Engineer in explaining this study to the regulatory agencies. When requested by the Engineer, the Contractor shall prepare a Remediation Plan based on the selected remedial method and shall submit this to the Engineer for approval. The time required for the Engineer's review of the Remediation Plan, including all necessary drawings, calculations, specifications, and other documentation will not exceed four weeks after a complete submittal is received. This work shall not be done unless authorized in writing by the Engineer.

E. If the site is determined to be contaminated with petroleum products; hazardous chemicals, materials, or wastes; or other solid wastes, and is required to be remediated, the HSO or other qualified individuals will supervise the Remediation Plan implementation as concurred to by the regulatory agencies, as directed. Hazardous Waste generated by remedial activities shall list the Colorado Department of Transportation as the hazardous waste generator on the required paperwork for projects on State Highways and their associated frontage roads. If this project is not on a State Highway or frontage road, then the appropriate local governmental entity having jurisdiction over the transportation system facility shall be listed as the hazardous waste generator. If the waste disturbed or produced was caused by Contractor negligence, the Contractor shall be listed as the hazardous waste generator. Remediation work shall be done only when authorized by the Engineer in writing.

250.04 Heavy Metal Based Paint Management. When the work includes the removal of paint or items covered with paint that may contain lead, chromium, or other heavy metals, the requirements of this subsection shall apply in addition to the requirements of subsection 250.03.

The requirements of the HASP shall be per OSHA Publication No. 3142, Working with Lead in the Construction Industry.

Paint Removal and Waste Disposal work shall be performed per 29 CFR 1926.62, State and local air quality regulations, the Steel Structures Painting Council (SSPC) Guide for Containing Debris Generated During Paint Removal Operations, the Industrial Lead Paint Removal Handbook (SSPC 91-18), and the references contained.

The following minimum precautions and procedures shall be followed unless modified in the approved HASP or its updates:

(a) The Contractor shall contact the CDPHE, Air Pollution Control Division to ascertain if an air pollution permit is required for the cleaning or demolition work. If an air pollution permit is required, the Contractor shall obtain the permit. The Contractor shall furnish the Engineer with a copy of the permit application and the permit issued before starting cleaning or demolition activities. A copy of the Air Pollution Emission Notice [APEN] shall be provided to the Engineer, if such notice is required under the Colorado Air Quality Control Commission's regulations. The processing of air pollution permits in non-attainment areas, or where public hearings are required, likely will take more than 90 days.

(b) The Contractor shall contain paint chips, corrosion residues, and spent abrasives, referred to as waste materials, resulting from the cleaning or demolition operations. The Contractor shall not deposit or release waste material into the water, air or onto the ground below or adjacent to the structure. The Contractor shall conduct cleaning operations to minimize the waste materials produced. Before beginning the work, the Contractor shall submit to the Engineer for acceptance, a detailed methods statement for capturing, testing, and disposing of the removed materials. The Engineer will have seven calendar days to review and accept or reject this methods statement.

(c) Abrasives utilized for blast cleaning shall be low-dusting and low waste. Unless approved otherwise, vacuum blasting or wheel blasting shall be used.

(d) The HSO shall sample and test the waste material for lead, chromium, and other paint associated heavy metals using the Toxicity Characteristic Leaching Procedure (TCLP) Test, Method 1311 of the EPA publication, Test Methods for Evaluating Solid Waste 846. Sample collection methodology and frequency shall be recommended by the HSO and accepted by the Engineer with an adequate number of samples taken to be representative of all waste material collected. If the waste material does not pass the TCLP test, it shall be disposed of in a permitted TSD facility as designated in writing by the Engineer. The waste materials handling decision shall be documented by a report (five copies) submitted to the Engineer. This documentation shall include a description of sample collection methodology, testing performed, test results, and comparison of test results with hazardous waste requirements. The waste material shall not be held at an unpermitted TSD facility site in excess of Resource Conservation and Recovery Act (RCRA) temporary storage time limits.

(e) When an item coated with paint is removed, all loose paint shall be removed and collected from the item within 24 hours of the time it is removed or placed onto the ground. All loose paint shall be removed and collected from a painted item before it is removed from the site. The Contractor shall contain loose paint until it is removed and collected. Loose paint is defined as that which can be removed by manual scraping methods. Over waterways, the Contractor shall capture all paint debris by the method specified in the methods statement. The paint debris shall be collected on a daily basis and shall be stored in a properly labeled, tightly sealed container, and placed in a secured location at the end of each working day.

(f) All painted steel components that are not designated to be salvaged shall be recycled. Contractor possession of the steel for future use shall be considered a form of recycling. Before transport of the components off-site, the Contractor shall obtain a letter from the recipients of the painted steel components stating that they have been fully informed of the contents of the paint and are capable of handling the paint. If the Contractor is to maintain future possession of the steel, the Contractor shall supply this letter. If there will be more than one recipient of the painted material, one letter shall be obtained from each recipient. The Contractor shall provide a copy of each letter to the Engineer. If the painted steel components will be recycled by melting, the letter from the recipient is not required. The Contractor shall submit a letter stating the destination of the painted steel components and that they will be melted.

(g) When the work consists of the removal of a bridge or components of a bridge coated with paint that has been assumed to contain lead, chromium, other heavy metals, or a combination thereof, the Contractor shall capture paint debris that is dislodged during removal operations. The Contractor may choose any method for dismantling the bridge, subject to the following required construction sequence limitations:

1. The concrete deck shall be removed before removal of the steel superstructure.
2. If the methods statement indicates that girders will be dropped to the ground during dismantling, all debris from the concrete deck removal operation shall be removed from the area below the bridge before any girders are dropped into this area.
3. Girders may be cut and dropped only if the span is located entirely over land.

250.05 Material Handling. This work consists of the additional handling of groundwater and soils to be excavated for construction of the project that are suspected or known to be contaminated. This work also includes stockpiling or containerization, analytical sampling and testing, and final disposition of contaminated groundwater and soils requiring special handling.

The Contractor shall maintain vertical trench walls for the work in the specified areas of known or potential contamination, as shown on the plans. Shoring may be necessary to meet this requirement. The Contractor shall confine the removal of contaminated groundwater and soils encountered as a result of the excavation activities in the specified areas to the vertical and horizontal limits of structure excavation specified in the Contract. The Contractor shall be responsible for any contaminated materials generated beyond the limits of excavation. This shall include any sampling, analysis, and disposal required, and the costs thereof. The Contractor shall be listed as the generator of any such material. The limits of excavation shall be determined as 18 inches outside of structures, including sewers, water lines, inlets, manholes, and other underground structures to be constructed, or as directed.

Specific areas of known or potential contamination have been identified in the project plans. There is the potential of encountering contaminated groundwater and soil, which has not been summarized in the plans or specifications, at unknown locations on the site. Suspected contaminated soil and groundwater shall be handled by one of three methods as follows:

(a) Materials Handling (Stockpile and Containerization). When recommended by the HSO and authorized by the Engineer, material shall be stockpiled or containerized for analysis and characterization for proper handling and, disposal, or both. Sampling and testing of materials shall be as described in the Contract. If analysis indicates that soil samples are designated as uncontaminated, as determined by the criteria shown in the Contract or as determined by the CDPHE, the associated soils will not require any special handling and will become the property of the Contractor and may be used on site, subject to other requirements of the Contract. Health and safety monitoring and strict fugitive dust control shall be conducted during the placement of these soils. If analysis indicates that groundwater samples are designated as uncontaminated, as determined by the criteria shown in the Contract or as determined by the CDPHE, the groundwater shall be handled per subsection 107.25.

Stockpiled and containerized materials shall be secured in compliance with the following provisions until they are determined to be uncontaminated:

1. The Contractor shall not store the material for more than 90 days.
2. The Contractor shall prevent any runoff from infiltrating the ground or running out of the containment area.
3. Soils and groundwater containing different contaminants shall be placed in separate containers or stockpiles.

4. The Contractor shall prevent the dispersion of materials or the dilution or mixing of containers and stockpiles.

5. The ground surface that the contaminated soils will be placed shall be covered with plastic sheeting, which will withstand the placement and removal of stockpiled materials without breaching.

6. The ground surface shall be graded to drain toward the edge of the soil piles and the berm or trench around them shall be covered by plastic sheeting.

7. Proper security shall be provided per 40 CFR.

(b) Solid Waste Disposal. Soils determined to be contaminated, but not hazardous, as established by criteria in the Contract or as determined by CDPHE or other regulatory agencies having jurisdiction, shall be handled and disposed of as recommended by the HSO and approved by the Engineer. The Contractor shall haul this material to a solid waste disposal facility.

(c) Contaminated Groundwater Disposal. Groundwater determined to be contaminated, but not hazardous, as established by criteria in the Contract or as determined by CDPHE or other regulatory agencies having jurisdiction, shall be handled and disposed of as recommended by the HSO and approved by the Engineer. The Contractor shall prepare a dewatering plan proposing at least three types of treatment and disposal options of contaminated groundwater as required by applicable statutes and regulations. One of the treatment options shall include permitting and onsite treatment before discharge or disposal. The dewatering plan shall be submitted to the Engineer for approval four weeks before dewatering activities begin.

(d) Hazardous Waste Disposal. Soils and groundwater that are designated or suspected to be hazardous shall be containerized immediately upon excavation or upon discovery. Hazardous material shall be labeled and transported to a permitted treatment, storage and disposal (TSD) facility or to a hazardous waste disposal facility approved by the Engineer.

(e) Additional Requirements. Stockpiled or containerized material characterized as uncontaminated, contaminated, or hazardous shall be stored and disposed of in a manner consistent with current established federal, state, and local regulations for waste materials.

Materials with contaminants not specifically regulated shall be disposed of by the Contractor as directed, in consultation with CDPHE. All areas where wastes are generated shall be reviewed by the HSO to identify potential contaminant sources that may result in a contaminated waste stream.

Contaminated groundwater and soils, which have been identified as solid waste or hazardous waste, requiring disposal according to federal, state, and local regulations, shall be transported per 49 CFR by the Contractor to an appropriately permitted treatment facility, landfill, incinerator, or asphalt plant or other facility approved to accept the waste. CDPHE and the landfill or other treatment or disposal facility shall be notified by the HSO of the material to be disposed of and the corresponding analytical test results before shipment. Potentially contaminated water collected from the lined trench of a stockpile shall be treated as required by Colorado Wastewater Discharge Permit System (CDPS) permits, 29 CFR and 40 CFR and reimbursed separately per Contract requirements.

250.06 Sample delivery. This work consists of the collection, containerization, and delivery of material samples for analysis to the testing facility designated in the Contract.

Environmental Protection Agency (EPA) protocol and standards shall be followed in the collection, containerization, and transport of samples to be analyzed, including the documentation of the proper chain of custody of all samples. The Contractor shall collect sufficient sample material to perform the required analysis and is responsible for ensuring that appropriate climate control has been provided for sample transport. Sample delivery shall be made within the maximum allowable holding time for each sample type, not to exceed 24 hours, excluding weekends. The time period required for sample collection and delivery to the testing facility will not be considered an excusable delay. The analysis to be completed and turnaround time shall be approved by the Engineer.

The Contractor shall provide the Engineer with a copy of documentation indicating that proper chain of custody requirements have been followed for all samples.

Quality control samples shall be provided by the Contractor per the quality control requirements of the testing facility designated in the Contract (quality control requirements are available from the Engineer). The Contractor shall prepare, label, and transport these samples to the testing facility in conjunction with the delivery of other samples authorized for analysis by the Engineer, at no additional cost.

The Engineer may request splits of samples, in advance of collection, which shall be provided at no additional cost by the Contractor.

250.07 Regulated Asbestos Contaminated Soils (RACS) Management. Environmental documents or plans listed in the special provisions shall include known or suspected locations that could involve encounters with RACS during excavation and other soil disturbing construction activities. Unexpected discoveries of RACS may occur during excavation and soil disturbing construction activities. RACS shall be properly managed or remediated, per subsection 250.07(a).

All asbestos related activities shall be performed by CDPHE certified asbestos professionals, contractors, or consultants.

Certifications are issued by the CDPHE, Indoor Air Quality Unit. A Colorado Certified Asbestos Building Inspector shall manage the assessment and disposal of RACS and other ACM. The Indoor Air Quality Unit within CDPHE is the only unit that certifies such professionals. The Contactor shall furnish a copy of the certification to the Engineer.

(a) Regulatory Compliance. RACS management is governed by 6 CCR 1007-2, Section 5.5, which includes and references regulatory compliance with Colorado Air Quality Control Commission *Regulation* No. 8 Part B-Asbestos. Colorado

Regulation No. 8 governs all asbestos activities, demolition, permitting, and certification of Certified Asbestos Professionals in the State of Colorado. The Contractor shall conform to all current regulations, policy directives, or both, issued by the CDPHE, and the Department.

(b) Asbestos Management and Visual Inspections. Asbestos management shall be performed by a CDPHE certified Asbestos Building Inspector. All inspections of the area of asbestos contaminated soil removal shall be performed by a CDPHE certified Asbestos Building Inspector to determine what, if any, controls must be instituted to allow future activity in the excavation area.

(c) *Permitting and Notification.* The CDPHE requires notification of any soil disturbing activity where asbestos is known, suspected, or discovered. A 24-hour notification to CDPHE is required before any soil disturbing activity of an unplanned asbestos discovery. A 10-workday notification to CDPHE is required before any soil disturbing activity in an area with known or potential RACS. Removal of asbestos-containing material on a facility component, that is located on or in soil that will be disturbed, with asbestos quantities above the following trigger levels shall be permitted and abated per the requirements of Colorado Air Quality Control Commission Regulation No. 8 (5 CCR 1001-10, Part B):

1. 260 linear feet on pipes,
2. 160 square feet on other surfaces, or
3. The volume of a 55-gallon drum.

All permit applications shall be submitted to the CDPHE a minimum of 10 days before start of work for approval. The permit application and notification shall be submitted simultaneously. A CDPHE certified General Abatement Contractor shall obtain all required State and local permits and shall be responsible for all associated fees. Permit application, notification, and waiver request forms shall be submitted to:

> Colorado Department of Public Health and Environment Permit Coordinator/APCD - SS - B1 4300
> Cherry Creek Drive South Denver, CO 80246-1530 Phone: (303) 692-3100 Fax: (303) 782-0278

Application and waiver forms are available on the CDPHE website.

(d) *CDOT's Regulated Asbestos-Contaminated Soil Management Standard Operating Procedure, dated October 18, 2016.* Asbestos contaminated soil shall be managed per 6 CCR 1007-2, Part 1, Section 5.5, Management of RACS. Regulations apply only upon unexpected discovery of asbestos materials during excavation and soil disturbing activities on construction projects, or when asbestos encounters are expected during construction. The Contractor shall comply with procedures detailed in the CDPHE's *Management of Regulated Asbestos Contaminated Soil Regulation* and CDOT's CDPHE approved *Regulated Asbestos-Contaminated Soil Management Standard Operating Procedure*, dated October 18, 2016, including the following minimum requirements:

1. Immediate actions and implementation of interim controls to prevent visible emissions, exposure, and asbestos contamination in surrounding areas.
2. Soil Characterization.
3. Training required for all personnel involved in excavation and other soil disturbing activities, once asbestos is encountered during construction or on projects where asbestos encounters are expected. Asbestos Awareness Training shall be given by a qualified and certified Asbestos Building Inspector with a minimum of six months' experience inspecting asbestos contaminated soil.
4. Assessment for the presence and extent, within the proposed area of disturbance, of asbestos discoveries, whether expected or unexpected, by a CDPHE Certified Asbestos Building Inspector.
5. Investigation and sampling required for risk assessment and management. Investigation, if required, shall be conducted by a CDPHE Certified Asbestos Building Inspector.

6. Risk assessment and determinations for further management or abatement.

   A. Risk assessment and determinations shall be made by a CDPHE Certified Asbestos Building Inspector and coordinated with the Engineer.

   B. Soil remediation is not necessarily required, depending on the circumstances.

7. Submit CDPHE 24-hour Notification Form for unexpected RACS discovery included in Attachment 1 of the CDOT Regulated Asbestos-Contaminated Soil Management Standard Operating Procedure.

8. Submit CDPHE 10-day Notification Form for planned RACS management included in Attachment 1 of the CDOT Regulated Asbestos-Contaminated Soil Management Standard Operating Procedure.

(e) Risk Assessment and Determinations for Further Management or Remediation. Risk assessment and determinations for further management or remediation shall be closely coordinated with the Project Engineer and Project Manager of the Statewide Management Plan.

250.08 Methamphetamine Lab Sites. Demolition of former Methamphetamine (meth) labs is enforced by the Governing Authority, which varies from county to county. The Contractor shall demolish all buildings that are identified as former meth labs, as listed in public listings by the Governing Authority. The Contractor shall provide evidence of demolition to the Governing Authority, obtain receipt of such evidence by the Governing Authority, and shall submit these to Engineer immediately following demolition.

Septic tank removal at known meth lab sites shall undergo preliminary assessment by an Industrial Hygienist or Certified Industrial Hygienist to determine proper removal and disposal. Work shall proceed per the recommendations of the Hygienist.

METHOD OF MEASUREMENT

250.09 Environmental Health and Safety Management will not be measured but will be paid for on a lump sum basis. This will include all work, materials, and hourly time charges by the HSO and other personnel required to accomplish the following:

(1) Preparation, submittal and briefing of the initial HASP.

(2) Preparation and submittal of the Waste Management Plan.

   A. Preparation and Submittal of the Dewatering Plan.

   B. Preparation and Submittal of the Remediation Plan.

(3) Procedures and equipment specified in subsections 250.03 - 250.07.

(4) PPE (levels C and D) for Contractor’s personnel for any contamination identified in the pre-construction investigations.

(5) Preparation and submittal of the final site report.

The quantity to be measured for Health and Safety Officer will be the total number of hours that the Health and Safety Officer is actually used, as authorized, for the following work:

(1) Field monitoring necessary to ensure the safety of workers on the site.

(2) Hours in excess of the items listed under Environmental Health and Safety Management.

(3) Hours that are necessary due to unforeseen site conditions.

(4) Hours of additional consultation or field work that is requested by the Engineer.

Equipment specified in subsection 250.03(a), preparation and submittal of the daily HSO diary, travel to and from the project site, and PPE (Levels C and D) required for use by the HSO will not be measured and paid for separately but shall be included in the hourly cost of the HSO.

The quantity to be measured for Monitoring Technician will be the total number of hours that Monitoring Technician is actually used as authorized. Equipment specified in subsection 250.03(b), supervision of the MT, preparation and submittal of the daily monitoring diary, travel to and from the project site, and PPE required for use by the MT (Levels C and D) will not be measured and paid for separately, but shall be included in the hourly cost of the MT.

Solid stockpiled materials will be measured by the cubic yard computed from cross sections by the average end area or other acceptable method. Disposal of solid waste and solid hazardous waste materials will be measured by the cubic yard in the disposal container.

Materials Sampling and Delivery will be measured by the actual number of samples collected, containerized, and transported to the testing facility indicated in the Contract.

Additional environmental health and safety management work required and authorized by the Engineer, but not included in the items listed above, will be considered extra work to be paid for per subsection 109.04, unless such work is caused by the Contractor's action.

BASIS OF PAYMENT

250.10 Partial payment for Environmental Health and Safety Management, as determined by the Engineer, will be made as the work progresses. The Contractor shall submit a schedule of environmental related Health and Safety Management work before the first partial payment is made. The schedule shall indicate the environmental related Health and Safety Management time for each work item that requires Contractor environmental related Health and Safety Management effort and the total time for the project.

The accepted quantity for Health and Safety Officer will be the number of hours actually used and approved for payment by the Engineer and will be paid for at the contract unit price.

The accepted quantity for Monitoring Technician will be the number of hours of onsite monitoring as approved by the Engineer and will be paid at the Contract unit price.

Environmental Health and Safety Management, Health and Safety Officer and Monitoring Technician bid items shall include vehicles, phone charges, supplies, printing, postage, office support, and all other miscellaneous costs associated with the work.

Payment for Groundwater Handling (Containerization and Analysis) will be made per subsection 109.04. Payment for Soil Handling (Stockpile) will be made at the contract unit price for all excavated material required to be stockpiled for analysis. The contract unit price will be full compensation for furnishing all materials, labor, equipment, and incidentals necessary to complete this work, and all handling of the material before disposal. This includes haul, stockpile, and security. Payment for this work will be in addition to any payment made under other bid items for excavation, embankment, or backfill on the project, or waste disposal of this material.

Payment for Solid Waste Disposal and Solid Hazardous Waste Disposal will be made at the appropriate contract unit price for the disposal of material determined to be either solid waste or solid hazardous waste. The contract unit prices will be full compensation for furnishing all materials, labor, equipment, tools, storage containers for transport, containerization of material for up to 60 days, and incidentals necessary to complete this work. This includes all handling of the material, loading for disposal, unloading for disposal, and borrow material required for replacement of excavated material disposed of offsite. It does not include stockpiling or containerization required for analysis that is included in the item Materials Handling (Stockpile and Containerization) paid for as described above. Payment for waste disposal fees and transport of hazardous waste will be made as shown below. Payment for this work will be in addition to any payment made under other bid items for excavation, embankment, backfill, or material handling (stockpile and containerization) on the project.

(1) Solid Waste. Transport costs to the disposal facility and disposal fees will be included in the contract unit price for this work.

(2) Solid Hazardous Waste. Transport costs, disposal fees, and treatment costs will be paid for by planned force account per subsection 109.04.

(3) Liquid Hazardous Waste. Transport costs, disposal fees, and treatment costs will be paid for by planned force account per subsection 109.04.

The cost of shoring required to limit the removal of contaminated materials to the specified limits shall be included in the contract unit prices for any excavation to be performed. Such shoring ordered by the Engineer in areas other than the specified areas of known or potential contamination, as shown on the plans, will be paid for per subsection 109.04.

Payment for Materials Sampling and Delivery will be made at the contract unit price for each material sample collected, containerized, and transported to the laboratory testing facility as designated in the Contract. The contract unit price will be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete this work including required sampling kits, containers, sample splits, and quality control samples.

The Contractor shall be responsible for damage caused by Contractor negligence to the environment, persons, or property. Expenditures associated with actions of the Contractor shall be borne by the Contractor at no cost to the project.

Contaminated groundwater containerized, treated, or disposed under the requirements of this specification will be paid for by planned force account per subsection 109.04.

The accepted quantities will be paid for at the contract unit price for each of the pay items listed below that appear in the bid schedule.

Pay Item	Pay Unit
Environmental Health and Safety Management	Lump Sum
Health and Safety Officer	Hour
Monitoring Technician	Hour
Materials Sampling and Delivery	Each
Materials Handling (Stockpile)	Cubic Yard
Solid Waste Disposal	Cubic Yard

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