

Construction Specifications

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Not Applicable

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Not Applicable

PART 1 - GENERAL

1.1 DESCRIPTION

A. Geotechnical and Hydrological Reports

1. A geotechnical study and/or a hydrological study were prepared for this site as approved by the Division.
2. The results of the field and laboratory tests used for the design are compiled in an appendix. The approximate locations of any test pits, trenches, borings, and soil and water sampling points are shown on the Plans.
3. Complete reports may be reviewed at the office of the Division or the Engineer. Electronic copies are available for the contractor. Any hardcopies may be obtained at the cost of reproduction and handling upon request and payment to the Engineer.

B. Use of Field Data

1. The data presented in the appendix and any other completed reports were obtained and prepared for use during completion of the design and (unless otherwise noted in the supplemental specifications) are NOT considered a part of the Contract Documents. This information is made available for bidder's use but is not a warranty of subsurface or hydrological conditions.
2. The data and report were prepared in accordance with generally accepted soil and water investigation procedures for abandoned mine reclamation project design. Any conclusions and recommendations made by others which are based on data presented in the appendix or other report are the sole responsibility of others.
3. Information included in the appendix and in the complete report presents only the data collected at the specific locations indicated and at the time samples or tests were performed. Variations may occur between testing and sampling locations, during different seasons of the year, or between the time of investigation and the time of construction.

C. Site Visit

1. Bidders should visit the site and acquaint themselves with existing conditions.
2. Prior to bidding, bidders may make their own subsurface investigations to satisfy themselves as to site and subsurface conditions, but such investigations may be performed only under time schedules and arrangements approved in advance by the Division.

1.2 REFERENCE SPECIFICATIONS

No additional specifications or standards are incorporated into this SECTION

PART 2 – PRODUCTS

No products are required in this SECTION.

PART 3 – EXECUTION

No work applies to this SECTION.

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Not applicable to this SECTION.

END OF SECTION 02000

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PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included

Work under this SECTION covers requirements for materials, tools, equipment and services necessary to complete Field Engineering of all work for this project. The work shall include, but is not necessarily limited to, completion of the following:

1. Surveys for acceptance of original ground lines
2. Stake Outs, including location and elevation of all work
3. Interim pay surveys as needed
4. Maintaining record survey notes and record plans (as-built drawings)
5. Final pay quantity surveys, including measurement of all bid items requiring taping or surveys
6. Preservation of the location(s) of land survey monuments, apparent property lines, all existing fencing, and any other features as noted on the plan or in other portions of the specifications

1.2 REFERENCE SPECIFICATIONS

No additional specifications or standards are incorporated into this SECTION

1.3 QUALITY ASSURANCE

- A. Contractor shall use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this SECTION.
- B. Contractor shall use equipment adequate in size, capacity and numbers to accomplish the work in a timely manner.
- C. In addition to complying with requirements of governmental agencies having jurisdiction, Contractor shall comply with the directives of Engineer and Division.
- D. Survey work and recording of data shall be in accordance with acceptable standards of practice in engineering and land surveying professions. Survey work shall be done with a licensed professional engineer or a licensed land surveyor in responsible charge, in accordance with provisions of Chapter 542B, Code of Iowa. This requirement is waived for that portion of the work that can be and is surveyed by Contractor's own personnel. The Contractor may use other competent persons that are trained in using Global Positioning System (GPS) equipment subject to the approval of the Engineer.

1.4 SUBMITTALS

- A. Record Plans (As Built Drawings): Specific requirements for record plans are indicated in the General Conditions (Document N, Paragraph 2-05 A) and in 3.7 below.
- B. Record Survey Notes: Specific requirements for record survey notes are indicated in the General Conditions (Document N, Paragraph 2-05 C), and in 1.2 D above.

- C. Survey notes of locations of all monuments, benchmarks, existing fences and any other reference points that will be disturbed as part of construction.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

Contractor shall examine the areas and conditions under which work of this SECTION will be performed and correct conditions detrimental to timely and proper completion of the work. Contractor shall not proceed until unsatisfactory conditions are corrected.

3.2 DIMENSIONS AND ELEVATIONS

Contractor shall verify in the field all dimensions and elevations which are required. Elevations indicated and referred to in the Specifications and on the Plans are based on the bench mark datum indicated on the Plans. Horizontal and vertical control reference points shown on the Plans shall be re-established as necessary by Contractor prior to performing any layout of the work. Contractor shall promptly notify Engineer in case of discrepancies.

3.3 POSITION, GRADIENT, AND ALIGNMENT

- A. Competent survey personnel employed and paid by Contractor shall lay out and stake out all control points and reference stakes required for construction of the work. Contractor shall carefully preserve all existing monuments, bench marks, fence locations, and reference points shown on the Plans or encountered during construction. All existing monuments, benchmarks, fence locations and other reference points shall be surveyed prior to commencement of construction in these areas with the survey notes provided to Engineer. When necessary or requested, Contractor shall repair or replace damaged reference points at no cost to Division.
- B. All work performed under this Contract shall conform to the lines, grades and elevations shown on the Plans and with any tolerances which may be set forth in the Construction Specifications.
- C. All work completed without being properly located and established from the control reference points and benchmarks shown on the Plans may be ordered removed and replaced at no cost to Division.
- D. Features such as terrace high points and low points, terrace outlets, ditches, etc., are shown on the Plans. Locate all features by coordinates or dimensions shown on the Plans. If no coordinates or dimension are shown, Contractor shall obtain this information electronically or request coordinates from Engineer.
- E. At the request of the Contractor, Engineer shall provide the site grading plan in a digital format to be used for GPS mounted equipment. The Engineer is not responsible for any misinterpretations or translations of the data that may arise.

3.4 FINAL PAY QUANTITY SURVEYS

- A. Any work item requiring field measurements shall be measured in place by Contractor accompanied by Engineer after said item is complete. Measurements shall be performed as agreed to by both the Engineer and Contractor.
- B. In the event surveying is required for final pay quantity, this work shall be performed and certified by a Contractor-retained licensed professional engineer or licensed land surveyor in responsible charge. In lieu of formal surveys, Contractor may wish to accept plan (bid) quantities for certain items as allowed for in the measurement and payment portion of each section.

3.5 INTERIM PAY QUANTITY SURVEYS

Any item of work which requires field measurements, and which is not being submitted as final for that item, need not be certified.

3.6 STAKE OUTS

- A. The number of earthwork stake outs is open to Contractor. A minimum of two (2) stake outs are required for earthwork when GPS mounted equipment is not used. The first stake out shall be near the beginning of the project to help establish rough grading limits, along with clearing and project limits. A final stakeout is required to establish final grades prior to liming for subgrade preparation. Interim stake outs shall be used at Contractor's discretion. The stake out used to establish final grades shall include stakes that are either set on a one hundred (100) foot grid, follow along contour lines with maximum one-hundred (100) feet spacing along the contour, or as needed to result in final grading consistent with project plans. Additional staking may be required to represent all site features. Engineer may request additional grade stakes to verify site features and/or elevations. Stake outs are not to be confused with required surveys for measurement purposes or as-built surveys.
- B. If the Contractor has equipment mounted with properly functioning GPS, then only a final check of key points or a final survey is required. The locations and frequency of checked locations shall be determined in consultation with the Engineer.

3.7 AS-BUILT SURVEY INFORMATION

- A. The final locations of the items listed below must be surveyed by Contractor. This may be completed during the final stake out listed in 3.6 above or with GPS mounted equipment prior to removal of control points. As-built survey data collected with uncrewed aerial vehicles (UAVs) is preferable. When UAVs are used LiDAR or photogrammetric data is acceptable.
- B. The final as-built survey should include the location and elevations of the following items:
 - 1. All terrace ridges and flow lines
 - 2. All riser intake locations inlet elevations, and pipe outlets
 - 3. Site perimeter of disturbed area
 - 4. Any fence installation locations
 - 5. General location and elevation of final grade with enough frequency that a topographic map of final grading can be developed by the Engineer
 - 6. Any other points requested by Engineer or Division

3.8 RECORD SURVEY NOTES

A copy of all construction survey notes by Contractor's surveyor, whether written or electronic, should be provided to Engineer as data is acquired.

3.9 PRESERVATION OF LAND SURVEY MONUMENTS

- A. Land survey monuments include but are not necessarily limited to: Property pins; Public Land Survey section corners; elevation benchmarks; or geodetic control points.
- B. All known land survey monuments that will be disturbed by construction are noted on the Plans.
- C. Whenever any land survey monument is encountered during construction, Contractor shall notify the Engineer and Division and direct his Surveyor to measure the position of the monument and collect all relevant data necessary to restore or replace the monument after construction is complete.
- D. Land survey monuments shall be restored or replaced pursuant to the requirements stipulated in Iowa Code Chapter 355. A monument preservation certificate **or** a section corner certificate **or** a retracement plat of survey shall accompany each restored or replaced land survey monument.
- E. It shall be the Surveyor's responsibility to determine and develop the appropriate document for each restored monument and record it in the county where the monument is located. The Surveyor shall provide a copy of the recorded document to Contractor, Engineer and Division.

PART 4 - MEASUREMENT AND PAYMENT

4.1 UNIT PRICES

- A. Field Engineering shall not be a payment item.
- B. Payment for Field Engineering shall be incidental to all items requiring Field Engineering.

4.2 SUMMARY – UNITS OF MEASUREMENT

Not applicable to this SECTION

END OF SECTION 02010

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SECTION 02100 - MOBILIZATION, SITE CLEARING & PREPARATION

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- 4.2 SUMMARY—UNITS OF MEASUREMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included

Work under this SECTION covers requirements for materials, tools, equipment, and services necessary to complete the site preparation and site cleanup work for this project. The work shall include, but is not necessarily limited to, completion of the following work:

1. Mobilization
2. Establishment of offices and project trailer
3. Installation of project sign
4. Acknowledge location of and help maintain electronic SWPPP documentation
5. Establishment of sanitary facilities
6. Removal and salvage of existing fencing
7. Installation and removal of temporary fencing
8. Protection of existing utilities, vegetation, and facilities to remain undisturbed
9. Site clearing and grubbing
10. Debris removal and disposal
11. Demobilization

1.2 REFERENCE SPECIFICATIONS

A. The following specifications or standards are incorporated by reference into this SECTION:

1. Recommendations for Tree protection during construction. Provided by Iowa State University (ISU) Extension Service. Document available at the following website address: https://naturalresources.extension.iastate.edu/forestry/care_maintenance/construction.html
2. SECTION 02120 – SEDIMENT AND EROSION CONTROL
3. SECTION 02200 – EARTHWORK, ROUGH GRADING
4. SECTION 02700 – PERMANENT SEEDING

B. Above-mentioned references, which do not appear printed with the Contract Documents, can be provided to Contractor upon request.

1.3 QUALITY ASSURANCE

- A. Contractor shall use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this SECTION.
- B. In addition to complying with requirements of governmental agencies having jurisdiction, Contractor shall comply with the directives of Engineer or Construction Observer and Division.
- C. Trees to remain shall be protected as described in 1.2, A. 1. above.
- D. Contractor shall comply with most current guidelines to protect the Indiana Bat and any other species specified in the Appendix or provided by the Division.

1.4 JOB CONDITIONS

- A. The Plans do not purport to show all objects existing on the site.

- B. The locations of utility mains, structures and service connections shown on the plans are approximate only and were obtained from records made available to Engineer and Division. There may be other existing utilities not known to Engineer and Division and not shown on the Plans. The verification of existence and the exact location determination of utility mains, structures and service connections shall be the responsibility of Contractor.
- C. Contractor shall not perform any work on or cause any damage to existing CRP land, wetlands or any other jurisdictional lands that are indicated on the Plans as not to be disturbed. Division has no permit to disturb these areas. These areas are under the jurisdiction of other authorities and any penalties or damages will become the responsibility of the Contractor. In addition, Contractor will complete all work necessary to restore the damage to these areas to an acceptable condition at no cost to Division.
- D. Contractor shall not perform work under the drip line of trees that are to remain. Contractor may request that certain trees within the Project Limits shown on the Plans remain in place. If permission is granted, Contractor shall protect these tree(s) from damage.
- E. Materials to be handled under this Contract include spoil, gob and coal refuse which may be toxic and/or acidic in nature. Miscellaneous debris, including potentially hazardous materials, are sometimes found on the surface or buried on these sites.
- F. Contractor shall not use explosives without written approval of Engineer.
- G. Unless indicated otherwise in the Contract Documents, removed, salvaged or demolished materials shall be the property of Contractor. Contractor salvaged materials and demolished materials shall be completely removed from the job site or buried on site as approved by Engineer or Construction Observer. Any items indicated in the Contract Documents to be salvaged to the landowner, such as existing fencing, shall be stored on site at a location approved by Engineer or Construction Observer.
- H. Contractor shall conduct all work in a manner which shall minimize, to the greatest practical extent, inconvenience to the public, and which shall result in a final product which leaves the site in an equal or better condition than prior to construction.
- I. No trees shall be cleared between the dates of April 1 to September 30 to comply with the requirements of the Indiana bat habitat without the express permission of the Division.

1.5 SUBMITTALS

- A. Contractor shall provide to Engineer a description and the location of any alternative off-site disposal area to be used other than a licensed landfill.
- B. Contractor shall submit a Construction Progress Schedule as specified in SECTION 3-23 CONSTRUCTION SCHEDULE of the General Conditions (*Document N*).
- C. Contractor shall submit weight tickets or billings for all off-site waste disposal, including trash, metal, appliances, tires, hazardous chemicals, etc., to Engineer or Construction Observer.
- D. Contractor shall provide Engineer or Construction Observer with record survey notes of all existing fence locations within the projects limits and any adjacent fencing to be temporarily removed prior to removing any existing fence. Contractor shall supply Engineer with record survey notes of any other feature to be documented as noted on the Plans or in the Supplemental Specifications.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Provide materials, not specifically described but required for proper completion of the work of this SECTION, as selected by Contractor subject to the approval of Engineer.

PART 3 - EXECUTION

3.1 SITE ACCESS

- A. Contractor shall access the site as designated on the Plans and/or as discussed at the pre-bid and pre-construction meetings. Any damage that occurs outside of the designated access will be repaired and restored at no cost to Division.
- B. Site access may require improvements, which include, but are not necessarily limited to, clearing, excavation, installation of tiling or pipe, and placement of macadam stone, erosion stone, or riprap. Unless noted otherwise in the Supplemental Specifications, work needed to facilitate and maintain access to the site during construction shall be considered incidental to the cost of mobilization. The cost for placement of stabilized construction entrance is included in SECTION 02120 – SEDIMENT AND EROSION CONTROL.
- C. Contractor shall remove the site access improvements that can be removed after the project is completed unless permission has been granted to leave them in place by Engineer and Division.
- D. Prior to project acceptance by Division, Contractor shall restore access routes as discussed in Paragraph 3.10.C. Restoration of access routes may include seed bed preparation and seeding that meet requirements of SECTION 02700 -- SEEDING.

3.2 SURFACE CONDITIONS

- A. In company with Engineer, visit the site and verify the extent and location of clearing and site preparation required. Completely remove items scheduled to be removed, leaving surfaces clean, solid and ready to receive new materials specified elsewhere.
- B. All trees outside the Project Limits shown on the Plans shall remain undisturbed. All trees within the Project Limits, except as noted hereafter, shall be removed. In areas of the site where minimal grading is required, the grading plan should be adjusted slightly in favor of saving well established trees. Cooperate with Engineer to achieve this intent.

3.3 PROTECTION

- A. Contractor shall be responsible for locating and protecting all utilities prior to initiating work. If damage does occur to any existing utilities, Contractor shall restore them in a manner acceptable to the utility provider and Engineer or Construction Observer at no cost to the Division.
- B. Contractor shall protect existing vegetation as discussed below.
 - 1. Protect tops, trunks and roots of existing trees and/or shrubs, indicated or implied to remain, from damage during all operations. Box, fence around, or otherwise protect trees before adjacent work is started. Do not permit heavy equipment or stockpiles within branch spread. Trim or prune to obtain working space in lieu of complete removal whenever possible. Conform to good horticultural practices. Preserve natural shape and character. Refer to ISU Publication as referenced in 1.2.C above.

2. Damaged trees shall be repaired or replaced to the satisfaction of Engineer. Repair may include, but not be limited to, trimming, pruning and application of pruning paint. Repair shall be completed within seventy-two (72) hours of occurrence of damage. Remove existing vegetation when damage occurs and survival is doubtful.
 3. Adjacent areas to the site with established vegetation shall be protected. If access through established vegetation is required, Contractor shall coordinate his access with Engineer or Construction Observer and restore the damaged areas as directed by Engineer.
- C. Contractor shall provide protection for persons and property as discussed below.
1. Barricade open depressions and holes occurring as part of this work.
 2. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, burning of landscape waste, equipment vibration and other hazards created by operations under this SECTION.
- D. Contractor shall use means necessary to prevent dust from becoming a nuisance to the public, to neighbors and to other work being performed on or near the site.
- E. Contractor shall always maintain access to the site.
- F. When requested by Division or Engineer, Contractor shall provide access through the site on an as needed basis to the landowner when access to adjacent lands is restricted.

3.4 OFFICE AND LAY-DOWN AREA

- A. Contractor shall establish, provide and initiate use of temporary facilities described herein within thirty (30) days of the initiation of construction activities and prior to the first Progress and Pay Request Meeting. The offices and lay-down area should be in the designated location shown on plans. If no location is provided, then they can be located anywhere within the Project Limits. Locations outside the Project Limits can only be used if documented permission from landowner on whose property these facilities are to be located is provided.
- B. Contractor's Field Office
- Provide adequate space for field office personnel, suitably furnished, lighted, heated and air conditioned.
- C. Unless specifically indicated elsewhere in the Contract Documents, Contractor shall provide all heat, power, sanitary, and any other utilities or facilities required to perform the work.
- D. Contractor shall terminate use and remove facilities at earliest reasonable time when they are no longer needed. Removal of all temporary facilities is required for final acceptance of the completed project.

3.5 STORM WATER POLLUTION PREVENTION PLAN (SWPPP) DOCUMENT STORAGE

- A. Division shall establish an electronic designated location to store the SWPPP, all associated reports and records of data used to complete the Notice of Intent.

Contractor shall have a mobile device readily available while working on the site that can access the electronic designated location.

3.6 EXISTING FENCES

- A. Any existing fences within the project limits that are indicated to remain shall be protected. If these fences are damaged, the Contractor shall repair them at no cost to Division. Fences outside of the Project Limits which interfere with construction operations shall not be relocated or dismantled until approval is obtained from Engineer or Construction Observer. In areas where existing fences outside of the Project Limits cannot be maintained due to construction operations, Contractor will be required to provide temporary fences or other means to prevent unauthorized vehicular, pedestrian or livestock access, as applicable. After work is completed in this area, a replacement fence of equal or better material type shall be installed at the same location at no additional cost to Division.
- B. Existing fences within the project limits shall be removed. If the plans indicate the fence is to be salvaged to landowner(s), fencing material shall be rolled in neat bundles and secured with salvaged posts stacked neatly and stored at a location on site to be approved by Engineer. If the landowner(s) do not want the fence salvaged to them, the fencing material becomes the property of Contractor and shall be disposed of as discussed in 3.8 below.
- C. Where existing fences are removed and subsequently replaced as a part of the work, field establish such reference points and ties as are necessary to ensure replacement fencing will follow the same alignment as the existing fencing.

3.7 CLEARING AND GRUBBING

- A. Contractor shall perform clearing and grubbing only to the extent necessary to perform excavation, grading, and other required work.
- B. Clearing includes felling and disposal of trees, brush and other vegetation. In cutting of timber growth, cuts shall be made such that all trees are felled into the area to be cleared. Exercise care when clearing near the Project Limits so as not to damage existing trees or vegetation to remain.
- C. Clearing also includes removal of all existing fencing materials as discussed in 3.6 above.
- D. Grubbing includes removal and disposal of tree stumps and roots larger than three (3) inches in diameter. Stumps and roots within three (3) feet of final (proposed) grades shall be grubbed. Backfill all excavated depressions with nearby soil or spoil material, compact to approximate density of adjacent undisturbed areas, and grade entire area to drain.
- E. In areas where the fill depth is greater than five (5) feet, undisturbed stumps and roots extending not more than six (6) inches above the original ground line and surface vegetation do not need to be removed unless they are located within the vicinity of a dam, terrace, or other structural element.

3.8 DEBRIS REMOVAL AND DISPOSAL

- A. Contractor shall remove and dispose of debris, rubbish, landscape waste and all other materials resulting from the site clearing and preparation operations by either recycling, burning, burying, off-site disposal, chipping, creating brush piles or a combination thereof. Specific requirements for various disposal techniques are discussed below.

B. Burning of Landscape Waste

1. State law requires that burning of landscape waste be limited to areas located at least one-quarter (1/4) mile from any inhabited building, unless a variance is obtained from the Iowa Department of Natural Resources or permission is obtained from all impacted residences located within one-quarter (1/4) mile of the proposed burn area.
2. Contractor shall obtain all necessary permits and comply with all regulatory agencies, including the local fire department, governing this work. The local fire department must be notified prior to any on site burning.
3. Only vegetative matter may be burned on site. Oil base materials are not allowed to be burned on site. Rubber tires cannot be used to start or maintain burning of brush.
4. No burning will be allowed on any area of the site containing coal refuse.
5. Large trees and stumps may require two (2) or more burning sequences. Tree trunks and limbs greater than three (3) inches in diameter may be sawn or cut in lengths not greater than forty-eight (48) inches and buried in lieu of burning.
6. Protection of property, trees and vegetation that are to remain, both inside and outside the Project Limits, shall always be maintained.

C. Burying Woody Debris

1. Trees, stumps, brush and the ashes from the burning of landscape waste may be buried within the project limits provided the requirements below are followed.
 - a. No burying of debris shall be completed within areas of the site which contain dams, terraces, any other structures, or where future settlement would be detrimental to the successful reclamation of the site.
 - b. Uncut trees may be placed into the muck at the bottom of dewatered ponds to provide support. The layer of trees shall be placed uniformly over the muck and shall not exceed a total thickness of five (5) feet.
 - c. All woody material to be buried that is not providing support over muck shall be broken or cut to a maximum dimension of forty-eight (48) inches and shall be spaced so normal fill material can be properly placed and compacted thereon. Mass dumping, without spreading and spacing of debris shall be prohibited. Buried woody debris shall not be allowed to accumulate greater than five (5) feet in depth and shall be covered with a minimum of five (5) feet of soil cover per foot of debris.
 - d. The top of the uppermost buried woody debris shall be at least five (5) feet below final grade.
 - e. Burial operations shall be permitted only in the presence of Engineer or Construction Observer.
2. Farm buildings may be buried provided they are emptied of any contents not authorized for burial and laid flat. Burial operations shall be permitted only in the presence of Engineer or Construction Observer.

D. Habitat Brush Piles

1. Brush piles for habitat may be used in some areas if permission is received from the landowner.
2. The location and number of brush piles shall be approved by Engineer or Construction Observer.
3. Brush piles shall not exceed fifty (50) feet in diameter and ten (10) feet in height.

E. Burial of Rocks and/or Coal Refuse: See Earthwork, Rough Grading, SECTION 02200, 3.8

F. Off-site Waste Disposal

1. Any household trash, tires, hazardous materials, etc. present at the site, whether shown on the plans or encountered during construction, shall be removed off-site to a licensed landfill or other location approved by Engineer. Weight tickets or billings are required for payment purposes.
2. Small debris and trash shall be removed by hand or with small equipment to avoid inclusion of excessive amounts of soil with the trash. If Division or Engineer or Construction Observer determines that excessive amounts of soil are included with the trash, additional hand sorting will be required.
3. Metal objects present at the site shall be salvaged where possible or taken to a licensed landfill or other approved location.
4. Special waste disposal items, such as tires, batteries, appliances or other hazardous materials, are handled separately. Contractor shall account for and dispose of these special waste disposal items as discussed in the Supplemental Specifications and/or on Plans, or as negotiated in an approved change order.

3.9 PROJECT SIGN AND JOB POSTER DISPLAY

A. Project Sign

1. The Division and any partners will provide the Contractor with the appropriate sign panels to be installed at the site.
2. Contractor shall provide the posts and necessary hardware to install the sign as shown on the plans. The sign location shall be approved by Engineer or Construction Observer prior to its installation.
3. The Division reserves the right to delay payment of the second application for payment until the project sign is in place.
4. Upon completion of all the work and final acceptance by Division, Contractor shall be responsible to remove the "Hard Hat Area" portion of the sign. This portion of the sign will be returned to the Division.

B. Job Poster Display

1. Upon beginning construction, Contractor shall install a Job Poster Display in a conspicuous location, approved by Division, which is visible to Contractor's employees and representatives of State and Federal agencies. The approved location for the Poster Display may not necessarily be in the same location as the Project Sign.
2. The Job Poster Display shall be securely fastened to a durable object against movement by wind or vandalism, but it will not be considered permanent. It will be removed from the site after completion of construction.
3. The Division shall delay payment of the second application for payment until the Job Poster Display is in place.
4. The display shall be sufficiently sized to accommodate all applicable posters required by the US Department of Labor and State of Iowa. All posters shall be provided to Contractor by Engineer at the pre-construction meeting and all posters shall be securely fastened to the display.
5. At a minimum the 11"x17" Davis-Bacon poster and the current wage determination shall be displayed. Additional posters may be required for display as directed by the Engineer or Division.
6. Weather protection: Contractor shall laminate each poster with clear plastic film or cover the entire display with suitable transparent plastic sheeting. Plexiglas™ (or equal) clear acrylic sheet will be considered preferable. The cover should make the entire display rain tight. The entire display board should be painted or sealed against moisture and deterioration.
7. Contractor shall replace all posters damaged by fading or moisture in timely fashion determined by Engineer or Division.

3.10 CLEANUP AND REPAIRS

- A. Contractor shall remove equipment, project materials and waste such as oil drippings, stones, gravel, packaging containers, etc., from the site and dispose of all waste at an approved off-site location.
- B. Contractor shall repair all areas of rill erosion with a depth greater than three (3) inches and width greater than four (4) inches, or as directed by Engineer or Construction Observer.
- C. All disturbed areas outside the Project Limits, such as access routes and lay down areas, shall be returned to their original condition by Contractor. Restoration of these areas are subject to the approval of the Engineer and/or Division.
- D. The materials, equipment and labor for cleanup and repairs are at no cost to Division.

PART 4 - MEASUREMENT AND PAYMENT

4.1 UNIT PRICES

- A. The construction cost of all work included in this SECTION of the Construction Specifications shall be included in Contractor's unit prices set forth in the Proposal and Schedule of Prices (*Document C*) for the work items described below.
- B. The unit price for each of these items shall include its pro rata share of overhead so that the sum of the products obtained by multiplying the unit prices so set forth by the amount of the work constructed and measured as described herein, shall constitute full payment to Contractor for performance of the work included in this SECTION.

Measurement and payment for each work item in this SECTION shall be in accordance with the following:

- 1. *Mobilization*: Payment for the cost of mobilization and demobilization and other incidental work thereto shall be included in the lump sum price set forth for "Mobilization." The lump sum price set forth in Contractor's Proposal and Schedule of Prices (*Document C*) shall include full compensation for mobilization; for work and operations necessary for the movement of personnel, equipment, supplies, and incidentals to and through the site; for establishment of offices, trailers and other facilities necessary for work on the project; for installing the project sign and removing a portion thereof; for having device on site to access electronic location of SWPPP while working, for demobilization and cleanup and repairs; for all other work or operations which must be performed or costs incurred when beginning or performing work on the project including bonding, insurance, obtaining permits, filing affidavits, paying fees, etc. See General Conditions (*Document N*) Item 6-01 and any permits included in an appendix to the specifications. This bid item also includes any additional work or materials needed to maintain the access route during construction.

The amount which Contractor will receive payment for, in accordance with the following schedule, will be limited to five (5) percent of the total Contract bid. Should the Contractor's bid for this item exceed five percent (5%), the amount over five (5) percent will not be paid until the Contract is finalized.

Basis of Payment: Partial payment of the lump sum amount bid for Mobilization, not exceeding five (5) percent, will be made in accordance with the following schedule:

- a. Upon Contract execution, ten (10) percent of the pay item will be paid.
- b. When five (5) percent or more of the original Contract amount is earned, an additional twenty (20) percent of the pay item will be paid.
- c. When ten (10) percent or more of the original Contract amount is earned, an additional twenty (20) percent of the pay item will be paid.
- d. When fifty (50) percent or more of the original Contract amount is earned, the remaining balance of the pay item will be paid up to a maximum of five (5) percent of the total bid.

Nothing herein shall be construed to limit or preclude partial payments for other items as provided for by the Contract.

2. *Site Clearing & Preparation:* The unit price for this work item, as shown in Contractor's Proposal, shall include full payment to Contractor for all clearing, site preparation, debris removal and disposal, fence removal, collecting and sorting special items like tires, and other work incidental thereto as required to complete the Project in accordance with requirements of the Contract Documents. This work shall be completed within all areas disturbed by construction operations and limited to the total area enclosed by the "Project Limit" lines shown on the Plans. Partial payments will be made based upon the estimated number of acres cleared or the percentage of clearing that is completed at the time of the pay request.
3. *Off-site Waste Disposal:* The unit price for this work item as shown in Contractor's Proposal, shall include full payment to Contractor for all work necessary to collect, load, transport, landfill fees and other work incidental thereto as required to complete the project in accordance with the requirements of the Contract Documents. The waste materials will be measured on the loaded ton as determined from weight tickets. The total estimated quantity for this work item includes only the household trash from the locations noted.

Special waste disposal items such as tires, batteries, appliances, or hazardous waste, will be paid for separately as discussed in the Supplemental Specifications and/or on Plans. If unanticipated special waste disposal items are discovered during construction, they will be addressed with a change order.

4.2 SUMMARY – UNITS OF MEASUREMENT

Units of measurement for bid items applicable to work covered by this SECTION are as follows:

<u>Description</u>	<u>Unit</u>
Mobilization	Lump Sum
Site Clearing and Preparation	Acre
Off-site Waste Disposal	Ton
Special Waste Disposal	Per Ticket

END OF SECTION 02100

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PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included

Work under this SECTION covers requirements for materials, tools, equipment and services necessary to install sediment and erosion control practices for this project. Practices may be declared permanent or temporary as shown on the plans or as directed by Engineer or Division. The work shall include, but is not necessarily limited to, completion of the following work:

1. Installation of sediment and erosion control practices.
2. Repairs or replacement of said sediment and erosion control practices.
3. Removal of said temporary sediment and erosion control practices not less than ninety (90) days and not later than six (6) months following a documented show of green vegetation on the site.
4. Assistance with SWPPP inspections and documentation upon request of Division

B. Construction sites where one (1) acre or more of land is disturbed or made bare are regulated by the National Pollutant Discharge Elimination System (NPDES) program. The purpose of these regulations is to reduce pollution to the nation's waterways. Coverage under the NPDES program for construction sites is obtained from the Iowa Department of Natural Resources (IDNR) through General Permit No. 2. The Division has submitted the permit application, the Engineer has developed the Storm Water Pollution Prevention Plan (SWPPP), and the Contractor is responsible for implementing the plan.

C. The SWPPP prepared by Engineer is included in the Plans. Contractor shall follow this plan unless modifications are made by Engineer or Division during the course of construction. Contractor shall be responsible for any damages that arise due to failure of Contractor to properly implement the erosion control plan. Division shall maintain the record copy of the SWPPP, including modifications or changes and inspection reports. Portions of the record documents will be provided by Engineer. Contractor shall assist as requested with SWPPP documentation.

1.2 REFERENCE SPECIFICATIONS

A. The following specifications are incorporated by reference:

1. Iowa Department of Transportation (IDOT) Standard Specifications 4130.03, 4130.04 and 4130.05
2. Statewide Urban Design and Specifications (SUDAS)
3. Natural Resource Conservation Service (NRCS) IA-95
4. Erosion Control Technology Council (ECTC) Standards
5. Test Method for the Examination of Composting and Compost (TMECC)
3. SECTION 02400 – SUBGRADE PREPARATION
4. SECTION 02700 – PERMANENT SEEDING

B. Should the above-mentioned sections not appear printed with the Contract Documents, they shall be made available upon request.

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this SECTION.

- B. In addition to complying with requirements of governmental agencies having jurisdiction, comply with the directives of Engineer and Division. Engineer or Division may request additional control methods to be implemented by Contractor.
- C. The SWPPP design prepared by the Engineer will be implemented by the Contractor. Modifications, repairs or replacement of erosion and sediment control measures and practices will be implemented by the Contractor as soon as practical.
- D. In the event of conflict between the SWPPP and the requirements with water pollution control laws, rules and regulations of other federal, state, and local agencies, the more restrictive laws, rules, or regulations will apply.

1.4 JOB CONDITIONS

- A. Abandoned mine land sites typically do not contain very good if any vegetative cover material and are highly susceptible to erosion. Contractor shall take care while grading the site to reduce the amount of sedimentation.
- B. Wetlands, ponds, and streams are often located within and adjacent to abandoned mine land sites. Extra care shall be exercised to protect these features from sedimentation where these features are to remain in place.
- C. Contractor shall protect all existing underground utilities, including any private tiles.

1.5 SUBMITTALS

- A. Contractor shall be a co-permittee with Division for the IDNR NPDES General Permit No. 2 for this site. The Division is responsible for permit fees, public notice, and permit submittal.
- B. The Contractor and any subcontractors that will perform grading, structural installation, and seeding shall sign the SWPPP Contractor Certification Statements as prepared by the Engineer.
- C. A physical hardcopy of a SWPPP documentation booklet is NOT required on site. An electronic copy of the SWPPP documentation booklet shall be developed by the Engineer and submitted to the Division. Division, with cooperation from Engineer and Contractor, will maintain SWPPP documentation for the duration of the project.
- D. One (1) scanned electronic copy of each signed Contractor certification statement shall be kept with the official SWPPP documentation booklet developed by Engineer. One (1) electronic copy of the SWPPP documentation booklet will be maintained by Division.
- E. Engineer shall submit to Division an electronic copy of a sketch or marked up drawing showing locations of sediment and erosion control practices that satisfy the objectives of the SWPPP. Upon request of the Division, Engineer shall submit electronic copies of updated drawings as necessary that document any changes to practices required by the SWPPP.
- F. Contractor shall provide any necessary information requested by Engineer or Division required for maintenance of the SWPPP documentation.
- G. Weekly SWPPP inspection reports will be developed by Division personnel. Electronic copies will be submitted to the Engineer and Contractor. Dates of observed deficiencies and dates of subsequent corrections to deficiencies shall be noted on the reports.

- H. Contractor shall submit to Engineer and Construction Observer documentation that various materials used for erosion and sediment control practices meet the requirements of the specifications.

1.6 SCHEDULING

- A. Contractor shall sequence his work to minimize erosion of the site and implement the sediment and erosion control measures as outlined in the SWPPP. No grading work will be allowed until the appropriate control measures are in place.
- B. When rain events cause necessary repairs or replacement to sediment and erosion control practices as determined by the inspection completed by Engineer or Division, Contractor shall implement the requested work as soon as practically possible.

PART 2 - PRODUCTS

2.1 QUARRIED STONE MATERIALS

- A. Macadam Stone: Macadam Stone shall conform to IDOT Section 4122, Gradation 13,
- B. Erosion Stone: Erosion stone shall be quarried limestone and shall consist of a nominal six (6) inch mixture by visual examination. Stone shall meet the specifications of IDOT Sections 4130.03, 4130.04 and 4130.05 Erosion Stone gradation.
- C. Riprap:
 - 1. Riprap shall be quarried limestone, sound, durable, and angular or blocky in shape. No more than ten (10) percent of the stone shall have an elongation greater than 3:1. No stone shall have an elongation greater than 4:1. Riprap shall be well-graded material meeting the specifications of IDOT Sections 4130.01 and 4130.02, Class E Revetment for Non-primary projects.
 - 2. The stone shall be free from cracks, seams, or other defects that would tend to increase its deterioration from natural causes. The material shall contain a combined total of not more than five (5) percent by weight of earth, sand, shale, and non-durable rock.
 - 3. Engineer or Division shall inspect the riprap at the quarry prior to initial loading and may do so periodically throughout material delivery. After visual inspection, Engineer may designate material as too fine or too coarse and may require material to be loaded from another area. If material changes occur as the material is delivered to the project site, Engineer has the authority to require removal of the objectionable material and replacement with suitable riprap at no cost to Division.

2.2 EROSION CONTROL MULCH

- A. Conventional Mulch - Materials shall consist of wheat, oats, rye, hay, grass cut from native grasses or other plants approved in writing by Division, that is of air-dry straw that has been properly cured and harvested. Mulch harvested after a killing frost or during dormant periods will not be acceptable. Mulch shall not be rotted, brittle, moldy, caked or otherwise degraded. Mulch shall generally be free of noxious weeds as published by the local County Weed Commissioner.
- B. Other types of mulch, including as hydro-mulch meeting SUDAS 9010, 2.07, may also be used subject to the approval of Engineer.

2.3. COMPOST BLANKETS

- A. Compost used for blankets shall be derived from a well-decomposed source of organic matter, produced using an aerobic composting process meeting Code of Federal Regulations (CFR) 503 for time, temperature and heavy metal concentrations. The compost shall have no visible admixture of refuse or other physical contaminants nor any material toxic to plant growth. The compost shall be certified by the U.S. Composting Council's Seal of Testing Assurance (STA) program and conform to the chemical, physical, and biological parameters of AASHTO MP 10-03, with the following additional requirements:
1. Follow U.S. Composting Council's TMECC guidelines for all testing.
 2. Organic Matter Content: 30% minimum.
 3. pH: between 6.0 and 8.0.
 4. Maturity (growth screening): Minimum 90% emergence for all compost to be vegetated.
 5. Particle size shall follow that shown in Table 02120-01:

Table 02120-01: Particle sizes for Compost Blankets

Sieve Size	Percent Passing*
2"	100
1"	90-100
3/4"	65-100
3/8"	0-75
*6 inch maximum particle length.	

- B. A biodegradable, organic binding agent or polyacrylamide can be mixed or injected into the compost as it is placed, provided it is not detrimental to the establishment of vegetation. The binding agent shall be applied at the rate recommended by the manufacturer.

2.4. SILT FENCES

- A. Fabric used for silt fences shall meet the requirements of IDOT 4196.01.
- B. Posts used for silt fences shall be steel T-posts with a minimum length of four (4) feet weighing at least one one-quarter (1 1/4) pounds per foot, exclusive of the anchor plate. Painted posts are not required.
- C. Wire or plastic ties with a minimum tensile strength of fifty (50) pounds shall be used for fasteners.

2.5. CHECK DAMS

- A. Check dams using silt fence shall comply with details of 2.4 above.
- B. Check dams using Rolled Erosion Control Products (RECP) shall be Type 4 with a minimum four (4) foot width and shall comply with details of 2.8 below.
- C. Triangular foam check dams shall have a height of eight (8) to ten (10) inches with a base width of sixteen (16) to twenty (20) inches and a length of seven (7) feet. The inner support material shall be

urethane foam and the outer cover shall be woven geotextile shaped to fit around the inner support material with the bottom edge extending two (2) to three (3) feet beyond the bottom edge.

- C. Filter fabric used for fabric checks shall consist of non-woven geotextile material and can be either heat-bonded or resin bonded and shall satisfy the material properties shown on Table 02120-02.

Table 02120-02: Properties of Non-Woven Geotextiles for Fabric Check Dams (from NRCS IA-95)

Property	Test Method	Class 1	Class 2	Class 3	Class 4 ³
Tensile strength (Lb.) ¹	ASTM D 4632 grab test	180 minimum	120 minimum	90 minimum	115 minimum
Elongation at failure (%) ¹	ASTM D 4632	> 50	> 50	> 50	> 50
Puncture (Lb.)	ASTM D 4833	80 minimum	60 minimum	40 minimum	40 minimum
Ultraviolet light (% residual tensile strength)	ASTM D 4355 150-hr exposure	70 minimum	70 minimum	70 minimum	70 minimum
Apparent opening size – AOS	ASTM D 4751	As specified max. #40 ²	As specified max. #40 ²	As specified max. #40 ²	As specified max. #40 ²
Permittivity sec ⁻¹	ASTM D 4491	0.70 minimum	0.70 minimum	0.70 minimum	0.10 minimum

¹ Minimum average roll value (weakest principal direction).

² U.S. standard sieve size.

³ Heat-bonded or resin bonded geotextile may be used for classes 3 and 4. They are particularly well suited to class 4. Needle punched geotextiles are required for all other classes.

- D. Rock check dams shall be composed of either Erosion Stone conforming to IDOT 4130, Gradation No. 34 or Riprap (revetment) conforming to IDOT 4130.02. All rock check dams shall be encapsulated in engineering fabric meeting the requirements of IDOT 4196.01C, unless noted otherwise.

2.6. EARTHEN DIVERSION BERMS AND FILTER BERMS

A. Earthen Diversion Berms

- Where specified by Engineer, earthen diversion berms may be used to divert surface runoff and trap eroded sediment. The location and dimensions of these berms shall be as agreed upon by the Engineer and Contractor.
- The earthen berm shall be constructed from on-site material in the immediate vicinity and shall be compacted as needed to provide stability. No benching or undercutting is required for temporary berms, which will be removed after general grading is completed.
- Should an Earthen Diversion Berm be considered permanent, its permanency should be indicated on the plan or its dimensions built directly into the grading plan.

B. Filter Berms

- Materials used for filter berms shall be derived from wood, bark, or other non-toxic vegetative feed stock. The material shall not contain any material that is toxic to plant growth. The target flow rate of the in-place material is ten (10) gallons per minute per linear foot. The material shall meet the particle sizes shown on Table 02120-3

Table 02120-03: Particle Sizes for Filter Sock or Filter Berm Filler

Sieve Size	Percent Passing
2 inch	100
1 inch	90-100
3/8 inch	0-30

2. Where specified by Engineer, filter berms of relatively short length may be constructed from a combination of macadam stone, erosion stone and/or riprap to function as a surface outlet for Earthen diversion berms.

2.7. WATTLES AND FILTER SOCKS

A. Wattles

1. Netting for wattles shall be degradable with an open weave having a nominal diameter of nine (9) inches or as specified.
2. Fill material shall consist of straw, wood excelsior, coir or other natural materials approved by Engineer.
3. Stakes to secure wattles shall be one (1) inch by one (1) inch wooden stakes or stakes of equivalent strength.

B. Filter Socks

1. Materials used for filter socks shall be derived from wood, bark or other non-toxic vegetative feed stock. The material shall not contain any material that is toxic to plant growth. The target flow rate of the in-place material is ten (10) gallons per minute per linear foot. The material shall meet the particle sizes shown on Table 02120-3
2. Where required for slope and sediment control applications, the filter sock shall consist of a continuous, tubular, knitted, mesh netting with three-eighth (3/8) inch openings constructed of five (5) millimeter thickness and photodegradable high-density polyethylene (HDPE).
3. Stakes to secure filter socks shall be by one (1) inch by two (2) inch hard wood stakes or stakes of equivalent strength.

2.8. Temporary Rolled Erosion Control Products (RECP)

Use temporary rolled erosion control products that are classified and have material properties according to the Erosion Control Technology Council's (ECTC) guidelines as follows:

A. RECP Type 1 (Ultra Short-Term): Functional longevity of three (3) months or less and classified as follows:

1. RECP Type 1A: Mulch control net, consisting of a photodegradable synthetic mesh or woven biodegradable natural fiber netting.
2. RECP Type 1B: Netless rolled erosion control blankets, consisting of natural and/or polymer fibers, mechanically interlocked and/or chemically adhered together to form a RECP.

3. RECP Type 1C: Single-net erosion control blankets and open weave textiles, consisting of processed degradable natural and/or polymer fibers, mechanically bound together by a single rapidly-degrading, synthetic or natural fiber netting, or an open weave textile of processed rapidly-degrading natural or polymer yarns or twines woven into a continuous matrix.
 4. RECP Type 1D: Double-net erosion control blankets, consisting of processed degradable natural and/or polymer fibers, mechanically bound together between two (2) rapidly-degrading, synthetic or natural fiber nettings.
- B. RECP Type 2 (Short-Term): Functional longevity between three (3) and twelve (12) months and classified as follows:
1. RECP Type 2A: Mulch control net, consisting of a photodegradable synthetic mesh or woven biodegradable natural fiber netting.
 2. RECP Type 2B: Netless rolled erosion control blankets, consisting of natural and/or polymer fibers, mechanically interlocked and/or chemically adhered together to form a RECP.
 3. RECP Type 2C: Single-net erosion control blankets and open weave textiles, consisting of an erosion control blanket composed of processed degradable natural or polymer fibers, mechanically bound together by a single degradable synthetic or natural fiber netting to form a continuous matrix or an open weave textile composed of processed degradable natural or polymer yarns or twines woven into a continuous matrix.
 4. RECP Type 2D: Double-net erosion control blanket, consisting of processed degradable natural and/or polymer fibers, mechanically bound together between two degradable synthetic or natural fiber nettings.
- C. RECP Type 3 (Extended Term): Functional longevity between twelve (12) and twenty-four (24) months and classified as follows:
1. RECP Type 3A: Mulch control nets, consisting of a slow-degrading synthetic mesh or woven natural fiber netting.
 2. RECP Type 3B: Erosion control blankets and open weave textiles, consisting of processed slow-degrading natural or polymer fibers, mechanically bound together between two (2) slow-degrading synthetic or natural fiber nettings to form a continuous matrix, or an open weave textile composed of processed slow-degrading natural or polymer yarns or twines woven into a continuous matrix.
- D. RECP Type 4 (Long Term): Functional longevity of thirty-six (36) months and classified as follows:
- Erosion control blankets and open weave textiles consisting of processed slow-degrading natural or polymer fibers, mechanically bound together between two (2) slow degrading synthetic or natural fiber nettings to form a continuous matrix, or an open weave textile composed of processed slow-degrading natural or polymer yarns or twines woven into a continuous matrix.
- E. Properties and Performance:
- Testing performed according to the ECTC's Testing Procedures for Rolled Erosion Control Products. Verify manufacturer's test results by independent testing. Material properties meeting the Erosion Control Technology Council's (ECTC) Standard Specifications for Rolled Erosion Control Products are shown on Table 02120-04:

Table 02120-04: Properties for Rolled Erosion Control Products

Classification	Slope Application	Channel Application	Min. Tensile Strength
	Max. Grade*	Permissible Shear Stress	
RECP Type 1A	5:1 (H:V)	0.25 lb/ft ²	5 lb/ft
RECP Type 1B	4:1 (H:V)	0.50 lb/ft ²	5 lb/ft
RECP Type 1C	3:1 (H:V)	1.50 lb/ft ²	50 lb/ft
RECP Type 1D	2:1 (H:V)	1.75 lb/ft ²	75 lb/ft
RECP Type 2A	5:1 (H:V)	0.25 lb/ft ²	5 lb/ft
RECP Type 2B	4:1 (H:V)	0.50 lb/ft ²	5 lb/ft
RECP Type 2C	3:1 (H:V)	1.50 lb/ft ²	50 lb/ft
RECP Type 2D	2:1 (H:V)	1.75 lb/ft ²	75 lb/ft
RECP Type 3A	5:1 (H:V)	0.25 lb/ft ²	25 lb/ft
RECP Type 3B	1.5:1 (H:V)	2.00 lb/ft ²	100 lb/ft
RECP Type 4	1:1 (H:V)	2.25 lb/ft ²	125 lb/ft
*Product tested according to ECTC Test Method No. 2 and meeting the ECTC Standard Specifications for "C" factor.			

- F. RECP Anchors shall be non-metallic stakes or staples as recommended by manufacturer, with a minimum length of six (6) inches.

2.9. TURF REINFORCING MATS (TRM)

- A. TRM Type 1: Use a TRM that is constructed of a web of mechanically or melt-bonded polymer netting, or monofilaments fibers that are entangled to form a strong and dimensionally stable mat. Bonding methods include polymer welding, thermal or polymer fusion or the placement of synthetic fibers between two high-strength, biaxially-oriented nets, mechanically bound by parallel stitching with polyolefin thread. Products may contain a degradable component.
- B. TRM Type 2 and 3: Use a TRM that is constructed of a web of mechanically or melt-bonded polymer netting, monofilaments or fibers that are entangled or woven to form a strong and dimensionally stable mat. Non-woven bonding methods include polymer welding, thermal or polymer fusion, or the placement of fibers between two (2) high-strength, biaxially oriented nets, mechanically bound by parallel stitching with polyolefin thread. Use only components that are one hundred (100) percent synthetic and resistant to biological, chemical and ultraviolet degradation.
- C. TRM Type 4: Use a high performance/survivability TRM that is composed of monofilament yarns woven into a resilient uniform configuration. Use a mat that has a matrix that exhibits very high interlock and reinforcement capacities with both soil and root systems and demonstrate a high tensile modulus. TRMs manufactured from discontinuous or loosely held together by stitched or glued, netting, or composites are not allowed in this category. Use only components that are one hundred (100) percent synthetic and resistant to biological, chemical and ultraviolet degradation. Use this category when field conditions exist with high loading and/or high survivability requirements. These requirements consist of maintenance,

structural backfills protecting critical structures, potential traffic areas, abrasion, higher factors of safety and/or general durability concerns.

- D. TRMs shall meet the minimum material and performance requirements contained in the Table 02120-05:

Table 02120-05: Properties for Turf Reinforcing Mats

	Property ¹	Test Method	Type 1	Type 2	Type 3	Type 4
Material	Thickness	ASTM D6525	0.25 in	0.25 in	0.25 in	0.25 in
	Tensile Strength ²	ASTM D6818	125 lb/ft	240 lb/ft	750 lb/ft	3,000 lb/ft
	UV Resistance ³	ASTM D4355	80% @ 500 hrs	80% @ 1,000 hrs	80% @ 1,000 hrs	90% @ 3,000 hrs
Performance	Maximum Shear Stress (Channel Applications) ⁴	ASTM D4640	7 lb/ft ²	10 lb/ft ²	12 lb/ft ²	15 lb/ft ²
	Maximum Slope Gradient (Slope Applications)	N/A	1:1 (H:V) or flatter	1:1 (H:V) or flatter	1:1 (H:V) or greater	1:1 (H:V) or greater

1. For TRMs containing degradable components, all values must be obtained on the non-degradable portion of the matting.
2. Minimum Average Roll Values, machine direction only. Tensile strength from ASTM D5035 may be substituted upon approval.
3. Tensile strength of structural components retained after exposure.
4. Minimum shear stress that fully-vegetated TRM can sustain without physical damage or excess erosion (0.5 in soil loss) during a 30-minute flow event in large scale testing. Acceptable large scale testing protocol includes ASTM D6460 or independent testing conducted by the Texas Transportation Institute, Colorado State University, Utah State University, or other approved testing facility. Bench scale testing is not acceptable.

2.10 TIED CONCRETE BLOCK MAT (TCBM)

- A. Tied concrete block mats shall be manufactured from individual concrete blocks cast into and tied together with a high-strength polypropylene geogrid. Each block shall be tapered, beveled and interlocked. Each block shall incorporate interlocking surfaces or connections that prevent lateral displacement of the blocks within the mats when they are lifted for placement.
- B. Physical Properties of Components
1. Polypropylene Geogrid used in the fabrication of the Tied Concrete Block Mat will be selected by the mat manufacturer. The selected geogrid must satisfy the minimum requirements of Table 02120-06, below.

Table 02120-06: Physical Characteristics of Geogrid for Tied Concrete Block Mat

Mass/Unit Area:	ASTM D-5261, 7.0 oz./yd ² (240 g/m ²)
Aperture Size Measured:	1.6 inch x 1.6 inch (40 mm x 40 mm)
Wide Width Tensile Strength:	ASTM D-6637 Machine Direction (MD), 2055 lb/ft (30 kN/m) Cross Machine Direction (CMD), 2055 lb/ft (30 kN/m) Elongation at Break, 6%
Tensile Strength @ 2%	ASTM D-6637 Machine Direction (MD), 822 lb/ft (12 kN/m) Cross Machine Direction (CMD), 822 lb/ft (12 kN/m)

Table 02120-06: Physical Characteristics of Geogrid for Tied Concrete Block Mat (Continued)

Tensile Strength @ 5%	ASTM D-6637 Machine Direction (MD), 1640 lb/ft (24 kN/m) Cross Machine Direction (CMD), 1640 lb/ft (24 kN/m)
Tensile Modulus @ 2%	ASTM D-6637 Machine Direction (MD), 41,100 lb/ft 600 kN/m Cross Machine Direction (CMD), 41,100 lb/ft 600 kN/m
Tensile Modulus @ 5%	ASTM D-6637, Machine Direction (MD), 32900 lb/ft (480 kN/m)

2. Cementitious Materials used to craft the concrete blocks shall conform to the following applicable ASTM specifications:
 - a. Portland Cements – Specification C 150, for Portland Cement
 - b. Blended Cements – Specification C 595, for Blended Hydraulic Cements
 - c. Hydrated Lime Types – Specification C 207, for Hydrated Lime Types
 - d. Pozzolans Specification C 618, for Fly Ash and Raw or Calcined Natural Pozzolans for use in Portland Cement Concrete

3. Aggregates used in the fabrication of the concrete block units shall conform to the following ASTM specifications, except that the aggregate gradation requirements shall not necessarily apply:

Normal Weight – Specification C 33, for Aggregates

4. Concrete block units, as cast, shall satisfy the requirements shown in Table 02120-07.

Table 02120-07: Physical Properties of Concrete Blocks for Tied Concrete Block Mat

	Min. Compressive Strength, psi (mPa)	Max. Water Absorption, lb/ft ³ (kg/m ³)
Individual Block	3500 (24)	12 (192)
Avg. of 3 Blocks	4000 (27.6)	10 (160)

5. Open Area: The Tied Concrete Block Mat shall have a minimum open area of ten (10) percent.
6. Chemical Resistance: The Tied Concrete Block Mat shall exhibit resistance to mild concentrations of acids, alkalis and solvents.
7. Backing: Tied Concrete Block Mat shall be packaged and shipped with a permanent Turf Reinforcement Mat (TRM) that shall provide for simultaneous placement with Tied Concrete Block Mat as it is unrolled. The TRM shall be Type 1 as described in 2.9 of this SECTION. The TRM shall also have a minimum forty (40) percent light penetration and a material density not greater than eight ounces per square yard (8.0 oz/yd²) as measured by ASTM D6566. Thicker or denser TRMs shall not be acceptable. Recyclex® TRM, or approved equal, will be an acceptable product for this application
8. Dimensions:
 - a. Roll Width: To facilitate shipping, Tied Concrete Block Mat should be packaged and shipped in widths specified on the plans. Manufactured widths do not exceed sixteen (16) feet.
 - b. Roll length: The length of rolls for tied block mat is indicated on the plan, but the roll length may be modified to custom lengths subject to engineer approval. Shop drawings shall be provided which illustrate how custom roll lengths will be properly installed to satisfy the requirements shown on the drawings. Cutting and splicing of rolls shall not be allowed except where pre-approved by Engineer. Total roll length

provided should be sufficient to allow for appropriate amounts of overlap at transverse seams, as recommended by the manufacturer.

- C. Stainless Steel Zip Ties: Stainless Steel Zip Ties (*hereafter "ties" for this SECTION*) shall be nominally twenty (20) inches long x five sixteenths (5/16) inch wide. Tie material shall be 304 Stainless Steel. Each tie shall have a minimum tensile strength of two hundred fifty (250) Lb. A sufficient number of ties shall be supplied so that one tie may be installed between every two (2) blocks along the seams of adjoining Tied Concrete Block Mats.
- D. Anchors to Secure the Mat:
1. Rebar "U" Rebar Anchors (*hereinafter "U-Anchors" for this SECTION*) may be used for either longitudinal or transverse seams depending upon the application subject to Engineer approval. Consult plan details or manufacturer's recommendations for acceptable use and spacing. Each U-Anchor shall be bent into the shape of a long slender "U" and made from #3 Grade 40 steel re-bar. The diameter of the bend shall be approximately three (3) inches. Each leg of the rebar staple shall be at least eighteen (18) inches in length exclusive of the bend. Some applications may require rebar staples to be epoxy coated to improve corrosion resistance. Consult Engineer or Supplemental Specifications for coating requirements. U-Anchors shall be installed perpendicular to the flow of water.
 2. Percussion (or duck bill) Earth Anchors: (*hereafter "percussion anchors" for this SECTION*) are used to secure tied block mat to the soil surface. Each anchor shall include a stainless steel cable having minimum dimensions of one-eighth (1/8) inch diameter x thirty (30) inches long. The duckbill fastened to one end of the cable is four three fourths (4 ¾) inches long x one (1) inch diameter made of tinz alloy aluminum alloy that will not corrode or rust. Each anchor shall provide a holding capacity of one thousand one hundred (1,100) lbs. in normal soil. A driving rod is required to drive the anchor assembly vertically into undisturbed soil to the required depth. After the duckbill is driven into the soil, an upward pull on anchor rotates the duckbill into a load-lock position approximately fifteen (15) degrees from horizontal. Further tension causes anchor to plane sideways through undisturbed soil, increasing pullout resistance. Percussion anchors shall require no rods, stakes, pipes, or stems to be left above ground except for a sufficient length of cable for re-tensioning
- E. Visual Inspection: All units shall be sound and free of defects that would interfere with the proper placing of the unit or impair the strength or permanence of the construction. Surface cracks incidental to the usual methods of manufacture, or surface chipping resulting from customary methods of handling in shipment and delivery, shall not be deemed grounds for rejection.
- F. Sampling and Testing: The purchaser or his authorized representative shall inspect the units upon delivery. Units missing more than four (4) blocks per eighty (80) square feet section shall be deemed grounds for rejection.
- G. Packaging: Tied concrete block mats are packaged in rolls with high strength lifting straps for moving material into place with an excavator. Contractor shall use spreader bars as necessary to adequately support rolls while lifting.
- H. Manufacturer: A manufacturer of the Tied Concrete Block Mat is Motz Enterprise, which markets the product under the name, "Flexamat". The manufacturer's contact information is as follows:
- Motz Enterprise, 11006 Reading Road, Cincinnati, OH 45241
Phone: 513-772-MOTZ (513-772-6689)*
- I. Engineer approved equivalents to the Flexamat product shall be acceptable.

2.11. SEDIMENT BASIN OUTLET STRUCTURES

The base, riser, and outlet pipe shall conform to the details as shown on the plans. The riser shall include an anti-vortex device and the outlet pipe shall include anti-seep collars as shown.

2.12. STABILIZED CONSTRUCTION ENTRANCE

Macadam crushed stone where construction entrance adjoins a publicly used road. Refer to SWPPP for location and dimensions.

PART 3 - EXECUTION

3.1 SWPPP PREPARATION

- A. The Erosion Control Plan for this project prepared by Engineer has been included in the Plans. The completed SWPPP will be provided to Contractor prior to initiation of construction and will be based on the Erosion Control Plan.
- B. Contractor shall be co-permittee with Division on the IDNR NPDES General Permit No. 2 that shall be completed by Division.

3.2 SWPPP MANAGEMENT

- A. Contractor shall maintain access to the site at all times during construction so that SWPPP management and inspections may be conducted.
- B. A SWPPP inspection must be conducted at least once every seven (7) calendar days. Division personnel will conduct the inspections, develop the reports, and distribute electronic copies. Contractor shall be available, upon request of the Division, to assist with the inspections as may be necessary. Inspections and reports are required at the specified interval from initiation of clearing until the Notice of Discontinuation is filed with the Iowa DNR.
- C. During construction, Contractor shall be responsible for implementation of the various sediment and erosion control practices prescribed in the SWPPP. At each progress meeting, the SWPPP practices shall be reviewed for compliance. Deficiencies shall be corrected prior to approval of payment for those measures. Division reserves the right to suspend all payments due to Contractor until deficiencies are corrected.
- D. Contractor shall properly manage all hazardous materials (i.e. fuel, oil, concrete wash out, etc.) brought to the site to conform to the SWPPP all at his own expense.
- E. Contractor may propose alternative measures than those specified by Engineer but shall receive approval from Division or Engineer prior to installation of these alternative measures. All changes and modifications must be documented and kept with the SWPPP documentation.
- F. Division will file the Notice of Discontinuation after final sufficient vegetation is established to provide final stabilization.
- G. Division will maintain SWPPP records for a period of three (3) years after the Notice of Discontinuation is submitted.

3.3 INSTALLATION OF SEDIMENT AND EROSION CONTROL MEASURES

A. Surface Roughening

1. Directional Tracking: Operate tracked equipment up and down slopes that are less steep than three to one (3:1) horizontal to vertical (H:V) to create ridges that are perpendicular to the slope.
2. Grooving/Furrowing: Use rippers, disks, harrows, chisel plows, or other equipment capable of operating on the slope to create grooves that are about three (3) inches deep and spaced a maximum of fifteen (15) inches apart. Grooves must be made along the contour and perpendicular to the slope. Surface roughening is often accomplished by deep disking associated with subgrade preparation as discussed in SECTION 02400.

B. Erosion Control Mulching

1. Conventional: Uniformly distribute mulch over the required area at a rate of two (2) tons per acre and work the mulch into the soil with a mulch tucker designed to anchor the mulch into soil by means of dull blades or disks.
2. Other types of mulching, if approved by Engineer, will be at the determined rates of application with appropriate equipment.

C. Compost Blankets

1. Loosen the ground to a minimum depth of one (1) inch and evenly apply the compost to the specified depth.
2. All concentrated flows shall be diverted away from the slope.
3. No heavy equipment shall be operated over the compost blanket throughout the required period of protection.

D. Temporary Erosion Control Seeding

1. Till soil to a minimum depth of five (5) inches with a disk, harrow, or field cultivator.
2. Apply Nitrogen (N) fertilizer to all seeded areas at a rate of fifty (50) pounds per acre.
3. On areas accessible to field machinery, sow seed with an end-gate cyclone seeder. Areas that are not accessible shall use hand-operated cyclone seeding methods.
4. Cover the seed and fertilizer lightly by tiling the seeded area with a disk, rigid harrow, spring tooth harrow or field cultivator.

E. Temporary Earth Diversion Structures

1. Construct the temporary earth diversion structure at the location and with the dimensions shown on the plans or as agreed to on site with Engineer. Adequately compact fill to prevent failures and seepage. Failures due to inadequate compaction shall be repaired by Contractor at no cost to Division.
2. Ensure positive drainage along the diversion ditch to the designated outlet area.

3. Apply temporary erosion control seeding if structures are specified to be vegetated.

F. Silt Fences

1. Install silt fences along the specified contour and to the dimension shown on the erosion control plan or as directed by Engineer. The ends of continuous run silt fences shall be turned uphill with a J-hook to prevent runoff from flowing around the end when the water behind the fence ponds to a level even with the top of the fence.
2. Install silt fence fabric with a mechanical soil slicing machine that creates a slit in the ground while simultaneously installing the fabric. The trenching method may be used when the slicing method cannot be used and is subject to approval by Engineer. The silt fence fabric shall be installed such that twelve (12) inches is installed at least six (6) inches below the ground line (folding is allowed). After the fabric is installed, the ground shall be compacted on each side by driving over the area with rubber-tired equipment or by other means as necessary to adequately anchor the material in the ground to prevent pullout and water flow under the fence.
3. Steel post supports shall be placed at a maximum spacing of eight (8) feet or as directed by an Engineer. The steel posts shall be installed with a minimum embedment depth of twenty (20) inches. Fabric shall be tied to the steel posts at least four (4) evenly spaced locations using metal ties or plastic ties that have ultraviolet protection.
4. Non-functioning silt fences that allow flow underneath or that are damaged due to improper installation shall be repaired or replaced by Contractor at no cost to Division.
5. Silt fences shall be cleaned out when the accumulated sediment reaches a level of one-half (1/2) the height of the silt fence or when the silt fence becomes clogged with sediment and no longer allows runoff to flow through. Silt fences shall be replaced when necessary.
6. Silt fences shall be removed after vegetation is established by removing the steel posts, stakes, ties and fabric from the site or burying material in an approved location and manner. The accumulated sediment shall be spread and distributed in surrounding areas and smoothed to match finished grade and to ensure proper drainage.

G. Check Dams

1. Install fabric and silt fence check dams as shown on the plans or as recommended by the manufacturer.
2. Fabric check dams shall be installed so that eighteen (18) inches are placed in a trench on the upstream side of its intended location. Material excavated from trench shall be replaced and compacted to hold the fabric check in place. The remaining eighteen (18) inches shall be placed loosely on the surface facing downstream.
3. Silt Fence check dams shall be installed as described in 3.3 F. above. Use adequate number of posts for support. Care shall be taken so the center of check dam is at least twelve (12) inches lower than the ends.
4. Install rock check dams following details provided on the plans. Use riprap, erosion stone, macadam stone or approved combination thereof. Choke voids with smaller stone or site soils as specified. The center shall be at least twelve (12) inches lower than the ends. The ends of the rock check dams shall be sufficiently keyed into the sides of the drainageway. Depending upon the application, rock check dams may be considered either permanent or temporary.

5. Clean out check dams as directed by Engineer when they become non-functioning by sediment accumulation.
6. Remove any temporary check dams as directed by Engineer after site is stabilized. All accumulated sediment and disturbed areas shall be regraded and spread as needed to match finished grade and ensure proper drainage.

H. Filter Berms

1. Filter berms shall be constructed to the dimensions and along the contour as shown on the plans or as directed by Engineer.
2. The ends of filter berms shall be turned uphill to prevent runoff from flowing around the ends.
3. Apply temporary erosion control evenly to the surface if the berm is specified to be vegetated.
4. Filter berm shall be cleaned out when sediment accumulation reaches one-half of the height of the berm or as directed by Engineer.

I. Filter Socks

1. Filter socks shall be filled with the appropriate filter material pneumatically to the size and length indicated on the plans or as directed by Engineer.
2. Filter socks shall be placed along the contour as indicated on the plans or as directed by Engineer. The ends of each filter sock shall be turned uphill to create a J-hook to prevent runoff from flowing around the ends when water ponds up to a level even with the top of the sock.
3. Filter socks shall be embedded into the soil surface at least one (1) inch and/or additional filter material or soil shall be placed on the uphill side of the filter sock between the filter sock and the ground as directed by Engineer
4. Drive support stakes into the ground on the downhill side of the filter socks at a maximum spacing of six (6) feet. Place additional stakes as needed to secure the sock and prevent movement.
5. Non-functioning filter socks that allow flow underneath or socks that are damaged due to improper installation shall be repaired or replaced by Contractor at no cost to Division.
6. Filter socks shall be cleaned out when the accumulated sediment reaches a level of one-half (1/2) the height of the sock or when the sock becomes clogged with sediment and no longer allows runoff to flow through.
7. Filter socks shall be removed at the appropriate time by slicing the sock longitudinally and removing the mesh and staking materials. The filter material and accumulated sediment shall be spread to match finished grade and ensure proper drainage.

J. Wattles

1. Construct a shallow trench that is two (2) to four (4) inches deep that matches the width and the contour of the wattle. Place the wattle and compact excavated soil against the wattle on the uphill side.

2. Drive stakes through the center of the wattle at a maximum spacing of four (4) feet and as needed to secure the wattle and prevent movement. Extra staking is needed at butted ends to prevent leakage. Do not overlap wattles vertically. Horizontal overlaps may be acceptable with Engineer approval.
3. Non-functioning wattles that allow flow underneath or wattles that are damaged due to improper installation shall be repaired or replaced by Contractor at no cost to Division.
4. Wattles shall be cleaned out when the accumulated sediment reaches a level of one-half (1/2) the height of the wattle or when the wattle becomes clogged with sediment and no longer allows runoff to flow through.
5. Wattles shall be removed at the appropriate time by slicing the wattle and removing the mesh and staking materials. The filler material and accumulated sediment shall be spread to match the finished grade and ensure proper drainage.

K. Temporary Rolled Erosion Control Products (RECPs)

1. Install all RECPs according to the manufacturer's published installation recommendations along with the following minimum requirements.
2. Grade and smooth surface. Remove all rocks, clods, vegetation or other obstructions that will prevent direct contact between the RECP and the soil surface.
3. When specified, prepare seedbed and place seed and fertilizer according to SECTION 02700.
4. Slope Application: Install anchor trench along at the top of the slope. Unroll the RECP down and horizontally across the slope. Place consecutive blankets down the slope end over end, shingle style. Overlap rolls a minimum of three (3) inches and install anchors at a maximum spacing of eighteen (18) inches along all the overlaps. Backfill and compact trench and place additional seed as required.
5. Channel Application: Install RECP As shown on the details shown on the plans.

L. Turf Reinforcement Mats (TRMs)

1. Install TRMs according to the published installation literature for the product specified and for the appropriate application.
2. Depending upon the sequence and timing of construction, it may be necessary to delay installation of TRMs to correspond to dates when permanent seeding can take place in the spring and fall seeding periods.

M. Sediment Basin Outlet Structures

1. Concrete Base: Construct concrete base and anchor riser section as shown on the plans.
2. Dewatering Device: Drill holes in riser section with the number, diameter and configuration as shown on the plans. Wrap the perforated section of the riser pipe with metal hardware cloth.
3. Riser and Barrel: Place the specified corrugated metal pipe and properly backfill as needed with compacted lifts of soil. The anti-vortex and anti-seep collars shall also be properly placed where shown on the plans.

4. Repairs required to the sediment basin or outlet structure due to improper installation shall be repaired by Contractor at no cost to Division.
- N. Stabilized Construction Entrance
1. Place macadam stone at entrance to correspond to the dimensions provided in the Plans, the SWPPP or as directed by Engineer. Alternative stone material may be proposed, but must be approved by Engineer.
 2. Engineer may require geotextile fabric to be installed under the macadam stone depending upon site conditions. In cases where non-woven geotextile fabric is required, the cost of the non-woven fabric shall be incidental to the cost of the macadam stone.
 3. If voids become plugged, replace or regrade as needed.

PART 4 - MEASUREMENT AND PAYMENT

4.1 UNIT PRICES

- A. The construction cost of all work included in this SECTION of the Construction Specifications shall be included in Contractor's unit prices set forth in the Proposal and Schedule of Prices (*Document C*) for the work items described below. The unit price for each of these items shall include its pro rata share of overhead and profit so that the sum of the products obtained by multiplying the unit prices so set forth by the amount of the work actually constructed, measured as described herein, shall constitute full payment to Contractor for performance of the work included in this SECTION. The unit price shall include all labor, materials, and equipment necessary for proper installation of the various practices.
1. The unit price shall also include cost for removal of temporary practices at the appropriate time once vegetation is established; unless extenuating circumstances exist as determined by Engineer or DIVISION, vegetation will be considered established ninety (90) days after a documented show of green across the site. If Contractor does not remove temporary practices in a timely manner, Division may delay payment of retainage or seek resolution with Contractor's bonding company.
 2. For certain particular practices identified by Engineer in Supplemental Specifications, where timely removal is critical, Division reserves the right to pay up to one-half (1/2) the unit price for the practice upon installation and the remaining one-half after satisfactory removal.
 3. If erosion and sediment control measures are properly installed by Contractor and storm events cause failure or reduces the effectiveness of these measures, replacement shall be completed as directed by Engineer and will be paid for by Division to Contractor as defined below.
 4. If temporary erosion and pollution control practices are required due to Contractor's negligence, carelessness, or failure to install permanent controls as part of his work as scheduled and are deemed necessary by Engineer or Division, the practices shall be completed by Contractor at no cost to Division.
 5. In case of repeated failures on part of Contractor to control erosion, pollution, and/or siltation, Division reserves the right to employ outside assistance to provide the necessary corrective actions. Such incurred direct costs, plus Engineering costs, will be at Contractor's own expense with the appropriate deduction taken from future pay requests.

B. Measurement and payment for each work item in this SECTION shall be in accordance with the following:

1. *Quarried Stone:* The bid unit price for quarried stone products like Riprap, Erosion Stone, Macadam Stone or similar stone materials shall include all costs to furnish and install the stone as specified in the plans. The unit price shall also include cost for geotextile fabric underlayment where required. Measurement for payment shall be based on the tonnage of stone installed as evidenced from weight tickets, rounded to the nearest one-tenth (0.1) ton. Only material placed in accordance with the Plans and Specifications shall be measured and paid.
2. *Surface Roughening:* Payment for surface roughening performed as directed by Engineer will be measured and paid for by the contract unit price per acre. Areas shall be jointly measured by Engineer and Contractor. Surface roughening shall not be considered a separate pay item when it is accomplished by the work of subgrade preparation.
3. *Erosion Control Mulching:* Payment for mulching will be measured and paid for at the contract unit price per acre. Mulch placed outside designated areas will not be measure for payment. Areas shall be measured jointly by Engineer and Contractor.
4. *Compost Blankets:* Payment for the cost of placing compost blankets will be measured and paid for by the contract unit price of each square foot for each thickness of blanket specified and shall include preparing the subgrade. Compost blankets placed outside specified areas will not be measured for payments. Measurements will be taken jointly by Engineer and Contractor.
5. *Temporary Erosion Control Seeding:* Payment for placement of temporary seeding will be measured and paid for by the acre. The unit contract price shall include preparing the subgrade, placement of fertilizer and seed, and final cultivating. The area for payment will be measured jointly by Engineer and Contractor.
6. *Temporary Earth Diversion Structures:* Payment for installation and removal of temporary earth diversion structures will be measured and paid for by the linear foot for each type and size of diversion structure. Payment will be jointly measured by contractor and Engineer. Full payment for this item will not be made until removal is complete. The unit price shall include all labor and equipment necessary.
7. *Silt Fences:* Payment for installation of silt fence will be measured and paid for at the contract unit price per linear foot of silt fence as measured jointly by the contractor and Engineer. The unit cost shall include all labor, equipment and materials for proper installation. Payment will be made for removal of silt fence, either at the end of the project after seeding is established or if replacement silt fence is required during construction. Payment will be made based on the contractor's unit price and will match the linear feet of silt fence installed. The removal of silt fence shall include removal and disposal of stakes, fabric and ties. Silt fence removal shall also include restoring the disturbed area to finished grade and removal or distribution of the accumulated sediment.
8. *Check Dams:* Payment for temporary check dams not constructed with erosion stone or riprap will be measured and paid for at the contract unit price per linear foot of each size and check dam specified. The length of the check dams will be measured jointly by Engineer and Contractor. .

Check dams made from erosion stone or riprap will be paid for to the nearest one-hundredth (0.01) of ton of material placed provided the dimensions of the check dam are similar to that shown on the plans or as otherwise approved. Filter fabric used beneath the erosion stone or

riprap will not be measured for payment and shall be considered incidental. The unit cost shall include all labor, equipment, and material costs that are necessary. Excavation costs and distribution of the soil materials are considered incidental and shall not be measured separately for payment.

9. *Filter Berms:* Payment for filter berms will be measured and paid for at the contract unit price by the linear foot of each size specified. Measurements will be taken longitudinally along the top of the berm and will be measured jointly by Contractor and Engineer. Filter berms that are needed to replace existing filter berms because of sediment accumulation will also be measured for payment.
10. *Filter Socks:* Payment for filter socks will be measured and paid for at the contract unit price by the linear foot of each diameter specified. Measurements will be taken jointly by Contractor and Engineer. Filter socks that are needed to replace existing filter socks because of sediment accumulation will also be measured for payment. Removal of filter sock will also be paid for at contractor's unit price and shall include removal and disposal of sock and stakes. The removal cost shall also include distribution of the accumulated sediment and filter material.
11. *Wattles:* Payment for wattles will be measured and paid for at the contract unit price per linear foot. Any excavation required for placement and the staking of the wattle shall be considered incidental to the installation costs. A separate contract unit price shall be provided for removal. The length of wattle for payment of installation and removal shall be the same and measured jointly by Engineer and Contractor.
12. *Temporary Rolled Erosion Control Products (RECPs):* Payment for temporary RECPs will be measured and paid for at the contract unit price per square yard of area covered for each type used. Overlaps will not be measured for payment. Staples, anchors, or other products needed for proper installation are considered incidental. Areas shall be jointly measured by Contractor and Engineer.
13. *Turf Reinforcing Mats (TRMs):* Payment for TRMs will be measured and paid for at the contract unit price per square yard of area covered for each type used. Overlaps will not be measured for payment. Staples, anchors, or other products needed for proper installation are considered incidental. Areas shall be jointly measured by Contractor and Engineer.
14. *Tied Concrete Block Mat (TCBM):* Payment for TCBMs will be measured and paid for at the contract unit price per square foot of area covered. Overlaps and lengths of mat used in anchor trenches, up to the amounts specified on the plans, will be measured for payment. Anchors, stainless steel ties and other products needed for proper installation are considered incidental. Areas shall be jointly measured by Contractor and Engineer.
15. *Sediment Basin Outlet Structures:* Measurement and payment will be made for each sediment basin outlet structure installed by size. The contract unit price shall include all materials, labor and equipment required to construct the outlet structure as specified and shown on the plans. The unit price for installation shall include the concrete base, anti-vortex device, outlet pipe and any anti-seep collars required. Earthwork required for construction of the sediment basin will be measured and paid as part of the general excavation quantities.

Measurement and payment will also be made for each sediment basin cleanout required during construction. Contract unit price includes dewatering and removal and disposal of accumulated sediment. The measurement and payment will also be made for each sediment basin outlet structure properly removed. Contract unit price includes dewatering and removal of sediment accumulated at the end of the project, disposal of the outlet structure, concrete base and

emergency spillway. Earthwork required to restore the sediment basin and restoration of the area to finished grade will be measured and paid for separately.

16. *Stabilized Construction Entrance:* The unit price shall include all materials and work required for installation of the stabilized construction entrance in conformance with these Construction Specifications and the Plans, including excavation, removal and disposal of excavated material and furnishing and placing the stone. Measurement for payment shall be based on the tonnage of granular surfacing material actually installed as determined from weight tickets, rounded to the nearest one-tenth (0.1) ton. Only material placed in accordance with the Plans and Specifications shall be measured and paid.

After the project is complete, and, if so directed by Engineer and Division, the granular material placed for the stabilized entrance shall be removed and either transported offsite or stockpiled for benefit of the landowner in an approved location on site. Any minor grading needed to maintain drainage shall also be included with removal at no additional cost to Division.

4.2 SUMMARY – UNITS OF MEASUREMENT

- . Units of measurement for bid items applicable to work covered by this SECTION are as follows:

<u>Description</u>	<u>Unit</u>
Quarried Stone (Riprap, Erosion Stone, Macadam Stone or similar)	Ton
Surface Roughening	Acre
Erosion Control Mulching	Acre
Compost Blankets	Square Foot
Temporary Erosion Control Seeding	Acre
Temporary Earth Diversion Structures	Linear Foot
Silt Fences – Installation	Linear Foot
Check Dams – Temporary	Linear Foot
Check Dams – Permanent	Ton
Filter Berms	Linear Foot
Filter Socks – Installation	Linear Foot
Wattles – Installation	Linear Foot
Temporary Rolled Erosion Control Products	Square Yard
Turf Reinforcing Mats	Square Yard
Tied Concrete Block Mat	Square Foot
Sediment Basin Outlet Structures – Installation	Lump Sum
Sediment Basin Outlet Structures – Cleanout	Lump Sum
Stabilized Construction Entrance	Ton

END OF SECTION 02120

INDEX

SECTION 02200 - EARTHWORK, ROUGH GRADING

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PART 1 - GENERAL

1.1 DESCRIPTION

Work under this SECTION covers the requirements for materials, tools, equipment, and services necessary to complete the earthwork to rough grade for this project. The work shall include, but is not necessarily limited to, completion of the following work:

- A. Acceptance of original ground lines or submittal of new survey data.
- B. Excavation.
- C. Implementation of Storm Water Pollution Prevention Plan (SWPPP).
- D. Conveyances, placement, and compaction of excavated materials.
- E. Site grading to elevations shown on the Plans.
- F. Construction of drainage ways and any necessary rechanneling of existing creeks.
- G. Field engineering.

1.2 REFERENCE SPECIFICATIONS

- A. The following specifications or applicable standards are incorporated by reference into this SECTION:
 - 1. SECTION 02010 – FIELD ENGINEERING.
 - 2. SECTION 02100 – MOBILIZATION, SITE CLEARING & PREPARATION.
 - 3. SECTION 02110 – IMPOUNDMENTS.
 - 4. SECTION 02120 – SEDIMENT AND EROSION CONTROL.
 - 5. SECTION 02220 – EARTHWORK, DAMS.
 - 6. Iowa Department of Natural Resources.
 - 7. Iowa Department of Transportation Standard Specifications.
 - 8. National Pollutant Discharge Elimination System (NPDES).
- B. Above-mentioned references, which do not appear printed with the Contract Documents, can be provided to Contractor upon request.

1.3 QUALITY ASSURANCE

- A. Contractor shall use adequate numbers of skilled workers who are thoroughly trained and experienced in necessary crafts and who are completely familiar with specified requirements and methods needed for proper performance of work of this SECTION.

- B. Contractor shall use equipment adequate in size, capacity, and numbers to accomplish work in a timely manner.
- C. Contractor shall comply with requirements of governmental agencies having jurisdiction and with directives of Engineer and Division.

1.4 JOB CONDITIONS

A. Definitions

1. "Access Route" shall be understood to mean the route by which Contractor gains access to the site. Access routes do not necessarily include impacts by mass grading operations other than clearing, grubbing and those operations required for maintenance of the access route during construction.
2. "Grading Limits" shall be understood to mean the maximum extent of excavation, earth movement, or other grading operations.
3. "Project Boundary" shall be understood to enclose the total area impacted by the construction including the access route to the site. Exclusive of the access route, the project boundary is usually identical to the grading limits.
4. "Substantial Earthwork" shall be understood to mean mass excavation and movement of soil material beyond what is reasonably required to facilitate Clearing and Site Preparation with the grading limits. The creation of access routes through the site during Clearing and Site Preparation shall not be considered Substantial Earthwork provided Contractor exercises care to minimize excavation.
5. "Large Rocks" or "Large Boulders" shall be understood to mean stones that are typically larger than approximately twelve (12) to eighteen (18) inches which cannot be lifted by hand.
6. "Excessively Large Rocks" shall be understood to mean stones or geologic formations that cannot be easily moved with a Caterpillar D6 bulldozer or equivalent.

B. Nature of Work Site

1. Materials to be handled under this Contract include quantities of spoil, gob, and coal refuse which may be toxic and/or acidic in nature.
2. The Project site is situated in an area where underground coal mining may have been conducted. There is a possibility that mine drifts or shaft openings are present on site. Contractor shall exercise reasonable caution in recognition of this potential hazard, and shall notify Engineer and Division immediately upon discovery of any openings or any signs of instability. Sealing of openings may be incorporated into this Contract through issuance of change orders, at the discretion of Division. Additional specifications will be provided by Division as needed.
3. During excavation in existing spoil piles, Contractor shall recognize the possible existence of cavities or smoldering fires and, if encountered, shall notify Engineer and Division promptly. Contractor shall exercise caution and be prepared to take appropriate actions since accelerated combustion may occur. Burning materials shall be extinguished before being covered or incorporated as fill. Contractor shall notify Division and Engineer if smoldering fires are encountered.

4. During excavation in existing spoil piles, Contractor shall recognize the possible existence of buried waste materials which may include demolition, household, municipal, or other deleterious materials. Contractor shall immediately secure the waste area and notify Engineer and Division who will make determinations of final waste disposals.
5. Spoil material used to construct fills is subject to significant increase in pore water pressure, particularly during rapid construction, with a corresponding decrease in shear strength that reduces the stability of slopes. Contractor shall exercise caution and notify Engineer and Division promptly should signs of slope instability appear.
6. Contractor shall maintain access to adjacent areas to which Landowner(s) require access as needed.

C. Earthwork Balance

1. The grades shown on Plans indicate a balance of earthwork materials when a shrinkage factor as indicated on the Plans or in the Supplemental Specifications is applied. Should a shortage or excess of material exist, final grades will be adjusted in areas as shown on the plans or as directed by Engineer at no additional cost to Division.
2. Changes in placement of fill material within the grading limits that impact the site drainage conditions or are in non-designated adjustment areas, can only be made with specific instructions by Engineer and Division.

D. Original Ground Lines

1. Acceptance of Original Ground Lines per Plans
 - a. Engineer has determined the excavation quantities using the original and proposed final grades indicated on the plans using a computer program. The original (or existing) ground lines are developed from aerial photography or Light Detection and Ranging (LiDAR). Additional site-specific survey information may have been obtained and combined with LiDAR or photogrammetry to develop the original ground lines shown in the plans. The cross sections included with the plans were developed from the original ground lines and are provided for the benefit of Contractor.
 - b. **Before** commencing **any** substantial earthwork activities as defined in 1.3.A, Contractor shall accept in writing the original ground lines provided on the Plans. The purpose for acceptance of ground lines is to establish Excavation as a fixed quantity. Engineer shall prepare a form to be signed by Contractor indicating Contractor's acceptance of original ground lines.
 - c. If Contractor seeks to revise the original ground lines as provided in 1.4.D.2., below, he may request signing the original ground lines acceptance be delayed until after the site is cleared.
 - d. Commencement or evidence of **any** substantial earthwork activities shall be considered presumptive evidence of Contractor's acceptance, whether or not Contractor signs the form.

2. Revision of Original Ground Lines

- a. Contractor may conduct a field survey at his own expense during or after clearing to verify accuracy of original ground data at an interval appropriate to depict actual site conditions. The survey must provide enough information to depict actual site conditions. Contractor may use conventional land survey, RTK GPS, or aerial methods to perform the survey. If an aerial method is selected, sufficient numbers of ground control points shall be used to validate the horizontal and vertical data. If ponds exist on the site, pond bathymetry shall be included. Contractor may perform the bathymetric survey at his expense or request this information from the Engineer.
- b. If Contractor's survey information indicates that the actual ground elevations differ from the original ground elevations included in the Plans, this information shall be forwarded to Engineer and Division immediately. The data shall be in the form of an electronic CAD drawing, compatible with AutoCAD, that will allow Engineer to perform analyses and verify any claims to a change in Excavation quantity. The drawing may contain either a point cloud or contours, and the data shall extend to all extremities of grading limits shown on the Plans.
- c. If Division and Engineer agree that there is a substantial difference between the original ground contours shown on the plans and the more recent survey data, then Division may, upon completion of clearing and grubbing operations, acquire additional survey information at its expense to verify Contractor's survey. This additional information will be used to establish a revised excavation quantity for the contract. Engineer may issue a revised grading plan to Contractor to address revisions to the original ground lines. In this situation, a change order will be developed to reflect the revised excavation quantity regardless of whether the change is in Contractor's favor
- d. Acceptance of the revised ground lines as discussed above, shall be mutually agreed to between Contractor and Division, in writing *prior* to the commencement of *any* substantial earthwork. Engineer shall prepare a form to be signed by Contractor indicating Contractor's acceptance of the revised ground lines. Revisions to the existing ground lines will *not* be considered or allowed after substantial earthwork has commenced.

1.5 PERMITS AND FEES

- A. Contractor shall obtain any permits required and pay any associated fees. If the project includes modifications to structures and/or roads, including providing access, that are under the jurisdiction of the local county, the appropriate permit shall be obtained by Contractor from the County Engineer prior to initiating any work in these areas. Contractor shall be reimbursed for the cost of the permits and extra materials required for work in these areas provided Contractor furnishes all documentation of those expenses to Division.
- B. Division has obtained any necessary permits from the U.S. Army Corps of Engineers for disturbance and mitigation of jurisdictional waters as shown on the plans for this project. The requirements of this permit have been incorporated into the Contract Documents. A copy of this permit can be made available upon request to the Division.

- C. Division has obtained a Storm Water Discharge Permit for this project. Contractor will become a co-permittee with Division on this Storm Water Discharge Permit. A Storm Water Pollution Prevention Plan has been developed by the Engineer for this project and is part of the permit. Contractor is also responsible for the inspections and keeping the SWPPP documentation current. Refer to SECTION 02120.
- D. If the project includes modifications to structures and/or roads, including providing access, that are under the jurisdiction of the local county, the appropriate permit shall be obtained by Contractor from the County Engineer prior to initiating any work in these areas.

1.6 SUBMITTALS

- A. Contractor shall submit the following information to Engineer:
 - 1. SWPPP certification forms developed by the Engineer and signed by Contractor and Subcontractors.
 - 2. Original Ground Lines acceptance or submittal of new topographic information.
 - 3. All Record Survey Notes.

1.7 SITE DISTURBANCES

- A. Contractor shall take precautions to ensure that equipment and vehicles do not unnecessarily disturb or damage areas or other site improvements identified to be outside of the project limits. Contractor shall comply with SECTION 3.10 CLEAN-UP AND REPAIRS.
- B. No work within or damage to any Conservation Reserve Program (CRP) land, existing wetland, or other jurisdictional area shall be permitted if said areas are to remain undisturbed as shown on the Plans. Division has no permit to disturb these areas. These areas are under the jurisdiction of other authorities and there could be fines levied against Contractor for disturbances in these areas.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

- A. General fill material consists of spoil piles, coal refuse materials, gob and all other soil material from required cut operations.
- B. Materials designated on the plans as select borrow, cover materials, or impervious fill shall not be used as general fill.
- C. If apparent good material suitable for use as select borrow, cover material, or impervious fill is encountered during excavation of general fill materials, Contractor shall notify Engineer immediately to evaluate these materials. Contractor shall segregate this good material from general fill as directed by Engineer. Depending upon the location, quantity, and quality of this material, a Change Order may be developed to address this good material located with excavation for general fill as agreed upon between Contractor and Division.

2.2 OTHER MATERIALS

- A. Contractor shall provide other materials, not specifically described but required for a complete and proper installation, as selected by Contractor, subject to the approval of Engineer.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Contractor shall examine areas and conditions under which work of this SECTION will be performed and correct any conditions detrimental to timely and proper completion of work. Examples of detrimental conditions and their corresponding acceptable corrections generally include, but are not necessarily limited to that shown in **TABLE 02200-1**:

Table 02200-1: Typical Detrimental Conditions and Commonly Acceptable Corrections

Detrimental Condition	Correction
Excessively wet soil material	Mix with drier material before incorporating into fill, disking, or push off to the side outside of fill areas
Frozen soil material	Remove and/or comply with 3.9 F of this SECTION
Shallow buried vegetative debris	Excavate and bury per SECTION 02100
Rocks or boulders	Comply with 3.8 C of this SECTION
Ponded water on the site	Comply with 3.6 of this SECTION

- B. Do not proceed with grading in unsatisfactory areas until corrections are completed.

3.2 ELEVATIONS AND LINES

- A. In general, the Project Boundary encloses the total area impacted by construction including the access route to the site. The grading limits show the maximum extent of mass grading operations. Both shall be as shown on Plans, approved by Division and Engineer. Contractor, accompanied by Engineer, shall jointly review the clearing and grading limits prior to clearing operations. The project boundary and grading limits shall be staked according to requirements set forth in SECTION 02010, Field Engineering.
- B. Minor refinements to grading limits, within the designed project boundary, as shown on Plans will be implemented by mutual agreement, in interest of the project, based on field conditions, at no additional cost to Division. It is the intent that the areal extent of these refinements, if any, be offsetting so that there is no significant increase or decrease in Project work.
- C. Constructed grades shall be established to be within three-tenths (0.3) feet of design grades as shown on Plans, except that this tolerance shall be adjusted as necessary to ensure positive drainage in all areas and to achieve earthwork balance with approval of Engineer and Division.

3.3 UTILITIES

- A. Contractor shall take all precautions needed to insure that existing utilities to remain, including septic systems and field tile, are adequately protected. If existing utilities become damaged, the service shall be restored as soon as possible and repairs completed at no cost to the Division.
- B. If active utility lines are encountered that were not made known to Contractor, Contractor shall take the necessary steps to protect the utility and maintain service at no additional cost to Division.
- C. If utility lines are found that interfere with the planned grading, Contractor shall immediately notify Engineer and Division.

3.4 PROTECTION OF PERSONS AND PROPERTY

- A. Contractor shall barricade all open holes and depressions that present a safety hazard during the course of his work.
- B. Contractor shall protect structures, utilities, and other facilities from damage caused by settlement, lateral movements, washouts, sedimentation, vibrations, and other hazards created by operations under this SECTION.
- C. Contractor shall use means necessary to prevent dust from becoming a nuisance to the public, neighbors, and to other work being performed on or near the site.
- D. Contractor shall always maintain access to adjacent areas.

3.5 SEDIMENT AND EROSION CONTROL

- A. Contractor shall implement the SWPPP for this project and conduct all earthwork activities to minimize losses due to erosion and sedimentation.
- B. Effective measures shall be initiated where needed to protect areas adjacent to the site prior to the commencement of clearing, grubbing, excavation, or other operations that will disturb the natural protection. Natural vegetation shall be preserved to the greatest extent possible. Contractor shall prevent siltation of existing and newly constructed drainage ways or repair them as necessary at his own expense.
- C. Work shall be scheduled to expose, for the shortest possible time, areas subject to erosion. SWPPP practices shall be implemented as soon as practical. Adequate and timely maintenance of SWPPP practices and other methods shall be Contractor's responsibility, as well as the subsequent removal of any temporary measures.
- D. Modifications to the SWPPP and repairs will likely be required during the course of the project. The Contractor will work in conjunction with the Engineer and Construction Observer to minimize offsite erosion and sediment. Modifications shall be documented and kept with the SWPPP file maintained by the Contractor.

3.6 CARE OF WATER

- A. Contractor shall be responsible for the care and control of all water that enters the site, either through precipitation, seepage, underground utilities, etc. Contractor shall furnish, install, operate, and maintain means and devices with which to properly remove and dispose of water that interferes with completion of the work. Any discharge shall be to approved drains or channels in accordance with NPDES requirements specified in SECTION – 02110 Impoundments.
- B. Contractor shall provide berms, channels, or basins as needed to protect adjacent areas from flooding caused by run off from the site. Contractor shall promptly remove all water collecting in depressions. Water that collects in depressions that cannot be removed by standard drying methods shall be tested, treated as necessary, and discharged in accordance with SECTION – 02110 Impoundments at no cost to Division.
- C. Any drainage facility used by Contractor shall be adequate to prevent damage to completed work at the site, and adjacent properties. Existing drainage channels and conduits shall be cleaned, enlarged, or supplemented as necessary to carry all increased runoff attributable to Contractor's operations.

3.7 GROUND SURFACE PREPARATION PRIOR TO FILL PLACEMENT

- A. Contractor shall remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills.
- B. Contractor shall plow, strip, or break up surfaces steeper than one (1) vertical to four (4) horizontal so that fill material will bond with existing surface.

3.8 EXCAVATION

- A. Contractor shall excavate material encountered within the grading limits to lines, grades, and elevations indicated on Plans and/or as specified herein. All material excavated is not specifically classified but shall be considered similar to Class 13 Excavation, Iowa DOT Item 2102.02.
- B. Contractor shall make every reasonable attempt to salvage the best soil encountered so that it can be placed within the upper twelve (12) inches of final grade since one of the primary goals of the project is to revegetate the site.
- C. Contractor shall inspect the site and form own opinion on the presence and extent of boulder and rock excavation anticipated.
 - 1. Rock and boulder excavation is not a unit price item and shall be considered as incidental in the unit price for excavation.
 - 2. Any large rocks and/or large boulders encountered during grading shall be relocated as necessary to provide a minimum of three (3) feet of fill over the object.
 - 3. Contractor shall promptly notify Engineer or Construction Observer if excessively large boulders are encountered which cannot be removed or excavated by conventional earth moving or ripping equipment and will not have at least three (3) feet of cover.
 - 4. Contractor shall not use explosives
- D. Contractor shall excavate and fill in a manner and sequence that will provide proper drainage at all times and minimizes off site sedimentation.
- E. Contractor shall properly backfill any unauthorized excavation, unless permission is received by Engineer and Division. Unauthorized excavation includes removal of materials beyond indicated elevations or dimensions, or Project Limits without a properly executed Change Order or Contract Amendment authorizing such additional excavation.
- F. Contractor shall be responsible for the safety and maintenance of all excavation sides and slopes until completion of backfilling and shall comply with all OSHA requirements.
- G. If coal seams are encountered during excavation, Contractor shall notify Division and the following shall apply:
 - 1. For coal seams located in "cut" areas above finished grades, the coal shall be excavated and buried in designated fill areas with at least three (3) feet of suitable cover soil. This work shall be performed at no additional cost to the Division.
 - 2. Coal seams encountered at or near finished grade, shall be over excavated a minimum three (3) feet and buried in an area designated by Engineer or Division and covered with at least three (3) feet of suitable soil. The excavation from which the coal seam was

extracted shall be backfilled with a minimum three (3) feet of suitable material. Depending upon the location and extent of the coal seam encountered near finished grade, Division may, negotiate a change order to compensate Contractor for the additional work of handling the coal seam.

3.9 FILL PLACEMENT AND COMPACTION

- A. Contractor shall place general fill materials in lifts not more than twenty- four (24) inches in loose thickness and run all rubber-tired equipment (i.e. scrapers, dump trucks) over the entire lift. If only track equipment is being used, the maximum loose lift thickness shall be limited to twelve (12) inches.
- B. General fill shall be placed in horizontal lifts. To facilitate horizontal placement of general fill, benching into existing slopes shall be required as described in Table 02200-2:

Table 02200-2 Benching Requirements for Placing General Fill On Existing Slopes

Slope	Benching Requirements
slope > 1:1	none: fill operations proceed from base upward in uniform lifts
1:1 ≥ slope ≥ 8:1	2' minimum height benches
8:1 > slope ≥ 10:1	1' minimum height benches
slope < 10:1	none: scarification required to promote bonding with fill material

- C. In areas of existing water impoundments as shown on Plans, and upon completion of dewatering, fill initiation shall be performed in accordance with Item 3.10 "Initiating Fill Placement in Ponds and Wet Areas" below.
- D. Fill placed in structural areas, such as embankments, shall be placed and compacted as discussed in SECTION 02220 – EARTHWORK, DAMS.
- E. Fill placed to construct terraces or roadways, shall be placed in lifts not to exceed twelve (12) inches in thickness and compacted in place with the wheels of rubber-tired equipment. If tracked equipment is used, the lift thickness shall not exceed six (6) inches. Fill material shall consist of cohesive material with a suitable moisture content to achieve compaction.
- F. Contractor shall not place frozen materials within any structural area and can only use frozen material as fill if all of the following conditions are met:
 - 1. Fill shall not be placed on any areas where the frost depth exceeds one (1) inch. Removal of frost materials shall be made at no additional expense to Division.
 - 2. Frozen materials shall be broken up so that no dimension of an individual piece exceeds about six (6) inches. Frozen material shall be well mixed with unfrozen material throughout lift to be compacted.
 - 3. Each lift containing frozen materials shall be covered with at least twenty-four (24) inches of frost-free materials.
- G. Refer to Supplemental Specifications concerning fill areas deeper than fifteen (15) feet.

3.10 INITIATING FILL PLACEMENT IN PONDS AND WET AREAS

- A. Contractor shall place fill in pond and wet areas in a manner that minimizes fill settlement in these areas as much as practical. Prior to placing fill in these areas, Contractor shall discuss his grading plans in these areas with Engineer in the dewatering planning meeting.

- B. Prior to placing fill in these areas, Contractor shall dewater areas with standing or impounded water in accordance with the neutralization and dewatering plan as developed in accordance with SECTION 02110 – Impoundments.
- C. In shallow swampy areas, Contractor may work these areas by pushing out the bottom muck with dry material from one end to the other. Contractor may have to periodically allow the muck time to drain, perhaps as much as several days, during filling operations in these areas. Work can be completed in other areas of the site during this drying time.
- D. In areas where deeper muck is present, Contractor shall initiate filling operations using one or more of following approved methods, or another method selected by Contractor subject to review and approval by Engineer. Individual methods may not be suitable for all applications.
 - 1. Squeeze out muck in bottom by dozing in dry material from one end of pond towards other. Contractor may have to periodically allow muck time to drain, perhaps several days, during which time Contractor may continue work elsewhere prior to resuming mucking operations.
 - 2. Push in dry material and intermix with muck until stable.
 - 3. Use cell method to isolate smaller zones within the area to be filled. The cell method consists of constructing cofferdams of widths no more than required for a dozer to properly construct them. These cofferdams shall be spaced as necessary to complete filling over the muck. The zones created by the cofferdams shall then be worked in accordance with items 1 and/ or 2 above.
 - 4. In areas receiving relatively deep fills (over ten (10) feet), Contractor may place an initial lift of no more than four (4) feet in height to bridge over the muck. Subsequent lifts shall be placed and compacted as outlined in Section 3.9 above. Any of these areas that result in slope instability or excessive settlement in the future shall be corrected as necessary by Contractor at no additional cost to Division.
 - 5. Any other method selected by Contractor and reviewed by Engineer which achieves desired objective, which is to permit stable filling operations to continue.
- E. Contractor shall prevent siltation of existing drainage ways and ponds during mucking operations and placement of fill over muck. Failure of Contractor to protect silt from leaving Project Limits shall be corrected at no cost to Division. Any vegetation disturbed as a result of failure shall be replaced in kind at no cost to Division.

3.11 GRADING

- A. The Contractor shall uniformly grade areas within the Project Limits as shown on the plans and as specified in this SECTION. Contractor shall also grade the transition areas adjacent to the site as needed to complete work and provide a smooth transition.
- B. In areas where a change of slope is required, Contractor shall construct a rolled transition section having a minimum radius of approximately eight (8) feet, unless adjacent construction will not permit such a transition, or if such a transition defeats positive control of drainage.
- C. Contractor shall finish grade all areas to drain readily.

3.12 FIELD QUALITY CONTROL

- A. Contractor shall obtain approval from Engineer or Construction Observer based on their inspection and approval of subgrades in fill areas prior to placement of fill.
- B. Contractor shall make changes in placement of fill material within the Project Limits as needed to adjust for inaccuracies inherent with estimating the shrinkage factor. These changes shall be made only after consultation with and direction from Engineer and/or Division.
- C. Contractor shall provide additional compaction of fill as directed by Engineer and Construction Observer if Engineer and Construction Observer determines that fills have been placed that were not properly compacted.
- D. Contractor shall notify Engineer and Construction Observer upon completion of stages of construction and obtain Engineer's approval before commencing with subsequent stages of construction.

3.13 MAINTENANCE

- A. Contractor shall protect all areas of newly graded fill as follows:
 - 1. Protect newly graded areas from traffic and erosion and keep free from trash and weeds.
 - 2. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.
- B. Contractor shall scarify the surface, reshape, and compact (if necessary) any completed areas that are disturbed by subsequent construction operations or adverse weather, prior to further construction, such as riprap placement or seeding.
- C. Contractor shall maintain new and existing drainage ways free from detrimental quantities of sediment, leaves, sticks, trash, and other debris during execution of the work.
- D. Contractor shall always maintain access to adjacent areas.
- E. Upon request by Engineer or Division, Contractor shall dredge or re-excavate drainage channels if these become silt-filled prior to establishment of vegetation. If the site has not yet been seeded, dredged material may be spread within the Grading Limits. If the site has been seeded, Contractor shall dispose of the dredged material in a manner and location approved by Engineer or Division.
- F. Contractor shall remove accumulated sediment from designed wetland ponds that were used for sediment control during construction.

PART 4 - MEASUREMENT AND PAYMENT

4.1 UNIT PRICES

- A. Construction cost of work included in this SECTION of the Construction Specifications shall be included in Contractor's unit prices set forth in the Proposal and Schedule of Prices (*Document C*) for work items described below. The unit price for each of these items shall include its pro rata share of overhead so that sum of products obtained by multiplying unit prices so set forth by amount of work constructed and measured as described herein, shall constitute full payment to Contractor for performance of work included in this SECTION.

- B. Measurement and payment for each work item in this SECTION shall be in accordance with following:

1. *Excavation*: Payment for the cost of excavation shall include all of the work necessary to complete grading the site to design grade as shown on the Plans. The preparation and implementation of Erosion Control Plan shall be paid under separate bid items.

Engineer shall determine in cubic yards the total amount of excavation to grade the site to the specified design grades. There will be no measurement and payment for overfill, overexcavation or unauthorized excavation. Assuming Contractor accepts original ground lines and the Engineer and Division agree, payment for this bid item will be based on the plan quantities which have been determined using a computer analysis. The Division reserves the right to require a topographic survey of final grades if they do not appear to be in compliance with the Plans.

If Contractor or Division does not accept the plan quantities, the following steps outlined below will be followed for payment.

- a. Contractor shall provide survey information to Engineer regarding the disputed existing topographic information as stated in Paragraph 1.4.D.2 of this Section.
- b. Contractor shall determine the amount of material excavated by completing a full survey of the site after completion of clearing but before commencement of significant earthwork activities and another full survey after all grading is completed. Contractor shall submit all survey notes and data to Engineer who will determine the amount of excavation based on this information. At a minimum, all survey information shall extend to the extremities of the grading limits shown on the plans.
- c. The grade tolerance established in Paragraph 3.2 above is to permit latitude in achieving final grades. Widespread overexcavation of up to three-tenths (0.3) feet in cut areas, either accidentally or for the sole purpose of increasing pay quantities, shall not be recognized for measurement and payment. In these instances, Division reserves the right to base the paid quantity of cubic yards of excavation upon the design grade contours shown on the plans.
- d. If the final grades do not appear to be in compliance with the plans, Division reserves the right to require a full topographic survey. Contractor shall provide to Engineer, at no cost to Division, electronic survey data for determining the final earthwork quantities using the original ground lines as stated in Paragraph 1.4.D.2 of this Section.

Contractor shall be paid at unit price for "Excavation" for each cubic yard as measured above. Said unit price shall constitute full payment for excavation, dewatering (excepting for discharge required in SECTION 02110), boulder relocation and burial, placing of fill, compaction, grading, and all incidental work pertaining thereto. No separate payment item is included for unauthorized excavation.

Partial pay requests will be made on the estimated percentage complete as agreed to by Contractor and Engineer applied to the contract totals for this bid item. Payment for the full amount of grading will only be made after the final staking is completed and the grading is accepted as completed by the Engineer.

2. *Erosion Control Measures:* Erosion Control Measures shall be implemented and paid for as provided in SECTION 02120 – Sediment and Erosion Control.

4.2 SUMMARY – UNITS OF MEASUREMENT:

Units of measurement for bid items applicable to work covered by this SECTION are as follows:

<u>Description</u>	<u>Unit</u>
Excavation	Cu. Yd.

END OF SECTION 02200

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SECTION 02220 - EARTHWORK, DAMS

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PART 1 - GENERAL

1.1 DESCRIPTION

Work Included:

Work under this SECTION covers requirements for materials, tools, equipment and services necessary to complete the Earth Dams for this project. The work shall include, but is not necessarily limited to, completion of the following work:

- A. Field engineering.
- B. Excavation.
- C. Dewatering of excavations prior to filling as may be required.
- D. Conveyance, placement, and compaction of excavated materials.
- E. Chemical/mechanical soil stabilization as may be required.
- F. Implementation of Storm Water Pollution Prevention Plan (SWPPP).

1.2 REFERENCE SPECIFICATIONS

- A. The following specifications or applicable standards are incorporated by reference into this SECTION:
 - 1. SECTION 02250 – EARTHWORK, SELECT BORROW
 - 2. SECTION 02310 – DRAINAGE SYSTEMS, DAMS AND STRUCTURES
 - 3. ASTM D1556: Density of Soil-in-Place by Sand-Cone Method or other equivalent method with Engineers approval.
 - 4. ASTM D698: Moisture-Density Relations of Soils and Soil-Aggregate Mixtures – Standard Proctor Test.
 - 5. ASTM D2922: Density of Soil and Soil Aggregate In-Place by Nuclear Methods.
 - 6. ASTM D3017: Standard Test Method for Water Content of Soil and Rock In-place by Nuclear Methods.
 - 7. ASTM D2487: Unified Soil Classification System (USCS).
 - 8. ASTM D4253: Maximum Index and Unit Weight of Soils Using a Vibratory Table.
 - 9. ASTM D4254: Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
 - 10. ASTM D558: Moisture-Density Relations of Soil-Cement Mixtures.
 - 11. ASTM D422: Particle-Size Analysis of Soils.

- 12. ASTM D4318: Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- 13. Iowa Department of Transportation Standard Specifications for Highway and Bridge Construction (IDOT).
- B. Above-mentioned references, which do not appear printed with the Contract Documents, can be provided to Contractor upon request.

1.3 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this SECTION.
- B. Use equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner.
- C. In addition to complying with requirements of governmental agencies having jurisdiction, comply with the directives of Engineer and Division.
- D. The Division/Engineer will retain the services of a Geotechnical Engineer to provide inspection of the core trench, material evaluation and approval, and compaction testing of fill where required. Contractor shall be responsible for coordinating and providing advance notice of any operations involving these components to allow adequate time for scheduling and testing.

1.4 JOB CONDITIONS

Nature of Work Site

- A. Materials to be handled under this Contract include quantities of spoil, gob, and coal refuse which may be toxic and/or acidic in nature.
- B. The Project site is situated in an area where underground coal mining could have been conducted. There is a possibility that mine drifts or shaft openings are present on site. Contractor shall exercise reasonable caution in recognition of this potential hazard and shall notify Engineer immediately upon discovery of any openings. Sealing of openings will be incorporated into this Contract through issuance of change orders, as required. Additional specifications will be provided by Division as needed.
- C. During excavation in existing spoil piles, Contractor shall recognize possible existence of cavities or smoldering fires and, if encountered, shall notify Engineer promptly. Contractor shall exercise caution and be prepared to take appropriate actions since accelerated combustion may occur. Burning materials shall be extinguished before being covered or incorporated as fill. Contractor shall notify Division and Engineer if smoldering fires are encountered.
- D. Spoil material used to construct fills is subject to significant increase in pore water pressure, particularly during rapid construction, with a corresponding decrease in shear strength, and thus slope stability. Contractor shall exercise caution and notify Engineer and Division promptly should signs of slope instability appear.

1.5 PERMITS AND FEES

Division has obtained any required permits from the Iowa Department of Natural Resources (IDNR) as required for construction of the dam(s) on this Project. All requirements of the permit(s) have been incorporated into the Construction Specifications and Plans.

1.6 SUBMITTALS

- A. Contractor shall submit or assist with obtaining samples of all on-site or off-site materials intended to be used to complete the work included in this SECTION. The samples shall be obtained by or submitted to the designated Geotechnical Engineer at least ten (10) working days in advance of its intended use. All samples shall be marked with its source and intended use.
- B. The Geotechnical Engineer shall make appropriate examinations, classifications, and perform necessary tests to determine the suitability of the material for its intended use. Engineer will notify Contractor of the suitability of the submitted samples. Any submitted samples deemed unsuitable shall not be used as intended and new samples must be submitted to or obtained by the Geotechnical Engineer.
- C. Contractor shall schedule and coordinate all construction activities requiring observation and testing with Engineer and/or Construction Observer and the designated Geotechnical Engineer.
- D. Copies of all laboratory and field tests will be provided to Contractor, Engineer and Division.

PART 2 - PRODUCTS

2.1 FILL MATERIAL

- A. Impervious Fill Material: Material used as impervious fill in areas designated on the Plans shall be obtained from the area(s) indicated on the Plans as Impervious Fill Material, or in areas as approved by Engineer and Division. Impervious Fill Material shall consist of clay or weathered shale materials that do not have less than sixty percent (60%) by dry weight passing a Standard No. 200 U.S. Sieve. Impervious fill shall be sorted to remove all material having any dimension greater than four (4) inches. All impervious fill shall be classified as CL, CH, or CL-CH in accordance with Unified Soil Classification System (USCS). All impervious fill shall be free from debris, roots, organic matter, frozen material, and coal refuse. Any layers or pockets of granular materials encountered within impervious fill borrow shall not be incorporated as impervious fill.
- B. General Fill Material: General fill materials consist of spoil piles, coal refuse materials, gob and all other soil material from required cut operations. All boulders, large rocks, organic matter, frozen material, and miscellaneous debris shall be sorted out and not used within the footprint of the dam.

2.2 FILTER SAND

- A. Material used to construct the filter blanket and the toe drain backfill shall conform to one of the following IDOT gradations. Fine aggregate shall not be of calcareous (limestone) nature. Submit material certifications to Engineer.

SECTION 4112, PCC Intermediate, Gradation No. 2.

SECTION 4117 (Class V), PCC FA & CA, Gradation No. 7.

SECTION 4131, Porous Backfill, Gradation No. 29.

SECTION 4134 (Natural Sand), Floodable Backfill, Gradation No. 36.

2.3 DAM OUTLET STRUCTURES

- A. Refer to SECTION 02310 - DRAINAGE STRUCTURES, DAMS

2.4 SELECT BORROW

- A. Refer to SECTION 02250 - EARTHWORK, SELECT BORROW

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this SECTION will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 ELEVATIONS AND LINES

- A. Contractor shall stake the alignment and grades of earth dams in the field as shown on the Plans.
- B. Rough grading shall be to within three-tenths (0.3) feet of lines and grades as shown on the Plans.
- C. The crest of the dam at its midpoint shall be overbuilt as indicated on the Plans to accommodate anticipated future settlement. The overbuilt crest of the dam shall taper from its mid-point to zero (0) inches at both abutments.

3.3 MAINTENANCE

- A. Protection of newly graded areas.
1. Protect newly graded areas from traffic and erosion, and keep them free from trash and weeds.
 2. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.

- B. Contractor shall scarify the surface, reshape, and compact (if necessary) any areas where grading is completed that becomes disturbed by subsequent construction operations or adverse weather, prior to further construction.
- C. Contractor shall maintain new and existing drainage ways free from detrimental quantities of sediment, leaves, sticks, trash and other debris during execution of the work.
- D. Contractor shall maintain access to adjacent areas at all times.
- E. Contractor shall implement the approved SWPPP for this Project and conduct all excavation and select borrow placement activities to minimize losses due to erosion and sedimentation of adjacent areas.

3.4 WATER CONTROL

- A. Contractor shall furnish, install, operate, and maintain all necessary and sufficient equipment and methods for controlling surface water and groundwater during construction of the earthen dam.
- B. Cofferdams may be used to divert water or collect water for pumping to protect the earth dam during construction. Cofferdams should be located beyond the limits of the proposed earth dam. The cofferdam(s) shall be removed after completion of the dam unless other arrangements are made with Engineer and Division.
- C. All excavations required for construction of the earth dam and drainage structures shall be dewatered as necessary to prevent excessive disturbance of exposed subgrade and allow for fill placement and compaction. Dewatering should be accomplished using pumps, drains, or other suitable methods.

3.5 SUBGRADE PREPARATION

- A. Contractor shall remove all vegetation, topsoil, soft or otherwise unsuitable material from the footprint of the dam as shown on the plans. Excavate further as needed to the subgrade elevation lines shown on the plans.
- B. The exposed subgrade shall be proofrolled with heavy equipment such as a loaded scaper or tandem-axle dump truck in the presence of the Geotechnical Engineer, and Engineer or Division. Soft or disturbed areas shall be improved by disking, drying and compacting with a sheep's foot roller or by overexcavating and replacing with suitable, properly compacted, impervious fill. The area and depth of the overexcavation as approved by Division and Engineer shall be jointly measured by Engineer and Contractor for payment quantities prior to backfilling.

3.6 CORE TRENCH

- A. The core trench shall be excavated in the location shown on the plans after the dam footprint has been stripped, proofrolled, and corrected as needed. The core trench shall extend to the minimum width and depth as shown on the plans, unless bedrock is encountered or conditions warrant additional excavation as determined by the Geotechnical Engineer.
- B. The Geotechnical Engineer and Engineer shall observe the core trench prior to backfilling. If additional excavation is required due to the site conditions, the Division shall be informed immediately and this additional excavation shall be measured for payment. If additional

excavation is required due to inadequate water control measures or construction techniques used by Contractor, this additional excavation and backfilling shall be completed at no additional cost to Division.

- C. The final core trench dimensions shall be measured jointly by Contractor and Engineer prior to backfilling. Only the amount of excavation approved by Engineer and Division shall be computed for payment. Additional excavated areas extending beyond the amount approved shall be properly backfilled at no additional cost to Division. Any survey information obtained by Contractor shall be provided to Engineer.
- D. The core trench shall be backfilled with impervious fill after receiving approval by Engineer. The impervious fill shall be placed and compacted in accordance with the requirements of this Section.
- E. The core trench shall be dewatered when necessary to allow for observations by Engineer and during fill placement. Subgrade and fill materials that become disturbed or too wet for proper compaction shall be removed and replaced at no additional cost to Division.

3.7 IMPERVIOUS FILL PLACEMENT - DAM

- A. Impervious fill, as approved by the Geotechnical Engineer, shall be placed in the core trench and within the designated areas of the embankment. Impervious fill shall also be placed as the pond liner where indicated on the Plans.
- B. Impervious fill shall be placed in horizontal lifts for the core trench and dam. Vertical benches shall be cut into adjacent slopes as needed to allow for horizontal placement.
- C. Impervious fill shall be placed and spread in horizontal loose lifts of no more than nine (9) inches and compacted to at least ninety-five (95) percent of the material's maximum standard Proctor dry density.
- D. The moisture content of the impervious fill shall be adjusted as needed by disking and drying or wetting the material to be within the range of minus two (2) percent to plus four (4) percent of the material's optimum moisture content as determined by the standard Proctor test.
- E. Compaction of impervious fill and general fill within the footprint of the dam and for the pond liner shall be accomplished with a sheep's foot roller meeting IDOT Section 2001.05A, Tamping-type rollers. Manual compaction equipment shall be used as required to prevent damage to structures and shall meet the same compaction requirements. No other types of compaction equipment will be allowed for placement of impervious fill, unless written approval is obtained from Division or Engineer.
- F. The exposed surface shall be properly prepared prior to placement of each subsequent lift. If the exposed surface becomes too smooth to bond to the next layer, the existing layer shall be scarified. If the exposed surface becomes excessively dry or moist, the surface shall be scarified and moisture conditioned as necessary before placing subsequent fill layers.
- G. Impervious fill shall not be placed during periods of freezing weather or over frozen materials. Frozen material shall not be used as impervious fill.

3.8 IMPERVIOUS FILL PLACEMENT- POND LINER

- A. The subgrade in pond areas to receive impervious fill shall be established to allow the design thickness of impervious material to be placed.
- B. The exposed subgrade shall be disked to a depth of at least six (6) inches and observed by the Geotechnical Engineer. Areas with sandy or otherwise unsuitable materials will be overexcavated and replaced with impervious fill. The overexcavation will extend so that at least two (2) feet of compacted and impervious material is present over sandy material. The exposed subgrade shall be moisture conditioned as necessary to be within minus two (2) percent to plus four (4) percent of the standard Proctor optimum moisture content. The disked subgrade material shall be compacted to at least ninety (90) percent of the material's standard Proctor maximum dry density.
- C. Impervious fill for the pond liner shall be placed in loose lift thicknesses or no more than eight (8) inches and compacted to at least ninety (90) percent of the material's maximum standard Proctor dry density at a moisture content between minus two (2) percent and plus four (4) percent of the material's maximum standard Proctor moisture content.

3.9 CONTROLLED GENERAL FILL PLACEMENT

- A. Controlled general fill materials shall be placed in the portions of the dam as shown on the plans adjacent to the impervious fill areas to the rough grade shown on the plans. General fill shall be placed concurrently with impervious fill.
- B. Controlled general fill placed within the footprint area of the dam shall be placed in horizontal lifts not to exceed twelve (12) inches in loose thickness. Each lift shall be compacted to at least ninety (90) percent of the material's maximum standard Proctor dry density. The moisture content of the general fill placed adjacent to the impervious fill within the footprint of the dam shall be adjusted as needed by diskings and drying or wetting to be within minus two (2) percent to plus four (4) percent of the material's optimum moisture content as determined by the standard Proctor test.
- C. Compaction of controlled general fill within the footprint area of the dam shall be accomplished with a sheep's foot roller meeting IDOT Section 2001.05A, soil compaction rollers. Manual compaction equipment shall be used as required to prevent damage to structures and shall meet the same compaction requirements. No other compaction equipment will be allowed for placement of impervious fill, unless written approval is obtained from Division.
- D. Controlled general fill shall not contain frozen materials, be placed over frozen material, or be placed during a period of freezing weather.

3.10 INTERNAL DRAINS

- A. The dam construction may include installation of internal drains such as a downstream drainage blanket, chimney drain and/or toe drain. Placement of impervious and general fill shall be completed in a manner that insures these drains function properly.
- B. Refer to SECTION 02310 – DRAINAGE STRUCTURES – DAMS and to the Plans for further details.

3.11 OUTLET STRUCTURES

The dam construction may include installation of both primary and emergency spillways. Refer to SECTION 02310 – DRAINAGE STRUCTURES – DAMS and to the Plans for further details.

3.12 SELECT COVER PLACEMENT

When select cover material is required, this material shall be placed after completion of construction of the earthen dam at the locations and with the thickness shown on the Plans. Refer to SECTION 02250 – EARTHWORK, SELECT BORROW.

3.13 TESTING

- A. Division shall pay all field and laboratory soil tests to ensure that proper compaction and moisture control are being achieved. All test data shall be regularly submitted by the selected Geotechnical Engineer to Engineer, Division, and Contractor.
- B. A minimum of one (1) standard Proctor test shall be performed on each cohesive material type used to construct the dam. Additional laboratory tests will be performed as needed to determine the material's suitability for its intended use.
- C. In-place field density tests shall be performed in sufficient number and locations to ensure that the impervious fill is being placed and compacted in accordance with the Construction Specifications. As a minimum, one (1) test shall be performed for every two (2) feet of loose fill thickness placed and at a maximum spacing of one hundred (100) feet along the length of the dam both within the impervious fill and general fill sections. Tests performed for the pond liner shall be taken as needed to ensure proper compaction and no less than on a one hundred (100) foot grid for each lift, including the subgrade.
- D. All areas with failing tests shall be reworked by Contractor and retested by the Geotechnical Engineer until the required compaction and the proper moisture content is achieved.
- E. Additional or supplemental field or laboratory tests requested by or conducted for the convenience of Contractor shall be completed at no additional cost to Division.

PART 4 - MEASUREMENT AND PAYMENT

4.1 UNIT PRICES

- A. Construction cost of all work included in this SECTION of the Construction Specifications shall be included in Contractor's unit prices set forth in the Proposal and Schedule of Prices (*Document C*) for the work items described below. The unit price for each of these items shall include its pro rata share of overhead so that the sum of the products obtained by multiplying the unit prices so set forth by the amount of the work constructed and measured as described herein, shall constitute full payment to Contractor for performance of the work included in this SECTION.
- B. Measurement and payment for each work item in this SECTION shall be in accordance with the following:
 - 1. *Undercut Excavation, Earth Dam*: The unit price for this item shall include all equipment, materials, and labor to remove material below the footprint of the dam as discussed in the Subgrade Preparation and Core Trench portions of this SECTION. Said unit price shall constitute full payment for undercut excavation, and all incidental work pertaining thereto.

Excavations for dewatering and cofferdams, if needed, are incidental to construction of the embankment and will not be included in the undercut quantity. Excavation for toe drains, filter sand, and outlet works conduit, if needed, will not be measured for payment and this associated cost should be included in the unit prices for each of these items.

Contractor will be paid for the undercut excavation based on conditions encountered during construction. The undercut area will be jointly measured by Contractor and Engineer. The backfill required for any overexcavation will be paid for as impervious fill. Any undercut excavation and associated backfill not approved by Engineer and Construction Observer will not be measured for payment.

Contractor shall be paid at the unit price for "Undercut Excavation" for each cubic yard as measured above. The quantity of cubic yards for the undercut excavation included in the bid items have been separated out of the overall excavation required for rough grading.

2. *Impervious Fill, Earth Dam and Pond Liners:* The unit price for this item shall include all equipment, materials, and labor required to properly place approved material in the core trench, undercut excavation, and within the designated area of the dam and pond liner as shown on the plans. Said unit price shall constitute full payment for dewatering, moisture adjustment and compaction, and all incidental work pertaining thereto.

Contractor will be paid for the bid quantity of impervious fill for the earth dam provided in the specifications unless additional undercut excavation was required or other changes were needed based on conditions encountered during construction. If additional undercut excavation was required, the approved quantity will be added to the bid quantity for impervious fill. If other areas of impervious fill were required by Engineer that are not shown on the plans or were not measured as part of the undercut, these areas will be jointly measured by Contractor and Engineer/Construction Observer. Any impervious or general fill placed in undercut excavations not approved by Engineer will not be measured for payment.

Contractor shall be paid at the unit price for "Impervious Fill" for each cubic yard compacted in place and as measured above. The quantity of cubic yards for the impervious fill included in the bid items have been separated out of the overall excavation required for rough grading and has been adjusted for the shrinkage rate indicated in the Supplemental Specifications or Plans.

3. *Controlled General Fill, Earth Dam:* The unit price for this item shall include all equipment, materials, and labor required to properly place approved material within the designated area of the dam as shown on the plans. Said unit price shall constitute full payment for dewatering, moisture adjustment and compaction, and all incidental work pertaining thereto.

Contractor will be paid for the bid quantity of controlled general fill for the earth dam as shown on the plans and in any other areas requested by Division and Engineer. Any controlled general fill placed in areas not approved by Engineer or Division will not be measured for payment. The quantity of cubic yards for the controlled general fill included in the bid items have been separated out of the overall excavation required for rough grading and has been adjusted for the shrinkage rate indicated in the Supplemental Specifications or Plans.

4.2 SUMMARY – UNITS OF MEASUREMENT:

Units of measurement for bid items applicable to work covered by this SECTION are as follows:

<u>Description</u>	<u>Unit</u>
Undercut Excavation, Earth Dam	Cu. Yd.
Impervious Fill, Earth Dam	Cu. Yd.
Impervious Fill, Pond Liner	Cu. Yd.
Controlled General Fill, Earth Dam	Cu. Yd.

END OF SECTION 02220

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SECTION 02230 - EARTHWORK, SHAFTS

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PART 1 - GENERAL

1.1 DESCRIPTION

Work Included

Work under this SECTION covers requirements for materials, tools, equipment, and services necessary to complete the filling of shafts for this project. The work shall include, but is not necessarily limited to, completion of the following work:

- A. Excavation.
- B. Conveyance.
- C. Placement of materials.
- D. Grouting.
- E. Discharging water.
- F. Site grading.

1.2 REFERENCE SPECIFICATIONS

- A. The following specifications or applicable standards are incorporated by reference into this SECTION:
 - 1. SECTION 02110 – IMPOUNDMENTS
 - 2. Detail Drawing -- Obelisk Site Marker (available from Division)
 - 3. Detail Drawing – Site Marker Plate Embedment (available from Division)
- B. Above-mentioned references, which do not appear printed with the Contract Documents, can be provided to Contractor upon request.

1.3 QUALITY ASSURANCE

- A. Contractor shall use adequate numbers of skilled workers who are thoroughly trained and experienced in necessary crafts and who are completely familiar with specified requirements and methods needed for proper performance of work of this SECTION.
- B. Contractor shall use equipment adequate in size, capacity and numbers to accomplish work in a timely manner.
- C. Contractor shall comply with requirements of governmental agencies having jurisdiction and with directives of Engineer and Division.

1.4 JOB CONDITIONS

- A. Any known shaft openings have been identified on the Plan Sheets. Unknown shafts, not shown on the plans may be discovered during construction. Contractor should recognize that additional unidentified openings may be encountered at the site.

- B. The Project site is situated in an area where underground coal mining was conducted. There is a possibility that mine drifts or additional shaft openings are present on site. Contractor shall exercise reasonable caution in recognition of this potential hazard. Contractor should also recognize that the soil around the shaft may be very unstable.

1.5 SUBMITTALS

Submittals include, but are not necessarily limited to weight tickets and/or shipping tickets for Rubble Fill Material and Granular Backfill Material delivered to site.

1.6 SITE DISTURBANCES

- A. Contractor shall take precautions, so equipment and vehicles do not unnecessarily disturb or damage existing grading or other site improvements.
- B. Contractor shall repair any damaged haul roads.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

- A. Rubble

Rubble shall consist of fragments of rock or masonry crumbled by natural or manmade forces. The size of the rubble shall be angular and equal to or larger than IDOT Item 4130.04, Erosion Stone (a nominal six (6) inch mixture). The maximum size will depend on the size of the shaft opening, placement method, and other factors.

- B. Granular Backfill Material

Granular backfill material shall consist of well-graded material similar to IDOT Type 4120.

- C. Select Borrow Material

Select Borrow Material shall consist of cohesive material that will support vegetation.

2.2 SITE MARKER

- A. A site marker will be placed adjacent to the closed shaft and shall include the following:
 - 1. A twelve-inch diameter concrete obelisk cast in place using a circular sonotube form. Consult Division for approved detail.
 - 2. A stainless-steel marker plate inscribed with the year erected and the project name, along with the name and phone number of the Division (515-281-4246). The stainless steel plate shall be five (5) inches wide by seven (7) inches long. Marker furnished by the Division and installed by Contractor. The marker plate will be pressed into the top of the concrete obelisk before the concrete hardens and secured with stainless-steel bolts. Consult Division for approved detail.
 - 3. Three (3) steel T-posts, each at least seven (7) feet long.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

Contractor shall examine areas and conditions under which work of this SECTION will be performed. Contractor shall correct conditions detrimental to timely and proper completion of work and cannot proceed until unsatisfactory conditions are corrected.

3.2 CARE OF WATER

During Construction, Contractor shall provide and always maintain ample means and devices with which to promptly remove and dispose of all water from every source entering the excavation as is necessary to complete the work. Contractor shall dewater as is necessary to allow for proper performance of the backfill that will reduce future subsidence. All water shall be neutralized as needed and discharged to approved drains or channels in accordance with NPDES requirements. These standards are specified in SECTION 02110 IMPOUNDMENTS.

3.4 EXCAVATION

- A. Contractor shall excavate materials encountered within limits of work that will allow for safety, placement of machinery, and fill placement.
- B. Contractor shall excavate around the entrance of the shafts as is needed to allow for placement of fill materials and as shown on the Plans. In general, the excavation should extend to the bottom of the entrance such that the bottom width is two (2) feet wider than the existing opening.

3.5 FILL PLACEMENT AND COMPACTION

- A. Contractor shall place Rubble Fill Material in the shaft to the depth from the surface as shown on the plans in such a manner as to avoid displacing materials located in the walls of the shaft. This may require the use of a conveyor or tremie to place the material. Other methods approved by Engineer may be used.
- B. Contractor shall place the rubble fill material within the excavation so that the material extends at least one (1) foot above the estimated mine roof and no more than four (4) feet from final grade, or as otherwise directed by the Engineer. The material shall be compacted every five (5) feet of material placement using the bucket of the excavator when practical.
- C. Contractor shall place a minimum of two (2) feet of Granular Backfill above the mixture of Rubble Fill Material, or as otherwise shown on the Plans or as directed by Engineer. Where possible, the Granular Backfill shall be compacted in place for every two (2) feet of material placed with the flat portion of the bucket of a hoe or similar equipment.
- D. Contractor shall place a minimum of two (2) feet of Select Borrow Material above the Granular Backfill Material or as otherwise shown on the plans or directed by Engineer. Contractor shall overfill the area a minimum of one (1) foot or as otherwise shown on the plans to allow for settlement. Contractor shall shape the final grade so that surface water is directed away from the abandoned mine shafts.

3.6 PLACEMENT OF SITE MARKER

- A. The permanent site marker shall be installed at the center of the shaft, and buried so that one (1) foot of the pipe is showing. The pipe shall be filled with grout or concrete. The brass plate shall

be bent ninety (90) degrees, two (2) inches from each end to form a "U" shape. The ends shall then be forced into the fresh concrete so that the inscription is showing and the inscription will be flush with the concrete and the top of the pipe. A seven (7) foot steel t-post shall be installed within one (1) foot of the permanent site marker such that around two (2) feet is embedded in the ground.

PART 4 - MEASUREMENT AND PAYMENT

4.1 UNIT PRICES

- A. Construction cost of work included in this SECTION of the Construction Specifications shall be included in Contractor's unit prices set forth in Proposal and Schedule of Prices (Document C) for work items described below. The unit price for each of these items shall include its pro rata share of overhead so that sum of products obtained by multiplying unit prices so set forth by amount of work actually constructed, measured as described herein, shall constitute full payment to Contractor for performance of work included in this SECTION.
- B. Measurement and payment for each work item in this SECTION shall be in accordance with following:
1. *Fill Material, Rubble*: The unit price, to the nearest one tenth (0.1) ton, as determined by weight tickets, and shall include all materials and work required for installation of the Rubble in conformance with the details and dimensions shown on the Plans and Specifications and as approved by Engineer.
 2. *Fill Material, Granular Backfill Material*: The unit price, to the nearest one hundredth (0.01) ton, as determined by weight tickets, and shall include all materials and work required for installation of the Granular Backfill Material in conformance with the details and dimensions shown on the Plans and Specifications or as approved by Engineer.
 3. *Fill Material, Select Borrow*: The lump sum price shall include materials and work necessary for construction of Fill Material from Select Borrow which will include discharging water, fill placement and grading.
 4. *Site Marker*: The unit price shall include the cost of all materials and labor to install the site marker, including, the steel pipe, brass marker, concrete to fill the pipe, and steel t-posts adjacent to the marker.

4.2 SUMMARY – UNITS OF MEASUREMENT:

Units of measurement for bid items applicable to work covered by this SECTION are as follows:

<u>Description</u>	<u>Unit</u>
Fill Material, Rubble	Ton
Fill Material, Granular Backfill	Ton
Fill Material, Select Borrow	Lump Sum
Site Marker	Each

END OF SECTION 02230

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PART 1 - GENERAL

1.1 DESCRIPTION

- A. **Work Included:** Work under this SECTION covers requirements for materials, tools, equipment and services necessary to complete the drainage systems for this project. The work shall include, but is not necessarily limited to, completion of the following work:
1. Field engineering
 2. Complete installation of all waterways
 3. Terraces construction
 4. Riprap ditches, ditch construction and riprap placement
 5. Pipe outlets
 6. Terrace intakes
 7. Underground outlets
 8. All excavation, backfill, and compaction necessary to complete these drainage systems

1.2 REFERENCE SPECIFICATIONS

- A. The following specifications or standards are incorporated by reference into this SECTION:
1. SECTION 02120— SEDIMENT AND EROSION CONTROL
- B. Above-mentioned references, which do not appear printed with the Contract Documents, can be provided to Contractor upon request.

1.3 QUALITY ASSURANCE

- A. Contractor shall use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this SECTION.
- B. Contractor shall use equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner.
- C. In addition to complying with the requirements of governmental agencies having jurisdiction, Contractor shall comply with the directions of Engineer and Division.

1.4 SUBMITTALS

- A. Submit material certification, including material type and gradation, for all riprap and porous backfill.
- B. Submit manufacturer's certification and material data for all material delivered to the project site for the work of this section.
- C. Submit weight tickets and/or shipping tickets for all materials delivered to the Project site for the work of this SECTION.

PART 2 - PRODUCTS

2.1 SPOIL MATERIALS

- A. Drainage way subgrades and backfill for pipe, tiling and risers shall be constructed of spoil materials from the required excavation. Backfill material shall be sorted as needed to become free of debris and rocks larger than one and one-half (1-1/2) inches adjacent to the tiling, and four (4) inches thereafter to the surface.

2.2 QUARRIED STONE MATERIALS

- A. Porous Backfill for subdrain shall be non-calcareous material meeting IDOT Item 4131, Gradation No. 29. Limestone porous backfill will not be allowed unless its use is specifically directed by Engineer.
- B. Pipe bedding used for support and backfill around pipe shall be crushed angular stone generally known as "one (1) inch clean stone". Pipe bedding shall meet the requirements of Class I bedding material as specified in SUDAS Section 3010, 2.02, A. Table 02300-01 specifies the gradation of pipe bedding.

Table 02300-01: Pipe Bedding Material Gradation

Sieve	Percent Passing
1.5"	100
1"	95 to 100
0.5"	25 to 60
No. 4	0 to 10
No. 8	0 to 5

- C. Macadam stone: Refer to SECTION 02120, PART 2
- D. Erosion stone: Refer to SECTION 02120, PART 2
- E. Riprap: Refer to SECTION 02120, PART

2.3 DRAINAGE CONDUITS

- A. Various material types and sizes are specified for drainage conduits as noted on the Plans or in the Supplemental Specifications. The conduit material used shall meet the minimum requirements as specified below. All drainage conduit used at the site shall be non-perforated unless specified otherwise.
- B. "Tiling" shall be understood to mean single wall or dual wall, corrugated plastic drainage conduit that is shipped to the project site in continuous rolls or coils. Rolls or coils of tiling are usually installed by a tiling machine that mechanically places the conduit in a relatively narrow trench immediately following a trenching wheel, chain, or plow.
- C. "Pipe" shall be understood to mean drainage conduit that is shipped to the site in straight lengths from the manufacturer to be installed in a trench created by an excavator bucket.
- D. The following nomenclature for various drainage conduits are noted in the plans and defined below.
 - 1. Single Wall Corrugated Polyethylene, Tiling (SWPE): SWPE conduit and fittings shall be non-perforated, corrugated polyethylene tubing equal to IDOT Section 4143.01-B. Fittings may be made from polyethylene resin meeting this specification or polyvinylchloride (PVC) meeting Schedule 40 or SDR-26 thickness.
 - 2. Dual Wall High Density Polyethylene Pipe (DWPE): DWPE pipe shall be non-perforated, high density, high molecular weight, polyethylene dual-wall pipe meeting the requirements of AASHTO M 294, Type S

corrugated exterior and smooth interior. The pipe shall conform to ASTM D3350 with a minimum cell classification value of 345420C and the minimum pipe stiffness at five percent five (5) percent deflection per ASTM D2412. The fittings supplied shall be made from polyethylene resin which meets this same specification.

3. Polyvinyl Chloride Pipe (PVC): PVC pipe shall be non-perforated, plastic PVC – ASTM D3034-SDR26 Type 1, Grade 1. Joints shall meet ASTM D3033/D3034 Standards.
4. Dual Wall Polypropylene High Performance Pipe (PPHP): PPHP shall have a smooth interior and annular exterior corrugations meeting ASTM F2736 for diameters up to thirty (30) inches and meeting ASTM F2881 for diameters of thirty-six (36) through sixty (60) inches. Polypropylene compound for pipe and fitting production shall be impact modified copolymer meeting the material requirements of ASTM F2736 – Section 4, ASTM F-2881 – Section 5, and AASHTO M330 – Section 6.1 for the respective diameters. Table 02300-03 specifies the minimum pipe stiffness based on diameter when tested in accordance with ASTM D2412.

Table 02300-03

Nominal Pipe (I.D) (inches)	12	15	18	24	30	36	42	48	60
Min. Pipe Stiffness @ 5% Deflection (#/in/in)	75	60	56	50	46	40	35	35	30

PPHP sections shall be joined with gasketed, integral, bell & spigot joints that conform to ASTM F2736 and ASTM F2881 for the respective diameters. The joints can be either spun-on, welded, or an integral bell and spigot. Pipe bells shall be reinforced with a polymer composite band installed by the manufacturer. Each spigot shall have two gaskets meeting the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gaskets are free from debris. These joints shall meet the watertight joint performance requirements of ASTM D3212.

- E. Dam and/or Wetland Pipes – See SECTION 02310 – Drainage Systems, Dams and Structures

2.4 OUTLETS FOR TILING OR PIPE

- A. The last 20 (twenty) lineal feet, minimum, of a run of SWPE or DWPE conduit to daylight shall be solid PVC pipe, Schedule 40 or SDR-26, sized to match the incoming conduit. Where a specified diameter of PVC pipe is not available in a single twenty (20) foot length, up to two (2) shorter lengths of PVC pipe may be used to construct an installed length exceeding twenty (20) lineal feet. The excess PVC need not be removed; the incoming conduit may be trimmed to accommodate the excess PVC.
- B. The PVC pipe shall be furnished with no more than one joint. The joint shall be solvent-welded or mechanically fastened with at least four one-fourth (4 ¼) inch dia. self-tapping stainless-steel screws. The minimum length of the fasteners shall be at least twice the thickness of the PVC pipe being joined.
- C. Outlet Tees, where required, shall be solid PVC, Schedule 40, or SDR-26 sized to match the incoming PVC outlet pipe. Outlet Tees shall be fastened with at least four one-fourth (4 ¼) inch dia. self-tapping stainless-steel screws. The minimum length of the fasteners shall be at least twice the thickness of the PVC pipe being joined.
- D. Non-perforated DWPE pipe may be substituted for PVC pipe if approved by Engineer, except where the pipe daylights into a stream or channel.

- E. A PVC Outlet for the last twenty (20) lineal feet of a run of PPHP to daylight is not required unless otherwise specified.

2.5 TERRACE RISERS AND OPEN SIDED AREA INTAKES

A. Terrace Risers

1. Risers shall be made from high density polyethylene as manufactured by Hickenbottom, Precision or approved equal. Sizes shall be as shown on the Plans.
2. The top three (3) feet shall be perforated with at least forty (40), one (1) inch diameter holes and at least thirty (30) open square inches per foot of riser.
3. Below grade, the riser shall be non-perforated. If perforations are below grade, then the openings shall be completely sealed with three (3) wraps of polyethylene tape or other suitable tape.
4. The riser shall connect onto the drainage conduit with a manufactured tee of a size to match the outgoing conduit diameter. Tees that constrict flows shall not be used.

B. Open Sided Area Intakes

1. Area intakes shall meet the specifications of SUDAS Specification Section 6010 and shall follow details for 'SW-513 Open-Sided Area Intake' and can be either pre-cast or cast-in place.
2. The locations, quantity, and dimensions shall be as indicated on the plan sheets.

C. Dam and/or Wetland Intakes – See SECTION 02310 – Drainage Systems, Dams and Structures.

2.6 EROSION CONTROL MAT

- A. Erosion control mats, where indicated on plans, shall be placed on slopes, channels, and spillways in conjunction with completion of the drainage system outlets to reduce sediment loss and erosion.
- B. Refer to SECTION 02120 2.1 H for further information regarding erosion control mat. Erosion Control Mat shall be considered synonymous with Temporary Rolled Erosion Control Products (RECP).

2.7 FILTER FABRIC

- A. Filter fabric shall meet the requirements of IDOT Section 4196.01-C, Engineering Fabric - Embankment Erosion Control.

2.8 CONCRETE

- A. All connections in piping where a change in pipe size or type occurs, and every joint where there is a sudden change in pipe direction, shall be sealed with tile tape and buttressed with concrete. Concrete can be ready-mix, hand-mix, or packaged gravel-mix concrete and should extend a minimum of three (3) inches all around the perimeter of the joint. Packaged concrete mix shall be hydrated before placement. Areas where concrete is known to be needed include:
 1. PE tubing to PVC outlets, all sizes
 2. Riser connections, all sizes
 3. Tiling to main line tiling at wye or tee, all sizes
 4. Any other locations shown on plans
- B. Concrete used for open-sided intakes shall meet the requirements of SUDAS 6010.

2.9 GROUT

- A. Grout shall be composed of ten (10) sacks or nine-hundred forty (940) pounds of Type I or II Portland cement with approximately two thousand two hundred (2,200) pounds of fine aggregate material conforming to IDOT 4110.01, Gradation No. 2 for each cubic yard. Potable water shall be added to provide a thick creamy consistency and should not exceed forty-seven (47) gallons per cubic yard. Air entraining admixtures conforming to ASTM C 260 shall be added to provide an entrained air content between six (6) to ten (10) percent.
- B. Flyash can also be substituted for Portland cement in the grout mixture provided the flyash used meets the requirements of IDOT Section 4108 and does not exceed twenty (20) percent of the Portland cement.

2.10 RODENT GUARDS

- A. Electroplated zinc-coated rodent guards for the appropriate size of piping, shall be as distributed by Agri Drain Corp. or approved equal. Rodent guards shall be hinged to allow debris to exit the drainage conduit when flows are present.

2.11 TRASH RACKS/BAR GUARDS

- A. Bar Guard Intakes: Trash racks shall be Bar Guard Intakes as distributed by Agri Drain Corp. or approved equal. Sizes shall be as shown on the Plans.
- B. Other Trash Racks or Guards shall be as specified in the Plans or the Supplement Specifications.

2.12 PIPE STRAPS

- A. Pipe straps used to restrain bell and spigot joints of DWPE and/or PPHP shall be Agri-Drain Pipe Straps or approved equal.
- B. Pipe straps shall be constructed with flat, woven, high-strength nylon fabric with welded stainless steel "D" rings. The loops at the ends of each strap shall be double sewn. Each sewn loop shall contain two (2) "D" rings.
- C. Pipe straps may be used in lieu of concrete collar subject to engineer approval.
- D. Pipe straps shall not be used with single wall corrugated tubing.

2.13 TILE TAPE

- A. Tile tape shall be provided to seal subsurface joints in tiling, riser, wye, and tee connections.
- B. Tile tape shall be as distributed by Agri-Drain Inc. or approved equal
- C. Tile tape shall be made from PVC material having the following properties:
 - 1. Tensile strength: 20 psi, minimum
 - 2. Elongation: 230%
 - 3. Dielectric capacity: 8800 volts

2.15 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by Contractor, subject to the approval of Engineer.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Contractor shall examine the areas and conditions under which work of this SECTION will be performed and shall correct conditions detrimental to timely and proper completion of the work. Contractor shall not proceed until unsatisfactory conditions are corrected.
- B. Known tile that will be impacted by this project are noted and addressed as needed on the Plans. Any additional tile found during construction shall be brought to the attention of Engineer immediately.

3.2 PROTECTION

- A. Contractor shall use means necessary to prevent dust from becoming a nuisance to the public, to neighbors and to other work being performed on or near the site.
- B. Contractor shall always maintain access to adjacent areas as needed.
- C. Contractor shall protect previous construction from damage while constructing drainage systems.
- D. Contractor shall protect drainage systems from damage during subsequent construction in the areas.
- E. Contractor shall follow all guidelines for trench safety provided by OSHA.

3.3 CARE OF WATER

- A. Contractor shall furnish and operate sufficient pumps and/or provide other means including materials, labor, and equipment to prevent interference to any work by water, ice or snow. No structure or pipe shall be laid in water, and no water shall be allowed to run into or over any work or pipe until the installation can accept water without damage or deterioration. Damage of any kind resulting from insufficient pumping facilities or similar lack of proper conduct of the work shall be corrected by Contractor at no cost to Division.

3.4 FLOW LINES AND GRADES

- A. Construct drainage systems precisely to lines and grades as shown on the Plans or as required for proper functioning.
- B. Pipe runs shall be installed straight with a uniform slope to meet entrance and exit conditions at both ends of the pipe run. Slopes shall be uniform in so far as practical. Piping shall be installed with a minimum of two (2) percent slopes unless conditions indicate flatter slopes are required.
- C. Match flow lines and provide smooth transitions between intersecting riprap ditches, between terrace tile outlets and riprap ditches, between subdrain outlet and grassed swale, and between terrace tile outlets and grassed swales.

3.5 TERRACES

- A. Terraces shall be installed after rough grading is completed. The flow line grades of the terraces must be adjusted as needed if terraces are constructed after placement of tile and risers.

- B. Terraces shall be constructed in conformance with details and dimensions shown on the Plans. Fill placement and compaction shall be as specified in Section 02200 EARTHWORK - ROUGH GRADING, Item 3.9 *Fill Placement and Compaction*.

3.6 TILING AND PIPE

A. Tiling

1. Install tiling in strict accordance with these Specifications, manufacturer's recommendations and the Plans. In case of discrepancy, the most stringent requirements shall apply. Install drainage conduit after completion of rough grading in affected areas.
2. Excavate trenches to a minimum depth of three one-half (3 1/2) feet below finish grades where grades permit. Rocks or other objects larger than one one-half (1 1/2) inches shall be removed from bottom of excavation where present. Additional excavation may be necessary to remove and replace soft, unstable material.
3. When a backhoe or excavator is used to place the tile, the trench width shall extend at least eight (8) inches and no more than fifteen (15) inches beyond each side of the spring line of the pipe to allow for compaction of material. The bottom of the trench should include a V-groove or semicircular trough sized to accept the diameter of the tiling without excess movement.
4. Smaller trench widths are allowed when tiling is installed with a tiling machine equipped with a cutting edge that creates a ninety (90) degree V-groove, or a semi-circular trough of a size that accepts the tiling without excess movement.
5. After excavation, lay tiling in bottom of trench. All joints shall be placed with the bell or female end facing upslope. Any unsuitable material, such as larger rocks or sticks or frozen material, shall be separated from excavated material to be used as backfill. If excavated material is unsuitable, then Contractor shall provide an alternate source of suitable backfill from on site. Carefully place and compact backfill using handheld equipment within the area around and to within six (6) inches above the tile to ensure that backfill is placed under the pipe haunches and that the tiling is properly and fully supported. Care shall be taken to not collapse or displace the tile during backfilling procedures. Backfill placed within the remainder of trench shall be placed in lifts of no more than one (1) foot in structural areas and no more than two (2) feet in non-structural areas. Mass dumping of backfill shall not be allowed. Each lift shall be compacted with either the bucket of an excavator or the wheel of construction equipment. Reshape and/or compact adjacent ground surface as required.
6. When specified for deep installations, provide granular bedding and backfill around the tiling as shown on the plans.
7. The last twenty (20) feet, minimum, tiling which daylights shall be rigid PVC pipe as provided in 2.3 of this SECTION. Connect the outlet pipe to the corrugated PE tubing with a Fernco or approved equal coupler. Seal the connection with tile tape and place a concrete collar around the joint. Install a rodent guard within six (6) inches of the daylight end of all PVC piping.
8. Where outlet tees are required on t outlet pipes, install the rodent guard in the pipe ahead of the outlet tee. Fasten outlet tee to pipe using fasteners as provided in 2.3 of this SECTION.
9. If any tiling collapses due to improper installation or from routing of construction equipment over the trench, or it becomes clogged for whatever reason, correct the malfunction at no cost to Division. Correction of any malfunction shall also be required during the one (1) year guarantee period and shall be repaired at no cost to Division.

B. PIPES

1. Pipes shall be installed in strict accordance with these Specifications, manufacturer's recommendations and the Plans. In case of discrepancy, the most stringent requirements shall apply. Install pipes after completion of rough grading in affected areas.
2. Excavate trenches to the minimum depth as shown on the Plans and to widths to allow for twelve (12) inches of clearance on each side of the pipe. The trench shall have vertical side walls to the crown of the pipe with the remainder of the excavations sloped as needed for stability and to satisfy OSHA requirements.
3. Lay the pipe in the center of the trench with female joints facing upstream. Place joint sealant as required as each piece is placed. All gaskets shall be protected during installation, and each joint shall be completely pushed together.
4. Install pipe straps at every joint if required by the plans or Supplemental Specifications.
5. Backfill with suitable material in lifts not exceeding eight (8) inches and compacted by hand-operated mechanical tampers to a height at least twelve (12) inches above the pipe. Exercise care not to cause the pipe to shift and/or to uplift while placing and compacting material up to the top of the pipe. Continue backfilling with compacted lifts to the surface. Mass dumping of the backfill will not be allowed. Settled areas shall be corrected by Contractor at no cost to Division.
6. When specified for deep installations, provide granular bedding and backfill around the tiling as shown on the plans. Furnish and encase the granular bedding in filter fabric
7. The last twenty (20) lineal feet, minimum, which daylights shall be rigid PVC pipe as provided in 2.3 of this SECTION. Connect the PVC outlet pipe to the corrugated PE tubing with a Fernco or approved equal coupler. Seal the transition joint with three (3) wraps of tile tape and install a concrete collar around the wrapped joint. Pipe straps may be used in lieu of a concrete collar if the pipe strap can be prevented from slipping off the PVC outlet pipe.
8. Where indicated in the Supplemental Specifications or where approved by the Engineer, pipe straps may be used in lieu of a concrete collar. When using pipe straps on a smooth PVC pipe without a bell, install two (2) ¼" dia. stainless steel thru bolts with washers into the PVC at the 3 o'clock and 9 o'clock positions to prevent slippage of the pipe strap. Bolts shall not puncture the pipe straps.
9. Install rodent guard within six (6) inches of the daylight end of all PVC outlets.
10. If any pipe collapses due to improper installation or from routing of construction equipment over the trench, or it becomes clogged for whatever reason, correct the malfunction at no cost to Division. Correction of any malfunction shall also be required during the one (1) year guarantee period and shall be repaired at no cost to Division.

3.7 RISERS AND OPEN SIDED INTAKES

A. Risers

1. Install terrace risers in strict accordance with these Specifications, manufacturer's recommendation and the Plans. In case of discrepancy, the most stringent requirements shall apply. Provide a tee for every riser. Depending on location, use an in-line tee or a blind tee with cap, as recommended by manufacturer. Fasten riser sections using stainless steel sheet metal screws. All riser tubing should be connected to the main run of tiling or pipe with a wye or a tee.
2. Seal all below-grade riser joints with three (3) wraps of tile tape or other suitable tape as provided in 2.3 of this SECTION and then cover joints with concrete collar that extends at least three (3) inches in each direction as shown on the Plans.

3. Backfill excavation with compacted lifts using excavated material unless this material is unsuitable. Provide suitable backfill material if necessary. Reshape and/or compact adjacent ground surface as required.
4. Contractor shall install two (2) steel fence posts on opposite sides of each riser and bind them together with No. 9 wire. Three (3) steel fence posts shall be used for risers that are ten (10) inches in diameter or greater.

B. Open-Sided Intakes

1. Open-sided intakes shall be placed to the specific elevations and dimensions indicated on the plans.
2. Pipe connecting to the intakes shall be placed as shown on the Plans and in accordance with SUDAS 6010.
3. If precast open-sided intakes are used provide a granular leveling course of one (1) inch clean, angular limestone four (4) to six (6) inches thick at the bottom of the structure and around the pipe connection adjacent to the structure.
4. Backfill material shall only be placed after adequate strength is acquired for the structure. Backfill shall consist of excavated material. Backfill material shall exclude rocks four (4) inches in diameter or larger. The backfill shall be placed in lifts of no more than six (6) inches and compacted using hand equipment.

3.8 FILTER FABRIC

- A. Filter fabric shall be delivered to the job site in such a manner as to facilitate handling and incorporation into the work without damage. Material shall be stored in such a manner as to prevent exposure to direct sunlight and damage by other construction activities.
- B. Prior to the installation of the fabric, the application surface shall be cleared of debris, sharp objects and trees. Tree stumps shall be removed to a depth of at least two (2) feet below the ground surface. In the case of subgrades, all wheel tracks or ruts more than three (3) inches in depth shall be graded smooth or otherwise filled with soil to provide a reasonably smooth surface.
- C. Fabric may be installed on the application surface either by hand or by mechanical methods, provided that the fabric is not torn or the surface rutted. Fabric of insufficient width or length to fully cover the specified area shall be lapped a minimum of twenty-four (24) inches or sewn. If sewn, the minimum lap shall be four (4) inches, and the seam strength shall be greater than or equal to the minimum grab tensile strength of the fabric when wet tested.
- D. Placement of material on the fabric shall be accomplished by spreading dumped material with a bulldozer blade or end-loader, in such a manner as to prevent tearing or shoving of the cloth. Dumping material directly on the fabric will only be permitted to establish an initial working platform. No vehicles or construction equipment shall be allowed on the fabric prior to placement of the granular blanket.
- E. Fabric which is damaged during installation or subsequent placement of riprap, due to failure of Contractor to comply with these provisions, shall be repaired or replaced at his expense, including costs of removal and replacement of the riprap. Torn fabric may be patched in-place by cutting and placing a piece of the same fabric over the tear. The dimensions of the patch shall provide for at least two (2) feet of overlap in every direction, and it shall be weighted or otherwise secured to prevent the granular material from causing lap separation.

3.9 RIPRAP DITCHES & OTHER RIPRAP WORK

- A. When rough grades have been achieved, excavate the area to receive riprap or erosion stone to permit placement of riprap or stone the full depth as shown on the Plans. Dispose of excavated material by incorporating it into general grading of the site. Care shall be taken to prevent placement of acidic spoil material on top of treated subgrade or cover material.
- B. Unless otherwise specified in plan details, riprap or erosion stone shall be placed over a six (6) inch thick filter layer of macadam stone, where required, in areas shown on the Plans and in a manner which shall produce a reasonably well-graded mass of stone with the minimum practical percentage of voids. All material shall be placed and distributed such that there shall be no objectionable accumulations of either the larger or smaller sizes of stone, and such that the entire mass of stone shall be in accordance with the lines, grades and thickness as shown on the Plans.
- C. Filter fabric may be used as an underlayment below the riprap in level plunge pools or stilling basins, but it shall not be used as an underlayment in drainage ditches lined with riprap or erosion stone. When filter fabric is specified, Contractor shall place the riprap or erosion stone to avoid tearing, puncturing, or shifting the filter fabric. Riprap or stone shall not be dropped more than two (2) feet when being placed on filter fabric. Tears or rips in the fabric shall be repaired in accordance with manufacturer's recommendations.
- D. It is the intent of this Specification to produce a compact riprap or stone protection in which all sizes of stone material are placed in their proper proportions. Placing or rearranging individual stones by hand or mechanical equipment should be anticipated and may be required to the extent necessary to secure the specified results.
- E. Contractor shall complete the following in riprap ditches requiring grout:
 - 1. Larger spaces between stones shall be filled with smaller pieces of riprap. The stones shall be compacted to give them firm bearing and stability.
 - 2. After stone surface has been inspected and approved, the spaces between the stones shall be filled with grout. The grout shall be brushed or broomed into the spaces to ensure proper filling.
 - 3. Grout placement and curing shall meet the requirements of IDOT Section 2507.03 E, Grouting.

3.10 EROSION CONTROL MAT

- A. Careful installation of erosion control mat is critical for its immediate and long-term performance. Contractor shall install per details shown on the Plans and in strict accordance with manufacturer's recommendations. Where details on the Plans show more stringent requirements, drawing details shall apply. Staking patterns shall be based on the design discharge rates as determined by the Engineer. The upper most portion of the mat shall be installed in an anchor trench in per the manufacturer's recommendations.
- B. Contractor shall fine grade the surface as uniformly as possible and remove any rocks, roots and other deleterious substances. The success of the mat relies heavily on its placement such that it is uniformly in contact with the ground. Proceed with seeding operations in Section 02700 –SEEDING, including soil testing, seedbed preparation, liming, fertilizing, seeding and mulching.
- C. After seeding and mulching has been performed in accordance with Section 02700, Contractor shall install erosion control mat as and where shown on the Plans.
- D. Contractor shall reseed all disturbed areas by hand. A light overseeding by hand of the overall mat area may be beneficial but is not mandatory.

PART 4 - MEASUREMENT AND PAYMENT

4.1 UNIT PRICES

- A. The construction cost of all work included in this Section of the Construction Specifications shall be included in Contractor's unit prices set forth in the Proposal and Schedule of Prices (*Document C*) for the work items described below. The unit price for each of these items shall include its pro rata share of overhead so that the sum of the products obtained by multiplying the unit prices so set forth by the amount of the work constructed and measured as described herein, shall constitute full payment to Contractor for performance of the work included in this SECTION.
- B. Measurement and payment for each work item in this SECTION shall be in accordance with the following:
1. *Terrace*: The unit price for terraces in this SECTION shall include materials, equipment and work required to construct (grade) the terraces in conformance with details and dimensions shown on the Plans. The length of installed terraces shall be measured along the center of the ridge to the nearest one (1) foot jointly by Contractor and Engineer.
 2. *Riser - Terraces*: Unit prices shall include all materials and work required for installation of risers in conformance with details and dimensions shown on the Plans, these Construction Specifications, and as may be required by the manufacturer. Unit prices shall include furnishing and installing risers, fittings, tape, concrete, excavation, backfill, metal stakes, and all other incidental construction including furnishing and installing silt fencing around the riser, cleaning of sediment, maintenance and repairs. Measurement for payment of risers shall be based on the number and size of specified risers, properly installed and maintained.
 3. *Open-Sided Intakes*: Unit price shall include all materials and work required for installation of open-sided intakes in conformance with details and dimensions shown on the Plans and these Specifications. Unit prices shall include furnishing and installing the intake, connecting pipes, concrete, excavation, backfill, and all other incidental construction including cleaning of sediment, maintenance and repairs. Measurement and payment of intake shall be based on the number of each type and size of riser properly installed and maintained.
 4. *Tiling*: The unit prices shall include all materials and work required for installation of the tile and fittings (SWPE and PVC as applicable) in conformance with details and dimensions shown on the Plans. The unit prices shall include furnishing and installing the pipe, fittings, trenching, removal and disposal of excess trench material, dewatering, backfill, compaction, and all other work items incidental thereto, including tape and concrete for sealing below-grade connections. Tees required on the ends of tiling shall also be incidental to this work item. Measurement for payment shall be based on the length of tiling for a specified diameter installed as determined from field measurements and rounded to the nearest foot. The measured length of tiling shall not include the length of Pipe Outlet conduit.
 5. *Pipes*: The unit prices shall include all materials and work required for installation of the various pipes and fittings in conformance with details and dimensions shown on the Plans. The unit prices shall include furnishing and installing the pipe, fittings, excavating, removal and disposal of excess trench material, dewatering, backfill, compaction, and all other work items incidental thereto, including sealing of below-grade connections. Measurement for payment shall be based on the length of various pipes for each specified diameter installed as determined from field measurements and rounded to the nearest foot.
 6. *Outlet Pipe*: The unit price for PVC outlets at the end of tile sections shall include all materials, equipment, and work required to install the outlets as shown on the plans including rodent guards, concrete, joint adapters, or pipe straps. Measurement and payment shall be based on the number of each type and size of outlet properly installed.
 7. *Filter Fabric*: Filter fabric used on the project, in accordance with the Plans and/or approved by Engineer, shall be measured and paid in this Item. The quantity of in-place fabric shall be measured to the nearest square yard jointly by Contractor and Engineer. Laps and waste shall not be measured.

Only material placed in accordance with the Plans and these Construction Specifications shall be measured and paid. *Note: Plans and Supplemental Specifications may indicate that Filter Fabric is incidental to associated work items.*

8. *Grout*: This unit price shall include all materials and work required for installation of grout (riprap channels, stilling basins, etc.) in conformance with these Construction Specifications and the Plans. Measurement for payment shall be based on cubic yards of grout installed as determined from delivery tickets, rounded to the nearest one (1) cubic yard. Only material placed in accordance with the Plans and these Construction Specifications or otherwise approved by Engineer or Division shall be measured and paid.
9. *Erosion Control Mat*: Erosion control mat will be paid as indicated in Specification SECTION 02120 – SEDIMENT AND EROSION CONTROL provided it is not considered incidental to other work items.

4.2 SUMMARY – UNITS OF MEASUREMENT

Proposal Bid Items applicable to work covered by this SECTION are as follows:

<u>Description</u>	<u>Unit</u>
Terrace	Lineal Foot
Riser - Terrace	Each
Open Sided Intakes	Each
Tiling - (size)	Lineal Foot
Pipes - (size)	Lineal Foot
Outlet Pipe– (size)	Each
Filter Fabric	Square Yard
Grout	Cubic Yard

END OF SECTION 02300

INDEX

SECTION 02310 - DRAINAGE SYSTEMS, DAMS AND STRUCTURES

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PART 1 - GENERAL

1.1 DESCRIPTION

Work Included:

Work under this SECTION includes the installation of manholes, inlets, drainpipe, seepage collars, porous backfill, stilling basins, filter fabric, riprap and grout, all as required for earthen dam or other drainage structures shown on the Plans. The work shall include, but is not necessarily limited to, completion of the following work:

- A. Field engineering.
- B. Drainage Blanket.
- C. Chimney Drain.
- D. Toe Drain.
- E. Pipe Outlets.
- F. Auxiliary Spillway.
- G. All excavation, backfill and compaction necessary to complete these drainage structures.

1.2 REFERENCE SPECIFICATIONS

- A. The following specifications or applicable standards are incorporated by reference into this SECTION:
 - 1. SECTION 02220 – EARTHWORK, DAMS
 - 2. SECTION 02300 – DRAINAGE SYSTEMS, GENERAL
 - 3. Iowa Department of Transportation Standard Specifications for Highway and Bridge Construction (IDOT)
 - 4. NRCS Conservation Practice Standard, Pond (387).
 - 5. AASHTO/ASTM STANDARDS
 - 6. Statewide Urban Design and Specifications (SUDAS)
- B. Above-mentioned references, which do not appear printed with the Contract Documents, can be provided to Contractor upon request.

1.3 QUALITY ASSURANCE

- A. Contractor shall use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this SECTION.
- B. Contractor shall use equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner.

- C. In addition to complying with requirements of governmental agencies having jurisdiction, Contractor shall comply with the directives of Engineer and Division.

1.4 SUBMITTALS

- A. Contractor shall submit material certification, including material type and gradation for all granular fill and for engineering fabric.
- B. Contractor shall submit supplier's material data for all pipes shown on the Plans to be used at the site.
- C. Contractor shall submit weight tickets and/or shipping tickets for all materials delivered to the Project site for the work of this SECTION.
- D. If the trash rack is not prefabricated, Contractor shall submit shop drawings to Engineer for approval prior to fabrication.

PART 2 - PRODUCTS

2.1 BACKFILL MATERIALS

- A. General Backfill: Unless specified in the Plans, ditch subgrades and backfill for pipes and risers shall be constructed of on-site materials from required excavation. Backfill material shall be sorted to remove all rocks or hard material with any dimension larger than one one-half (1 1/2) inches from the backfill area within six (6) inches of the pipes and risers. Thereafter, no dimension of the material within the backfill shall exceed four (4) inches. Backfill material shall be considered impervious fill, and any sand material found from the required excavation shall be sorted out and not used as backfill.
- B. Porous Backfill: Backfill material around toe drains and for the drainage blanket and chimney drain, where shown on the plans, shall consist of non-calcareous sand (not limestone product) meeting the requirements of IDOT Section 4112, Fine Aggregate for Mortar, Gradation No. 2. Refer to SECTION 02220 – EARTHWORK, DAMS.

2.2 DRAINAGE CONDUITS

- A. Various material types and sizes are specified for drainage conduits as noted on the Plans or in the Supplemental Specifications. The conduit material used shall meet the minimum requirements as specified below. All drainage conduit used at the site shall be non-perforated unless specified otherwise.
- B. "Tiling" shall be understood to mean single wall, corrugated plastic drainage conduit that is shipped to the project site in continuous rolls or coils. Rolls or coils of tiling are usually installed by a tiling machine that mechanically places the conduit in a relatively narrow trench immediately following a trenching wheel, chain, or plow.
- C. "Pipe" shall be understood to mean drainage conduit that is shipped to the site in straight lengths from the manufacturer to be installed in a trench created by an excavator bucket.
- D. Single Wall Corrugated Polyethylene Tubing (SWPE)

1. Perforated single wall corrugated polyethylene (PE) tubing and fittings shall conform to IDOT Section 4143.01-B, Pipe for Longitudinal Subdrains with sizes as shown on the Plans.
 2. SWPE shall not be used to convey drainage from concrete structures.
- E. Dual Wall High Density Polyethylene Pipe (DWPE)
1. DWPE pipe shall be high density, high molecular weight, polyethylene pipe meeting the requirements of AASHTO M 294, Type S corrugated exterior and smooth interior. The pipe shall conform to ASTM D3350 with a minimum cell classification value of 345420C and the minimum pipe stiffness at five (5) percent deflection per ASTM D2412.
 2. The fittings supplied shall be made from polyethylene resin which meets this same specification.
 3. Perforated DWPE may be used for Toe Drains or Subdrains subject to Engineer approval.
- F. Polyvinyl Chloride Pipe (PVC)
1. PVC pipe shall be plastic PVC – ASTM D3034-SDR26 Type 1, Grade 1.
 2. Joints shall meet ASTM D3033/D3034 Standards.
- G. Reinforced Concrete Pipe (RCP):
1. All reinforced concrete pipe shown on the Plans shall meet the requirements of IDOT Section 4145. The diameter and length shall match that shown on the Plans. All lift holes and unused tie holes shall be properly plugged.
 2. Joints for RCP: Joints shall be sealed with cold applied bituminous jointing material or rubber gaskets. Where gasketed joints are used, they shall meet the requirements of ASTM C443.
 3. Ties for RCP: Unless otherwise noted on the Plans ties shall be required to secure the first three joints beginning from the daylight end of a run of RCP. The ties shall conform to Type 2 connections for sealed joints.
- H. Polypropylene High-Performance Pipe (PPHP)
1. PPHP shall have a smooth interior and annular exterior corrugations meeting ASTM F2736 for diameters up to thirty (30) inches and meeting ASTM F2881 for diameters of thirty-six (36) through sixty (60) inches. Polypropylene compound for pipe and fitting production shall be impact modified copolymer meeting the material requirements of ASTM F2736 – Section 4, ASTM F-2881 – Section 5, and AASHTO M330 – Section 6.1 for the respective diameters. Table 02310-01 specifies the minimum pipe stiffness based on diameter when tested in accordance with ASTM D2412.

Table 02310-01

Nominal Pipe (I.D) (inches)	12	15	18	24	30	36	42	48	60
Min. Pipe Stiffness @ 5% Deflection (#/in/in)	75	60	56	50	46	40	35	35	30

2. PPHP sections shall be joined with gasketed, integral, bell & spigot joints that conform to ASTM F2736 and ASTM F2881 for the respective diameters. The joints can be either spun-on, welded, or an integral bell and spigot. Pipe bells shall be reinforced with a polymer composite band installed by the manufacturer. Each spigot shall have two gaskets meeting the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gaskets are free from debris. These joints shall meet the watertight joint performance requirements of ASTM D3212.

2.3 ANTI-SEEP COLLARS AND FILTER DIAPHRAGMS

A. Anti-seep Collars

1. Manufactured anti-seep collars shall meet the dimensions and consist of the material types shown on the plans.
2. Cast-in-place concrete anti-seep collars shall be constructed as specified with a monolithic pour.

B. Filter Diaphragms

1. Filter diaphragms (also known as sand or drainage diaphragms) shall be designed and installed in accordance with plans and the requirements of NRCS Conservation Practice Standard 387.
2. The filter diaphragm shall be a minimum of two (2) feet thick and extend in all directions a minimum of two times the outside pipe diameter from the surface of the pipe.
3. The filter diaphragm shall consist of sand meeting the requirements of ASTM C-33.
4. Provide an outlet at the base with a minimum six-inch diameter perforated drain tubing.
5. Perforated drain tubing shall be enclosed within porous stone backfill.
6. Connect the perforated tubing to non-perforated tubing which extends to the downstream toe of the berm.
7. Install a PVC outlet for the last twenty (20) lineal feet to daylight and install a rodent guard.

2.4 DROP INLETS AND OPEN SIDED AREA INTAKES

A. Drop Inlets

1. Drop Inlets shall consist of either a cast-in-place or precast reinforced concrete pipe (RCP), Class 3, with a cast-in-place paved invert or fillet. Reinforced concrete pipe shall meet the requirements of ASTM C76, Wall B. Sizes and lengths shall be as shown on plans. Any joints shall be gasketed and sealed per the manufacturer's recommendations. All lift holes shall be plugged with grout.
2. The base for the risers shall be either a cast-in-place or a pre-manufactured base that conforms to the dimensions and includes the required steel reinforcement as indicated on the Plans.

B. Open-Sided Area Intakes

1. Area intakes shall meet the specifications of SUDAS Specification Section 6010 and shall follow details for 'SW-513 Open-Sided Area Intake' and can be either pre-cast or cast-in place.
2. The locations, quantity, and dimensions shall be as indicated on the plan sheets.

2.5 TRASH RACKS AND BAR GUARDS

- A. Trash Rack: The trash racks shall be as shown on the plans, including the type, size, and diameter. If the trash rack is not pre-fabricated, then shop drawings shall be submitted to Engineer for approval prior to fabrication. Anti-vortex protection shall also be included as shown on the plans.
- B. Bar Guard Intakes: Bar Guard Intakes as distributed by AgriDrain Corp. or approved equal. Sizes shall be as shown on the Plans.

2.6 CONCRETE

- A. All connections for drainage conduit where a change in diameter, size or type occurs and every joint where there is a sudden change in pipe direction, shall be sealed and/or buttressed with concrete. Concrete can be ready-mix, hand-mixed or packaged gravel-mix concrete. Areas where concrete is known to be needed include:
1. Pipe connections to riser and paved invert.
 2. Toe drains connection to subdrain outlet pipe.
- B. Structural concrete placed for the bases of structures and anti-seep collars shall be ready-mix concrete with a minimum twenty-eight (28) day strength equal to three thousand five hundred pounds per square inch (3,500 psi). Concrete shall contain admixture to provide entrained air. Concrete shall be mixed and placed in accordance with IDOT Section 2403. Concrete used for seepage collars shall be placed with a monolithic pour.

2.7 PIPE STRAPS

- A. Pipe straps used to restrain bell and spigot joints of corrugated dual wall HDPE or PPHP pipe shall be AgriDrain Pipe Straps or approved equal.

- B. Pipe straps shall be constructed with flat, woven, high-strength nylon fabric with welded stainless steel "D" rings. The loops at the ends of each strap shall be double sewn. Each sewn loop shall contain two (2) "D" rings.
- C. Pipe straps shall not be used with single wall corrugated tubing.

2.8 OTHER MATERIALS

- A. Refer to SECTION 02300 – DRAINAGE SYSTEMS, GENERAL for details relating to rodent guards, erosion stone, riprap, grout, and filter fabric for the stilling basins, pipe protection, and any other areas where these materials are used.
- B. Provide other materials, not specifically described but required for a complete and proper installation, as selected by Contractor, subject to the approval of Engineer.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Contractor shall examine the areas and conditions under which work of this SECTION will be performed and correct conditions detrimental to timely and proper completion of the work. Contractor shall not proceed until unsatisfactory conditions are corrected.

3.2 PROTECTION

- A. Contractor shall use means necessary to prevent dust from becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.
- B. Contractor shall always maintain access to adjacent areas as needed.
- C. Contractor shall protect previous construction from damage while constructing drainage systems.
- D. Contractor shall protect drainage systems from damage during subsequent construction in the areas.

3.3 CARE OF WATER

Furnish and operate sufficient pumps and/or provide other means including materials, labor and equipment to prevent interference to any work by water, ice or snow. No structure or pipe shall be laid in water, and no water shall be allowed to run into or over any work or pipe until installation is capable of accepting water without damage or deterioration. Damage of any kind resulting from insufficient pumping facilities or similar lack of proper conduct of the work shall be corrected by Contractor at no cost to Division.

3.4 FLOW LINES AND GRADES

- A. Contractor shall construct drainage systems precisely to lines and grades as shown on the Plans or as required for proper functioning. Any changes in elevations or grades must be approved by Engineer.
- B. Pipe runs shall be installed straight with a uniform slope to meet entrance and exit conditions at both ends of the pipe run. Slopes shall be uniform in so far as practical.

- C. Match flow lines and provide smooth transitions between intersecting riprap ditches and between tile outlets and riprap ditches or grassed swales. Contractor shall complete this work in a manner to prevent falling or ponding of water at these intersections.

3.5 INSTALLATION OF TOE DRAINS

- A. Install perforated SWPE or DWPE for toe drains and subdrains in strict accordance with these Specifications, manufacturer's recommendations and the Plans. In case of discrepancy, the most stringent requirements shall apply. The Plans or Supplemental Specifications shall specify whether single wall or dual wall drainage conduit is required.
- B. Excavate trenches as needed to establish the necessary grades for placement. The trenches shall be excavated with an excavator bucket of sufficient width to allow for compaction of porous backfill along the sides and haunches of the tile.
- C. After excavation, place any required filter fabric and drainage conduit in bottom of trench. Connect tubing to proper outlet placing concrete or pipe straps to restrain all joints.
- D. Hand place and compact backfill material around drainage conduit as shown on the Plans. Place material carefully under the haunches so that the drainage conduit drainage conduit is properly and fully supported. In placing and compacting material around the drainage conduit, exercise care to prevent tubing shifting and/or uplift. Backfill remainder of excavation with compacted lifts using excavated material unless this material is unsuitable. Provide suitable backfill material if necessary. Reshape and/or compact adjacent ground surface as required.
- E. In lieu of B, C & D, above, a wheel or chain type tiling machine capable of installing porous backfill in the trench concurrently with the drainage conduit may be used subject to Engineer approval.
- F. If any drainage conduit collapses due to improper installation or from routing of construction equipment over the trench, or it becomes clogged for whatever reason, the malfunction shall be corrected at no cost to Division. Correction of any malfunction shall also be required during the one year guarantee period and shall be repaired at no cost to Division.

3.6 INSTALLATION OF CHIMNEY DRAIN

- A. All tiling, pipe and/or drainage medium shall be placed to provide a hydraulic connection to the chimney drain. Plastic sheeting or other acceptable barriers shall be used to protect the hydraulic connection while cohesive embankment material is being placed.
- B. The embankment shall be constructed as provided in SECTION 02220 – EARTHWORK, DAMS to a height of no greater than four (4) feet. At this height, a trench shall be excavated to the specified width that extends to the protected drainage connection.
- C. All loose cohesive material and the protective barrier shall be removed. Porous backfill shall then be placed in lifts not to exceed eight (8) inches in height and compacted using hand operated equipment such as a vibratory plate compactor or jumping jack.
- D. Plastic sheeting or other acceptable barriers shall be to protect the porous medium after the porous backfill has been placed to the top of the constructed embankment.

- E. Placement of fill material for construction of the embankment can continue until a height of four (4) feet past the top of the last lift of chimney drain material has been achieved. The steps listed above shall be repeated until the design height of the chimney drain has been reached. Any backfill material that becomes contaminated with cohesive material shall be removed and replaced at no cost to Division.

3.7. INSTALLATION OF DRAINAGE BLANKET

- A. Carefully excavate area for the drainage blanket as indicated on plans to design grade and remove all loose material and clods greater than two (2) inches in diameter. Carefully place the porous granular material for the blanket without allowing it to become contamination with cohesive materials.
- B. The material for the drainage blanket should be placed in lifts no greater than six (6) inches and compacted in place using a walk behind vibratory steel plate or other method as approved by Engineer.
- C. After the drainage blanket material is placed in accordance with the specified location and depth, carefully place cohesive fill material over this porous medium so that it is not excessively disturbed and contaminated. No general earthmoving equipment should be operating directly over the porous medium until at least one (1) foot of cohesive material has been placed.
- D. Any porous material that becomes excessively contaminated or disturbed as determined by Engineer shall be removed and replaced with suitable material at Contractor's own expense.

3.8 PIPE

- A. Excavate the trench to grades necessary to place the pipe as indicated on the Plans. The sides of the trench shall be sloped as needed for stability and to satisfy OSHA requirements. The lower portion of the trench shall have vertical side walls to reduce the amount of stress on the pipe. The bottom width shall provide approximately twelve (12) inches between the haunch of the pipe and the side walls of the trench to permit hand compaction of the backfill on either side of the pipe. Place any granular bedding material around the pipe as shown on the Plans.
- B. Lay the pipe in the center of the trench with female joints facing upstream. Place joint sealant as required as each piece is placed. All gaskets shall be protected during installation. Backfill with suitable material in lifts not exceeding eight (8) inches and compacted by hand operated mechanical tampers to a height at least twelve (12) inches above the pipe. Exercise care not to cause the pipe to shift and/or to uplift while placing and compacting material up to the top of the pipe. Backfill should be placed evenly on both sides of the pipe. Continue backfilling with compacted lifts to the surface.
- C. Mass dumping of the backfill shall not be allowed. Settled areas shall be corrected by Contractor at no cost to Division.
- D. Anti-seep collars or filter diaphragms shall be placed around the pipe as shown on the Plans. The size of the excavation for anti-seep collars shall be at least that indicated on the plans. Cast-in-place anti-seepage collars shall be constructed with a monolithic pour using the sides of the excavation as forms where possible. The excavation shall be cleared of all loose material prior to placement of concrete. After the concrete has sufficiently cured, remove any forms and proceed with backfilling. Cohesive backfill shall be placed against the portion of seepage collars made with forms. The fill shall be placed in lifts not exceeding eight (8) inches in loose thickness and

compacted by hand operated mechanical tampers. The fill shall be placed on both sides evenly on both sides of the anti-seepage collars.

3.9 STRUCTURES: DROP INLETS AND OPEN SIDED INTAKES

A. Drop Inlets

1. Install Drop Inlets in strict accordance with these Specifications, manufacturer's recommendation, and the Plans. In case of discrepancy, the most stringent requirements shall apply.
2. Install concrete base for the drop inlet as shown on the Plans. Install vertical RCP sections and neatly core drill or saw a hole in the vertical pipe for the outgoing pipe and any incoming pipes. The hole shall be no greater in size than required to permit the outgoing pipe to be inserted into the riser. Insert pipe into the structure a distance no greater than required to properly make the connection; do not unduly restrict the flow area. Wrap the opening with tile tape, strips of filter fabric or other approved material to seal the annular space and encase the entire connection with concrete. Provide fillet concrete in base of riser to direct flows into outflowing pipe. Furnish and install appropriately sized trash rack or riser guard where shown on the Plans.
3. Backfill excavation with compacted lifts using excavated material unless this material is unsuitable. Provide suitable backfill material if necessary. Reshape and/or compact adjacent ground surface as required.

B. Open Sided Intakes

1. Open sided intakes shall be placed to the specific elevations and dimensions indicated on the plans.
2. Pipe connecting to the intakes shall be placed as shown on the Plans and in accordance with SUDAS 6010.
3. Backfill material shall be placed after adequate strength is acquired for the structure. Backfill shall consist of excavated material with rocks larger than four (4) inches in diameter sorted out. The backfill shall be placed in lifts of no more than six (6) inches and compacted using hand equipment.
4. If precast open-sided intakes are used, provide a granular leveling course of one (1) inch clean, angular limestone four (4) to six (6) inches thick at the bottom of the structure and around the pipe connection adjacent to the structure.

PART 4 - MEASUREMENT AND PAYMENT

4.1 UNIT PRICES

- A. Construction cost of all work included in this Section of the Construction Specifications shall be included in Contractor's unit prices set forth in the Proposal and Schedule of Prices (*Document C*) for the work items described below. Unit price for each of these items shall include its pro rata share of overhead so that the sum of the products obtained by multiplying the unit prices so set forth by the amount of the work constructed and measured as described herein, shall constitute full payment to Contractor for performance of the work included in this SECTION.

- B. Measurement and payment for each work item in this SECTION shall be in accordance with the following:
1. *Toe Drain*: The unit prices shall include all materials and work required for installation of the drainage conduit in conformance with details and dimensions shown on the Plans. The unit prices shall include furnishing and installing the tubing, fittings, trenching, removal and disposal of excess trench material, backfill, compaction, and all other work items incidental thereto, including rodent guards, tile tape and concrete for sealing below-grade connections. Measurement for payment shall be based on the length of a specified diameter installed as determined from field measurements and rounded to the nearest one (1) lineal foot.
 2. *Porous Backfill*: Unit prices for porous backfill shall include all work, materials, labor, and equipment needed to place the material as shown on the plans. The costs for excavation and protection barriers are incidental and shall be included with the unit price for these items. The volume of material placed will be determined by Engineer by measuring the height and width of the excavation prior to backfilling. Additional quantities required due to over-excavation or wider trenches not directed by the Engineer will not be approved for payment.
 3. *Pipe*: These unit prices shall include all materials and work required for installation of the pipe in conformance with details and dimension shown on the Plans and these Specifications. The unit prices shall include furnishing and installing the pipe, fittings, trenching, removal and disposal of excess trench material, anti-seepage collars, backfill, compaction and all other work items incidental thereto, including rodent guards. Measurement for payment shall be based on length of pipe for a specified diameter actually installed as determined from field measurements and rounded to the nearest foot.
 4. *Structure*: Unit price shall include all materials and work required for installation of drop inlets or open-sided area intakes in conformance with details and dimensions shown on the Plans and these Specifications. Unit prices shall include furnishing and installing the structure and trash rack or bar guard, concrete base, connecting the pipe, concrete, excavation, backfill, and all other incidental construction including removal of any accumulated sediment, maintenance and repairs. Measurement and payment of structures shall be based on the number of each size and type of structure properly installed and maintained.

4.2 SUMMARY – UNITS OF MEASUREMENT:

Units of measurement for bid items applicable to work covered by this SECTION are as follows:

<u>Description</u>	<u>Unit</u>
Toe Drain - (size)	Lineal Foot
Porous Backfill - Toe Drain	Cubic Yard
Porous Backfill – Chimney Drain	Cubic Yard
Porous Backfill – Drainage Blanket	Cubic Yard
Pipe - (size)	Lineal Foot
Structure - (type & size)	Each

END OF SECTION 02310

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SECTION 02400 - SUBGRADE PREPARATION

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PART 1 - GENERAL

1.1 DESCRIPTION

A. Applicability

This SECTION provides for the common situations where cover material is not available and for those rare situations where cover material is available.

B. Work Included

Work under this SECTION covers requirements for materials, tools, equipment and services necessary to complete the subgrade preparation for this project. The work shall include, but is not necessarily limited to, completion of the following work:

1. Field engineering.
2. Soil testing.
3. Wetland undercut and subgrade preparation.
4. Lime-mulch application.
5. Incorporation of the applied lime and mulch materials.

1.2 REFERENCE SPECIFICATIONS

A. The following specifications or standards are incorporated by reference into this SECTION:

1. Iowa Agricultural Liming Material Act.
2. SECTION 02250 EARTHWORK, SELECT BORROW
3. SECTION 02700, PERMANENT SEEDING
4. Trees to remain shall be protected as described by Iowa State University (ISU) Extension Service at https://naturalresources.extension.iastate.edu/forestry/care_maintenance/construction.html

B. Above-mentioned references, which do not appear printed with the Contract Documents, can be provided to Contractor upon request.

1.3 QUALITY ASSURANCE

- A.** Contractor shall use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with specified requirements and methods needed for proper performance of work of this SECTION.
- B.** Contractor shall use equipment adequate in size, capacity and numbers to accomplish work in a timely manner.
- C.** In addition to complying with requirements of governmental agencies having jurisdiction, Contractor shall comply with directives of Engineer and Division.

1.4 DELIVERY, HANDLING AND STORAGE

- A. Storage of materials on job site must be approved in writing by Engineer.
- B. Materials approved for storage on site which are being degraded due to storage must be removed and replaced at no additional cost to Division.
- C. Deliver packaged materials to the site in the supplier's original unopened containers; each container to bear certification as specified.
- D. Store packaged materials off ground and protected from moisture.

1.5 SUBMITTALS

- A. Agricultural Lime
 - 1. Contractor shall submit vendor's certified analysis for ECCE (Effective Calcium Carbonate Equivalent) in minimum pounds of ECCE per ton of material, fineness of agricultural lime, and supplier's name and location.
 - 2. Contractor shall submit results of recent moisture tests for the agriculture lime.
- B. Weight Tickets

Contractor shall submit weight tickets and/or shipping tickets of all materials delivered to the site for the work in this SECTION to Engineer for payment purposes.
- C. Soil Tests

Soil tests to determine the applicable liming rate shall be taken by the Engineer with assistance from Construction Observer and Contractor. Test results will be submitted to the Contractor and Division when received by Engineer. Payment for these tests will be made by Engineer.

1.6 SITE DISTURBANCES

Contractor shall take precautions to ensure that equipment and vehicles do not unnecessarily disturb or damage existing grading or other site improvements. Any areas identified by Engineer or Division as becoming excessively disturbed shall be repaired at Contractor's own expense.

PART 2 - PRODUCTS

2.1 AGRICULTURAL LIME

- A. Agricultural lime shall be ground calcitic limestone conforming to the current requirements of the Iowa Agricultural Liming Material Act. The liming material shall contain calcium in the carbonate, oxide or hydroxide form, or a combination thereof. The lime shall have a minimum fineness of fifty-five (55) percent and shall contain at least one thousand (1,000) pounds ECCE per ton of lime to be applied.
- B. If agricultural lime with at least one thousand (1,000) pounds ECCE per ton is not locally available, Contractor may submit a proposal for use of equivalent material based upon the minimum pounds required of ECCE per acre.

- C. Lime sludge salvaged from water treatment plants or other industrial operations can be used for agricultural lime if it can be uniformly distributed over the site. Moisture content and ECCE tests results shall be provided to Engineer and Division to determine application rates. Moisture tests will be taken by Engineer during placement and application rates will be adjusted as appropriate.

2.2 MULCH – NON-WETLAND AREAS

- A. Conventional mulch shall be air-dry and shall consist of straw, harvested from oats, rye or wheat, corn stover (stalks), hay or grass forage cut from native grasses or other plants approved in writing by the Division.
- B. Conventional mulch shall have been properly cured, harvested and baled. Mulch harvested after a killing frost or during dormant periods will not be acceptable.
- C. All mulch shall be free of noxious weeds as published by the local County Weed Commissioner and other weeds deemed undesirable by Engineer, such as foxtail, etc.
- D. Each load of mulch shall be subject to inspection and acceptance by Engineer or Construction Observer prior to unloading.
- E. Alternatives to conventional mulch material like wood chips or composted organic materials, may be considered but are subject to approval by Engineer and Division. Mulch substitutions shall be tested for moisture content. The bulk weight of alternative mulch furnished and applied must be adjusted to provide an amount of dry mass equivalent to that provided by conventional mulch, which contains an assumed air-dry moisture content of twenty (20) percent. Based upon moisture tests, Engineer shall determine the adjusted bulk application rate for the substitute mulch.
 - 1. Wood Chips – This substituted material can either be processed on site or delivered to the site.
 - a. All material must be able to pass through a one-half (1/2) inch screen and shall not have excessive amounts of leaves or soil.
 - b. All material shall be able to decompose within a sixty (60) day to ninety (90) day period.
 - c. Additional nitrogen must be applied prior to disking to provide better decomposition.
 - i. The amount of active nitrogen required is approximately one (1) percent of the dry weight of the wood chips, subject to adjustment by Engineer.
 - ii. This additional nitrogen will not be measured for payment and is considered incidental to allow for the use of wood chips as a substitute for mulch.
 - 2. Composted Organic Materials
 - a. Compost can be derived from processed wood chips, food waste or other non-hazardous organic waste, subject to approval by Engineer.
 - b. Compost shall be able to pass through a one-half (1/2) inch screen.

- c. Compost shall be aged at least twelve (12) months and from an approved supplier.

2.3 MULCH – WETLAND AREAS

- A. Mulch material, condition and quality shall conform to the provisions of 2.2 A through C above.
- B. Each load of mulch shall be subject to inspection and acceptance by Engineer or Construction Observer prior to unloading.
- C. No alternatives to conventional mulch shall be considered for use in wetland areas.

2.4 WETLAND FERTILIZER

- A. Fertilizer shall be a standard commercial product which, when applied at the proper rate, will supply the quantity of total active nitrogen (N) at a rate of thirty (30) pounds per acre for the lower portion of the subgrade treated in wetland areas.
- B. Fertilizer shall be uniform in composition, liquid or dry, and shall be free flowing. Fertilizer may be delivered in bulk from the supplier or in its original unopened containers. Any fertilizer which becomes caked or otherwise damaged, making it unsuitable for use, will not be accepted.

2.5 COVER MATERIAL

- A. Cover material soil shall be subject to approval of the Engineer and Division. It shall exhibit suitable soil pH, texture and structure appropriate for supporting grass vegetation. Evaluation of soil properties may include visual, tactile and/or laboratory tests.
- B. Should soil exhibit sub-optimal pH but possess suitable soil texture and structure, it may be considered suitable for cover material, if a neutralization period is implemented.

Cover material may include, but is not necessarily limited to:

- 1. Dark brown to black topsoil of appropriate texture typically encountered in the A horizon of a soil profile.
- 2. Light to dark yellowish brown, lean, sandy or silty clay loam to silty or sandy clay with redoximorphic features typically encountered in the B horizon of a soil profile.
- C. Gray to black soil materials typically encountered below the B horizon in a soil profile are generally not considered suitable for use as cover material without detailed testing.
- D. Platy shale, shale-like coal slag or spoily materials shall NOT be considered suitable for cover material.

PART 3 - EXECUTION

3.1 TIMING – WITHOUT COVER MATERIAL -- NEUTRALIZATION PERIOD REQUIRED

- A. When cover material is NOT available, both time and moisture are required for lime to neutralize acidic spoil material and for mulch to decompose. A delay period is required to enhance the benefit between the lime/mulch treatment and seeding operations. The length of the delay is dependent on many factors including lime and mulch properties, soil properties, and weather conditions.
- B. Contractor shall coordinate his work to achieve maximum delay time, perhaps as much as several months or over-winter, at no additional expense to Division. Contractor shall request approval of Division for when the seeding operations can begin.

3.2 TIMING – WITH COVER MATERIAL

- A. Prior to application of ag lime, Engineer and Division shall approve the final grades of areas to receive cover material.
- B. No cover material shall be placed over untreated spoil material. All agriculture lime application and incorporation shall be completed in areas designated to receive cover material.
- C. No cover material shall be placed in constructed wetland areas until the agricultural lime, fertilizer and mulch have been placed and properly incorporated. If cover material is placed inadvertently prior to placement of agriculture lime to neutralize the soils, Contractor shall remove and replace the cover material as needed at his own cost to allow for the lime to be placed and incorporated.
- D. When cover material is available, it shall be applied as a uniform thickness on top of treated spoil material per the requirements of SECTION 02250 EARTHWORK, SELECT BORROW. The minimum thickness of cover material placed shall be nine (9) inches unless a greater thickness is determined by Engineer based upon the volume of cover material available.
- E. When approved cover material is properly placed over treated spoil material, a neutralization period is not required unless additional time is required to improve sub-optimal soil pH as directed by the Engineer or Division.
- F. If Engineer or Division determines that the addition of mulch will improve the soil tilth of cover material, mulch shall be applied and incorporated into the cover material the rate specified in 3.7 A. below. Contractor shall limit the depth of incorporation so that spoil material below the cover is not brought up to the finished surface. Mulch so incorporated shall be allowed at least thirty (30) days to decompose prior to seeding.

3.3 SOIL TESTING

- A. WITHOUT Cover Material: As the Contractor is nearing final grade in portions of the site to prepare for seeding, the Contractor shall contact and schedule soil sampling with the Engineer.
- B. WITH Cover Material: As the Contractor is nearing final subgrade in portion(s) of the site to prepare for placement of select borrow (cover) material, the Contractor shall contact and schedule soil sampling with the Engineer. The Engineer is to collect the samples, assisted by the Construction Observer and Contractor, and submit them for testing.

- C. The Engineer is to collect the samples, assisted by the Construction Observer and Contractor, and submit them for testing.
 - 1. Engineer and Contractor shall collect composite samples of not less than ten (10) well-distributed individual soil cores from any contiguous area of ten (10) acres or less. Soil cores shall be three-quarter (3/4) inch to one (1) inch diameter to a depth of about twelve (12) inches. Areas having observable differences in material types or surface conditions (soil types) shall be handled as different samples, even if less than (10) ten acres.
 - 2. Engineer shall combine soil cores to form composite samples for each (10) ten acres of contiguous area and/or observable different soil types by mixing well and placing in sample bag to be sent to laboratory. (e.g. If total area is 30 acres and has two (2) distinctly different soil types of fifteen (15) acres each, then there should be four (4) composite samples containing ten (10) soil cores each – two (2) composite samples from each soil type.)
- D. Engineer shall take responsibility to have each composite soil sample delivered to an approved soil testing laboratory. Each sample should be tested for the properties listed below. It should be noted by Contractor that test results for Item #3 below can often take four (4) weeks or longer to receive. The Engineer cannot be held responsible for delays in schedule due to Contractor scheduling of sampling or the time it takes for the laboratory to complete the tests.
 - 1. pH.
 - 2. Buffer pH.
 - 3. Acid/Base Accounting based on pyritic sulfur with total sulfur
- E. Engineer shall obtain liming recommendations to achieve a pH of at least 6.5 for spoil from the laboratory and submit the results to Division. The cost of all services required from the testing laboratory for initial liming recommendations shall be the responsibility of Engineer.
- F. Soil test results and laboratory recommendations shall be used by Engineer and Division in determining the amount of ag lime to be applied. The final rate determined by Division and Engineer shall be applied by Contractor and this rate may be more or less than that recommended by the laboratory.

3.4 WETLAND AREAS – WITHOUT COVER MATERIAL

- A. Subgrade Preparation
 - 1. Engineer and Division shall approve the final grades in the wetland areas prior to incorporation of mulch and fertilizer materials by Contractor.
 - 2. After final grade acceptance, Contractor shall excavate at least nine (9) inches of material below final grade in the constructed wetland areas as shown on the plans. This material shall be set aside to be replaced after this exposed layer has been treated.

B. Application for Undercut Area

1. Agricultural Lime (tons ECCE per acre) shall be applied at the same rate as that determined from the soil tests taken for the rest of the site.
2. Fertilizer – Nitrogen (N) shall be applied at a rate of thirty (30) pounds per acre.
3. Mulch – Mulch shall be applied at a rate of five (5) tons per acre.

C. Incorporation for Undercut Area

1. Contractor shall apply and incorporate the lime, fertilizer and mulch into the exposed undercut area over the entire wetland areas as designated in the plans. The depth of incorporation shall extend at least nine (9) inches into the spoil material beneath the undercut level and shall be completed with an acceptable method as approved by the Engineer.
2. Application will not be permitted during adverse conditions, such as high winds, surface frost to a depth of greater than one (1) inch, excessive moisture in the surface to be treated, or if rain is predicted within the time Contractor estimates will be required for application and incorporation of the mulch and fertilizer within the approved wetland area(s).

D. Replacement of Undercut Material

After application and incorporation of lime, fertilizer, and mulch is complete in the undercut subgrade, Contractor shall replace the excavated material.

E. Application for Replaced Undercut Material

1. Agricultural Lime –Agricultural lime (tons ECCE per acre) shall be applied at the same rate as that determined from the soil tests taken for the rest of the site.
2. Fertilizer – Nitrogen (N) shall be applied at a rate of thirty (30) pounds per acre.
3. Mulch – Mulch shall be applied at a rate of five (5) tons per acre.

F. Incorporation for Replaced Undercut Material

Contractor shall apply and incorporate ag lime, fertilizer, and mulch into the replaced material from undercut area over the entire wetland areas as designated on the plans. The depth of incorporation shall extend at least nine (9) inches into the spoil material beneath the undercut level and shall be completed with an acceptable method as approved by the Engineer.

3.5 WETLAND AREAS – WITH COVER MATERIAL

A. Subgrade Preparation

Contractor shall establish the final grade, less the depth of cover, in the areas where constructed wetlands are shown on the plans. The Engineer and Division shall approve the final grades in the wetland areas prior to incorporation of lime materials by Contractor as described in *3.6 Lime-mulch Application* above.

B. Application Rates – Prior to Cover Placement

1. Agricultural Lime –Agricultural lime (tons ECCE per acre) shall be applied at the same rate as that determined from the soil tests taken for the rest of the site prior to placement of cover material.
2. Fertilizer – Nitrogen (N) shall be applied at a rate of thirty (30) pounds per acre prior to placement of cover material or as otherwise indicated in the Supplemental Specifications.
3. Mulch – Mulch shall be applied at a rate of five (5) tons per acre prior to placement of cover material or as otherwise indicated in the Supplemental Specifications.

C. Incorporation – Prior to Cover Placement

1. After final grade acceptance and before placement of cover material, Contractor shall apply and incorporate the lime, fertilizer and mulch over the entire wetland areas as designated on the plans. The depth of incorporation shall extend at least into the upper nine (9) inches of spoil material and shall be completed with an acceptable method as approved by the Engineer. Cover material can then be placed over the wetland treated subgrade as shown on the plans.
2. Application will not be permitted during adverse conditions, such as high winds, surface frost to a depth of greater than one (1) inch, excessive moisture in the surface to be treated, or if rain is predicted within the time Contractor estimates will be required for application and incorporation of the mulch and fertilizer within the approved wetland area(s).

D. Application Rates and Incorporation – After Cover Placement

1. After placement of cover material, areas within the wetland areas will receive additional lime and fertilizer, as established in SECTION 02700- SEEDING. Additional mulch shall also be applied at a rate of two (2) tons per acre on the cover material within the wetland areas shown on the plans. These materials shall be incorporated into the cover material as soon as conditions allow and prior to the impoundment of water. Care shall be taken not to mix the spoil material into the cover material during this disking.

3.6 LIME-MULCH APPLICATION – WITHOUT COVER MATERIAL

A. Application Rates

1. Agricultural Lime - Contractor shall plan to apply lime (tons ECCE per acre) at the rate as shown on the plans or listed in the Supplemental Specifications unless a different rate is specified based on the results of soil tests as described in 3.3.D. which are taken after rough grading is completed. The application rate provided in these documents is based on limited information available and is for bidding purposes. Actual application rate will vary depending upon soil test results.
2. Mulch, Subgrade - Contractor shall apply mulch at a rate of five (5) tons per acre or as otherwise indicated in the Supplemental Specifications.
3. Weight Tickets - Weight tickets shall be provided to the Engineer to determine that the appropriate amount of lime and mulch was applied prior to incorporation.

B. Incorporation

1. Contractor shall demonstrate to Engineer and Division on a small plot of one-tenth (1/10) acre or more in size, the method and equipment which will be used to thoroughly mix the lime-mulch materials into the upper twelve (12) inches of spoil. When an acceptable method is agreed to by Engineer and Division, that method shall be used throughout the Project. Engineer and Division reserve the right to reject the method of incorporation as it progresses if the previously approved procedure stops obtaining the desired results.
2. Prior to the application and incorporation of the lime and mulch materials, Engineer and Division shall approve the final grades and the lime application rates based on the spoil test results. Contractor shall request approval to initiate the lime-mulch application on areas of at least five (5) acres in size.
3. Contractor will obtain Engineer and Division's approval of site conditions prior to application of lime or mulch. Application will not be permitted during adverse conditions such as high winds, surface frost to a depth greater than one (1) inch, excessive moisture in the surface to be treated, or if rain is predicted within the time Contractor estimates will be required for application and incorporation of the lime-mulch within the approved area.
4. After receiving approval from Engineer and/or Division, Contractor shall evenly apply agricultural lime and mulch directly on the surface to be treated. Contractor shall incorporate the lime/mulch into the upper twelve (12) inches of material the same day the lime and mulch are applied, using the agreed upon method per 3.6.B.1 above. Incorporation shall be done along the contour, and compaction shall be kept to a minimum. This may require multiple passes to thoroughly mix both the lime and mulch through the upper twelve (12) inches.

C. Contractor shall use means necessary to prevent dust from becoming a nuisance to public, to neighbors and to other work being performed on or near site.

D. No lime or mulch shall be applied on site if that load of lime or mulch is not accompanied by an appropriate weight ticket. All lime and mulch weight tickets for material applied on site shall be submitted to the construction observer or engineer upon arrival of the material on site. If Contractor applies lime or mulch prior to construction observer or engineer receiving appropriate weight ticket for that material, or in the absence of the construction observer or engineer, Division may require additional lime and/or mulch be applied to the site at Contractor's expense to assure that Contract specified amounts are met.

3.7 LIME-MULCH APPLICATION – WITH COVER MATERIAL

A. Application Rates

1. Agricultural Lime – If required by Engineer or Division, Contractor shall plan to apply ag lime (tons ECCE per acre) at the rate determined by engineer based on the results of soil tests as described in 3.3.D. which are sampled from stockpiles of cover material. The soil tests of cover material should not include acid-base accounting unless it is recommended by Engineer in consultation with Division. This application of agricultural lime may, be in addition to agricultural lime applied immediately prior to seeding.

2. Mulch, Subgrade – If required by Engineer or Division, Contractor shall apply mulch at a rate of five (5) tons per acre to improve soil tilth of the cover material. This application of mulch shall not be considered equivalent to *Mulch, Seeding* described in SECTION 02700.
- B. Incorporation of the additional agricultural lime and/or mulch shall proceed as described in 3.6 B. above except the depth of incorporation shall not exceed the thickness of the cover material.

PART 4 - MEASUREMENT AND PAYMENT

4.1 UNIT PRICES

- A. Construction cost of all work included in this SECTION of the Construction Specifications shall be included in Contractor's unit prices set forth in Proposal and Schedule of Prices (*Document C*) for work items described below. Unit price for each of these several items shall include its pro rata share of overhead so that sum of products obtained by multiplying unit prices so set forth by amount of work actually constructed, measured as described herein, shall constitute full payment to Contractor for performance of work included in this SECTION.
- B. Measurement and payment for each work item in this SECTION shall be in accordance with following:

1. *Subgrade Preparation:* Contractor's unit price for Subgrade Preparation shall constitute full payment for Incorporation of agricultural lime and mulch into wetland and non-wetland areas. At Contractor's option, it may also include compensation for rock picking and removal.

The Subgrade Preparation area will be based upon the grading footprint as shown on the plans, rounded to the nearest one-tenth (1/10) acre. Any field adjustments made will be measured jointly by Contractor and Engineer. The total area for payment shall only be counted **once** EXCEPT in the case for those measured areas where cover material is placed **and** where that cover material requires additional incorporation of agricultural lime and mulch as determined by the Engineer.

2. *Agricultural Lime:* Contractor's unit price for agricultural limestone used in subgrade preparation work shall represent full payment for furnishing, delivery, and application of the lime in accordance with the specifications. The unit price for *Agricultural Lime* required in this SECTION shall be considered equal to the unit price for *Agricultural Lime* required in SECTION 02700, PERMANENT SEEDING. Submittals required under Item 1.5 *Submittals* of this SECTION shall accompany each shipment of agricultural limestone for payment. Actual application rate will vary, pending recommendations of soil tests conducted in accordance with Item 3.3 *Soil Testing*, of this SECTION. This pay item will also include lime placed on both the undercut and replaced material within the wetland areas.

Measurement for payment purposes shall be actual number of tons of ECCE, based upon a dry unit weight, applied by Contractor in complying with requirements of this SECTION.

3. *Mulch, Subgrade:* Contractor's unit price for Mulch, Subgrade shall represent full payment for furnishing approved mulch materials, including freight, delivery and application. This pay item shall also include mulch placed into both the undercut and the replaced material within the wetland areas. No additional adjustment in unit price

will be made if substitute materials are used. No additional payment will be made if additional nitrogen is required with use of approved substituted mulch material.

Engineer will determine in acres, to the nearest one-tenth (1/10) acre, the actual area in which the mulch application was performed. Contractor shall provide field measurements as required to show the limits of the area mulched. Delivery receipts showing certified weight prior to placement will be used to confirm that sufficient mulch required tons per acre incorporation of mulch.

4. *Wetland Fertilizer:* Payment for fertilizer, Nitrogen (N), furnished, delivered, and applied into wetland areas, per requirements of this SECTION, shall be made in accordance with Contractor's unit prices for wetland fertilizer. Bulk weight tickets must accompany each shipment of fertilizer and shall form the basis for measurement and payment. Measurement for payment purposes shall be the actual weight to the nearest one pound (1.0 Lb.) of active ingredient for the nutrient.
5. *Wetland Undercut and Replacement:* Contractor's unit price for wetland undercut and replacement shall constitute full payment for excavation of undercut material, stockpiling the material nearby, and replacement of the undercut material after the initial incorporation is complete and all other incidental work including the incorporation of the fertilizer, mulch, and agricultural lime.

The wetland undercut and replacement area will be based upon the wetland areas as shown on the plans rounded to the nearest one-tenth (1/10) acre. Any field adjustments made will be measured jointly by Contractor and Engineer. The total area for payment is only counted once.

4.2 SUMMARY – UNITS OF MEASUREMENT

Units of measurement for bid items applicable to work covered by this SECTION are as follows:

<u>Description</u>	<u>Unit</u>
Subgrade Preparation	Acre
Agricultural Lime	Ton (ECCE)
Mulch, Subgrade	Acre
Wetland Fertilizer	Pound (active ingredient)
Wetland Undercut and Replacement	Acre

END OF SECTION 02400

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PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work under this SECTION covers requirements for materials, tools, equipment and services necessary to complete the herbaceous seeding of all areas disturbed during construction of this project. The work shall include, but is not necessarily limited to, completion of the following work:
 - 1. Preparation of seedbed.
 - 2. Testing surface materials for lime and fertilizer application rates.
 - 3. Applying lime, fertilizer, and seed.
 - 4. Applying mulch.
 - 5. Applying erosion control mat, if specified.
 - 6. Temporary fencing if required.
 - 7. Field engineering.

1.2 REFERENCE SPECIFICATIONS

- A. The following specifications or applicable standards are incorporated by reference into this SECTION:
 - 1. SECTION 02400 – SUBGRADE PREPARATION.
 - 2. U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act and Iowa State laws.
 - 3. Iowa Agricultural Liming Material Act.
- B. Above-mentioned references, which do not appear printed with the Contract Documents, can be provided to Contractor upon request.

1.3 QUALITY ASSURANCE

- A. Qualifications of Workers: Provide at least one person who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the best methods for their installation and who shall direct all work performed under this SECTION.
- B. All seed shall meet or exceed requirements contained in specifications of this SECTION and Federal, State and County laws requiring inspection for plant disease and insect control and shall be labeled and certified in accordance with U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act and Iowa State laws. All seed must be dated for test and be from the last season prior to date of delivery.
- C. Lime Materials shall be a Standard Ground Agricultural Limestone which meets current requirements of the Iowa Agricultural Liming Material Act.

- D. Fertilizer shall be a commercial grade fertilizer and shall meet standards for grade and quality as per the requirements of the Iowa Department of Agriculture and Land Stewardship.
- E. Mulch shall meet the requirements of PART 2 PRODUCTS of this SECTION. Contractor shall identify to Engineer the locations from which the straw mulch was obtained and prove weight.
- F. Engineer reserves the right, at any time, to sample all materials for testing to determine compliance with the requirements of this SECTION.
- G. Contractor (or his designated subcontractor) shall notify Engineer when subgrade preparation, liming and fertilizer, seeding, and mulching is planned to occur. Any work completed without notifying Engineer will be subject to withheld payment until work can be verified.

1.4 JOB CONDITIONS

- A. Areas to be seeded include all project areas disturbed by excavation, grading and other construction procedures required for the completion of this contract.
- B. Seeding shall be performed only during the seasons specified. The planting operation shall not be performed during times of drought, excessive moisture, or other unfavorable climatic conditions.
- C. Prior to the work of this SECTION, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- D. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.
- E. Prior to permanent seeding, the waiting period as determined by Division will be required after the lime and mulch has been applied to sites where no cover material is available. This waiting period is necessary to allow the lime-spoil reaction and mulch decomposition to occur, providing a suitable environment for vegetation. The waiting period typically requires ninety (90) days. This waiting period is not needed for areas where non-acidic cover material is placed over lime treated spoils.

1.5 SUBMITTALS

- A. Certificates and Receipts
 - 1. Certification shall be submitted to Engineer that all seed to be used is in compliance with the following:
 - a. The Federal Seed Act.
 - b. Iowa Department of Agriculture & Land Stewardship regulations.
 - c. Species type and pounds of pure live seed (PLS) certification.
 - d. Date and results at germination and purity tests.
 - e. Test date to determine the percentages of germination and purity have been completed within a nine (9) month period, exclusive of the calendar month in which the test was completed.

- f. The seed analysis on the label shall be mechanically printed.
 - 2. Suppliers certification of Effective Calcium Carbonate Equivalent (ECCE) content per ton of material must be submitted to and approved by Engineer prior to initial applications and subsequently as requested by Engineer. Necessary information shall include:
 - a. Name and location of supplier.
 - b. Name and address of agency and/or laboratory making ECCE determination.
 - c. Clear identification of stockpile from which limestone is obtained.
 - d. Date of last ECCE test and those for the previous four (4) tests on which ECCE is based.
 - e. Receipts stating weight of material on each truck which arrives on site.
 - 3. Fertilizer delivered in bulk shall be accompanied by the suppliers' certification of analysis and weight for each shipment made to the job site. Fertilizer delivered in individual containers shall be sealed and clearly marked for analysis and weight.
 - 4. Contractor shall supply verification of the weight of mulch delivered to the job site in a method satisfactory to Engineer.
- B. Testing
- 1. Contractor shall select a soil testing laboratory for use on the seeding work and submit the name, address and telephone number for approval by Engineer at least thirty (30) calendar days prior to sampling time.
 - 2. Contractor shall submit to Engineer and Division the results of all tests for specified lime and fertilizer recommendations prior to application as specified in Item 3.2 in this SECTION. Payment for these tests will be made by Contractor.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store and handle materials in accordance with the General Conditions and the Supplemental Specifications.
- B. Storage of all materials on the job site must be approved in writing in advance by Engineer.
- C. Any materials approved for storage on site which, in the opinion of Engineer or Division, are being degraded due to storage must be removed and replaced at no additional cost to Division.
- D. Use all means necessary to protect materials from the elements during delivery, handling and storage.
- E. Deliver packaged materials (seed, etc.) to site in supplier's original unopened containers; each container to bear certification as specified. Pure live seed (PLS) certification shall be attached to all seed containers and shall not be removed except by Engineer.
- F. Store packaged materials off ground and protect from moisture. Moisture damaged materials are unacceptable. Wet, moldy or otherwise damaged seed is unacceptable.

1.7 SITE DISTURBANCES

- A. Take precautions to insure that equipment and vehicles do not unnecessarily disturb or damage existing grading, other site improvements, or adjacent areas to the work.
- B. Repair any damage and return site and adjacent areas disturbed by Contractor's operations to original condition at no cost to Division.

PART 2 - PRODUCTS

2.1 AGRICULTURAL LIME

- A. Agricultural lime shall be ground calcitic limestone conforming to the current requirements of the Iowa Agricultural Liming Material Act. The lime shall have a minimum fineness of fifty-five (55) percent and shall contain not less than one thousand (1,000) pounds ECCE per ton of lime to be applied.
- B. If lime containing not less than one thousand (1,000) pounds ECCE per ton is not locally available, Contractor may submit a proposal for use of equivalent material based upon the minimum pounds required of ECCE per acre.
- C. Lime sludge salvaged from water treatment plants or other industrial operations shall not be approved as a substitute for agricultural lime for permanent seeding.

2.2 FERTILIZER

- A. Inorganic fertilizer shall be a standard commercial product which, when applied at the proper rate, shall supply the quantity of total nitrogen (N), available phosphoric acid (P), and soluble potassium (K) as specified herein.
- B. Inorganic fertilizer shall be a commercial balanced fertilizer, uniform in composition, liquid or dry and free flowing. Fertilizer may be delivered bulk from the supplier or in its original unopened containers. Any fertilizer which becomes caked or otherwise damaged, making it unsuitable for use, will not be accepted.

2.3 MULCH

- A. Mulch materials shall consist of wheat, oats, rye, hay, grass cut from native grasses or other plants approved in writing by Division. Corn stubble is not an acceptable type of mulch for this application.
- B. Mulch shall be of air dry straw that has been properly cured and harvested. Mulch harvested after a killing frost or during dormant periods will not be acceptable. Mulch shall not be rotted, brittle, moldy, caked or otherwise degraded.
- C. Mulch shall be free of noxious weeds as published by the local County Weed Commissioner and other weeds deemed undesirable by Engineer, such as foxtail, etc.
- D. Each load of mulch shall be subject to inspection and acceptance by Engineer prior to unloading.
- E. At least fifty (50) percent of the salvage weight of each mulch bale shall contain mulch with a length of ten (10) inches or greater. This requirement shall apply to all mulch intended for crimping into the sown seedbed.

2.4 SEED

- A. All seed delivered to the job site shall be labeled according to the U.S. Department of Agriculture Federal Seed Act and shall be furnished in containers with tags showing seed mixture, purity, germination, weed content, name of seller, and date on which seed was tested.
- B. Moldy seed or seed which has been damaged in storage shall not be used.
- C. Seed that is more than one growing season in age shall not be used unless acceptable cold storage can be proven. If adequate cold storage is documented, seed may only be used if a twelve-month germination and viability test is performed.
- D. Seed Mixture: Seed mixtures shall consist of the number of varieties and proportions of pure live seed (PLS) thereof as specified in the Supplemental Specifications. The percentage of pure live seed and the bulk application rate of seed mixture shall be determined using equations 1 and 2 as follows:

Equation 1:

$$\text{Percent Pure Live Seed (\%PLS)} = \left\{ \frac{\% \text{ purity}}{100} \times \left(\frac{\% \text{ germination (a)}}{100} + \frac{\% \text{ hard seed}}{100} \right) \right\} \times 100$$

Equation 2:

$$\text{Actual Bulk Seed Applied per Acre} \left(\frac{\text{Bulk Lb.}}{\text{Acre}} \right) = \frac{\text{Req'd Lb. PLS per acre}}{\left(\frac{\% \text{ PLS}}{100} \right)}$$

- (a) TZ tests may be used instead of a germination test provided TZ tests report the percentage of viable seeds observed in a representative sample

E. Species Substitution

Substitutions of select plant species may be made subject to approval of the Division as discussed below.

1. The Contractor shall provide documentation that a particular species was sought from a variety of suppliers before concluding that a species is unavailable.
2. If after an exhaustive search was performed, and a particular species is determined to be unavailable, a substitution that exhibits a bloom period similar to the species it replaces shall be proposed. A legume should be substituted for a legume, a forb for a forb and a grass for a grass. Obligate (OBL) species should be substituted for obligate species, and facultative (FAC) for facultative. Preference shall be given to species native to Iowa and/or the upper Midwest of the United States.
3. The seed application rate of the proposed substitution(s) shall provide seed coverage at least equal to the seed coverage provided with the specified rate of the species it replaces.
4. The list of possible substitutions may be extensive, and availability may vary over time; therefore, any substitutions should be proposed and approved no sooner than sixty (60) days prior to the anticipated seeding date.

PART 3 - EXECUTION

3.1 INITIAL PREPARATION

- A. Except in the case of temporary seeding, the required lime/mulch treatment specified in Section 02400 - SUBGRADE PREPARATION shall have been performed and completed prior to initiating work of this SECTION in any area.
- B. Areas of the site that do not have cover material shall also have had the neutralization period completed as determined by Division.
- C. Any wetland or pond areas with pooled water levels above the specified seeding elevations for wetland seeding shall be lowered as needed at no additional cost to Division.

3.2 TESTING – SOIL FERTILITY

- A. Contractor shall collect samples of finish grades as specified below for testing provided all of the initial preparations are completed. Engineer **must** be present when samples are collected to prepare a sampling location plan. The samples shall be submitted to laboratory to determine lime and fertilizer recommendations. Payment for these soil tests will be the responsibility of Contractor.
 - 1. Engineer and Contractor shall collect composite samples of not less than ten (10) well-distributed individual soil cores from any contiguous area of ten (10) acres or less. Cores shall be three-quarter (3/4) inch to one (1) inch diameter to a depth of approximately six (6) to eight (8) inches. Areas having observable differences in material types or surface conditions (soil types) shall be handled as different composite samples, even if less than (10) ten acres.
 - 2. Contractor shall combine soil cores to form composite samples for each (10) ten acres of contiguous area and/or observable different soil types by mixing well and placing in sample bag(s) to be sent to laboratory. (e.g. If total area is 30 acres and has two distinctly different soil types of 15 acres each, then there should be four (4) composite samples containing ten (10) soil cores each – two (2) composite samples from each soil type.)
- B. Deliver each composite soil sample to the approved soil testing laboratory. Deliver samples for testing six (6) to eight (8) weeks prior to the beginning of the specified planting period. A shorter lead time may be possible depending on the laboratory. Test each composite sample for:
 - 1. pH.
 - 2. Buffer pH (Buffer Index).
 - 3. CEC (Cation Exchange Capacity).
 - 4. Phosphorus - Bray I (P₁ weak Bray) with recommendations.
 - 5. Exchangeable Potassium with recommendations.
 - 6. Nitrate Nitrogen with recommendations.

- C. Recommendations from the lab shall include rates for applying lime, nitrogen, phosphorus, and potassium for the appropriate grass mix (pasture land) for each area.
- D. Submit test results and laboratory recommendation to Engineer and Division for review at least one (1) week prior to scheduled date for application of lime and/or fertilizer.
- E. Soil test results and laboratory recommendations shall be used by Engineer and Division to determine the amounts of lime and fertilizer to be applied for various areas. Engineer's and Division's final rates shall govern and these rates may be more or less than those recommended by the laboratory.
- F. Cost of all services required from the testing laboratory for fertility shall be the responsibility of Contractor.

3.3 SEEDBED PREPARATION

- A. Dispose of any growth, rocks, or other obstructions which might interfere with tilling, seeding, or later maintenance operations. Break up clods, and dispose of rocks, woody debris and other objects which are six (6) inches or greater in diameter. These obstructions may become exposed during any of the disking operations described below and shall be removed.
- B. **FIRST DISKING:** Till all areas to be seeded by disking or other approved method to thoroughly loosen and pulverize the soil to a depth of six (6) inches. This may require multiple passes of the disk or other approved equipment. Lime and fertilizer shall not be incorporated during this first disking operation. If cover material has been placed over lime-treated spoil, care shall be taken to disk in manner and depth to prevent the acid material from mixing into the cover material.
- C. **SECOND DISKING:** Following the first disking operation apply ag lime and fertilizer (see Item 3.4 *Liming and Fertilizing* below) then re-disk the site to a depth of three (3) inches. Multiple passes may be required to complete this second disking.
- D. **THIRD DISKING:** Following the second disking harrow the site with an approved field cultivator or other approved tillage equipment, until the condition of the seedbed is suitable for seeding. The harrow shall be set to achieve the desired result. This may require manually resetting the teeth to a greater depth, weighting the harrow, removing extension arms on either side of the main frame, a combination of the above, or other modifications. In lieu of harrowing, or if the harrow is not producing the desired result, re-disk the area until the condition of the seedbed is suitable for seeding.
- E. After the third disking operation, and prior to seed application, firm the seedbed with an approved cultipacker or similar piece of equipment. Cultipacking shall continue until such time as a finely pulverized and firmly compacted seedbed is obtained and accepted by Engineer. The seedbed shall be cultipacked again following completion of seeding to ensure adequate seed-soil contact.
- F. Maintain the seedbed until seeded and mulched to provide a smooth area with no rills or eroded areas. Repair and restore prepared seedbed if it becomes eroded or otherwise disturbed.
- G. Throughout seedbed preparation activities, disking, harrowing and other operations may expose rocks, boulders, rubbish, debris, etc. During and/or upon completion of each disking and harrowing operation, and prior to continuing with the next operation, pick up all debris, rubbish, etc., remove or bury all boulders, and pick up all rocks that hinder seedbed preparation or will impede seeding the site or mechanical mowing of the reclaimed site. Dispose of rocks and

boulders in locations as approved by Engineer. Dispose of debris, rubbish, etc. by burying on site or hauling to an approved landfill.

- H. Contractor shall not perform seedbed preparation when ground conditions are unsuitable due to excessive moisture, snow, frost, or frozen ground, as determined by Engineer or Division.

3.4 LIMING AND FERTILIZING

- A. Agricultural lime, nitrogen (N), phosphorus (P), and potassium (K) shall be applied to all areas to be seeded, and shall be incorporated by disking into the top three (3) inches of the prepared seedbed.
- B. Lime and fertilizer shall be incorporated separately or simultaneously, depending upon the timing of product delivery and application.
1. **Lime:** The lime shall be applied and incorporated no less than one (1) week prior to seeding. Once applied, it shall be incorporated within a period of time which will avoid losses due to wind or rain.
 2. **Fertilizer:** The fertilizer must be applied and incorporated no more than one (1) week prior to seeding. Once applied, it too shall be incorporated within a period of time which will avoid losses due to wind or rain.
 3. If lime and/or fertilizer is applied but not yet incorporated, and Engineer or Division believes significant loss of lime and/or fertilizer has occurred due to bad weather, Engineer or Division may then require Contractor to reapply lime, fertilizer, or both, as applicable, at the rates and in the areas of the site so directed by Engineer and Division, at no additional cost to Division.
 4. Incorporation of lime and fertilizer, whether done separately or simultaneously, shall be considered the second disking operation (see Item 3.3 SEEDBED PREPARATION, D above). Once the lime and fertilizer have both been applied and incorporated, continue seedbed preparation as described in 3.3 SEEDBED PREPARATION.
- C. The application rate of agricultural limestone shall be based upon results of soil tests conducted in Item 3.2 TESTING – SOIL FERTILITY in this SECTION. For bidding purposes, it is estimated that the rate provided on the plans or in the Supplemental Specification shall be applied.
- D. Nitrogen (N), Phosphorus (P) and Potassium (K) fertilizer shall be applied to permanent cover seeding at a rate determined by the results of the soil testing in Item 3.2 TESTING - FERTILITY, in this SECTION. For bidding purposes, the rates provided on the plans or in the Supplemental Specification shall be applied.

3.5 SEEDING

- A. All seeding shall be completed within the seeding season dates shown below. Temporary seeding shall be completed at any time where weather and soil conditions will promote vegetation growth. Determine seeding season in consultation with Engineer and Division.

Spring	April 1 - May 30
Fall	August 15 - September 15 (1)*
Dormant	November 15 – hard frost (2)**

(1)* Native species shall NOT be seeded during the Fall season

*(2)**Dormant seeding for the permanent seeding mix may begin once observed soil temperatures are below 50 degrees Fahrenheit (50°F) for at least five (5) consecutive days*

- B. If Contractor foresees that seeding cannot be completed within the specified seeding seasons, he shall submit a written request for a seeding date extension to Division. All seeding completed outside of approved seeding dates is at Contractor's risk. Any repairs and reseeding that becomes necessary as a result of work completed outside the approved dates shall be completed by Contractor at no cost to Division.
- C. General Requirements:
1. As weather and site conditions permit, within the specified seeding season, seed site areas as shown on the Plans and all other disturbed areas.
 2. When conditions are such that less than satisfactory results are likely to be obtained by reason of drought, excessive moisture, snow, or frozen soil, seeding work shall be halted and resumed only when conditions are favorable or when approved alternative or corrective measures and procedures have been affected.
 3. Proceed with seeding work as rapidly as portions of the site become available within seasonal limitations. In any event, seeding shall be accomplished before the prepared seedbed becomes eroded, crusted over, or dried out and shall not be conducted when the ground is frozen or snow covered. Should seeding not be accomplished prior to the prepared seedbed becoming eroded, crusted over, or dried out, or the ground becomes snow covered or frozen, Engineer or Division shall require Contractor to rework the seedbed as necessary prior to seeding at no cost to Division.
 4. Schedule permanent seeding such that mulching of seeded areas takes place no later than forty-eight (48) hours after seeding partial areas. The time period between seeding and mulching shall be shortened if it appears adverse weather conditions could either cause damage to the seeded area or delay the timely application of mulch. If, prior to mulching, the seeded area is damaged by adverse weather, or success of the seeding is in doubt due to Contractor's failure to apply mulch in a timely manner, the seedbed for the area so affected shall be re-prepared and re-seeded, all at no additional compensation. Re-application of ag lime, fertilizer, or both may also be required depending on Engineer's or Division's opinion of the severity of damage due to weather or, in the case of fertilizer, on the time lapse between the initial fertilizer application and reseeding. Reapplication of lime and/or fertilizer, if required by Engineer or Division, shall also be done at no cost to Division.
- D. Seed Placement:
1. **Non-Native Seed Mixes – PRIOR to application of Seeding mulch:**
 - a. Seed all areas to be seeded with the appropriate seed mix as shown on the Supplemental Specifications. Seed species shall be applied at the rates provided in the Supplemental Specifications. Sow seed along the contour using a grassland or rangeland drill set for the specified seeding rates. The drill shall be equipped with double coulter furrow openers. The drill shall be subject to acceptance by Engineer. Drill seeding shall be accomplished with rows set no more than eight (8) inches apart. Overlap each successive seeding passes at least one (1) row width to ensure complete coverage. Upon a show of green, non-acidic bare areas will be reseeded at no additional cost to Division.

- b. Embed the seed at a depth recommended for the species.
- c. Broadcasting by centrifugal-type or hydroseeder broadcasters, or by hand shall also be allowed in areas not accessible to drills or other equipment, and may be allowed for correction or bare spots. Once broadcast, the seed must be covered with soil to a depth recommended for the species.
- d. Upon completion of the seeding operation, cultipack the seedbed to provide a positive seed-soil contact. If the drill seeder is equipped with an approved cultipacker or press wheels, separate operations shall not be necessary. The type of cultipacker/seeder to be used shall be subject to acceptance by Engineer.

2. **Native Seed Mixes – AFTER placement of Seeding mulch:**

- a. Seed all areas to be seeded with the appropriate seed mix as shown on the Supplemental Specifications. Seed species shall be applied at the rates provided in the Supplemental Specifications. Sow seed along the contour using a grassland or rangeland drill especially manufactured for planting native seed species. The machine shall be set to distribute seed at the specified seeding rates. The drill shall be equipped with a depth band which limits the maximum depth of seed placement. Native seeding drills with double disc openers are preferable, but other configurations may be acceptable. The native seeding drill should NOT include no-till coulters. The drill shall be subject to inspection and acceptance by Engineer or Division. Drill seeding shall be accomplished with rows set no more than eight (8) inches apart. Overlap each successive seeding pass at least one (1) row width to ensure complete coverage. Upon a show of green, non-acidic bare areas will be reseeded at no additional cost to Division.
- b. Embed the seed at a depth recommended for the species. **Native seeding mixes shall be planted NO DEEPER than one-fourth (1/4) of one inch.**
- c. Broadcasting by centrifugal-type or hydro-seeder broadcasters, or by hand shall also be allowed in areas not accessible to drills or other equipment and may be allowed for the correction of bare spots. Once broadcast, the seed must be covered with soil to a depth recommended for the species.
- d. Upon completion of the seeding operation, cultipack the seedbed to provide a positive seed-soil contact. If the drill seeder is equipped with an approved cultipacker or press wheels, separate operations shall not be necessary. The type of cultipacker/seeder to be used shall be subject to acceptance by Engineer.

E. Seed Mix Verification:

- 1. Each bag or package of seed mix shall include a tag or label affixed to it which or indicates the seed mix or species contained within it. Adhesive labels, where available, are preferable. If tags or labels are sewn onto the bags, the seam SHALL NOT obscure the printing. Information on the tag or label shall conform to the requirements of 1.4 A of this SECTION.
- 2. Neatly remove the tag or label from each bag. Care shall be taken to avoid mutilating the tag or label during removal. Tags or labels shall not be “ripped” or torn from the bag

or package. Tags or labels that become torn into shall be taped by contractor. Mutilated tags or labels shall not be acceptable.

3. Provide all tags or labels to the Engineer for verification that the specified seed mix with any approved substitutions was applied at the approved rates.
4. In the event Contractor cannot provide tags or labels in acceptable condition to the Engineer, Contractor shall provide a complete master mix tag from his supplier, which demonstrates the appropriate amount of pure live seed was shipped to the site. The master tag shall indicate the project name and show the information on it must conform to the requirement of 1.5 A of this SECTION.
5. Engineer shall perform the verification using the germination and purity information shown on the tags, labels or master tag provided by Contractor. After the applied seed mix is verified, Engineer shall provide all seed tags or labels to the Division.

3.6 MULCHING

- A. Areas receiving erosion control mat do not require mulch after being seeded, but those areas may be mulched if it facilitates the Contractors operations
- B. Timing
 1. **Non-native seed mixes:** for areas sown with non-native seed mixes, mulch shall be applied, but it may be performed either before or after planting at Contractor's option.
 2. **Native seed mixes:** areas to be sown with native seed mixes SHALL have the mulch applied and tucked BEFORE the native seed mix is planted.
 3. Hydromulch, where specified, shall be applied at the specified rate after non-native or native seed mixes are planted.,.
- C. Mulch shall be uniformly applied at the rate of two (2) tons per acre. The mulch may be spread either by hand or by mechanical spreader. When spread by hand, it shall be torn from the bale, "fluffed up" and spread uniformly over the area. When spread by mechanical spreader, the machine shall be adjusted to prevent cutting the mulch into pieces shorter than six (6) inches and to provide uniform distribution of the mulch over the area. The mulch, when applied, shall provide a uniform cover.
- D. After application, the mulch shall be anchored into the soil by crimping into the soil with a mulch tiller to a minimum depth of two (2) inches. Anchoring shall be accomplished by using a mulch tiller with rolling coulter type disk which shall be sufficiently dull on the cutting edge to prevent cutting the mulch. The disk must be of sufficient diameter to prevent the frame of the mulch tiller from dragging the mulch. The number of passes over the mulch shall not exceed two (2).
- E. The mulch shall not be covered with excessive amounts of soil. The rows or furrows made by the straw mulch crimping equipment (mulch tiller) shall be spaced not more than nine (9) inches apart.
- F. All straw mulching operations shall be done on the contour. The spreading and anchoring will be so scheduled and performed progressively so that wind damage will be held to a minimum as approved by Engineer.

3.7 MAINTENANCE

- A. Protection of Seeding:
 - 1. Vehicular traffic on areas seeded with temporary or permanent seeding, shall be restricted to travel necessary to establish seeding and other travel approved by Engineer.
 - 2. Protect seeded areas from damage due to operations of other contractors and trades, and trespassers. Maintenance shall commence immediately following seeding operations and shall continue until Division has issued final acceptance of the project. Repair or replace damaged areas.
- B. Reconditioning Existing Areas:
 - 1. Contractors equipment, project materials, and wastes such as oil drippings, stones, gravel, packaging containers, etc., shall be removed from the site or disposed of in a manner approved by Engineer and Division.
 - 2. All disturbed areas including areas outside grading limits, such as entrance and haul roads, shall be reconditioned and planted to the satisfaction of the Division.
- C. Repairs:
 - 1. Repair all areas of rill erosion with a depth of greater than three (3) inches and width greater than four (4) inches.
 - 2. Repair defects in vegetation having individual bare areas greater than one (1) square foot or total bare areas exceeding two (2) percent of the entire vegetated area.
 - 3. The costs of materials and labor for repairs shall be performed at no additional cost to Division.

3.8 MINIMUM REQUIREMENTS FOR ACCEPTANCE

- A. Ninety (90) days following evidence of plant growth or green-up, Division, Engineer, and Contractor shall inspect and evaluate the seeded areas for acceptance based on the criteria listed below.
- B. The plant growth shall provide a minimum of seventy-five (75) percent cover over the seeded area. Areas failing to meet this cover density shall be interseeded or reseeded and mulched as required by Engineer and Division, at no cost to Division.
- C. A majority of native plants species included in the seed mixture should be present in the vegetation stand growing on site. Division acknowledges that some native species will not be observed for two (2) to three (3) growing seasons.
- D. Areas of suspected hot spots shall be soil tested by Engineer or Division to determine if the failure of the seeding to meet acceptance criteria is due to low pH conditions. Engineer and/or Division may require Contractor to lime, fertilize, seed, and mulch these areas. Any additional work required in confirmed hot spot areas shall be paid for by Division at the appropriate bid item cost for each work item.

- E. Following repair of defects, unaccepted areas, and reseeding of hot spot areas, the repaired areas will again be inspected ninety (90) days after evidence of plant growth or greenup. These areas shall be evaluated using the criteria listed in this Section.
- F. In the event that in either the original seeding, repair seeding, or reseeding of hot spots it is found that the work, materials, or seedbed preparation failed to meet the quality or application rates specified, additional work shall be required at no cost to Division.

3.9 CONTRACT CLOSE OUT PROCEDURES

- A. Closeout procedures and Final Acceptance Requirements are outlined in paragraph 7-13 of the General Conditions (Document N).
- B. Refer to General Conditions Paragraph 5-10 related to Seeding and Seedling Plantings and the start of the Guarantee Period.
- C. The Final Pay Application and Retainage Payment Application shall be prepared by Division and signed by all parties after completion of the punch list and final inspection.
- D. Final Project Acceptance may be provided in writing by Division on or after the date of publication of the Notice of Completion in the newspaper.
- E. The Contractor and Division shall jointly perform a site greenup inspection as outlined in Paragraph 3.8 above. If additional work is required based on this greenup inspection, Contractor shall complete this work as soon as possible. A follow up greenup inspection shall occur as jointly agreed up by Division and Contractor after all additional required work is completed. If Contractor refuses to complete any requested work at any time prior to Division's acceptance of established vegetation, Division will seek resolution with Contractor's Bonding Company.
- F. Contractor shall re-seed areas where established vegetation is absent or limited and it is evident there has been a mechanical failure, inadequate overlap, missed areas, incorrect seed mix, missing species, or other items noted by Engineer and/or Division. Contractor shall not be held responsible for poor performance of the seed when acidic soils or adverse climate conditions are determined to be responsible for the poor performance.

PART 4 --MEASUREMENT AND PAYMENT

4.1 UNIT PRICES AND PAYMENT CALCULATION

- A. Construction cost of all work included in this SECTION of the Construction Specifications shall be included in Contractor's unit prices set forth in the Proposal and Schedule of Prices (*Document C*) for the work items described below. Unit price for each of these several items shall include its pro rata share of overhead so that the sum of the products obtained by multiplying the unit prices so set forth by the amount of the work constructed and measured as described herein, shall constitute full payment to Contractor for performance of the work included in this SECTION.
- B. Measurement and payment for each work item in this SECTION shall be in accordance with the following:
 - 1. *Seedbed preparation*: Contractor's unit prices for Seedbed preparation shall represent full payment for the preparation of areas for seeding in accordance with requirements of this SECTION. Said unit price shall include all costs for multiple passes of tillage required including the pickup and disposal of rocks.

Measurement for payment purposes shall be the area properly prepared in acres, rounded to the nearest one-tenth (1/10) acre. Contractor shall provide field measurements as required to show the limits of the seeding. Engineer will determine in acres, to the nearest one-tenth (1/10) acre, the actual area that seeding has been performed, based on Contractor's field measurements. In lieu of field measurements, Contractor may request acceptance of plan (bid) quantity in accordance with 7-01 MEASUREMENT (Document N). Measurement and payment for seedbed preparation shall be made once without regard to the number of tillage passes required.

2. *Agricultural Limestone:* Contractor's unit price for agricultural limestone used for permanent seeding work shall represent full payment for the furnishing, delivery and application per these specifications.

The unit price for agricultural limestone applied to satisfy requirements of this SECTION shall be identical to the unit price for agricultural limestone used to satisfy requirements of SECTION 02400. The estimated quantity of agricultural limestone required for work in this SECTION shall be included with the estimated quantity of agricultural limestone required for work in SECTION 02400

The actual application rate shall be determined by the Engineer based upon the results of soil tests conducted in Item 3.1 TESTING--SOIL FERTILITY in this SECTION. Costs for incorporation agricultural limestone in this SECTION shall be included in *Seedbed Preparation*.

Measurement for payment purposes shall be the actual number of tons of effective calcium carbonate equivalence (ECCE) applied by Contractor in complying with requirements of this SECTION. Weight tickets must accompany each shipment of agricultural lime and shall form the basis for measurement and payment.

3. *Nitrogen (N), Phosphorous (P), and Potassium (K):* Payment for all fertilizer furnished, delivered, and applied into seedbeds, per requirements of this SECTION, shall be made in accordance with Contractor's unit prices. The actual application rates for Phosphorous (P) and Potassium (K) will vary from the bid quantity depending upon results of soil tests conducted in Item 3.2 TESTING – SOIL FERTILITY in this SECTION. The cost of soil testing for Nitrogen, Phosphorus and Potassium application rates shall be incidental to the work of this SECTION. At Engineer's option, the cost of nitrogen for temporary seeding may be measured and paid as part of the cost of implementing the Storm Water Pollution Prevention Plan in SECTION 02120. Also at Engineer's option, the cost of nitrogen for wetland fertilizer may be measured and paid for in SECTION 02400.

Measurement for payment purposes shall be the actual weight of active ingredient, to the nearest pound, for each of the fertilizer nutrients specified. Fertilizer suppliers may refer to active ingredients as "units" of nutrient.

4. *Seeding:* Contractor's unit prices for Seeding shall represent full payment for the planting of all seeded areas in accordance with requirements of this SECTION. Said unit price shall include the furnishing of all seed materials for the specified seed mix, planting of seeds, and culti-packing including all required equipment, labor and any required reseeding to complete all permanent seeding as specified herein.

Measurement for payment purposes shall be the area seeded in acres, rounded to the nearest one-tenth (1/10) acre. Contractor shall provide field measurements as required to show the limits of the seeding. Engineer will determine in acres, to the nearest one-tenth (1/10) acre, the actual area that seeding has been performed, based on

Contractor's field measurements. In lieu of field measurements, Contractor may request acceptance of plan (bid) quantity in accordance with 7-01 MEASUREMENT (Document N). Payment for seeding shall be made only after all submittals have been approved as required under this SECTION. Seeding for areas outside the specified seeding area will not be measured for payment. No separate measurement and payment apply to over-seeding; the cost of over-seeding shall be subsidiary to seeding.

In the event that the Contractor's cost of seed material increases ten percent (10%) or more from the time Contractor submitted the bid to the time the seed is purchased, the Division agrees to reimburse Contractor for the additional cost of the seed material provided Contractor requests the cost adjustment and demonstrates the cost difference. Differences in the seed cost shall be demonstrated as follows:

- a. Contractor shall submit a request for a seed cost adjustment in writing on his company letterhead summarizing the cost difference, and
- b. Contractor shall furnish a price quote from his seed supplier that is dated on or prior to the date Contractor's bid was received and opened by Division, and
- c. Contractor shall furnish a current price quote from his seed supplier that is dated no more than seven days prior to Contractor's written request for a seed price adjustment, and
- d. Both price quotes shall be mechanically printed and provided on seed supplier's letterhead, and
- e. No text on either price quote shall show evidence of mutilation, smearing, overwriting, or other forms of tampering. In no event shall quotes with handwritten markings that affect price information be considered acceptable or valid.

If seeding is performed by Contractor's subcontractor, price quotes shall be provided by the subcontractor's seed supplier.

If Contractor requests a seed cost adjustment but is unable to provide the appropriate documentation as specified above, Division shall deny the seed cost adjustment request, and the Contractor's original unit price for seeding shall apply.

5. *Mulch, Seeding:* Contractor's unit price for mulch shall represent full payment for mulching in accordance with requirements of this SECTION 02700 – SEEDING. Said unit price shall include the furnishing and application of all straw mulch, including all required equipment and labor to complete the work as specified herein. Payment for mulch shall be made only after all submittals have been approved as required under this SECTION 02700 - SEEDING. Payment will not be made on total site acreage if not substantiated by adequate weight tickets.

Measurement for payment purposes shall be by the acre which shall be identical to the area as measured and approved for upland seeding and wetland fringe seeding.

4.2 SUMMARY—UNITS OF MEASUREMENT

Units of measurement for bid items applicable to work covered by this SECTION are as follows:

<u>Description</u>	<u>Unit</u>
Seedbed Preparation	Acre
Agricultural Limestone	Ton (ECCE)
Nitrogen (N)	Pound (active ingredient)
Phosphorus (P)	Pound (active ingredient)
Potassium (K)	Pound (active ingredient)
Upland Seeding	Acre
Mulch, Seeding	Acre
Wetland Fringe Seeding	Acre

END OF SECTION 02700