

CONSTRUCTION SPECIFICATIONS

INDEX

SECTION 02010 - FIELD ENGINEERING

PART 1 - GENERAL

- 1.1 DESCRIPTION
- 1.2 QUALITY ASSURANCE
- 1.3 SUBMITTALS

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

- 3.1 SURFACE CONDITIONS
- 3.2 DIMENSIONS AND ELEVATIONS
- 3.3 POSITION, GRADIENT, AND ALIGNMENT
- 3.4 FINAL PAY QUANTITY SURVEYS
- 3.5 INTERIM PAY QUANTITY SURVEYS
- 3.6 STAKE OUTS
- 3.7 RECORD SURVEY NOTES
- 3.8 MEASUREMENT AND PAYMENT

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 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 of monuments, bench marks, apparent property lines, all existing fencing, and any other features as noted on the plan or in other portions of the specifications.

1.2 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 of 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 can use other competent persons trained using Global Positioning System (GPS) equipment subject to the approval of the Engineer.

1.3 SUBMITTALS

- A. Record Plans (As Built Drawings): Specific requirements for record plans are indicated in the General Conditions (Document N, Paragraph 2-05 A).
- 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

- 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 DIMENSIONS AND ELEVATIONS

- A. 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 shown 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, bench marks, 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 with 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 bench marks 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

- A. 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. 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 survey is required. The locations and frequency of checked locations shall be determined in consultation with the Engineer.

3.7 RECORD SURVEY NOTES

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

3.8 MEASUREMENT AND PAYMENT

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

END OF SECTION 02010

INDEX

SECTION 02100 - MOBILIZATION, SITE CLEARING & PREPARATION

PART 1 - GENERAL

- 1.1 DESCRIPTION
- 1.2 QUALITY ASSURANCE
- 1.3 JOB CONDITIONS
- 1.4 SUBMITTALS

PART 2 - PRODUCTS

- 2.1 MATERIALS

PART 3 - EXECUTION

- 3.1 SURFACE CONDITIONS
- 3.2 PROTECTION
- 3.3 OFFICE AND LAY-DOWN AREA
- 3.4 STORM WATER POLLUTION PREVENTION PLAN (SWPPP) DOCUMENT STORAGE
- 3.5 EXISTING FENCES
- 3.6 CLEARING AND GRUBBING
- 3.7 DEBRIS REMOVAL AND DISPOSAL
- 3.8 PROJECT SIGN
- 3.9 CLEAN-UP AND REPAIRS
- 3.10 MEASUREMENT AND PAYMENT

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. Establish location and maintain 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 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 and Division.
- C. Applicable Standard: Iowa State University (ISU) Extension Service Publication PM-909, "Preventing Construction Damage to Trees".
- D. Contractor shall comply with most current guidelines to protect the Indiana Bat as provided by the Division or in the Appendix.

1.3 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.
- 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 considered to 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. 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.
- 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.

1.4 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 3-24 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.
- D. Contractor shall provide Engineer 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 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.

3.2 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 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 with good horticultural practices. Preserve natural shape and character. Refer to ISU Publication PM-909, "Preventing Construction Damage to Trees".
 - 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 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 maintain access to the site at all times.
- 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.

3.3 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 located 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 written permission from landowner on whose property these facilities are to be located is provided.

- B. Contractor's Field Office
 - 1. 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.

3.4 STORM WATER POLLUTION PREVENTION PLAN (SWPPP) DOCUMENT STORAGE

- A. Contractor shall establish a designated location on site to store the SWPPP, all associated reports, and records of data used to complete the Notice of Intent.
 - 1. If the contractor's field office is used for to store SWPPP documentation, then appropriate measures to allow access shall be provided.
 - 2. If a contractor's field office is not provided, then an alternative weather proof location on site shall be established.

3.5 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. 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 the same material type or better shall be replaced at the same location at no 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 3.6 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.

3.6 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 3.4 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 three (3) feet, undisturbed stumps and roots extending not more than six (6) inches above the ground line and surface vegetation do not need not be removed unless they are located within the vicinity of a dam, terrace, or other structural element.

3.7 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. Specifics 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 be maintained at all times.
- C. Burying
 - 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 that contains 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 in dewatered ponds containing muck to provide support. The trees shall be placed uniformly over the muck and shall not exceed a total thickness of five (5) feet.
 - c. All products to be buried 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, will not be allowed. Buried

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 cover per foot of debris. The top of the uppermost buried debris shall be at least five (5) feet below final grade. Burial operations shall be permitted only in the presence of Engineer.

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.

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.
3. Brush piles shall not exceed fifty (50) feet in diameter and ten (10) feet in height.

E. 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 and sorted by hand. Additional sorting may be requested by Engineer or Division prior to weighing if it is determined that excessive amounts of soil are included with the trash.
3. Metal objects present at the site shall be salvaged where possible or taken to a licensed landfill or other approved location.

3.8 PROJECT SIGN

- A. The Division and any partners will provide the Contractor with the appropriate signage to be installed at the site.
- B. Contractor will provide the posts and necessary hardware to install the sign as shown on the Plans. The location shall be approved by Engineer prior to installation.
- C. The Division reserves the right to delay payment of the second application for payment until the project sign is in place.
- D. 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.

3.9 CLEAN-UP AND REPAIRS

- A. Contractor shall remove equipment, project materials, and wastes such as oil drippings, stones, gravel, packaging containers, etc., from the site and dispose of wastes 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.

- C. All disturbed areas outside the Project Limits, such as entrance and haul roads and lay down areas, shall be returned to their original condition by Contractor and as approved by the Engineer.
- D. The materials, equipment, and labor for clean up and repairs are at no cost to Division.

3.10 MEASUREMENT AND PAYMENT

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 actually constructed, 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:

- A. *Mobilization:* Payment for the cost of mobilization and demobilization and other work incidental 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 preparatory 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 establishing and maintaining SWPPP documentation storage location, 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.

The amount which Contractor will receive payment for, in accordance with the following schedule, will be limited to five percent (5%) of the total Contract bid. Should the Contractor's bid for this item exceed five percent (5%), the amount over five percent (5%) 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 percent (5%), will be made in accordance with the following schedule:

1. Upon Contract execution, ten percent (10%) of the pay item will be paid.
2. When five percent (5%) or more of the original Contract amount is earned, an additional twenty percent (20%) of the pay item will be paid.
3. When ten percent (10%) or more of the original Contract amount is earned, an additional twenty percent (20%) of the pay item will be paid.
4. When fifty percent (50%) 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 percent (5%) of the total bid.

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

- B. *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, 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.

- C. *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. Handling and disposal of special items such as tires, batteries, or hazardous waste, will be paid for separately. All other trash and debris will be disposed of in accordance with these specifications.
- D. *Summary:* Proposal 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

INDEX

SECTION 02300 - DRAINAGE SYSTEMS, GENERAL

PART 1 - GENERAL

- 1.1 DESCRIPTION
- 1.2 QUALITY ASSURANCE
- 1.3 SUBMITTALS

PART 2 - PRODUCTS

- 2.1 SPOIL MATERIALS
- 2.2 PIPE
- 2.3 RISERS
- 2.4 EROSION CONTROL MAT
- 2.5 FILTER FABRIC
- 2.6 RIPRAP
- 2.7 EROSION STONE
- 2.8 CONCRETE
- 2.9 GROUT
- 2.10 RODENT GUARDS
- 2.11 TRASH RACKS/BAR GUARDS
- 2.12 POROUS BACKFILL
- 2.13 PIPE STRAPS
- 2.14 OTHER MATERIALS

PART 3 - EXECUTION

- 3.1 SURFACE CONDITIONS
- 3.2 PROTECTION
- 3.3 CARE OF WATER
- 3.4 FLOW LINES AND GRADES
- 3.5 TERRACES
- 3.6 TILING, RISERS AND OPEN SIDED INTAKES
- 3.7 PIPES
- 3.8 FILTER FABRIC
- 3.9 RIPRAP DITCHES & OTHER RIPRAP WORK
- 3.10 EROSION CONTROL MAT
- 3.11 MEASUREMENT AND PAYMENT

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 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 directions of Engineer and Division.

1.3 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 two (2) inches adjacent to the tiling, and four (4) inches thereafter to the surface.

2.2 PIPE

A. Corrugated Polyethylene

1. Pipe for tiling shall be non-perforated corrugated polyethylene (PE) tubing and fittings, equal to IDOT Section 4143.01-B, with sizes as shown on the Plans. Fittings may be made of polyvinylchloride (PVC), Schedule 40 or SDR-26. Pipe for tiling outlet, the last 20 (twenty) feet minimum, shall be solid PVC pipe, Schedule 40 or SDR-26, sized to match the incoming PE tubing. The PVC pipe shall be furnished with no more than one joint. Tees required at wetland tiling outlets shall be solid PVC, Schedule 40, or SDR-26 sized to match the incoming PVC pipe. Solid HDPE pipe as described below can be substituted for the end piece if approved by Engineer, except where the tile exits perpendicular into a stream or channel.

B. High Density Polyethylene Pipe (HDPE)

1. HDPE 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 percent (5%) deflection per ASTM D2412. The fittings supplied shall be made from polyethylene resin which meets this same specification.

C. Polyvinyl Chloride Pipe (PVC)

1. PVC pipe shall be plastic PVC – ASTM D3034-SDR35 Type 1, Grade 1. Joints shall meet ASTM D3033/D3034 Standards.

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

2.3 RISERS

A. Terrace Outlets

1. Risers shall be as manufactured by Hickenbottom, Inc.; Agri Drain Corporation; or approved equal. Sizes shall be as shown on the Plans. 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. Below grade, the riser shall be non-perforated; if perforated, openings shall be completely sealed with three (3) wraps of polyethylene tape or other suitable tape. The riser shall connect onto the tiling with a manufactured tee of a size to match the outgoing tile. Tees which constrict flows shall not be allowed.

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 Outlets – See SECTION 02310 – Drainage Systems, Dams and Structures.

2.4 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. Unless noted otherwise, erosion control mat for slopes shall be made of interlocking coconut or wood fibers with plastic netting applied to both sides for holding the fibers in place. The product should be rated to perform on slopes of up to two horizontal to one vertical (2H:1V) with a longevity of more than twelve (12) months and up to two (2) years.
- C. Unless noted otherwise, erosion control mat for channels and spillways shall be made of interlocking coconut or wood fibers with plastic netting applied to both sides for holding the fibers in place. The product should be rated to perform on slopes of up to two horizontal to one vertical (2H:1V) with a longevity of more than two (2) years and up to three (3) years, and must be capable of withstanding the flows as determined by Engineer.
- D. Wire staples will not be allowed on the project. All “stapling” of the mat must be done using twelve (12) inch long, tapered hardwood stakes. The staking pattern shall match the manufacturer’s recommended stapling pattern for the project’s soil and discharge conditions and, where more stringent, the pattern shown on the Plans.

2.5 FILTER FABRIC

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

2.6 RIPRAP

- A. Riprap shall be quarried limestone, sound, durable, and angular or blocky in shape. No more than ten percent (10%) 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.
- B. 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.
- C. Engineer 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.

2.7 EROSION STONE

- A. Erosion stone for the tiling outlets 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.

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 and/or buttressed with concrete. Concrete can be ready-mix, hand-mixed, 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 and forty (940) pounds of Type I or II Portland cement with around two-thousand two-hundred (2200) 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 air content of 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 piping when flows are present.

2.11 TRASH RACKS/BAR GUARDS

- A. Bar Guard Intakes
1. 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 on the Plans or the Engineering Special Conditions.

2.12 POROUS BACKFILL

- A. Porous Backfill for subdrain shall be non-calcareous material meeting IDOT Item 4131, Gradation No. 29. Limestone porous backfill will not be allowed.

2.13 PIPE STRAPS

- A. Pipe straps used to restrain bell and spigot joints of corrugated dual wall HDPE pipe 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.

2.14 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 maintain access to adjacent areas at all times 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 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. 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 percent (2%) 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.
- 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, RISERS AND OPEN SIDED INTAKES

- 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 tiling after completion of rough grading in affected areas.
 - 2. Excavate trenches to a minimum depth of three and one-half (3.5) feet below finish grades where grades permit, and to a width no wider than eighteen (18) inches for six (6) inch tiling. In lieu of using a backhoe for installation, tiling may be installed with a tiling machine provided the machine is equipped with a cutting edge which creates either a ninety (90) degree V-groove, or a semi-circular trough of a size which shall accept the tiling without excess movement.
 - 3. After excavation, lay tiling in bottom of trench. Sort out any unsuitable material, such as larger rocks or sticks, from excavated material to be used as backfill. If excavated material is unsuitable, then provide an alternate source of suitable backfill. Carefully place and compact backfill within the area around and to within one-half (0.5 feet) 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. Each lift shall be compacted with either the bucket of a hoe or the wheel of construction equipment. Reshape and/or compact adjacent ground surface as required.
 - 4. Except at top riser of each run of tiling, connect subsequent riser tubing to main tiling run with a wye or tee. Place concrete collar around entire tee and pipe joint.
 - 5. Seal all below grade joints in tiling with three (3) wraps of polyethylene tape or other suitable tape. This applies to all tees, wyes, elbows, couplings, joints, etc. that also have a concrete collar.
 - 6. The last twenty (20) feet, minimum, of terrace tiling which daylights shall be rigid PVC piping. Seal the transition joint between PE tubing and PVC pipe as per A.4 above and place a concrete collar around the joint. Install a rodent guard within six (6) inches of the outlet end of all PVC piping. Where tiling outlets into a wetland, install the rodent guard in the pipe ahead of the outlet tee. Fasten outlet tee to pipe using aluminum sheet metal screws.
 - 7. 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. Riser
 - 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 tees for every riser. Depending on location, use either an in-line tee or a blind tee with cap, as recommended by manufacturer. Fasten riser sections using aluminum sheet metal screws. Seal below-grade riser joints with three (3) wraps of polyethylene tape or other suitable tape and then cover joints with concrete as shown on the Plans.
 - 2. 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.
 - 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.
- C. Open Sided Intakes
 - 1. Open sided intakes shall be placed to the specific elevations and dimensions indicated on the plans.
 - 2. Tile 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.

3.7 PIPES

- A. 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.
- B. 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.
- C. 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.
- D. 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.

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 in excess of 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 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 equal to or more than 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 off of previously placed material with a bulldozer blade or end-loader, in such a manner as to prevent tearing or shoving of the cloth. Dumping of 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.
- B. Riprap or erosion stone shall be placed over filter fabric 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. Contractor shall place the riprap or erosion stone so as to not tear, puncture, or shift 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 fairly compact riprap or stone protection in which all sized of material are placed in their proper proportions. Placing or rearranging of 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 completely 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 trenched in per 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 – INTERIM 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.

3.11 MEASUREMENT AND PAYMENT

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 actually constructed, 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:

- A. *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 to the nearest foot jointly by Contractor and Engineer.
- B. *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.

- C. *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.
- D. *Tiling:* The unit prices shall include all materials and work required for installation of the tile and fittings (PE 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 actually installed as determined from field measurements and rounded to the nearest foot.
- E. *Tile Outlet:* 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.
- F. *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 actually installed as determined from field measurements and rounded to the nearest foot.
- G. *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.
- H. *Riprap and Erosion Stone:* The unit prices shall include all materials and work required for installation of the riprap or erosion stone 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 riprap or erosion stone actually installed as determined from weight tickets, rounded to the nearest one-hundredth (0.01) ton. Only material placed in accordance with the Plans and these Specifications shall be measured and paid.
- I. *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 actually installed as determined from delivery tickets, rounded to the nearest 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.
- J. *Erosion Control Mat:* Erosion control mat will be paid as indicated in Specification SECTION 02120 – SEDIMENT AND EROSION CONTROL.

K. *Summary:* 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
Tile Outlet – (size)	Each
Pipes - (size)	Lineal Foot
Filter Fabric	Square Feet
Riprap	Tons
Erosion Stone	Tons
Grout	Cubic Yard

END OF SECTION 02300

INDEX

SECTION 02310 - DRAINAGE SYSTEMS, DAMS AND STRUCTURES

PART 1 - GENERAL

- 1.1 DESCRIPTION
- 1.2 QUALITY ASSURANCE
- 1.3 SUBMITTALS

PART 2 - PRODUCTS

- 2.1 BACKFILL MATERIALS
- 2.2 PIPE
- 2.3 ANTI-SEEP COLLARS
- 2.4 RISER
- 2.5 TRASH RACK/BAR GUARDS
- 2.6 CONCRETE
- 2.7 PIPE STRAPS
- 2.8 OTHER MATERIALS

PART 3 - EXECUTION

- 3.1 SURFACE CONDITIONS
- 3.2 PROTECTION
- 3.3 CARE OF WATER
- 3.4 FLOW LINES AND GRADES
- 3.5 INSTALLATION OF TOE DRAINS
- 3.6 INSTALLATION OF CHIMNEY DRAIN
- 3.7 INSTALLATION OF DRAINAGE BLANKET
- 3.8 PIPES
- 3.9 RISERS
- 3.10 MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

Work under this SECTION includes the installation of manholes, inlets, drain pipe, seepage collars, porous backfill, stilling basins, and 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:

1. Field engineering
2. Drainage Blanket
3. Chimney Drain
4. Toe Drain
5. Pipe Outlets
6. Auxiliary Spillway
7. All excavation, backfill, and compaction necessary to complete these drainage structures.

1.2 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. References
 1. Iowa Department of Transportation Standard Specifications for Highway and Bridge Construction (IDOT).

1.3 SUBMITTALS

- A. Contractor shall submit material certification, including material type and gradation for all granular fill and for engineer 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 pre-fabricated, Contractor shall submit shop drawings to Engineer for approval prior to fabrication.

PART 2 - PRODUCTS

2.1 BACKFILL MATERIALS

A. General Backfill:

1. Unless specified in the Plans, ditch subgrades and backfill for pipes and risers shall be constructed of materials from required excavation. Backfill material shall be sorted to remove all rocks or hard material with any dimension larger than two (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:

1. 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 PIPES

A. Corrugated Polyethylene (PE)

1. Pipe for toe drains and subdrains shall be perforated corrugated polyethylene (PE) tubing and fittings equal to IDOT Section 4143.01-B, Pipe for Longitudinal Subdrains with sizes as shown on the Plans.

B. High Density Polyethylene Pipe (HDPE)

1. HDPE 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 percent (5%) deflection per ASTM D2412. The fittings supplied shall be made from polyethylene resin which meets this same specification.

C. Polyvinyl Chloride Pipe (PVC)

1. PVC pipe shall be plastic PVC – ASTM D3034-SDR35 Type 1, Grade 1. Joints shall meet ASTM D3033/D3034 Standards.

D. 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. The joints shall be sealed using cold applied bituminous jointing material. All lift holes shall be properly plugged.
2. All joints shall be gasketed joints meeting the requirements of ASTM C443. The first three joints from the downstream end shall be tied with Type 2 Connections for sealed joints, unless otherwise noted on Plans.

E. 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. The pipe shall have the following minimum pipe stiffness based on diameter when tested in accordance with ASTM D2412.

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

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

2.4 RISERS

- A. Reinforced Concrete
 1. Concrete risers 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.

2.5 TRASH RACK/BAR GUARDS

- A. Trash Rack
 1. 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
 - 1. Bar Guard Intakes as distributed by Agri Drain Corp., or approved equal. Sizes shall be as shown on the Plans.

2.6 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 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 drain connection to subdrain outlet pipe.
- B. Structural concrete placed for the riser base and anti-seep collars shall be ready-mix concrete with a minimum strength of three-thousand, five-hundred pounds per square inch (3500 psi) at twenty-eight (28) days and shall be air-entrained. 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 pipe 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.

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 maintain access to adjacent areas at all times 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

- A. 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 tiling in strict accordance with these Specifications, manufacturer's recommendations, and the Plans. In case of discrepancy, the most stringent requirements shall apply.
- B. Excavate trenches as needed to establish the necessary grades for placement. The trenches shall be excavated with a backhoe of sufficient width to allow for compaction of backfill along the sides and haunches of the tile.
- C. After excavation, place any required filter fabric and tile in bottom of trench. Connect tiling to proper outlet placing concrete as a seal at all joints.
- D. Hand place and compact backfill material around tiling as shown on the Plans. Place material carefully under pipe haunches so that the tiling is properly and fully supported. In placing and compacting material around the tiling, exercise care not to cause the tiling to shift 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. If any tiling 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 tile and 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 with for the drainage blanket as indicated on plans to design grade and remove all loose material and clods greater than 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 will not be allowed. Settled areas shall be corrected by Contractor at no cost to Division.

- D. Anti-seepage collars shall be placed around the pipe as shown on the Plans. The size of the excavation for anti-seepage 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 RISERS

- A. Install risers in strict accordance with these Specifications, manufacturer's recommendation, and the Plans. In case of discrepancy, the most stringent requirements shall apply.
- B. Install concrete base for risers as shown on the Plans. Install riser sections and neatly cut or saw a hole in the riser 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 riser a distance no greater than required to properly make the connection; do not unduly restrict the flow area of the riser. Wrap the opening with rags to seal the annular space and seal 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.
- C. 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.

3.10 MEASUREMENT AND PAYMENT

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 actually constructed, 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:

- A. *Tiling*: The unit prices shall include all materials and work required for installation of the tile in conformance with details and dimensions shown on the Plans. The unit prices shall include furnishing and installing the tile, fittings, trenching, removal and disposal of excess trench material, backfill, compaction, and all other work items incidental thereto, including rodent guards and tape and concrete for sealing below-grade connections. Measurement for payment shall be based on the length of tiling for a specified diameter actually installed as determined from field measurements and rounded to the nearest foot.
- B. *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 should 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 overexcavation or wider trenches not directed by the Engineer will not be approved for payment.
- C. *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.

- D. *Riser:* Unit price shall include all materials and work required for installation of risers in conformance with details and dimensions shown on the Plans and these Specifications. Unit prices shall include furnishing and installing the riser and trash rack or bar guard, concrete base, connecting the pipe, concrete, excavation, backfill, and all other incidental construction including furnishing and installing silt fencing around the riser, where required, cleaning of sediment, maintenance and repairs. Measurement and payment of riser shall be based on the number of each riser properly installed and maintained.
- E. *Summary:* Proposal Bid Items applicable to work covered by this Section are as follows:

<u>Description</u>	<u>Unit</u>
Tiling - (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
Riser - (size)	Each

END OF SECTION 02310

INDEX

SECTION 02410 - SUBGRADE PREPARATION, WITH COVER MATERIAL

PART 1 - GENERAL

- 1.1 DESCRIPTION
- 1.2 QUALITY ASSURANCE
- 1.3 PERMITS AND FEES
- 1.4 DELIVERY, HANDLING, AND STORAGE
- 1.5 SUBMITTALS
- 1.6 SITE DISTURBANCES

PART 2 - PRODUCTS

- 2.1 AGRICULTURAL LIME
- 2.2 WETLAND FERTILIZER
- 2.3 WETLAND MULCH

PART 3 - EXECUTION

- 3.1 TIMING
- 3.2 TESTING
- 3.3 LIME APPLICATION
- 3.4 WETLAND AREAS
- 3.5 MEASUREMENT AND PAYMENT

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 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. Lime application.
4. Incorporation of the applied lime material.
5. Wetland subgrade preparation.

1.2 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.

D. Applicable Standard

1. Iowa Agricultural Liming Material Act.
2. Iowa State University (ISU) Extension Service Publication PM-909, "Preventing Construction Damage to Trees". Copies can be made available from Division upon request.

1.3 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 site in supplier's original unopened containers; each container to bear certification as specified.

D. Store packaged materials off ground and protect from moisture.

1.4 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.

- B. Weight Tickets
 - 1. 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
 - 1. Soil tests to determine the applicable liming rate shall be taken by the Engineer with assistance from Contractor. Test results will be submitted to the Contractor and Division when received by Engineer. Payment for these tests will be made by Engineer.

1.5 SITE DISTURBANCES

- A. Contractor shall take precautions to insure that equipment and vehicles do not unnecessarily disturb or damage existing grading or other site improvements. Any areas identified by Engineer 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 percent (55%) and shall contain at least one-thousand (1000) pounds ECCE per ton of lime to be applied.
- B. If lime containing not less than one-thousand (1000) 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 provided that 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 the engineer during placement and application rates will be adjusted as appropriate.

2.2 WETLAND FERTILIZER

- A. Fertilizer shall be a standard commercial product which, when applied at the proper rate, will supply the quantity of total nitrogen (N) at a rate of thirty (30) pounds per acre.
- 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.

2.3 WETLAND MULCH

- A. Mulch materials shall consist of oats, rye, hay, corn stalks, grass cut from native grasses or other plants approved in writing by Division.
- B. Mulch shall be of air dry mulch that has been properly cured and harvested. Mulch harvested after a killing frost or during dormant periods will not be acceptable.
- 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. Wetland mulch shall be applied at a rate of five (5) tons per acre into the spoil material and incorporated prior to placement of cover material.
- F. Additional mulch will be placed in the wetland areas after the cover material is in place at the standard seeding mulching rate of two (2) tons per acre as required in SECTION 02700 – INTERIM SEEDING. Mulch placed in wetland areas during seeding will be incorporated into the soil instead of only being crimped. The placement and incorporation of mulch in the cover material will be paid for under SECTION 02700- INTERIM SEEDING.

PART 3 - EXECUTION

3.1 TIMING

- A. No cover material shall be placed over untreated spoil material. All agriculture lime placement and incorporation shall be completed in areas designated to receive cover material.
- B. No cover material shall be placed in created wetland areas as shown on the plans until the agricultural lime, fertilizer, and mulch have been placed and properly incorporated.
- C. 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.

3.2 TESTING

- A. As the Contractor is nearing final subgrade in portions of the site to prepare for placement of select borrow material, the Contractor shall contact and schedule soil sampling with the Engineer. The Engineer is to collect the samples, assisted by the 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 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. Engineer shall deliver each composite soil sample 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 up to 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

- C. Engineer shall obtain liming recommendations to achieve a pH of 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.
- D. Soil test results and laboratory recommendations shall be used by Engineer and Division in determining the amount of 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.

3.3 LIME APPLICATION

A. Application Rates

- 1. Agricultural Lime, Subgrade - Contractor shall plan to apply lime (tons ECCE per acre) at the rate listed on the plans or as provided in the Supplemental Specifications unless a different rate is specified based on the results of soil tests taken after rough grading is completed as described in Item 3.2.D. The application rate provided in these documents is based on limited information available and is for bidding purposes. Actual application rate will vary depending on the recommendation of the soil tests.

B. Incorporation

- 1. Engineer and Division shall approve the final grades and the lime application rates based on the spoil test results prior to the application and incorporation of the lime by Contractor. Contractor shall request approval to initiate the lime application on areas of at least five (5) acres in size.
- 2. Contractor will obtain Engineer and Division's approval of site conditions prior to application of lime. 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 within the area approved.
- 3. After receiving Engineer and/or Division approval, Contractor shall evenly apply agricultural lime directly on the surface to be treated. Contractor shall incorporate the lime into the upper twelve (12) inches of material the same day the lime is applied, using the agreed upon method per B.1 above. Incorporation shall be done on the contour and compaction shall be kept to a minimum. This may require multiple passes in order to thoroughly mix the lime in 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 shall be applied on site if that load of lime is not accompanied by an appropriate weight ticket. All lime weight tickets for material applied on site shall be submitted to the Resident upon arrival of the material on site. If Contractor applies lime prior to Resident receiving appropriate weight ticket for that material, or in the absence of the Resident, Division may require additional lime be applied to the site at Contractor's expense to assure that Contract specified amounts are achieved.

3.4 WETLAND AREAS

A. Subgrade Preparation

- 1. 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 3.3 *Lime 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 the additional lime and fertilizer, as established in SECTION 02700-INTERIM 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 impoundment of water. Care shall be taken to not mix the spoil material into the cover material during this disking.

3.5 MEASUREMENT AND PAYMENT

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.

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

- A. *Agricultural Lime, Subgrade:* Contractor's unit price for limestone used in rough grade preparation work, including constructed wetland areas, shall represent full payment furnishing, delivery, application, and incorporation of lime in accordance with specifications. Submittals required under Item 1.5 *Submittals* of this SECTION shall accompany each shipment of agricultural limestone for payment. Actual application rate will vary, except in the wetland areas, pending recommendations of spoil tests conducted in accordance with Item 3.2 *Testing*, of this SECTION.

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

- B. *Wetland Fertilizer:* Payment for wetland fertilizer, Nitrogen (N), furnished, delivered, applied and incorporated into wetland areas, per requirements of this SECTION, shall be made in accordance with Contractor's unit prices for wetland fertilizer. Weigh 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 pound.
- C. *Wetland Mulch:* Contractor's unit price for Wetland Mulch shall represent full payment for all materials, application, mixing, plowing, disking, and all incidental work pertaining to the delivery, placement and incorporation of mulch as a part of the wetland subgrade preparation prior to placement of the cover material and the additional mulch placed after the cover material is in place.

The wetland mulch area will be based upon the areas as shown on the plans rounded to the nearest tenth (0.1) acre. Any field adjustments made will be measured jointly by Contractor and Engineer. The total area for payment is only counted once. Delivery receipts showing certified weight will be used to confirm required tons for incorporation of mulch.

- E. *Summary:* Proposal bid items applicable to work covered by this SECTION are as follows:

<u>Description</u>	<u>Unit</u>
Agricultural Lime, Subgrade	Ton (ECCE)
Wetland Fertilizer	Pound
Wetland Mulch	Acre

END OF SECTION 02410

INDEX

SECTION 02700 – INTERIM SEEDING

PART 1 - GENERAL

- 1.1 DESCRIPTION
- 1.2 QUALITY ASSURANCE
- 1.3 JOB CONDITIONS
- 1.4 SUBMITTALS
- 1.5 DELIVERY, STORAGE, AND HANDLING
- 1.6 SITE DISTURBANCES

PART 2 - PRODUCTS

- 2.1 AGRICULTURAL LIME
- 2.2 FERTILIZER
- 2.3 MULCH
- 2.4 SEED
- 2.5 LEGUME SEED INOCULANT

PART 3 - EXECUTION

- 3.1 INITIAL PREPARATION
- 3.2 TESTING - FERTILITY
- 3.3 SEEDBED PREPARATION
- 3.4 LIMING AND FERTILIZING
- 3.5 SEEDING
- 3.6 MULCHING
- 3.7 MAINTENANCE
- 3.8 MINIMUM REQUIREMENTS FOR ACCEPTANCE
- 3.9 MEASUREMENT AND PAYMENT

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 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. Inoculants used for treating legume seed shall be pure culture of nitrogen-fixing bacteria prepared specifically for the legumes specified in PART 2 PRODUCTS of this SECTION. Inoculant containers must be clearly marked by the manufacturer for each specified species and have an expiration date.
- G. Engineer reserves the right, at any time, to sample all materials for testing to determine compliance with the requirements of this SECTION.
- H. 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.

1.3 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 interim 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.

1.4 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.
 - 5. Inoculants delivered to the job site must be clearly identified and marked with expiration dates.

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.

1.5 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. At no time shall seed materials or inoculants be stored outside of the specified planting periods. Inoculants shall be stored in a cool place, away from heat. Partially used packages of inoculants shall be tightly resealed.
- G. Store packaged materials off ground and protect from moisture. Moisture damaged materials are unacceptable. Wet, moldy or otherwise damaged seed is unacceptable.

1.6 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 percent (55%) and shall contain not less than 1000 pounds ECCE per ton of lime to be applied.
- B. If lime containing not less than 1000 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 interim 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 percent (50%) 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 that has been damaged in storage shall not be used. Seed that is more than one growing in ages shall not be used.
- C. Seed Mixture: Seed mixtures shall consist of the varieties, mixtures and application rates by pound pure live seed (PLS) per acre as stated in the Supplemental Specifications and as determined below:

$$\text{Pure Live Seed per pound (PLS/lb)} = \frac{(\% \text{ purity}) \times (\% \text{ germination})}{100 \quad 100}$$

$$\text{Actual pounds of seed per acre} = \frac{\text{lbs PLS per acre}}{(\text{PLS})/\text{lb.}}$$

2.5 LEGUME SEED INOCULANT

- A. Inoculant for treating leguminous seed shall be a pure culture of nitrogen-fixing bacteria, specific for the seed species to be inoculated. Containers shall be plainly marked with the expiration date for use and manufacturer's directions for inoculating seed.
- B. Methods of inoculation shall conform to manufacturer's recommendations for the particular species of legume.

- C. Inoculants shall be applied at the manufacturer's recommendation.
- D. Use sufficient inoculants to cover all leguminous seed before mixing with other seeds. Seed shall be slightly moistened or a sticker shall be used to ensure the inoculant adheres to the seed. The time lapse for sowing seed following inoculation shall not exceed 24 hours.

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, WITHOUT COVER MATERIAL or 2410 - SUBGRADE PREPARATION, WITH COVER MATERIAL 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 waiting 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 - 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 about twelve (12) 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. Dispose of clods, rocks and other objects which are six (6) inches or greater in diameter. These obstructions can become exposed during any of the disking operations described below and shall be removed.
- B. 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. This entire operation shall be considered the **first disking**. Lime and fertilizer shall not be incorporated during the first disking operation. If cover material has been placed over lime-treated spoil, care shall be taken to not disk in manner and depth that causes the acid material to be mixed into the cover material.
- C. After application of lime and fertilizer (see Item 3.4 *Liming and Fertilizing* below), redisk the site to a depth of three (3) inches. Multiple passes may be required. This entire operation shall be considered the **second disking** operation.
- D. Harrow the site 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, redisk the area until the condition of the seedbed is suitable for seeding. This entire operation shall be considered the **third disking** operation.
- E. After the third disking operation, and prior to seed application, firm the seedbed with a 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 test conducted in Item 3.2 TESTING - 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 interim seeding shall be completed within the seeding season dates shown below. Temporary seeding shall be completed at any time where weather will promote vegetation growth.

Spring	April 1 - May 30
Fall	August 15 - September 15
Dormant	November 15 to Freeze Up
- 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 reseeded 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 interim 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 or the area so affected shall be reprepared and the area reseeded, all at no additional compensation. Reapplication of 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 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. Interim Seeding:

1. Seed all areas to be seeded with the appropriate seed mix as shown on the Plans. Seed shall be applied at the rates provided in the Supplemental Specifications. Sow seed with 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 drills set at no more than six (6) inches apart. Overlap each successive seeding pass to ensure complete coverage. Upon a show of green, non-acidic bare areas will be reseeded at no additional cost to Division.
2. Embed the seed at a depth recommended for the species.
3. 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.
4. Upon completions 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.

3.6 MULCHING

- A. Mulch shall be applied immediately to all areas sown to interim or temporary seed, except areas receiving erosion control mat.
1. 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.

2. 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).
3. 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.
4. 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 interim 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 percent (2%) of the entire vegetated area.
3. The costs of materials and labor for repairs are 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%) 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. All plants included in the seed mixture must be present in the vegetation stand growing on site. If a species is nearly or totally absent from the vegetation stand, Engineer and Division will require Contractor to interseed the missing species at no cost to Division.
- 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 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 reseeded 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 reseeded 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 MEASUREMENT AND PAYMENT

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 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 actually constructed, 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:

- A. *Agricultural Limestone, Seeding:* Contractor's unit price for limestone used in interim seeding work shall represent full payment for the furnishing, delivery, application and incorporation as per these specifications. The actual application rate will vary pending the recommendation of soil tests conducted in Item 3.1 TESTING -FERTILITY in this SECTION.

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.

- B. *Nitrogen (N), Phosphorous (P), and Potassium (K):* Payment for all fertilizer furnished, delivered, applied and incorporated 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 pending results of soil tests conducted in Item 3.2 TESTING - FERTILITY in this SECTION. The cost of soil testing for Phosphorus and Potassium application rates shall be included in Contractor's unit prices. The cost of nitrogen for temporary seeding shall be measured and paid for as part of the cost of implementing the Storm Water Pollution Prevention Plan in SECTION 02120. The cost of nitrogen for wetland fertilizer shall be measured and paid for in either in SECTION 02400 or SECTION 02410.

Measurement for payment purposes shall be the actual weight to the nearest pound of each of the fertilizer components described.

- C. *Seeding:* Contractor's unit prices for Interim and Wetland Fringe Seeding shall represent full payment for the planting of all interim seeded areas in accordance with requirements of this SECTION. Said unit price shall include the furnishing of all seed materials, soil testing, seedbed preparation, inoculants, planting of seeds, and mulching, including all required equipment labor and any required reseeding to complete all interim 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. Seeded areas outside the Project Limits will not be measured for payment. No separate measurement and payment apply to overseeding; the cost of over-seeding shall be subsidiary to seeding.

- D. *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 weigh tickets.

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

- E. *Summary:* Proposal Bid Items applicable to work covered by this SECTION are as follows:

<u>Description</u>	<u>Unit</u>
Agricultural Lime, Seeding	Ton (ECCE)
Nitrogen (N)	Pound
Phosphorus (P)	Pound
Potassium (K)	Pound
Interim Seeding	Acre
Mulch, Seeding	Acre
Wetland Fringe Seeding	Acre

END OF SECTION 02700

**SUPPLEMENTAL CONSTRUCTION
SPECIFICATIONS**

SUPPLEMENTAL CONSTRUCTION SPECIFICATIONS BLIZZARD AML TILE REPAIR PROJECT

EXPLANATION

- A. The purpose of this Section of the Specifications is to provide supplemental information which is required to complete the Standard Construction Specifications and to set forth supplementary requirements, modifications and/or deletions which are required to make the whole of the Construction Specifications project specific.
- B. References to Section, Paragraph and Sub-paragraph numbers used in these Supplemental Construction Specifications are intended to coincide with reference numbers for corresponding Sections, Paragraphs and Sub-paragraphs in the Standard Construction Specifications.
- C. Where there is any variance between the Standard Construction Specifications and these Supplemental Construction Specifications, the Supplemental Construction Specifications shall take precedence.
- D. Where any section of the Standard Construction Specifications is modified or any Paragraph, Sub-paragraph or Clause thereof is changed or deleted by these Supplemental Construction Specifications, the unaltered provisions of that Section, Paragraph, Sub-paragraph or Clause in the Standard Construction Specifications shall remain in effect. Unless these Supplemental Construction Specifications make specific reference to the modification or deletion of a Paragraph, Sub-paragraph or Clause in the Standard Construction Specifications, no changes are intended and paragraphs contained in these Supplemental Construction Specifications are intended only to supplement, amplify, or clarify said Standard Construction Specifications.

SECTION 02700 – SEEDING

2.4 SEED

- D. **(New Paragraph)** The following seed mix shall be used:
1. Interim Seed Mix

Common Name	Scientific Name	Seed Rate (PLS/ac)
Fall (August 15-September 15) Winter Wheat	<i>triticum aestivum</i>	50

3.4 LIMING AND FERTILIZING

- E. **(New Paragraph)** The application rate of “Agricultural Lime, Seeding” is five (5) tons ECCE/acre. No fertilizer or mulch is required to be applied. Agricultural Lime, Seeding material shall be surface applied on all disturbed areas and as directed by Engineer. Harrow to incorporate lime, seeding, and to smooth surface.

END OF SUPPLEMENTAL SPECIFICATION