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SECTION 02000 - SUBSURFACE INVESTIGATION

PART 1 - GENERAL

1.1 DESCRIPTION

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

Not Applicable

PART 1 - GENERAL

1.1 DESCRIPTION

A. Geotechnical and Hydrological Reports

1. A geotechnical study and/or a hydrological study, were prepared for this site as approved by the Division.

2. The results of the field and laboratory tests used for the design are compiled in an appendix. The approximate locations of any test pits, trenches, borings, and soil and water sampling points are shown on the Plans.

3. Complete reports may be reviewed at the office of the Division or the Engineer. Copies may be obtained at the cost of reproduction and handling upon request and payment to the Engineer.

B. Use of Field Data

1. The data presented in the appendix and any other completed reports were obtained and prepared for use during completion of the design and are NOT considered a part of the Contract Documents. This information is made available for bidder's use but is not a warranty of subsurface or hydrological conditions.

2. The data and report were prepared in accordance with generally accepted soil and water investigation procedures for abandoned mine reclamation project design. Any conclusions and recommendations made by others which are based on data presented in the appendix or other report are the sole responsibility of others.

3. Information included in the appendix and in the complete report presents only the data collected at the specific locations indicated and at the time samples or tests were performed. Variations may occur between testing and sampling locations, during different seasons of the year, or between the time of investigation and the time of construction.

C. Site Visit

1. Bidders should visit the site and acquaint themselves with existing conditions.

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

PART 2 - PRODUCTS

No products are required in this SECTION.

PART 3 - EXECUTION

No work, nor measurement and payment, applies to this SECTION.

END OF SECTION 02000

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SECTION 02010 - FIELD ENGINEERING

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1.1 DESCRIPTION
1.2 QUALITY ASSURANCE
1.3 SUBMITTALS

PART 2 - PRODUCTS

Not Applicable

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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 pior 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

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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
35 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:

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

END OF SECTION 02100

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SECTION 02110 - IMPOUNDMENTS

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PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included

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

1. Water quality testing of existing water bodies to be discharged.
2. Development of the Neutralization and Dewatering Plan.
2. Neutralization of acid water.
3. Water quality verification tests.
4. Discharge of neutralized impounded water bodies.

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.

1.3 PERMITS

A. Division and hence Contractor must comply with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit for discharge of water off the site. The water quality standards for discharged water are specified in this SECTION.

1.4 JOB CONDITIONS

A. The site requires dewatering of impounded water bodies to complete the required grading. The anticipated water bodies to be dewatered are indicated on the Plans. However, depending on weather conditions prior to and during construction, the number of water bodies required to be dewatered may be more or less than the number shown on the Plans.

B. Some sites have water bodies that are not to be disturbed and shall remain at the site. These water bodies, if any, are identified on the plans. Care should be taken to minimize disturbance to the areas surrounding these water bodies and minimize the amount of sediment delivered to them. Appropriate measures shall be taken to protect from sediment as shown on the Storm Water Pollution Prevention Plan (SWPPP) or as directed by the Engineer.

C. Water quality evaluations of the water bodies at the site have been taken during project development. Those water bodies anticipating treatment prior to discharge are noted on the Plans. Water quality can change over time and new tests of all water bodies requiring discharge off site must be taken during construction and prior to discharge to determine if treatment is required and to what extent. It is also possible that water quality can change during discharging operations, requiring cessation of discharging operations and additional treatment before discharging can continue.

D. Water that does not meet the NPDES parameters may not be discharged off site until acceptable neutralization is obtained. Contractor may not proceed with liming treatment(s) without the approval of Engineer.

E. The materials used to neutralize acidic water are caustic and Contractor shall take appropriate precautionary measures when handling hydrated lime. See Item 3.2 in this SECTION.

1.5 SUBMITTALS

A. Laboratory Approval

Contractor shall select a testing laboratory to provide testing required under this SECTION. The name and address of the testing laboratory to be used in this work shall be submitted to and must be accepted by Engineer prior to start of this work.

The testing laboratory may perform the required testing on site provided the work plan describing the proposed treatment, equipment, and the field methods of testing have been accepted by Engineer prior to start of this work. Field testing equipment must meet the minimum resolution capabilities and be able to provide measurements within the minimum ranges listed below:

MINIMUM FIELD TESTING EQUIPMENT REQUIREMENTS

Parameter	Units	Range	Increments
pH	unit	4.0-10.0	0.1 units
total iron	mg/l	0.5-10.0	0.1 mg/l
total manganese	mg/l	0.5-10.0	0.1 mg/l
suspended solids	mg/l	0-500	5.0 mg/l
acidity/alkalinity	mg/l	As needed	5.0 mg/l

B. Certification and Receipts

1. Submit certification that liming agents meet the minimum criteria of this SECTION.

2. Submit receipts and weigh tickets of liming agents delivered to the project site.

C. Test Results

1. Submit results of water quality test results for both before and after neutralization, neutralization determinations, and field quality tests taken during discharge operations.

PART 2 - PRODUCTS

2.1 LIME MATERIALS

A. Hydrated lime [$Ca(OH)_2$] shall meet requirements of ANSI/AWWA B202-93 and shall not have less than sixty-two percent (62 %) available calcium oxide which is equivalent to eighty-one and nine-tenths percent (81.9%) calcium hydroxide.

2.2 DELIVERY, STORAGE AND HANDLING

A. Deliver liming agents to the site in their original containers with all labels or certificates intact and legible for Engineer's inspection.

B. Contractor shall use all means necessary to protect materials from the elements during storage and handling.

C. In the event of damage or rejection, Contractor shall immediately make all replacements necessary to the approval of Engineer at no additional cost to Division.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

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

3.2 PRECAUTIONS

A. Hydrated lime is a caustic material. Sustained and unprotected exposure to hydrated lime may be hazardous to workers. Contractor shall instruct workers in the proper handling of bulk lime and lime slurry and shall take all necessary steps to protect working personnel and the general public.

3.3 DISCHARGING ON SITE

A. Discharging impounded water on site is allowed provided all of the following requirements are met.

1. Engineer and Division are in agreement that this method of discharge is feasible.

2. Water can be released onto the site in a controlled manner either through pumps or careful breaching of dikes.

3. Designated area can absorb the water without exiting the site either by direct runoff or through groundwater by observable seeps.

B. Discharging impounded water on site shall be considered incidental to grading and will not be measured for payment.

3.4 WATER SAMPLING AND TESTING (ALL IMPOUNDED WATER BODIES)

A. Contractor shall obtain composite samples of all impounded water to be discharged off site. This round of composite samples from each impounded water body shall be used to determine if treatment is necessary or not. If test results indicate treatment is not necessary, the impounded water may be discharged off site with periodic field testing during discharge. If treatment is necessary, the test results shall be used to evaluate the amount of lime required to neutralize the acid water.

B. Contractor shall collect composite samples and submit for testing as follows:

1. At least one (1) composite water sample shall be taken from each impoundment. Impoundments containing more than ten (10) acre-feet of water shall have one (1) additional sample shall be taken for every ten (10) acre-feet of water or fraction thereof.

2. A composite sample shall consist of equal parts of four surface samples taken throughout the area the composite sample represents. The location of all sampling points shall be such that when all the composite samples are obtained for a given impounded water body, they are representative of the entire impounded water body area insofar as practical.

3. Obtain sample bottles of proper type and size with appropriate preservatives, as well as sample gathering and delivery procedures, directly from the laboratory. Store and ship samples refrigerated (under ice) if and as required by laboratory.

4. Each composite sample shall be delivered to the approved laboratory within 24 hours of collection. Each composite sample shall be tested for pH, total acidity/alkalinity (mg/l), total iron (mg/l), total manganese (mg/l), and total suspended solids (mg/l).

5. Contractor shall submit copies of the laboratory results to Engineer and Division prior to the meeting at the site to develop the neutralization or discharge plan.

6. Contractor shall pay all costs associate with sampling and testing.

3.5. NEUTRALIZATION AND DEWATERING PLANNING MEETING

A. Contractor, Engineer, and Division shall meet at the site to discuss and develop the neutralization and dewatering plan. The Contractor foreman or other personnel who will be responsible for this portion of the work must be in attendance at this meeting. The minutes of this meeting shall be prepared by Engineer and distributed to all parties prior to initiating this portion of the work. The neutralization and dewatering plan shall at a minimum include the following:

1. Schedule for completion of neutralization if necessary, and dewatering for all impounded water along with a list of personnel planned to complete this work.

2. In the case of multiple acidic impounded water bodies, the proposed order in which the impounded water bodies will be neutralized and dewatered. Water may be moved within the site from one impounded water body to another before neutralizing or discharging off site. This can be done by pumping or gravity flow, provided that all three of the conditions listed below are met.

   a. The receiving impounded water body is structurally sound and has adequate capacity to contain the discharge.

   b. There is no significant transfer of soft sediment (muck) into the receiving impounded water body.

   c. There is no outflow of water off the project site.

3. Laboratory approval information as required in Paragraph 1.5 A. Laboratory Approval of this SECTION.

4. Method(s) to be used to neutralize the water, including the number and types of equipment to be used. If multiple methods are used, it shall be determined which method will be used on each impounded water body.

5. Proposed water sampling methods used to assure that neutralized water meets NPDES discharge limits as outlined in Item 3.7 DISCHARGE OF IMPOUNDMENTS found in this SECTION.

6. A copy of the site plan(s) showing the routes of discharge for each impounded water body and location of any constructed basins or modified impounded water bodies used for neutralization of acidic water on site.

7. Erosion protection to be used on discharge routes.

8. Safety precautions to be used to assure workers will be protected from the caustic effects of hydrated lime.

3.6 WATER TREATMENT (IMPOUNDED WATER BODIES REQUIRING NEUTRALIZATION PRIOR TO DISCHARGE)

A. Hydrated lime for neutralization of acid impoundments shall not be applied during periods where the temperature is anticipated to be below freezing.

B. Applications of lime as a dry powder directly to the water surface over the entire impounded water body shall not be permitted. The hydrated lime shall be mixed with the impounded water and applied as a slurry.

C. The impounded water shall be continuously circulated during application of the slurry to assure thorough mixing of the lime slurry and impounded water.

D. After impounded water bodies requiring treatment are neutralized with a pH of between 6.0 and 9.0, a second round of composite samples shall be obtained. If this second round test results indicate unacceptable pH, total iron, total manganese, or total suspended solids, the water shall be retreated if necessary, remixed, or any other action as may be required. Retests are required until acceptable laboratory results are obtained.

E. Timing is critical for this task. Samples must be analyzed and discharge must be initiated as soon as possible when results are within NPDES parameters. If a rainfall event occurs that creates runoff into the impoundments between the time samples are collected and tested and prior to discharge, new samples must be taken and tests performed.

F. No acidic spoil material may be placed in the water body after the water samples are taken and prior to discharge.

G. If it is determined that Contractor's actions has caused treated water to no longer meet the NPDES discharge parameters, Contractor shall retreat the water as needed at no additional cost to Division.

3.7 DISCHARGE OF IMPOUNDMENTS

A. Impounded water, whether treated or untreated, shall not be discharged off-site unless Engineer is present, and not until the testing performed by Contractor indicates the discharge effluent is within the following NPDES parameters:

1. pH between 6.0 and 9.0
2. Total iron content less than 7.0 mg/l
3. Total manganese content less than 4.0 mg/l
4. Total suspended solids less than 70 mg/l

B. The impoundment shall be discharged immediately after the water meets the discharge parameters and has been accepted by Engineer. New samples and tests shall be required if discharging the water is delayed by Contractor, acidic seeps into the impounded water body are discovered, significant precipitation occurs, or the field tests indicate a change in pH outside the acceptable discharge limits.

C. Once favorable laboratory results have been obtained and discharge commences, Engineer shall periodically test the discharge for pH. If the pH of the discharge changes to below 6.0 or above 9.0, Contractor shall cease discharging, retreat as appropriate, and obtain a satisfactory test result prior to further discharge.

D. Contractor shall discharge all impoundments before any ice is present on the surface of the water. Any impoundment not discharged prior to surface ice formation shall be retreated as needed at no additional cost to Division.

E Contractor shall prevent soil erosion in the area downstream of the discharging facility. Silt fences, or other silt collectors may be necessary to contain erosion of acid soils.

F. Contractor shall take appropriate actions to prevent further accumulation of surface runoff or seepage immediately after the impounded water is discharged. Contractor shall be responsible for testing, treating, and discharging any water that is impounded due to surface runoff or seepage after the initial discharge has been completed at no cost to Division.

3.8 TREATMENT AND DISCHARGE SUMMARY

A. The table provided in the Supplemental Specifications or Plans presents data from samples taken at the time field investigations were conducted to assist Contractor in estimating the amount of lime that could be needed to neutralize impounded water bodies. The table includes acidity and the estimated volume of water which existed at the time of those investigations and needs to be discharged.

B. The table also presents the expected number of first and second round composite samples for the water bodies at the site. Further rounds of composite samples may be necessary if satisfactory discharge parameters are not achieved after initial treatment and testing or if conditions change during discharge.

C. The information in the table is provided for Contractor's use. Actual field conditions at time of construction are subject to variation depending upon rainfall events and other causes. While lime used in accordance with this Section will be paid for, all sampling, testing, and discharge of all water shall be included in the lump sum bid for Impoundment Discharge.

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 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 work actually constructed, measured as described herein, shall constitute full payment to Contractor for performance of the work included in this SECTION of the Construction Specifications or on the Plans.

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

A. *Hydrated Lime:* This unit price shall include all costs for liming materials, application, and circulation. Lime neutralization treatment required for acid water which has been allowed by Contractor to accumulate in depressions caused by Contractor's work, or in impoundment basins previously treated and discharged off-site shall be performed by Contractor at no cost to Division. The payment quantity for lime neutralization of acid water shall be the actual number of tons of hydrated lime incorporated into the acid water as validated by weigh tickets furnished to Engineer during neutralization operations.

B. *Impoundment Discharge:* Contractor shall be paid at the lump sum price for this item. This amount shall be full compensation for attending the neutralization and dewatering planning meeting, for all water sampling and testing, and for discharge of all impoundments. Contractor will only be reimbursed once for discharge of all impoundments. Any further impoundment discharge required resulting from groundwater seeps, precipitation, or other reasons shall be incidental. Any resulting water sampling/testing or further acid water treatment, including lime, shall be incidental. The lump sum price for this work item shall include full payment for all work as required to complete all impoundment discharge in accordance with the requirements of this SECTION. If impoundments are able to discharged on site, no payment will be made. The cost associated with discharging impoundments on site shall be treated like SECTION 02200 – 3.6 CARE OF WATER, and is incidental to excavation.

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

Description	Unit
Hydrated Lime	Ton
Impoundment Discharge	Lump Sum

END OF SECTION 02110

INDEX

SECTION 02120 – SEDIMENT AND EROSION CONTROL

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- L. Turf Reinforcement Mats (TRMs)
- M. Sediment Basin Outlet Structures
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3.4 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 install sediment and erosion control practices for this project. The work shall include, but is not necessarily limited to, completion of the following work:

1. Installation of sediment and erosion control structures.
2. Repairs to sediment and erosion control measures.
3. Replacement of damaged erosion control measures.
4. Removal of sediment and erosion control structures.
5. SWPPP inspections and documentation.

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

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

1.2 QUALITY ASSURANCE

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

B. In addition to complying with requirements of governmental agencies having jurisdiction, comply with the directives of Engineer and Division. Engineer or Division may request additional control methods to be implemented by Contractor.

C. The SWPPP as prepared by the Engineer will be implemented by the Contractor. Modifications, repairs, or replacement of sediment control measures and practices will be implemented by the Contractor as soon as practical. Inspections and reports as required by the permit (once every seven (7) calendar days) will be the responsibility of the Contractor, but can be completed by persons with the Contractor, Engineer, Division, Project Partners, or other competent persons. Reports shall be provided to the Engineer on a regular basis.

D. In the event of conflict between the SWPPP and the requirements with water pollution control laws, rules, and regulations of other federal, state, and local agencies, the more restrictive laws, rules, or regulations will apply.

E. References

1. Statewide Urban Design and Specifications (SUDAS)

2. Iowa Department of Transportation (IDOT) Standard Specifications

1.3 JOB CONDITIONS

A. Abandoned mine land sites typically do not contain very good if any vegetative cover material and are highly susceptible to erosion. Contractor shall take care while grading the site to reduce the amount of sedimentation.

B. Wetlands, ponds, and streams are often located within and adjacent to abandoned mine land sites. Extra care shall be exercised to protect these features from sedimentation where these features are to remain in place.

C. Contractor shall protect all existing underground utilities, including any private tiles.

1.4 SUBMITTALS

A. Contractor shall be a co-permittee with Division for the IDNR NPDES General Permit No. 2 for this site. The permit fees, public notice, and permit submittal will be completed and paid for by Division.

B. The Contractor and any subcontractors that will perform grading, structural installation, and seeding shall sign the SWPPP Contractor Certification Statements as prepared by the Engineer.

C. The Contractor shall provide copies of the inspection reports to the Engineer at least once per month.

D. Contractor shall submit to Engineer documentation that various materials used for erosion and sediment control meet the requirements of the specifications.

1.5 SCHEDULING

A. Contractor shall sequence his work to minimize erosion of the site and implement the sediment and erosion control measures as outlined in the SWPPP. No grading work will be allowed until the appropriate control measures are in place.

B. When rain events cause necessary repairs or replacement to sediment and erosion control practices as determined by the inspection completed by Engineer or Division, Contractor shall implement the requested work as soon as practically possible.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Erosion Control Mulch

1. Conventional Mulch - Materials shall consist of wheat, oats, rye, hay, grass cut from native grasses or other plants approved in writing by Division, that is of air dry straw that has been properly cured and harvested. Mulch harvested after a killing frost or during dormant periods will not be acceptable. Mulch shall not be rotted, brittle, moldy, caked or otherwise degraded. Mulch shall generally be free of noxious weeds as published by the local County Weed Commissioner.

2. Other types of mulch, such as hydromulch meeting SUDAS 9010, 2.07, may also be used but is subject to the approval of Engineer.

B. Compost Blankets

1. Compost used for blankets shall be derived from a well-decomposed source of organic matter, produced using an aerobic composting process meeting Code of Federal Regulations (CFR) 503 for time, temperature, and heavy metal concentrations. The compost shall have no visible admixture of refuse or other physical contaminants, nor any material toxic to plant growth. The compost shall be certified by the U.S. Composting Council's Seal of Testing Assurance (STA) program and conform to the chemical, physical, and biological parameters of AASHTO MP 10-03, with the following additional requirements:

   a. Follow U.S. Composting Council's TMECC guidelines for all testing.

   b. Organic Matter Content: 30% minimum.

   c. pH: between 6.0 and 8.0.

   d. Maturity (growth screening): Minimum 90% emergence for all compost to be vegetated.

   e. Particle Size:

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

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

C. Temporary Erosion Control Seeding

1. Fertilizer consisting of nitrogen (N).

2. Seed consisting of the following mix depending upon the time of year. All seed rates shall be based on pure live seed as discussed in SECTION 02700.

Common Name	Application Rate (lbs/acre)	Application Dates
SPRING AND FALL		March 1-May 20 and August 15 - September 30
Oats	65	
Grain Rye	25	
Red Clover	5	
Timothy	5	

Common Name	Application Rate (lbs/acre)	Application Dates
SUMMER		May 21 –August 14
Oats	95	
Grain Rye	35	
Red Clover	5	
Timothy	5	

D. Silt Fences

1. Fabric used for silt fences shall meet the requirements of IDOT 4196.01.

2. Posts used for silt fences shall be steel T-posts with a minimum length of four (4) feet weighing at least one and one-quarter (1-1/4) pounds per foot, exclusive of the anchor plate. Painted posts are not required.

3. Wire or plastic ties with a minimum tensile strength of fifty (50) pounds shall be used for fasteners.

E. Check Dams

1. Check dams using silt fence shall comply with details of 2.1.D above

2. Check dams using Rolled Erosion Control Products (RECP) shall be Type 4 with a minimum four (4) foot width and shall comply with details of 2.1.H below.

3. Triangular foam check dams shall have a height of eight (8) to ten (10) inches with a base width of sixteen (16) to twenty (20) inches and a length of seven (7) feet. The inner support material shall be urethane foam and the outer cover shall be woven geotextile shaped to fit around the inner support material with the bottom edge extending two (2) to three (3) feet beyond the bottom edge.

4. Filter fabric used for fabric checks shall consist of non-woven geotextile material and can be either heat-bonded or resin bonded and shall have the following properties:

Tensile Strength	90 lb minimum per ASTM D4632 grab test
Elongation at Failure	less than or equal to 50% per ASTM D4362 grab test
Puncture	40 lb minimum per ASTM D4833
Apparent Opening Size (AOS)	No. 40 US Standard Sieve size per ASTM D4751
Permittivity	0.7 sec^{-1} minimum per ASTM D4491
Ultraviolet light	70% of residual tensile strength per ASTM D4355 with 150 hour exposure.

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

F. Filter Berms and Filter Socks

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

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

2. Where required for slope and sediment control applications, the filter sock shall consist of a continuous, tubular, knitted, mesh netting with three-eighth (3/8) inch openings constructed of five (5) millimeter thickness and photodegradable high density polyethylene (HDPE).

3. Filter socks will be supported by one (1) inch by two (2) inch hard wood stakes or stakes of equivalent strength.

G. Wattles

1. Netting for wattles shall be degradable with an open weave having a nominal diameter of nine (9) inches or as specified.

2. Fill material shall consist of straw, wood excelsior, coir, or other natural materials approved by Engineer.

3. Stakes shall be one (1) inch by one (1) inch wood stakes or stakes of equivalent strength.

H. Temporary Rolled Erosion Control Products (RECP)

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

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

   a. RECP Type 1.A: Mulch control net, consisting of a photodegradable synthetic mesh or woven biodegradable natural fiber netting.

   b. RECP Type 1.B: Netless rolled erosion control blankets, consisting of natural and/or polymer fibers, mechanically interlocked and/or chemically adhered together to form a RECP.

   c. RECP Type 1.C: Single-net erosion control blankets and open weave textiles, consisting of processed degradable natural and/or polymer fibers, mechanically bound together by a single rapidly-degrading, synthetic or natural fiber netting, or an open weave textile of processed rapidly-degrading natural or polymer yarns or twines woven into a continuous matrix.

   d. RECP Type 1.D: Double-net erosion control blankets, consisting of processed degradable natural and/or polymer fibers, mechanically bound together between two rapidly-degrading, synthetic or natural fiber nettings.

2. RECP Type 2 (Short-Term): Functional longevity between three (3) and twelve (12) months and classified as follows:

   a. RECP Type 2.A: Mulch control net, consisting of a photodegradable synthetic mesh or woven biodegradable natural fiber netting.

b. RECP Type 2.B: Netless rolled erosion control blankets, consisting of natural and/or polymer fibers, mechanically interlocked and/or chemically adhered together to form a RECP.

c. RECP Type 2.C: Single-net erosion control blankets and open weave textiles, consisting of an erosion control blanket composed of processed degradable natural or polymer fibers, mechanically bound together by a single degradable synthetic or natural fiber netting to form a continuous matrix, or an open weave textile composed of processed degradable natural or polymer yarns or twines woven into a continuous matrix.

d. RECP Type 2.D: Double-net erosion control blanket, consisting of processed degradable natural and/or polymer fibers, mechanically bound together between two degradable synthetic or natural fiber nettings.

3. RECP Type 3 (Extended Term): Functional longevity between twelve (12) and twenty-four (24) months and classified as follows:

a. RECP Type 3.A: Mulch control nets, consisting of a slow-degrading synthetic mesh or woven natural fiber netting.

b. RECP Type 3.B: Erosion control blankets and open weave textiles, consisting of processed slow-degrading natural or polymer fibers, mechanically bound together between two slow-degrading synthetic or natural fiber nettings to form a continuous matrix, or an open weave textile composed of processed slow-degrading natural or polymer yarns or twines woven into a continuous matrix.

4. RECP Type 4 (Long Term): Functional longevity of thirty-six (36) months and classified as follows: Erosion control blankets and open weave textiles, consisting of processed slow-degrading natural or polymer fibers, mechanically bound together between two slow degrading synthetic or natural fiber nettings to form a continuous matrix, or an open weave textile composed of processed slow-degrading natural or polymer yarns or twines woven into a continuous matrix.

5. Properties and Performance:

Testing performed according to the ECTC's Testing Procedures for Rolled Erosion Control Products. Verify manufacturer's test results by independent testing.

Material properties meeting the Erosion Control Technology Council's (ECTC) Standard Specifications for Rolled Erosion Control Products as follows:

Classification	Slope Application	Channel Application	Min. Tensile Strength
	Max. Grade*	Permissible Shear Stress	
RECP Type 1.A	5:1 (H:V)	0.25 lb/ft^2	5 lb/ft
RECP Type 1.B	4:1 (H:V)	0.50 lb/ft^2	5 lb/ft
RECP Type 1.C	3:1 (H:V)	1.50 lb/ft^2	50 lb/ft
RECP Type 1.D	2:1 (H:V)	1.75 lb/ft^2	75 lb/ft
RECP Type 2.A	5:1 (H:V)	0.25 lb/ft^2	5 lb/ft

RECP Type 2.B	4:1 (H:V)	0.50 lb/ft^2	5 lb/ft
RECP Type 2.C	3:1 (H:V)	1.50 lb/ft^2	50 lb/ft
RECP Type 2.D	2:1 (H:V)	1.75 lb/ft^2	75 lb/ft
RECP Type 3.A	5:1 (H:V)	0.25 lb/ft^2	25 lb/ft
RECP Type 3.B	1.5:1 (H:V)	2.00 lb/ft^2	100 lb/ft
RECP Type 4	1:1 (H:V)	2.25 lb/ft^2	125 lb/ft
*Product tested according to ECTC Test Method No. 2 and meeting the ECTC Standard Specifications for "C" factor.			

6. RECP Anchors shall be stakes or staples as recommended by manufacturer, with a minimum length of 6 inches.

I. Turf Reinforcing Mats (TRM)

1. TRM Type 1: Use a TRM that is constructed of a web of mechanically or melt-bonded polymer netting, or monofilaments fibers that are entangled to form a strong and dimensionally stable mat. Bonding methods include polymer welding, thermal or polymer fusion, or the placement of synthetic fibers between two high-strength, biaxially-oriented nets, mechanically bound by parallel stitching with polyolefin thread. Products may contain a degradable component.

2. TRM Type 2 and 3: Use a TRM that is constructed of a web of mechanically or melt-bonded polymer netting, monofilaments, or fibers that are entangled or woven to form a strong and dimensionally stable mat. Non-woven bonding methods include polymer welding, thermal or polymer fusion, or the placement of fibers between two high-strength, biaxially oriented nets, mechanically bound by parallel stitching with polyolefin thread. Use only components that are 100% synthetic and resistant to biological, chemical, and ultraviolet degradation.

3. TRM Type 4: Use a high performance/survivability TRM that is composed of monofilament yarns woven into a resilient uniform configuration. Use a mat that has a matrix that exhibits very high interlock and reinforcement capacities with both soil and root systems and demonstrate a high tensile modulus. TRMs manufactured from discontinuous or loosely held together by stitched or glued, netting, or composites are not allowed in this category. Use only components that are 100% synthetic and resistant to biological, chemical, and ultraviolet degradation. Use this category when field conditions exist with high loading and/or high survivability requirements. These requirements consist of maintenance, structural backfills protecting critical structures, potential traffic areas, abrasion, higher factors of safety, and/or general durability concerns.

4. TRMs shall meet the minimum material and performance requirements contained in the following table:

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

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

J. Sediment Basin Outlet Structures

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

K. Stabilized Construction Entrance

1. Use IDOT Section 4122, Gradation 13, Macadam crushed stone where construction entrance adjoins a publicly used road. Refer to SWPPP for location and dimensions.

L. Earthen Sediment Berms

1. In some instances, berms constructed from on site soil material can be used to keep sediment out of areas to be protected such as streams or wetlands. The location and dimensions of these berms shall be as agreed upon by the Engineer and Contractor.

2. The earthern berm shall be constructed from on site material in the immediate vicinity and shall be compacted as needed to provided stability. No benching or undercutting is required for berms that will be removed after general grading is completed.

PART 3 - EXECUTION

3.1 SWPPP PREPARATION

A. The Erosion Control Plan for this project prepared by Engineer has been included in the Plans. The completed SWPPP will be provided to Contractor prior to initiation of construction and will be based on the Erosion Control Plan.

B. Contractor shall be co-permittee with Division on the IDNR NPDES General Permit No. 2 that shall be completed by Division.

3.2 SWPPP MANAGEMENT

A. Contractor and all subcontractors are required to sign the certification statement one (1) week prior to start of construction. The signed copies shall be kept with the official SWPPP documentation maintained by Contractor.

B. Engineer will compile a booklet containing a copy of the SWPPP, blank weekly inspection forms to be completed, and copies of the plan for the SWPPP to keep track of any changes and modifications that occur. Contractor shall provide a waterproof mailbox or other container that will house the SWPPP booklet on site. Provisions should be made for representatives of Engineer, Division, and IDNR personnel to have access to the booklet kept at the site.

C. Contractor shall be responsible for implementation of the various control measures during construction within the project limits as defined in the SWPPP.

D. Contractor shall properly manage all hazardous materials (i.e. fuel, oil, concrete wash out, etc.) brought to the site to conform to the SWPPP all at his own expense.

E. Contractor may propose alternative measures than those specified by Engineer but shall receive approval from Division or Engineer prior to installation of these alternate measures. All changes and modifications must be documented and kept with the SWPPP documentation.

F. Contractor is responsible to complete the required site inspections as required by the SWPPP, which is once every seven (7) calendar days. A report will be completed and filed for each inspection. The Engineer will provide the blank forms to the Contractor. The Contractor is responsible to collect and file all inspection reports, regardless of which entity performed the inspection. Inspections and reports are required at the specified interval from initiation of clearing until final green up acceptance.

G. Contractor shall maintain access to the site at all times during construction.

H. Division will file the Notice of Discontinuation after final stabilization is achieved.

I. Contractor will submit the complete SWPPP documentation to the Division after final green up since the records have to be maintained for a period of three (3) years after the Notice of Discontinuation is submitted.

3.3 INSTALLATION OF SEDIMENT AND EROSION CONTROL MEASURES

A. Surface Roughening

1. Directional Tracking: Operate tracked equipment up and down slopes that are less steep than three to one horizontal to vertical (3H:1V) to create ridges that are perpendicular to the slope.

2. Grooving/Furrowing: Use rippers, disks, harrows, chisel plows, or other equipment capable of operating on the slope to create grooves that are about three (3) inches deep and spaced a maximum of fifteen (15) inches apart. Grooves must be made along the contour and perpendicular to the slope.

B. Erosion Control Mulching

1. Conventional: Uniformly distribute mulch over the required area at a rate of two (2) tons per acre and work the mulch into the soil with a mulch tucker designed to anchor the mulch into soil by means of dull blades or disks.

2. Other types of mulching, if approved by Engineer, will be at the determined rates of application with appropriate equipment.

C. Compost Blankets

1. Loosen the ground to a minimum depth of one (1) inch and evenly apply the compost to the specified depth.

2. All concentrated flows shall be diverted away from the slope.

3. No heavy equipment shall be operated over the compost blanket throughout the required period of protection.

D. Temporary Erosion Control Seeding

1. Till soil to a minimum depth of five (5) inches with a disk, harrow, or field cultivator.

2. Apply Nitrogen (N) fertilizer to all seeded areas at a rate of fifty (50) pounds per acre.

3. On areas accessible to field machinery, sow seed with an endgate cyclone seeder. Areas that are not accessible shall use hand-operated cyclone seeding methods.

4. Cover the seed and fertilizer lightly by tiling the seeded area with a disk, rigid harrow, spring tooth harrow, or field cultivator.

E. Temporary Earth Diversion Structures

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

2. Ensure positive drainage along the diversion ditch to the designated outlet area.

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

F. Silt Fences

1. Install silt fences along the specified contour and to the dimension shown on the erosion control plan or as directed by Engineer. The ends of continuous run silt fences shall be turned uphill with a J-hook to prevent runoff from flowing around the end when the water behind the fence ponds to a level even with the top of the fence.

2. Install silt fence fabric with a mechanical soil slicing machine that creates a slit in the ground while simultaneously installing the fabric. The trenching method may be used

when the slicing method cannot be used and is subject to approval by Engineer. The silt fence fabric shall be installed such that twelve (12) inches is installed at least six (6) inches below the ground line (folding is allowed). After the fabric is installed, the ground shall be compacted on each side by driving over the area with rubber tired equipment or by other means as necessary to adequately anchor the material in the ground to prevent pullout and water flow under the fence.

3. Steel post supports shall be placed at a maximum spacing of eight (8) feet or as directed by Engineer. The steel posts shall be installed with a minimum embedment depth of twenty (20) inches. Fabric shall be tied to the steel posts at least four (4) evenly spaced locations using metal ties or plastic ties that have ultraviolet protection.

4. Non-functioning silt fences that allow flow underneath or that are damaged due to improper installation shall be repaired or replaced by Contractor at no cost to Division.

5. Silt fences shall be cleaned out when the accumulated sediment reaches a level of one-half the height of the silt fence or when the silt fence becomes clogged with sediment and no longer allows runoff to flow through. Silt fences shall be replaced when necessary.

6. Silt fences shall be removed at the appropriate time by removing the stakes, ties, and fabric from the site or burying material in an approved location and manner. The accumulated sediment shall be spread and distributed in surrounding areas and smoothed to match finished grade and to ensure proper drainage.

G. Check Dams

1. Install check dams as shown on the plans or as recommended by the manufacturer.

2. Filter fabric check dams will be installed so that eighteen (18) inches are placed in a trench on the upstream side of its intended location. Material excavated from trench shall be replaced and compacted to hold the fabric check in place. The remaining eighteen (18) inches shall be placed loosely on the surface facing downstream.

3 Clean out check dams as directed by Engineer when they become non-functioning by sediment accumulation.

4. Remove any temporary check dams as directed by Engineer after site is stabilized. All accumulated sediment and disturbed areas shall be regraded and spread as needed to match finished grade and ensure proper drainage.

H. Filter Berms

1. Filter berms shall be constructed to the dimensions and along the contour as shown on the plans or as directed by Engineer.

2. The ends of filter berms shall be turned uphill to prevent runoff from flowing around the ends.

3. Apply temporary erosion control evenly to the surface if the berm is specified to be vegetated.

4. Filter berm shall be cleaned out when sediment accumulation reaches one-half of the height of the berm or as directed by Engineer.

I. Filter Socks

1. Filter socks shall be filled with the appropriate filter material pneumatically to the size and length indicated on the plans or as directed by Engineer.

2. Filter socks shall be placed along the contour as indicated on the plans or as directed by Engineer. The ends of the each filter sock shall be turned uphill to create a J-hook to prevent runoff from flowing around the ends when water ponds up to a level even with the top of the sock.

3. Additional filter material or soil shall be placed on the uphill side of the filter sock between the filter sock and the ground.

4. Drive support stakes into the ground on the downhill side of the filter socks at a maximum spacing of ten (10) feet. Place additional stakes as needed to secure the sock and prevent movement.

5. Non-functioning filter socks that allow flow underneath or socks that are damaged due to improper installation shall be repaired or replaced by Contractor at no cost to Division.

6. Filter socks shall be cleaned out when the accumulated sediment reaches a level of one-half the height of the sock or when the sock becomes clogged with sediment and no longer allows runoff to flow through.

7. Filter socks shall be removed at the appropriate time by slicing the sock longitudinally and removing the mesh and staking materials. The filter material and accumulated sediment shall be spread to match finished grade and ensure proper drainage.

J. Wattles

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

2. Drive stakes through the center of the wattle at a maximum spacing of four (4) feet and as needed to secure the wattle and prevent movement. Extra staking is needed at butted ends to prevent leakage. Do not overlap wattles.

3. Non-functioning wattles that allow flow underneath or wattles that are damaged due to improper installation shall be repaired or replaced by Contractor at no cost to Division.

4. Wattles shall be cleaned out when the accumulated sediment reaches a level of one-half the height of the wattle or when the wattle becomes clogged with sediment and no longer allows runoff to flow through.

5. Wattles shall be removed at the appropriate time by slicing the wattle and removing the mesh and staking materials. The filler material and accumulated sediment shall be spread to match finished grade and ensure proper drainage.

K. Temporary Rolled Erosion Control Products (RECPs)

1. Install all RECPs according to the manufacturer's published installation recommendations along with the following minimum requirements.

2. Grade and smooth surface. Remove all rocks, clods, vegetation, or other obstructions that will prevent direct contact between the RECP and the soil surface.

3. When specified, prepare seedbed and place seed and fertilizer according to SECTION 02700.

4. Slope Application: Install anchor trench along at the top of the slope. Unroll the RECP down and horizontally across the slope. Place consecutive blankets down the slope end over end, shingle style. Overlap rolls a minimum of three (3) inches and install anchors at a maximum spacing of eighteen (18) inches along all the overlaps. Backfill and compact trench and place additional seed as required.

5. Channel Application: Install RECP As shown on the details shown on the plans.

L. Turf Reinforcement Mats (TRMs)

1. Install TRMs according to the published installation literature for the product specified and for the appropriate application.

2. Depending upon the sequence and timing of construction, it may be necessary to delay installation of TRMs to correspond to dates when permanent seeding can take place in the spring and fall seeding periods.

M. Sediment Basin Outlet Structures

1. Concrete Base: Construct concrete base and anchor riser section as shown on the plans.

2. Dewatering Device: Drill holes in riser section with the number, diameter and configuration as shown on the plans. Wrap the perforated section of the riser pipe with metal hardware cloth.

3. Riser and Barrel: Place the specified corrugated metal pipe and properly backfill as needed with compacted lifts of soil. The anti-vortex and anti-seep collars shall also be properly placed where shown on the plans.

4. Repairs required to the sediment basin or outlet structure due to improper installation shall be repaired by Contractor at no cost to Division.

N. Stabilized Construction Entrance

1. Place stone at entrance to correspond to the dimensions provided in the SWPPP or as directed by Engineer. Alternative material can be proposed, but must be approved by Engineer.

2. If voids become plugged, replace or regrade as needed.

3.4 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. The unit price shall include all labor, materials, and equipment necessary for proper installation of the various controls. Maintenance of the SWPPP documentation and management of the required inspections are incidental and should be included in the sediment and erosion control measures required for this project.

If erosion and sediment control measures are properly installed by Contractor and storm events cause failure or reduces the effectiveness of these measures, replacement shall be completed as directed by Engineer and will be paid for by Division to Contractor as defined below.

If temporary erosion and pollution control measures are required due to Contractor's negligence, carelessness, or failure to install permanent controls as part of his work as scheduled and are deemed necessary by Engineer or Division, the measure shall be completed by Contractor at no cost to Division.

In case of repeated failures on part of Contractor to control erosion, pollution, and/or siltation, Division reserves the right to employ outside assistance to provide the necessary corrective measures. Such incurred direct costs, plus Engineering costs, will be at Contractor's own expense with the appropriate deduction taken from future pay requests.

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

A. *Surface Roughening:* Payment for surface roughening performed as directed by Engineer will be measured and paid for by the contract unit price per acre. Areas shall be jointly measured by Engineer and Contractor.

B. *Erosion Control Mulching:* Payment for mulching will be measured and paid for at the contract unit price per acre. Mulch placed outside designated areas will not be measure for payment. Areas shall be measured jointly by Engineer and Contractor.

C. *Compost Blankets*: Payment for the cost of placing compost blankets will be measured and paid for by the contract unit price of each square foot for each thickness of blanket specified and shall include preparing the subgrade. Compost blankets placed outside specified areas will not be measured for payments. Measurements will be taken jointly by Engineer and Contractor.

D. *Temporary Erosion Control Seeding:* Payment for placement of temporary seeding will be measured and paid for by the acre. The unit contract price shall include preparing the subgrade, placement of fertilizer and seed, and final cultivating. The area for payment will be measured jointly by Engineer and Contractor.

E. *Temporary Earth Diversion Structures:* Payment for installation and removal of temporary earth diversion structures will be measured and paid for by the linear foot for each type and size of diversion structure. Payment will be jointly measured by contractor and Engineer. Full payment for this item will not be made until removal is complete. The unit price shall include all labor and equipment necessary.

F. *Silt Fences:* Payment for installation of silt fence will be measured and paid for at the contract unit price per linear foot of silt fence as measured jointly by the contractor and Engineer. The unit cost shall include all labor, equipment, and materials for proper installation. Payment will be made for removal of silt fence, either at the end of the project after seeding is established or if replacement silt fence is required during construction. Payment will be made based on the contractor's unit price and will match the linear feet of silt fence installed. The removal price for silt fence shall include removal and disposal of stakes, fabric, and ties. The removal price shall also include restoring the disturbed area to finished grade and removal or distribution of the accumulated sediment.

G. *Check Dams:* Payment for temporary check dams not constructed with erosion stone or riprap will be measured and paid for at the contract unit price per linear foot of each size and check dam specified. The length of the check dams will be measured jointly by Engineer and Contractor. A separate unit price shall be provided for removal when required.

Check dams made from erosion stone or riprap will be paid for to the nearest one-hundredth (0.01) of ton of material placed provided the dimensions of the check dam are similar to that shown on

the plans or as otherwise approved. Filter fabric used beneath the erosion stone or riprap will not be measured for payment and shall be considered incidental. The unit cost shall include all labor, equipment, and material costs that are necessary. Excavation costs and distribution of the soil materials are considered incidental and shall not be measured separately for payment.

H. *Filter Berms:* Payment for filter berms will be measured and paid for at the contract unit price by the linear foot of each size specified. Measurements will be taken longitudinally along the top of the berm and will be measured jointly by Contractor and Engineer. Filter berms that are needed to replace existing filter berms because of sediment accumulation will also be measured for payment.

I. *Filter Socks:* Payment for filter socks will be measured and paid for at the contract unit price by the linear foot of each diameter specified. Measurements will be taken jointly by Contractor and Engineer. Filter socks that are needed to replace existing filter socks because of sediment accumulation will also be measured for payment. Removal of filter sock will also be paid for at contractor's unit price and shall include removal and disposal of sock and stakes. The removal cost shall also include distribution of the accumulated sediment and filter material.

J. *Wattles:* Payment for wattles will be measured and paid for at the contract unit price per linear foot. Any excavation required for placement and the staking of the wattle shall be considered incidental to the installation costs. A separate contract unit price shall be provided for removal. The length of wattle for payment of installation and removal shall be the same and measured jointly by Engineer and Contractor.

K. *Temporary Rolled Erosion Control Products (RECPs):* Payment for temporary RECPs will be measure and paid for at the contract unit price per square yard of area covered for each type used. Overlaps will not be measured for payment. Staples, anchors, or other products needed for proper installation are considered incidental. Areas shall be jointly measured by Contractor and Engineer.

L. *Turf Reinforcing Mats (TRMs):* Payment for TRMs will be measure and paid for at the contract unit price per square yard of area covered for each type used. Overlaps will not be measured for payment. Staples, anchors, or other products needed for proper installation are considered incidental. Areas shall be jointly measured by Contractor and Engineer.

M. *Sediment Basin Outlet Structures:* Measurement and payment will be made for each sediment basin outlet structure installed by size. The contract unit price shall include all materials, labor, and equipment required to construct the outlet structure as specified and shown on the plans. The unit price for installation shall include the concrete base, anti-vortex device, outlet pipe, and any anti-seep collars required. Earthwork required for construction of the sediment basin will be measured and paid as part of the general excavation quantities.

Measurement and payment will also be made for each sediment basin cleanout required during construction. Contract unit price includes dewatering, and removal and disposal of accumulated sediment. The measurement and payment will also be made for each sediment basin outlet structure properly removed. Contract unit price includes dewatering and removal of sediment accumulated at the end of the project, disposal of the outlet structure, concrete base, and emergency spillway. Earthwork required to restore the sediment basin and restoration of the area to finished grade will be measured and paid for separately.

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

After project is complete and if so directed by Engineer and Division, the granular material placed for the stabilized entrance shall be removed and disposed of by burying on site. Any minor grading needed to maintain drainage shall also be included with removal.

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

Description	Unit
Surface Roughening	Acre
Erosion Control Mulching	Acre
Compost Blankets	Square Foot
Temporary Erosion Control Seeding	Acre
Temporary Earth Diversion Structures	Linear Foot
Silt Fences – Installation	Linear Foot
Silt Fences – Removal	Linear Foot
Check Dams – Temporary	Linear Foot
Check Dams – Permanent	Ton
Filter Berms	Linear Foot
Filter Socks – Installation	Linear Foot
Filter Socks – Removal	Linear Foot
Wattles – Installation	Linear Foot
Wattles – Removal	Linear Foot
Temporary Rolled Erosion Control Products	Square Yard
Turf Reinforcing Mats	Square Yard
Sediment Basin Outlet Structures – Installation	Lump Sum
Sediment Basin Outlet Structures – Cleanout	Lump Sum
Sediment Basin Outlet Structures – Removal	Lump Sum
Stabilized Construction Entrance	Ton
Stabilized Construction Entrance – Removal	Lump Sum

END OF SECTION 02120

INDEX

SECTION 02200 - EARTHWORK, ROUGH GRADING

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PART 1 - GENERAL

1.1 DESCRIPTION

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

1. Acceptance of original ground lines or submittal of new survey data.
2. Excavation.
3. Implementation of Storm Water Pollution Prevention Plan (SWPPP).
4. Conveyances, placement, and compaction of excavated materials.
5. Site grading to elevations shown on the Plans.
6. Construction of drainage ways and any necessary rechannelization of existing creeks.
7. Field engineering.

1.2 QUALITY ASSURANCE

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

B. Contractor shall use equipment adequate in size, capacity, and numbers to accomplish work in a timely manner.

C. Contractor shall comply with requirements of governmental agencies having jurisdiction and with directives of Engineer and Division.

D. Applicable Standards:
Iowa Department of Natural Resources
Iowa Department of Transportation Standard Specifications
National Pollutant Discharge Elimination System (NPDES)

1.3 JOB CONDITIONS

A. Nature of Work Site

1. Materials to be handled under this Contract include quantities of spoil, gob, and coal refuse which may be toxic and/or acidic in nature.

2. The Project site is situated in an area where underground coal mining may have been conducted. There is a possibility that mine drifts or shaft openings are present on site. Contractor shall exercise reasonable caution in recognition of this potential hazard, and shall notify Engineer and Division immediately upon discovery of any openings or any signs of instability. Sealing of openings may be incorporated into this Contract through issuance of change orders, at the discretion of Division.

3. During excavation in existing spoil piles, Contractor shall recognize the possible existence of cavities or smoldering fires and, if encountered, shall notify Engineer and Division promptly. Contractor shall exercise caution and be prepared to take appropriate actions since accelerated combustion may occur. Burning materials shall be extinguished before being covered or incorporated as fill.

4. During excavation in existing spoil piles, Contractor shall recognize the possible existence of buried waste materials which may include demolition, household, municipal,

or other deleterious materials. Contractor shall immediately secure the waste area and notify Engineer and Division who will make determinations of final waste disposals.

5. Spoil material used to construct fills is subject to significant increase in pore water pressure, particularly during rapid construction, with corresponding decrease in shear strength that reduces the stability of slopes. Contractor shall exercise caution and notify Engineer promptly should signs of slope instability appear.

B. Earthwork Balance

1. The grades shown on Plans indicate a balance of earthwork materials when a shrinkage factor as indicated on the Plans or in the Supplemental Specifications is applied. Should a shortage or excess of material exist, final grades will be adjusted in areas as shown on the plans or as directed by Engineer.

2. Changes in placement of fill material within the project limits that impact the site drainage conditions or are in non-designated adjustment areas, can only be made with specific instructions by Engineer and Division.

C. Original Ground Lines

1. Engineer has determined the excavation quantities based on original ground lines developed from aerial photography or LIght Detection And Ranging (LIDAR) and the proposed final grade lines using a computer program. The cross sections included with the plans are developed from this information and provided for the benefit of Contractor. ***Before*** commencing ***any*** work, Contractor shall accept in writing the original ground lines provided on the Plans or may obtain revisions as follows:

a. Contractor may conduct field surveys at his own expense to verify accuracy of original ground data at an interval appropriate to depict actual site conditions. If Contractor's survey information indicates that the actual ground elevations differ from the original ground elevations included in the Plans, this information shall be forwarded to Engineer and Division immediately.

b. If Division and Engineer agree that there is a substantial difference between the original ground contours shown on the plans and the more recent survey data, then Division will acquire additional survey information at its expense upon completion of clearing and grubbing operations. This additional information will be used to establish revised grading quantities for the contract. Contractor will be provided with the new information and a change order will be developed.

2. Acceptance of the original ground lines, and any revisions as discussed above, shall be mutually agreed to between Contractor and Division, in writing ***prior*** to the commencement of ***any*** earthwork. Revisions to the existing ground lines will ***not*** be considered or allowed after earthwork has commenced. Engineer shall prepare a form to be signed by Contractor indicating Contractor's acceptance of original or revised ground lines, as applicable. Commencement of earthwork activities shall be considered presumptive evidence of Contractor's acceptance, whether or not Contractor signs the form.

1.4 PERMITS AND FEES

A. Contractor shall obtain any permits required and pay any associated fees.

B. Division has obtained any necessary permits from the U.S. Army Corps of Engineers for disturbance and mitigation of wetlands as shown on the plans for this project. The requirements of

this permit have been incorporated into the Contract Documents. A copy of this permit can be made available upon request to the Division.

C. Division will obtain a Storm Water Discharge Permit for this project. Contractor will become a co-permittee with Division on this Storm Water Discharge Permit. A Storm Water Pollution Prevention Plan has been developed by the Engineer for this project and is part of the permit. Contractor is also responsible for the inspections and keeping the SWPPP documentation current.

D. If the project includes modifications to structures and/or roads, including providing access, that are under the jurisdiction of the local county, the appropriate permit shall be obtained by Contractor from the County Engineer prior to initiating any work in these areas.

1.5 SUBMITTALS

A. Contractor shall submit the following information to Engineer:

1. SWPPP completed by Engineer and signed by Contractor and Subcontractors.

2. Original Ground Line acceptance or submittal of new topographic information.

3. All Record Survey Notes.

1.6 SITE DISTURBANCES

A. Contractor shall take precautions to ensure that equipment and vehicles do not unnecessarily disturb or damage existing grading or other site improvements. Contractor shall repair any damage and return site to original condition at no cost to Division.

B. No work in or damage to any Conservation Reserve Program (CRP) land, existing wetland, or other jurisdictional areas to remain undisturbed as shown on the Plans will be permitted. Division has no permit to disturb these areas. These areas are under the jurisdiction of other authorities and there could be fines levied against Contractor for disturbances in these areas.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

A. General Fill Material consists of spoil piles, coal refuse materials, gob and all other soil material from required cut operations.

B. Materials designated on the plans as select borrow, cover materials, or impervious fill shall not be used as general fill.

C. If apparent good material suitable for use as select borrow, cover material, or impervious fill is encountered during excavation of general fill materials, Contractor shall notify Engineer immediately to evaluate these materials. Contractor shall segregate this good material from general fill as directed by Engineer. Depending upon the location, quantity, and quality of this material, a Change Order may be developed to address this good material located with excavation for general fill as agreed upon between Contractor and Division.

2.2 OTHER MATERIALS

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

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

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

3.2 ELEVATIONS AND LINES

A. Limits of grading shall be as shown on Plans, or as approved by Division and Engineer. Contractor, accompanied by Engineer, shall jointly review the limits of work prior to clearing operations. Minor refinements to grading limits, within the existing Project Limits, as shown on Plans will be implemented by mutual agreement, in interest of project and based on field conditions, at no additional cost to Division. It is the intent that the areal extent of these refinements, if any, be offsetting so that there is no significant increase or decrease in Project work.

B. The grades shall be established to be within three-tenths (0.3) feet of grades as shown on Plans, except that this tolerance shall be adjusted as necessary to ensure positive drainage in all areas.

3.3 UTILITIES

A. Contractor shall take all precautions needed to insure that existing utilities to remain, including septic systems and field tile, are adequately protected. If existing utilities become damaged, the service shall be restored as soon as possible and repairs completed at no cost to the Division.

B. If active utility lines are encountered that were not made known to Contractor, Contractor shall take the necessary steps to protect the utility and maintain service at no additional cost to Division.

C. If utility lines are found that interfere with the planned grading, Contractor shall immediately notify Engineer and Division.

3.4 PROTECTION OF PERSONS AND PROPERTY

A. Contractor shall barricade all open holes and depressions that present a safety hazard during the course of his work.

B. Contractor shall protect structures, utilities, and other facilities from damage caused by settlement, lateral movements, washouts, sedimentation, vibrations, and other hazards created by operations under this SECTION.

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

D. Contractor shall maintain access to adjacent areas at all times.

3.5 SEDIMENT AND EROSION CONTROL

A. Contractor shall implement the SWPPP for this project and conduct all earthwork activities to minimize losses due to erosion and sedimentation.

B. Effective measures shall be initiated where needed to protect areas adjacent to the site prior to the commencement of clearing, grubbing, excavation, or other operations that will disturb the natural protection. Natural vegetation shall be preserved to the greatest extent possible. Contractor shall prevent siltation of existing and newly constructed drainage ways or repair them as necessary at his own expense.

C. Work shall be scheduled to expose, for the shortest possible time, areas subject to erosion. Adequate maintenance of such other methods shall be Contractor's responsibility, as well as the subsequent removal of the temporary measures.

D. Modifications to the SWPPP and repairs will likely be required during the course of the project. The Contractor will work in conjunction with the Engineer to minimize offsite erosion and sediment. Modifications shall be documented and kept with the SWPPP file maintained by the Contractor.

3.6 CARE OF WATER

A. Contractor shall be responsible for the care and control of all water that enters the site, either through precipitation, seepage, underground utilities, etc. Contractor shall furnish, install, operate, and maintain means and devices with which to properly remove and dispose of water that interferes with completion of the work. Any discharge shall be to approved drains or channels in accordance with NPDES requirements specified in SECTION – 02110 Impoundments.

B. Contractor shall provide berms, channels, or basins as needed to protect adjacent areas from flooding caused by run off from the site. Contractor shall promptly remove all water collecting in depressions. Water that collects in depressions that cannot be removed by standard drying methods shall be tested, treated as necessary, and discharged in accordance with SECTION – 02110 Impoundments at no cost to Division.

C. Any drainage facility used by Contractor shall be adequate to prevent damage to completed work at the site, and adjacent properties. Existing drainage channels and conduits shall be cleaned, enlarged, or supplemented as necessary to carry all increased runoff attributable to Contractor's operations.

3.7 GROUND SURFACE PREPARATION PRIOR TO FILL PLACEMENT

A. Contractor shall remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills.

B. Contractor shall plow, strip, or break up surfaces steeper than one (1) vertical to four (4) horizontal so that fill material will bond with existing surface.

3.8 EXCAVATION

A. Contractor shall excavate material encountered within the Project Limits to lines, grades, and elevations indicated on Plans and/or as specified herein. All material excavated shall be considered unclassified excavation (Class 13 Excavation, IDOT Item 2102.02).

B. Contractor shall make every reasonable attempt to salvage the best soil encountered so that it can be placed within the upper twelve (12) inches of final grade since one of the primary goals of the project is to revegetate the site.

C. Contractor shall inspect the site and form own opinion on the presence and extent of boulder and rock excavation anticipated.

1. Rock and boulder excavation is not a unit price item and shall be considered as incidental in the unit price for excavation.

2. Any large rocks and boulders encountered during grading shall be relocated as necessary to provide a minimum of three (3) feet of fill over the object.

3. Contractor shall promptly notify Engineer if excessively large boulders are encountered which cannot be removed or excavated by conventional earth moving or ripping equipment and will not have at least three (3) feet of cover.

4. Contractor shall not use explosives.

D. Contractor shall excavate and fill in a manner and sequence that will provide proper drainage at all times and minimizes off site sedimentation.

E. Contractor shall properly backfill any unauthorized excavation, unless permission is received by Engineer and Division. Unauthorized excavation includes removal of materials beyond indicated elevations or dimensions, or Project Limits without a properly executed Change Order or Contract Amendment authorizing such additional excavation.

F. Contractor shall be responsible for the safety and maintenance of all excavation sides and slopes until completion of backfilling and shall comply with all OSHA requirements.

3.9 FILL PLACEMENT AND COMPACTION

A. Contractor shall place general fill materials in lifts not more than twenty- four (24) inches in loose thickness and run all rubber-tired equipment (i.e. scrapers, dump trucks) over the entire lift. If only track equipment is being used, the maximum loose lift thickness shall be limited to twelve (12) inches.

B. General fill shall not be placed directly on slopes exceeding four horizontal to one vertical (4:1). Contractor shall cut benches that are a minimum of two (2) feet in height into these steeper slopes to allow for horizontal placement of fill. Fill placed on steeper slopes shall proceed from the base upward.

C. In areas of existing water impoundments as shown on Plans, and upon completion of dewatering, fill initiation shall be performed in accordance with Item 3.10 "Fill Initiation in Ponds and Wet Areas" below.

D. Fill placed in structural areas, such as embankments, shall be placed and compacted as discussed in SECTION 02220 – EARTHWORK, DAMS.

E. Fill placed to construct terraces or roadways, shall be placed in lifts not to exceed twelve (12) inches in thickness and compacted in place with the wheels of rubber-tired equipment. If tracked equipment is used, the lift thickness shall not exceed six (6) inches. Fill material shall consist of cohesive material with a suitable moisture content to achieve compaction.

F. Contractor shall not place frozen materials within any structural area and can only use frozen material as fill if all of the following conditions are met:

1. Fill shall not be placed on any areas where the frost depth exceeds one (1) inch. Removal of frost materials shall be made at no additional expense to Division.

2. Frozen materials shall be broken up so that no dimension of an individual piece exceeds about six (6) inches. Frozen material shall be well mixed with unfrozen material throughout lift to be compacted.

3. Each lift containing frozen materials shall be covered with at least twenty-four (24) inches of frost-free materials.

G. Contractor shall not compact the top twelve (12) inches of fill that does not receive cover material and shall take care to minimize compaction of the final surfaces to improve revegetation success.

3.10 FILL INITIATION IN PONDS AND WET AREAS

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

B. Prior to placing fill in these areas, Contractor shall dewater areas with standing or impounded water in accordance with the neutralization and dewatering plan as developed in accordance with SECTION 02110 – Impoundments.

C. In shallow swampy areas, Contractor may work these areas by pushing out the bottom muck with dry material from one end to the other. Contractor may have to periodically allow the muck time to drain, perhaps as much as several days, during filling operations in these areas. Work can be completed in other areas of the site during this drying time.

D. In areas where deeper muck is present, Contractor shall initiate filling operations using one or more of following approved methods, or another method selected by Contractor subject to review and approval by Engineer. Individual methods may not be suitable for all applications.

1. Squeeze out muck in bottom by dozing in dry material from one end of pond towards other. Contractor may have to periodically allow muck time to drain, perhaps several days, during which time Contractor may continue work elsewhere prior to resuming mucking operations.

2. Push in dry material and intermix with muck until stable.

3. Use cell method to isolate smaller zones within the area to be filled. The cell method consists of constructing cofferdams of widths no more than required for a dozer to properly construct them. These cofferdams shall be spaced as necessary to complete filling over the muck. The zones created by the cofferdams shall then be worked in accordance with items 1 and/ or 2 above.

4. In areas receiving relatively deep fills (over ten feet), Contractor may place an initial lift of no more than four (4) feet in height to bridge over the muck. Subsequent lifts shall be placed and compacted as outlined in Section 3.9 above. Any of these areas that result in slope instability or excessive settlement in the future shall be corrected as necessary by Contractor at no additional cost to Division.

5. Any other method selected by Contractor and reviewed by Engineer which achieves desired objective, which is to permit stable filling operations to continue.

E. Contractor shall prevent siltation of existing drainage ways and ponds during mucking operations and placement of fill over muck. Failure of Contractor to protect silt from leaving Project Limits shall be corrected at no cost to Division. Any vegetation disturbed as a result of failure shall be replaced in kind at no cost to Division.

3.11 GRADING

A. The Contactor shall uniformly grade areas within the Project Limits as shown on the plans and as specified in this SECTION. Contractor shall also grade the transition areas adjacent to the site as needed to complete work and provide a smooth transition. The finished grade shall be that which is ordinarily obtained by a blade grader.

B. In areas where a change of slope is required, Contractor shall construct a rolled transition section having a minimum radius of approximately eight (8) feet, unless adjacent construction will not permit such a transition, or if such a transition defeats positive control of drainage.

C. Contractor shall finish grade all areas to drain readily.

3.12 FIELD QUALITY CONTROL

A. Contractor shall obtain Engineer's inspection and approval of subgrades in fill areas prior to placement of fill.

B. Contractor shall make changes in placement of fill material within the Project Limits as needed to adjust for inaccuracies inherent with estimating the shrinkage factor. These changes shall be made only after consultation with and direction from Engineer and/or Division.

C. Contractor shall provide additional compaction of fill as directed by Engineer if Engineer determines that fills have been placed that were not properly compacted.

D. Contractor shall notify Engineer upon completion of stages of construction and obtain Engineer's approval before commencing with subsequent stages of construction.

3.13 MAINTENANCE

A. Contractor shall protect all areas of newly graded fill as follows:

1. Protect newly graded areas from traffic and erosion, and keep free from trash and weeds.

2. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.

B. Contractor shall scarify the surface, reshape, and compact (if necessary) any completed areas that are disturbed by subsequent construction operations or adverse weather, prior to further construction, such as riprap placement or seeding.

C. Contractor shall maintain new and existing drainage ways free from detrimental quantities of sediment, leaves, sticks, trash, and other debris during execution of the work.

D. Contractor shall maintain access to adjacent areas at all times.

E. Contractor shall dredge or re-excavate drainage channels if these become silt-filled prior to establishment of vegetation. If the site has not yet been seeded, dredged material may be spread within the Project Limits. If the site has been seeded, Contractor shall dispose of the dredged material in a manner and location approved by Engineer or Division.

3.14 MEASUREMENT AND PAYMENT

Construction cost of work included in this SECTION of the Construction Specifications shall be included in Contractor's unit prices set forth in the Proposal and Schedule of Prices (*Document C*) for work items described below. The unit price for each of these items shall include its pro rata share of overhead so that sum of products obtained by multiplying unit prices so set forth by amount of work 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. *Excavation*: Payment for the cost of excavation shall include all of the work necessary to complete grading the site to final grade as shown on the plans. The preparation and implementation of Erosion Control Plan shall be paid under separate bid items.

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

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

1. Contractor shall provide survey information to Engineer regarding the disputed existing topographic information as stated in Paragraph 1.3.C of this Section.

2. If Engineer and Division agree that a discrepancy exists, Division will acquire additional survey information as needed. Engineer will compute a revised quantity based on the new information that will be used for the Excavation quantity in the contract and issue a change order.

3. As an alternative, Contractor can determine the amount of material excavated by completing a full survey of the site after clearing is completed and before grading begins and then after grading is completed. Contractor shall submit all survey notes and data to Engineer who will determine the amount of excavation based on this information.

4. The grade tolerance established in Paragraph 3.2 above is to permit latitude in achieving final grades. Widespread overexcavation of up to three-tenths (0.3) feet in cut areas, either accidentally or for the sole purpose of increasing pay quantities, shall not be recognized for measurement and payment. In these instances, Division reserves the right to base the paid quantity of cubic yards of excavation upon the final grade contours shown on the plans.

5. If the final grades do not appear to be in compliance with the plans, Division reserves the right to require a full topographic survey. Contractor shall provide to Engineer at no cost to Division, electronic survey data for determining the final earthwork quantities using the original ground lines as stated in Paragraph 1.3C of this Section.

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

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

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

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

Description	Unit
Excavation	Cu. Yd.

END OF SECTION 02200

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PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included

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

1. Field engineering.
2. Complete installation of all waterways.
3. Terraces construction.
4. Riprap ditches, ditch construction and riprap placement.
5. Pipe outlets.
6. Terrace intakes.
7. Underground outlets.
8. All excavation, backfill, and compaction necessary to complete these drainage systems.

1.2 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 lop 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:

Description	Unit
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

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SECTION 02400 - SUBGRADE PREPARATION, WITHOUT COVER MATERIAL

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PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included

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

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

1.2 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.

2. Contractor shall submit results of recent moisture tests for the agriculture lime.

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 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.

2.3 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 for the lower portion of the subgrade treated in wetland areas.

B. Fertilizer shall be uniform in composition, liquid or dry, and shall be free flowing. Fertilizer may be delivered in bulk from the supplier or in its original unopened containers. Any fertilizer which becomes caked or otherwise damaged, making it unsuitable for use, will not be accepted.

PART 3 - EXECUTION

3.1 REACTION PERIOD

A. Both time and moisture are required for lime to neutralize acidic spoil material and for mulch to decompose. A delay period is required to enhance the benefit between the lime/mulch treatment and seeding operations. The length of the delay is dependent on many factors including lime and mulch properties, soil properties, and weather conditions. Contractor shall coordinate his work to achieve maximum delay time, perhaps as much as several months or over-winter, at no additional expense to Division. Contractor shall request approval of Division for when the seeding operations can begin.

3.2 TESTING

A. As the Contractor is nearing final grade in portions of the site to prepare for seeding, the Contractor shall contact and schedule soil sampling with the Engineer. 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 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 WETLAND AREAS

A. Subgrade Preparation

1. Engineer and Division shall approve the final grades in the wetland areas prior to incorporation of mulch and fertilizer materials by Contractor.

2. After final grade acceptance, Contractor shall excavate at least nine (9) inches of material below final grade in the constructed wetland areas as shown on the plans. This material shall be set aside to be replaced after this exposed layer has been treated.

B. Application for Undercut Area

1. Agricultural Lime –Agricultural lime (tons ECCE per acre) shall be applied at the same rate as that determined from the soil tests taken for the rest of the site.

2. Fertilizer – Nitrogen (N) shall be applied at a rate of thirty (30) pounds per acre.

3. Mulch – Mulch shall be applied at a rate of five (5) tons per acre.

C. Incorporation for Undercut Area

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

2. Application will not be permitted during adverse conditions, such as high winds, surface frost to a depth of greater than one (1) inch, excessive moisture in the surface to be treated, or if rain is predicted within the time Contractor estimates will be required for application and incorporation of the mulch and fertilizer within the approved wetland area(s).

D. Replacement of Undercut Material

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

E. Application for Replaced Undercut Material

1. Agricultural Lime –Agricultural lime (tons ECCE per acre) shall be applied at the same rate as that determined from the soil tests taken for the rest of the site.

2. Fertilizer – Nitrogen (N) shall be applied at a rate of thirty (30) pounds per acre.

3. Mulch – Mulch shall be applied at a rate of five (5) tons per acre.

F. Incorporation for Replaced Undercut Material

1. Contractor shall apply and incorporate the lime, fertilizer, and mulch into the replaced material from undercut area over the entire wetland areas as designated on the plans. The depth of incorporation shall extend at least nine (9) inches into the spoil material beneath

the undercut level and shall be completed with an acceptable method as approved by the Engineer.

3.4 LIME-MULCH APPLICATION

A. Application Rates

1. Agricultural Lime, Subgrade - Contractor shall plan to apply lime (tons ECCE per acre) at the rate as shown on the plans or listed in the Supplemental Specifications unless a different rate is specified based on the results of soil tests 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.

2. Mulch, Subgrade - Contractor shall apply mulch at a rate of five (5) tons per acre or as otherwise indicated in the Supplemental Specifications.

3. Weight Tickets - Weight tickets shall be provided to the Engineer to determine that the appropriate amount of lime and mulch has been applied prior to incorporation.

B. Incorporation

1. Contractor shall demonstrate to Engineer and Division on a small plot of one tenth (1/10) acre or more in size, the method and equipment which will be used to thoroughly mix the lime-mulch materials into the upper twelve (12) inches of spoil. When an acceptable method is agreed to by Engineer and Division, that method shall be used throughout the Project. Engineer and Division reserve the right to reject the method of incorporation as it progresses if the previously approved procedure stops obtaining the desired results.

2. 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 and mulch materials by Contractor. Contractor shall request approval to initiate the lime-mulch application on areas of at least five (5) acres in size.

3. Contractor will obtain Engineer and Division's approval of site conditions prior to application of lime or mulch. Application will not be permitted during adverse conditions such as high winds, surface frost to a depth greater than one (1) inch, excessive moisture in the surface to be treated, or if rain is predicted within the time Contractor estimates will be required for application and incorporation of the lime-mulch within the area approved.

4. After receiving approval from Engineer and/or Division, Contractor shall evenly apply agricultural lime and mulch directly on the surface to be treated. Contractor shall incorporate the lime/mulch into the upper twelve (12) inches of material the same day the lime and mulch are applied, using the agreed upon method per 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 both the lime and mulch through the upper twelve (12) inches.

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

D. No lime or mulch shall be applied on site if that load of lime or mulch is not accompanied by an appropriate weight ticket. All lime and mulch weight tickets for material applied on site shall be submitted to the Resident upon arrival of the material on site. If Contractor applies lime or mulch prior to Resident receiving appropriate weight ticket for that material, or in the absence of the

Resident, Division can require additional lime and/or mulch be applied to the site at Contractor's expense to assure that Contract specified amounts are met.

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 shall represent full payment for 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, pending recommendations of spoil tests conducted in accordance with Item *3.2 Testing*, of this SECTION. This pay item will also include lime placed on both the undercut and replaced material within the wetland areas.

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

B. *Mulch, Subgrade*: Contractor's unit price for Mulch, Subgrade shall represent full payment for all materials, application, mixing, plowing, disking, and all incidental work pertaining to incorporating the mulch with agricultural limestone as a part of the lime-mulch application. This pay item will also include mulch placed and incorporated into both the undercut and the replaced material within the wetland.

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

C. *Wetland Fertilizer:* Payment for 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.

D. *Wetland Undercut and Replacement:* Contractor's unit price for wetland undercut and replacement shall constitute full payment for excavation of undercut material, stockpiling the material nearby, and replacement of the undercut material after the initial incorporation is complete and all other incidental work. Incorporation of the fertilizer, mulch, and lime shall be included in the cost of each of these items delivered to the site.

   The wetland undercut and replacement 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.

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

Description	Unit
Agricultural Lime, Subgrade	Ton (ECCE)
Mulch, Subgrade	Acre
Wetland Fertilizer	Pound
Wetland Undercut and Replacement	Acre

END OF SECTION 02400

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SECTION 02500 - FENCING

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PART 1- GENERAL

1.1 DESCRIPTION

A. Work Included

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

1. Field engineering.
2. Removal and salvage to landowners of existing fence.
3. Installation of field fence.
4 Installation of field gates.

1.2 QUALITY ASSURANCE

A. Contractor shall use adequate number 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 in 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. Applicable Standards

1. American Society for Testing and Materials (ASTM)
   A 116: Zinc-Coated (Galvanized) Steel Woven Wire Fence and Brace Wire
   A 121: Zinc-Coated (Galvanized) Steel Barbed Wire

2. Iowa Department of Transportation (IDOT)

1.3 JOB CONDITIONS

A. Where existing fences are to be removed and subsequently replaced as a part of the work, Contractor shall field establish such reference points and ties as are necessary to ensure replacement fencing will follow the same alignment as existing fencing. If it is noted to salvage the fence to the landowner, then the existing fencing shall be carefully removed where noted on the Plans and salvaged as described in SECTION 02100 MOBILIZATION, SITE CLEARING, AND PREPARATION, Part 3.4. Also refer to paragraph 4-05 in the General Conditions (*Document N*) for other requirements regarding existing and new fencing.

B. Where new fencing is located along property lines, all affected landowners and/or public agencies shall mutually agree on location of the new fencing. In the event the location of the new fencing cannot be agreed upon by all, the affected portion in contention shall not be installed.

C. In the event fencing is installed during or after seeding work in SECTION 02700 – INTERIM SEEDING, Contractor shall exercise care not to damage the seedbed or seeded area. In the event of damage, redress, reseed, replant, and remulch as applicable.

D. Installation of some fencing may be impacted by the location of existing buried utilities. Contractor shall have all the utilities properly marked prior to installation of the fence and is responsible for any damage that may occur as a result of this work.

1.4 SUBMITTALS

A. Contractor shall submit the suppliers' certifications to Engineer that fencing, posts, gates and hardware meet the indicated specifications.

1.5 DELIVERY, STORAGE AND HANDLING

A. Contractor shall store and handle materials in accordance with applicable requirements of the General and Special Conditions and in accordance with the supplier's requirements.

PART 2 - PRODUCTS

2.1 GENERAL

A, Materials that are considered to be "standard products" of a manufacturer may be used when such products conform to the Specifications.

2.2 POSTS AND BRACING

A. Posts

1. Wood posts shall meet the requirements of IDOT Section 4154.07. Metal posts as shown on IDOT Standard Road Plan, MI-103, Sheet 2 are not allowed, except at water crossings.

B. Steel Braces

1. Steel braces shall meet the requirements of IDOT Section 4154.08.

C. Brace Wires

1. Brace wires shall be two double strands of No. 9 wire twisted tight with a short stick or board which shall be left in place for future tightening. Bracing wire shall meet the requirements of IDOT Section 4154.05.

2.3 FENCING

A. Woven Wire

1. Woven wire fencing shall meet the requirements of IDOT Section 4154.02, and shall conform to ASTM A-116, Class 3 zinc coating. It shall be forty-seven (47) inches high with a fabric design meeting ASTM Design Number 1047-6-11.

B. Barbed Wire

1. Barbed wire shall be galvanized steel with a four (4) point pattern of round barbs spaced five (5) inches on center that meets the requirements of IDOT Section 4154.04. Note that only a single top strand of barb wire is required. The bottom strand as shown on IDOT Standard Road Plan, MI-103, Sheet 2, is not to be installed.

C. Staples

1. Staples shall be hot-dipped galvanized and shall consist of either screw shank type (or equivalent) with a minimum length of one and one-quarter inches (1-1/4") or No. 9 plain wire with a minimum length of one and three-quarter inches (1-3/4"). All staples used shall meet the requirements of IDOT Section 4154.06.

2.4 GATES AND HARDWARE

A. All gates shall be comprised of twelve (12) foot panels. The panels shall be fabricated from rolled steel tubing with a diameter of two (2) inches and shall be shop painted. Single gates will have one (1) panel and double gates shall have two (2) panels. Gates shall be installed as indicated on the Plans or in the Supplemental Specifications.

B. Mounting hardware, including hinges and latches, shall be as recommended by the gate manufacturer for the particular site installation. Provide case hardened chain of suitable length to secure gate if not provided by manufacturer.

PART 3 - EXECUTION

3.1 PERFORMANCE

A. Contractor shall install fencing in accordance with these Construction Specifications and Plans.

B. All six (6) inch wood posts shall be set a minimum of forty-two (42) inches below grade. All four (4) inch posts shall be set a minimum of thirty (30) inches below grade. If post holes are bored, backfill around wood posts with tamped material from excavation or with concrete. Posts may be driven into the ground in lieu of boring post holes.

C. Contractor shall provide brace assemblies consisting of with steel braces and diagonal bracing wires to brace the wood posts at the following locations:

1. Points of connection to existing fence.
2. End posts.
3. Points of deflection in horizontal alignment exceeding ten (10) degrees.
4. Points of deflection in vertical alignment exceeding thirty (30) degrees.
5. On in-line sections exceeding five-hundred (500) feet, evenly spaced so as not to exceed five-hundred (500) feet.

D. Contractor shall stretch the woven wire fabric and barbed-wire on outside of posts on corners and curves.

E. Contractor shall attach woven wire fabric and barbed wire to each wood post with at least four (4) staples.

F. Contractor shall cut and tie off the woven wire fabric and barbed wire at all end posts and brace posts adjacent to corner and angle posts.

G. Contractor shall hand tension the woven wire fabric and barbed wire at all corner post assemblies from the brace post around the corner post to the other brace post.

H. All materials and installation procedures shall be similar to IDOT Standard Road Plan MI-103 which is included in the Appendix for reference. Differences are noted in Items 2.2A and 2.3B of this SECTION.

I. Contractor shall install the gates and hardware in accordance with manufacturer's recommendations and secure with a chain unless another device is provided by manufacturer.

3.2 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 of the Constructions Specifications or on the Plans, including field engineering.

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

A. *Field Fence:* New fencing shall be paid for at the unit price per linear foot, rounded to the nearest foot, for fencing furnished and installed according to the Plans and as specified herein. Only new fencing as shown on the Plans shall be measured for payment. Any existing fencing otherwise removed and replaced by Contractor, whether replaced with salvaged fencing or with new fencing, shall not be measured for payment. The length of fence approved for payment will be jointly measured in the field by Contractor and Engineer.

B. *Single Gate:* Single gate and all gate hardware shall be paid for at the unit price for each single gate furnished and installed in accordance with this SECTION.

C. *Double Gate:* Double gate and all gate hardware shall be paid for at the unit price for each double gate furnished and installed in accordance with this SECTION

D. *Summary:* Proposal Bid Items applicable to work covered by this Section are as follows:

Description	Unit
Field Fence	Lineal Foot
Single Gate (1 – 12 foot panel)	Each
Double Gate (2 – 12 foot panels)	Each

END OF SECTION 02500

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SECTION 02700 – INTERIM SEEDING

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PART 1 - GENERAL

1.1 DESCRIPTION

A. Work under this SECTION covers requirements for materials, tools, equipment and services necessary to complete the herbaceous seeding of all areas disturbed during construction of this project. The work shall include, but is not necessarily limited to, completion of the following work:

1. Preparation of seedbed.
2. Testing surface materials for lime and fertilizer application rates.
3. Applying lime, fertilizer, and seed.
4. Applying mulch.
5. Applying erosion control mat if specified.
6. Temporary fencing if required.
7. Field engineering.

1.2 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:

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

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

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 MATIERAL 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 (P_1 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 - FERTILITLY 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 reseeding that becomes necessary as a result of work completed outside the approved dates shall be completed by Contractor at no cost to Division.

C. General Requirements:

1. As weather and site conditions permit, within the specified seeding season, seed site areas as shown on the Plans and all other disturbed areas.

2. When conditions are such that less than satisfactory results are likely to be obtained by reason of drought, excessive moisture, snow, or frozen soil, seeding work shall be halted and resumed only when conditions are favorable or when approved alternative or corrective measures and procedures have been affected.

3. Proceed with seeding work as rapidly as portions of the site become available within seasonal limitations. In any event, seeding shall be accomplished before the prepared seedbed becomes eroded, crusted over, or dried out and shall not be conducted when the ground is frozen or snow covered. Should seeding not be accomplished prior to the prepared seedbed becoming eroded, crusted over, or dried out, or the ground becomes snow covered or frozen, Engineer or Division shall require Contractor to rework the seedbed as necessary prior to seeding at no cost to Division.

4. Schedule 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 reseeding of hot spot areas, the repaired areas will again be inspected ninety (90) days after evidence of plant growth or greenup. These areas shall be evaluated using the criteria listed in this Section.

F. In the event that in either the original seeding, repair seeding, or reseeding of hot spots it is found that the work, materials, or seedbed preparation failed to meet the quality or application rates specified, additional work shall be required at no cost to Division.

3.9 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:

Description	Unit
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
LARKIN AML RECLAMATION 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 s 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 02000 - SUBSURFACE INVESTIGATION

1.1 DESCRIPTION

A. The approximate locations of borings are shown in Appendix A of the geotechnical report.

SECTION 02100 - MOBILIZATION, SITE CLEARING & PREPARATION

1.2 QUALITY ASSURANCE

D. The following address can be utilized as one reference for Indiana Bat guidelines: http://www.fws.gov/midwest/endangered/mammals/inba/index.html

SECTION 02120 – SEDIMENT AND EROSION CONTROL

2.1 MATERIALS

K. Granular Surfacing

1. Granular Surfacing material shall be crushed stone with a nominal maximum size of 3 inches in accordance with IDOT Section 4122.

3.3 INSTALLATION OF SEDIMENT AND EROSION CONTROL MEASURES

N. Granular Surfacing

1. Install granular surfacing material as shown on the plans or as directed by the Engineer.
2. Regrade or replace granular surfacing material once the voids become plugged with mud or as directed by Engineer.

3.4 MEASUREMENT AND PAYMENT

N. Granular Surfacing: The unit price shall include all materials and work required for installation of the granular surfacing material in conformance with these Construction Specifications and the Plans, including excavation, removal and disposal of excavated material, and furnishing and placing the stone.

Measurement for payment shall be based on the tonnage of granular surfacing material actually installed as determined from weight tickets, rounded to the nearest one-tenth (0.1) ton. Only material placed in accordance with the Plans and Specifications shall be measured and paid.

SECTION 02400 - SUBGRADE PREPARATION (WITHOUT COVER MATERIAL)

3.4 LIME-MULCH APPLICATION

A. Application Rates

1. Contractor shall apply lime at the rate of forty (40) tons ECCE/acre for bidding purposes. Actual application rate may vary depending on the recommendation of the soil tests.

SECTION 02700 – INTERIM SEEDING

REPLACE "INTERIM" WITH "PERMANENT" THROUGHOUT SECTION 02700.

2.4 SEED

C. Seed Mixture:

The permanent seed mixture for the reclaimed mine area, within the project limits, shall be as shown on Table 1 below. The appropriate seeding rate shall be determined by time of the year the seeding is conducted as specified in 3.5 A. of this SECTION and as shown in Table 2. The appropriate cover crop shall be chosen for the season in which seeding occurs. All Legume seeds shall be inoculated; refer to note immediately below:

Legume Seed Inoculant (All Seed Mixes except **Wetland Fringe Seed Mix**)

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.

Methods of inoculation shall conform to manufacturer's recommendations for the particular species of legume.

Use sufficient inoculant 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 twenty-four (24) hours.

Table 1. Upland Seeding Mixture for Reclaimed Mine Area

Common Name	Scientific Name	Seeding Rate Lb.(PLS/ac)
Partridge pea	*cassia fasciculate*	4.0
Alsike clover	*trifolium hybridum*	4.0
Purple prairie clover	*dalea purpurea*	0.7
Red clover	*trifolium pretense L.*	2.0
Red fescue	*festuca rubra*	8.0
Redtop	*agrostis alba*	2.7
Timothy	*phleum pretense*	6.7
Virginia wild rye	*elymus virginicus*	*6.7*
Big bluestem	*andropogon gerardii*	*5.3*
Little bluestem	*schizachyrium scoparium*	*4.0*
Indian grass	*sorgastrum nutans*	*4.0*
Total		**48.1**
Spring Cover		
Oats	*avena sativa*	32
Dormant Cover		
Winter wheat	*triticum aestivum*	45

3.4 LIMING AND FERTILIZING

C. For bidding purposes, assume the application rate of agricultural limestone is five (5) tons ECCE/acre.

D. For bidding purposes, assume the application rate of Nitrogen is one hundred (100) pounds per acre, Phosphorus is fifty (50) pounds per acre, and Potassium is eighty (80) pounds per acre.

END OF SUPPLEMENTAL
SPECIFICATIONS

APPENDIX A

Geotechnical Engineering Report

Larkin AML Reclamation Project
11516 220th Avenue
Near Ottumwa, Iowa

April 21, 2014
Terracon Project No. 08135115-01

Prepared for:
Oates Associates
Collinsville, Illinois

Prepared by:
Terracon Consultants, Inc.
Des Moines, Iowa

terracon.com

Terracon

Environmental ■ Facilities ■ Geotechnical ■ Materials

April 21, 2014

Terracon

Oates Associates
100 Lanter Court, Suite 1
Collinsville, Illinois 62234

Attn: Mr. Alan J. Goepfert, P.E., P.L.S., PTOE
P: 618.345.2200 x 117
E: al.goepfert@oatesassociates.com

Re: Geotechnical Engineering Report
Larkin AML Reclamation Project
11724 180th Avenue
Near Ottumwa, Iowa
Terracon Project No. 08135115-01

Dear Mr. Goepfert:

Terracon Consultants, Inc. (Terracon) completed subsurface and geotechnical engineering services for the Larkin Abandoned Mine Land (AML) Reclamation project near Ottumwa, Iowa. Terracon performed these services in general accordance with our proposal dated November 15, 2013 (Terracon Proposal No. P08130756 Revision 4). Terracon completed water quality and wetland delineation reports for this site (Terracon Project No. 08137095, dated January 24, and February 4, 2014, respectively) and were submitted under separate covers. This report presents the results of our subsurface exploration and provides geotechnical recommendations for earthwork.

We appreciate the opportunity to be of service to you on this project. If you have any questions regarding this report, or if we may be of further service to you, please contact us.

Sincerely,
Terracon Consultants, Inc.

Alexander J. Wolfe, E.I.
Staff Geotechnical Engineer

Jeffrey L. Magner, P.E.
Office Manager

Report Distribution: Addressee (1) + PDF

LICENSED PROFESSIONAL ENGINEER
JEFFREY L. MAGNER
14651
IOWA

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

Jeffrey L. Magner, P.E. April 21, 2014
Date

My license renewal date is December 31, 2014.

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Exhibit B-1 Laboratory Testing
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Exhibit C-1 General Notes
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GEOTECHNICAL ENGINEERING REPORT
LARKIN AML RECLAMATION PROJECT
11724 180TH AVENUE
NEAR OTTUMWA, IOWA

Terracon Project No. 08135115-01
April 21, 2014

1.0 INTRODUCTION

Terracon completed a subsurface exploration and geotechnical engineering services for the Larkin Abandoned Mine Land (AML) Reclamation project south and west of the residence at 11724 180th Avenue near Ottumwa, Iowa. The exploration consisted of four (4) soil borings performed to depths of approximately 29½ to 40½ feet below the existing ground surface (designated B-1 through B-4) in the proposed reclamation area. Terracon performed these services in general accordance with our proposal dated November 15, 2013 (Terracon Proposal No. P08130756 Revision 4).

Logs of the borings along with a Boring Location Diagram are in Appendix A of this report. This report presents the results of our subsurface exploration and provides geotechnical engineering recommendations relative to:

- subsurface soil conditions
- groundwater conditions
- earthwork

2.0 PROJECT INFORMATION

2.1 Project Description

Item	Description
Location	▪ SE ¼ of Section 7, and the NE ¼ of Section 18, Township 72 North, Range 15 West, in Wapello County, Iowa ▪ The AML is planned for the area south and west of the residence at 11724 180th Avenue, Ottumwa, Iowa. ▪ See Exhibit A-1 in Appendix A for the boring location diagram and vicinity map.
Current ground cover	▪ The 40 acre site is covered by spoil piles and sparse to dense areas of trees. ▪ Agricultural land is located adjacent to the north, west, and south sides of the AML site. A wooded area is located adjacent to the east side of the site.

Item	Description
Existing topography	■ The site has numerous mine spoil piles with relatively steep slopes. ■ The site terrain has relatively abrupt grade changes. Elevations range from about 710 feet to 770 feet. ■ Several man-made drainage channels are located between the mine spoil piles, along a former tributary corridor. The drainage ways flow primarily toward outlets around the north, west, and south sides of the site. ■ Grades of surrounding farm and wooded areas slope down to the AML site. ■ Existing ponded areas are located near the north, southwest, and southeast portions of the site.
Proposed improvements	■ Develop a wetland mitigation area near the southeastern portion of the AML site. ■ Create geomorphically compatible drainage channels. ■ Re-shape spoil piles, former strip-mined slopes, and terraces. Soften existing slopes. ■ Add rock check dams to existing drainage channels. ■ Fill in existing ponded areas. ■ At the time of this report, the reclaimed land is anticipated to be used for pasture and agricultural land. Structures are not anticipated within the re-graded area.
Proposed grading (from the Conceptual Grading Plan, dated September 6, 2013)	■ We anticipate that cuts and fills in the project area will be about 10 to 30 feet. ■ Additional cuts or fills may be needed in localized areas.
Cut and fill slopes	■ Slopes of about 8:1 (horizontal to vertical) to 20:1 are planned along the north, west, and southwest portions of the AML site. ■ Slopes of about 3:1 to 6:1 are planned along the south and east portions of the AML site.

3.0 SUBSURFACE CONDITIONS

3.1 Typical Profile

Based on the results of the borings, subsurface conditions at the tested locations can be generalized as follows:

Stratum	Approximate Depth to Bottom of Stratum	Material Encountered	Comments
1	Borings 1, 3, and 4 – 26 to 33 feet Boring termination at about 40½ feet in Boring 2.	Mine Overburden Fills: Fat clay and clayey shale of varying degrees of weathering	■ *Water contents:* 13 to 27% ■ *SPT N-values*: 5 to 13 bpf ○ N-values of 40 bpf in Boring 2 at a depth of about 34 feet
2	Boring termination at about 40½ feet in Boring 3.	Lean to fat clay (CL/CH)	Stiff consistency
3	Boring termination at about 29½ to 40½ feet in Borings 1 and 4	Shale bedrock	Highly weathered

Conditions encountered at each boring location are indicated on the individual boring logs. The stratification lines shown on the boring logs represent the approximate boundaries between soil and bedrock types. In-situ, transitions between materials may be gradual. Details for each of the borings can be found on the boring logs in Appendix A of this report.

3.2 Groundwater

The borings were observed during drilling and shortly after completion of drilling operations for the presence and level of groundwater. Groundwater was not encountered in the borings at these times.

Long term observations in piezometers or observation wells sealed from the influence of surface water are often required to define groundwater levels.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff, stages of the adjacent drainage ways and ponded areas, and other factors not evident at the time the borings were performed. Therefore, groundwater levels at other times during earthwork operations may be different than the levels indicated on the boring logs.

4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

4.1 Geotechnical Considerations

4.1.1 Variable Fill Materials

Relatively thick deposits of existing fill consisting of mine spoils (fat clay and shale) were encountered in all of the borings. The fill extended to about 26 to 33 feet below ground surface (bgs) in Borings 1, 3, and 4 and to termination depths at about 40½ feet in Boring 2. The

existing fill materials in the borings included primarily cohesive soils and bedrock materials of varying hardness (i.e., rock-like shale and apparent coal). The existing fill materials exhibited variable moisture contents (ranging from 13 to 27%) and variable standard penetration test "N"-values (ranging from 5 to 40 bpf). These materials do not appear to have been placed in a controlled manner. These variable materials should be anticipated to be prevalent across the site.

Although not encountered in the borings, there is a risk that unsuitable materials (e.g., larger cobble and boulder size particles with open voids between pieces, tree stumps, logs, etc.) may be buried within the fill materials. Variable existing fill materials that remain in-place could be subject to future settlement, resulting in changes in ground elevation following final grading. If unsuitable materials are encountered during grading operations, the materials should be removed from the fill. Particle sizes larger than 6 inches in any dimension should not be incorporated into new fill materials unless they are broken down to smaller fragments.

4.1.2 Deep Fills

Fills on the order of about 10 to 30 feet are anticipated across the site (particularly within existing ponded areas and drainage paths). Where the relatively thick deposits of new fill will be placed to develop design grades, the weight of the new fill will likely compress in-place existing fill materials or underlying native soils. The thick deposits of new fill will also be prone to compression under their own weight. These components of settlement will result in widespread to sporadic areas of non-uniform settlement of the completed fill surfaces. The settlement can be erratic over some distances if the new or existing fill contains unsuitable materials and zones of poorly compacted material.

Fill thicknesses should be placed to relatively uniform heights or elevations over broad areas during earthwork operations, but graded to control run-off and avoid standing water, to reduce differential settlements. Creation of slopes should be avoided so that fill materials can be placed on relatively horizontal surfaces.

The existing fill that will remain in place is apt to include unprocessed bedrock materials of varying sizes and hardness. There is a possibility of void spaces being present around these types of materials. As finer material migrates into these voids, there is a potential for ground loss or subsidence reflecting to the finished ground surface. As such, large size particles should not be used in new fill materials. Rock-like shale materials that are part of the existing fills or new fill have a tendency to soften with time and from the accumulation of water, resulting in long term compressibility. Rock-like shale materials require pulverization and moisture adjustments to utilize as new fill.

Lacustrine deposits or end-dumped materials at the bottom of ponded areas typically have relatively high moisture contents, low densities and strengths, and can be compressible. If the construction schedule allows, consideration could be given to removing the high moisture content and low strength pond sediments, moisture conditioning (i.e., drying), and recompacting the

sediments according to the recommendations in this report prior to placing new fill materials. Drying of the excavated pond materials could be performed by using chemical treatments or by air drying methods.

Potential settlements of the new fill materials could not be estimated with the available data, but additional field and laboratory studies can be performed to evaluate the settlements, if requested.

If the owner is concerned about settlements, we recommend installing monitoring devices in stages of the incremental fill placement, or at the time the new fill reaches final grade. The monuments should be surveyed on a regular basis and the data provided to Terracon for evaluation of the magnitudes and rate of settlement. Terracon can provide additional recommendations regarding settlement monitoring upon request.

4.1.3 Groundwater and Dewatering

Although groundwater was not observed during drilling operations, we anticipate that groundwater will be encountered in excavations and during mass grading (e.g., deeper cut areas). We anticipate that the groundwater levels in different portions of the site would change with amounts of precipitation and site drainage patterns. Perched water is possible in the existing fill materials, especially if sand seams are encountered.

Dewatering of the site during construction should be addressed in advance of construction. Trench drains or diversion ditches may be needed to collect and divert accumulated water away from cut areas. Standing water should be removed promptly, and the site rough grading maintained in a crowned or pitched fashion to accommodate runoff. Dewatering systems (e.g., well points) will be required were excavations encounter sand seams below groundwater levels. The contractor is responsible for employing appropriate dewatering methods to control seepage and facilitate construction.

An outflow trench should be used when draining the existing ponded areas prior to performing excavations or fill placement. The pond drainage should be diverted to a reliable discharge area. The increased water flowing over on-site materials will likely erode the exposed soils. Prior to construction, the location of the trench should be selected to reduce the potential for erosion of materials at the toes of existing slopes. Consideration should be given to lining the trench and discharge point with rip-rap materials to maintain the sides and bottom of the trench.

Seepage exiting the face of cut slopes will reduce the stability of the slope. In addition, placement of new fill over areas where seepage occurs is not recommended. Seepage should be collected (e.g., a subsurface drain tile) and removed before it exits the face of the slope, and before new fills are placed.

4.1.4 Slope Considerations

From the Conceptual Grading Plan dated September 6, 2013, we understand slopes for the proposed grading are planned to be 6:1 horizontal to vertical (H:V) or flatter. An exception to this occurs at two locations where an existing high wall is located, and proposed slopes will be graded at 3:1 (H:V). Our scope of services does not include slope stability analyses related to the new fill sections or cut slope sections.

Fill slopes on the order of 6:1 (H:V) or flatter are generally stable when properly designed and side slopes are not subject to seepage from water bearing layers and toe erosion. Slope sections approaching 3:1 (H:V) and steeper are more prone to develop stability issues, particularly when embankment heights exceed about 10 to 15 feet and would require further analysis to evaluate their potential performance.

Shallow surficial slumps/slides should be expected on the proposed cut and fill slopes approaching 3:1 (H:V). Erosion protection or permanent vegetation should be established as soon as possible after slopes are graded to reduce the potential for surficial instability. Steeper slopes will be susceptible to erosion, and may be difficult to maintain. Alternately, the proposed slopes could be flattened, and Terracon would be pleased to provide analyses for flatter slope configurations. Alterations of grading and drainage patterns can also affect the stability of existing slopes.

Due to the relatively unknown characteristics of the existing deposits of mine spoils, stability analysis would be prudent for any new slopes, particularly:

- slopes cut steeper than existing grades,
- where new fill is added along or above existing slopes,
- new slope embankments supported above sediments within the existing drainage ways and ponded areas

During the site preparation for areas where new fills are placed on existing slopes, care should be taken to ensure good bond between the new fill and existing soils. Existing slopes should be benched to provide horizontal surfaces for placement and compaction of new structural fill. The benching and removal of weak near surface soils, where encountered, would help to reduce the potential for creating a plane of weakness at the interface of the existing slope and new fill. Where existing slopes are steeper than 5:1 (horizontal to vertical), bench widths of about 10 feet (capable of allowing operation of compaction equipment) are recommended. Bench heights should be no higher than 3 feet.

4.2 Earthwork

4.2.1 Site Preparation

Site preparation should commence with stripping of all vegetation, organic soils, root systems, and any unsuitable materials (e.g., debris, desiccated soil, frozen soil, etc.) from the site surface. Terracon personnel should evaluate the depth of removal of unsuitable materials during construction.

Subgrades should be evaluated for the presence of unsuitable areas during earthwork operations. Unstable areas and exposed soft soils will not be suitable for immediate placement of fill materials. Options for subgrade improvement could include the following:

- Overexcavating soft or unstable areas to depths encountering firm and stable materials;
- Scarification, moisture conditioning (e.g., air drying), and recompaction of unstable areas;
- If fill sections can tolerate the potential for future, larger settlements, "bridging" areas of unsuitable soils with an initial lift thickness of 18 to 24 inches of suitable fill materials to provide relatively firm surficial conditions; or
- Placing a layer of approved crushed stone (less than 6 inches in any dimension) in unstable areas.

The use of low contact pressure, track equipment, or remote excavation equipment could be considered to assist in earthwork operations. Terracon should be retained to provide more detailed stabilization recommendations as the need for subgrade stabilization occurs.

Fill placed in excessive lift thicknesses as "bridging" material over soft or unstable deposits will be prone to future settlements. Where necessary, we recommend "bridging" lift areas be limited to areas less than 2,500 square feet. It would also be prudent to document the locations of unstable areas that are "bridged" or stabilized (i.e., with GPS coordinates) in order to correlate with final graded areas that may be susceptible to more settlement, or used for other developmental purposes.

4.2.2 Material Types

We understand that future structures are not planned to be supported over the reclaimed land. Use of materials with relatively high plasticities such as fat clays and weathered shale materials could be considered. In potential future site development areas that would be sensitive to subgrade volume change and resultant distress to structures, Terracon should be contacted to provide additional recommendations for these areas. Fill for the AML reclamation work should meet the following material requirements:

- Materials should be free of organic matter and debris;
- Particle sizes should be smaller than 6 inches in any dimension;

- Rock-like shale materials should be processed (pulverized) and moisture conditioned; and
- Soils with organic contents greater than 5% are suitable for use as fill within 2 feet of final grades.

Limitations for use as fill material include:

- Large rock particles (larger than 6 inches in any dimension);
- Frozen materials should not be used as fill; and
- Fill should not be placed on frozen subgrades;

A sample of each material type should be submitted to Terracon for evaluation prior to use as fill.

4.2.3 Compaction Requirements

The table below presents recommended compaction and moisture control criteria for fill placed for the geomorphically altered site grading. We understand that the final grades will be tolerable to settlements, and future structures are not planned to be supported over the reclaimed land. Higher degrees of compaction could be considered in potential future site development areas that would be sensitive to settlement. Terracon should be contacted to provide additional recommendations for these areas.

Item	Description [1]
Fill lift thickness	■ 9 inches or less in loose thickness when heavy, self-propelled compaction equipment is used.
Compaction of cohesive materials and processed shale in green (non-structural) areas [2]	■ Each lift should be compacted with a sheepsfoot roller until the full weight of the sheepsfoot roller is supported entirely on its feet (i.e., roller walkout when foot penetration is less than 3 inches), but not less than four passes per lift, or ■ At least 90% of the material's standard Proctor maximum dry density (ASTM D 698).
Compaction of granular materials in green (non-structural) areas [2]	■ Each lift should be compacted with at least four passes of a smooth drum vibratory roller weighing at least 10 tons, or ■ At least 90% of the material's standard Proctor maximum dry density (ASTM D 698).
Moisture content of cohesive soil	■ Within the range of 0% to +4% of the optimum moisture content as determined by the standard Proctor test at the time of placement and compaction.
Moisture content of granular material [4]	■ Workable moisture levels.

1. Compaction values and moisture contents are relative to standard Proctor maximum dry density and optimum moisture content (ASTM D698).

Continued from page 8

2. We recommend the fill be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.
3. If the granular material is a coarse sand or gravel, is of a uniform size, or has a low fines content, compaction comparison to relative density may be more appropriate. In this case, granular materials should be compacted to at least 70% relative density (ASTM D 4253 and D 4254).
4. Specifically, the moisture content of the granular material should be at a level to achieve compaction without the granular material bulking during placement or pumping when proofrolled.

4.2.4 Grading and Drainage

Adequate drainage should be provided on the site during construction. Excessive moisture can significantly reduce the support capability of soils and contribute to soft subgrades and difficult earthwork operations. During earthwork operations, exposed subgrades should be properly sloped to provide rapid drainage so that risks of saturation of the subgrades can be reduced. The soil types observed in the borings are easily eroded by surface water, so appropriate erosion control measures should be provided.

All surface water that accumulates on subgrades should be removed as soon as possible. Groundwater which collects in excavations should be removed as soon as possible.

4.2.5 Earthwork Construction Considerations

Unstable ground conditions will likely be encountered in deeper cut areas and prior to fill placement in the existing ponded areas, and will be worsened if groundwater and surface water are not properly managed. Unstable ground conditions could develop during general construction operations, particularly if the soils are wetted and/or subjected to repetitive construction traffic. Should unstable subgrade conditions develop, stabilization measures will need to be employed as discussed in section **4.2.1 Site Preparation**. Terracon should be contacted to discuss alternatives to stabilize subgrades.

As a minimum, all temporary excavations should be sloped or braced as required by Occupational Safety and Health Administration (OSHA) regulations to provide stability and safe working conditions. Temporary excavations will probably be required during grading operations. The grading contractor, by their contract, is usually responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations as required, to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, state and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards.

Terracon should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation; placement and compaction of structural fill; and backfilling of excavations into the completed subgrade.

4.3 Liming Requirements

Chemical analytical tests were performed on eight (8) discrete samples in the laboratory. Due to variations that will likely occur in soil materials vertically and horizontally across the site, we suggest performing additional chemical analytical tests during construction to confirm the liming requirements.

The liming results provided by Minnesota Valley Testing Laboratories, Inc. are summarized in the table below and are included in Exhibit B-2. .

Sample Location	pH of Sample	Sample Buffer Index	Liming Requirement [1] (lbs/acre)	
			To pH = 6.5	To pH = 6.9
Boring 1 (4 to 5½ ft)	3.5	4.1	20220	25030
Boring 1 (6 to 14 ft)	3.8	5.0	13690	17590
Boring 2 (4 to 5½ ft)	2.4	3.9	21670	26680
Boring 2 (14 to 15½ ft)	3.6	4.2	19500	24200
Boring 3 (4 to 5½ ft)	2.8	5.0	13690	17590
Boring 3 (14 to 15½ ft)	4.6	6.8	620	2720
Boring 4 (4 to 5½ ft)	3.0	5.2	12240	15940
Boring 4 (9 to 10½ feet)	2.8	4.8	15140	19240

1. Lime needs as 100% effective neutralizing power (ENP) for a 6" plow depth.

We recommend a contractor experienced with performing liming operations at mine reclamation projects be engaged.

5.0 GENERAL COMMENTS

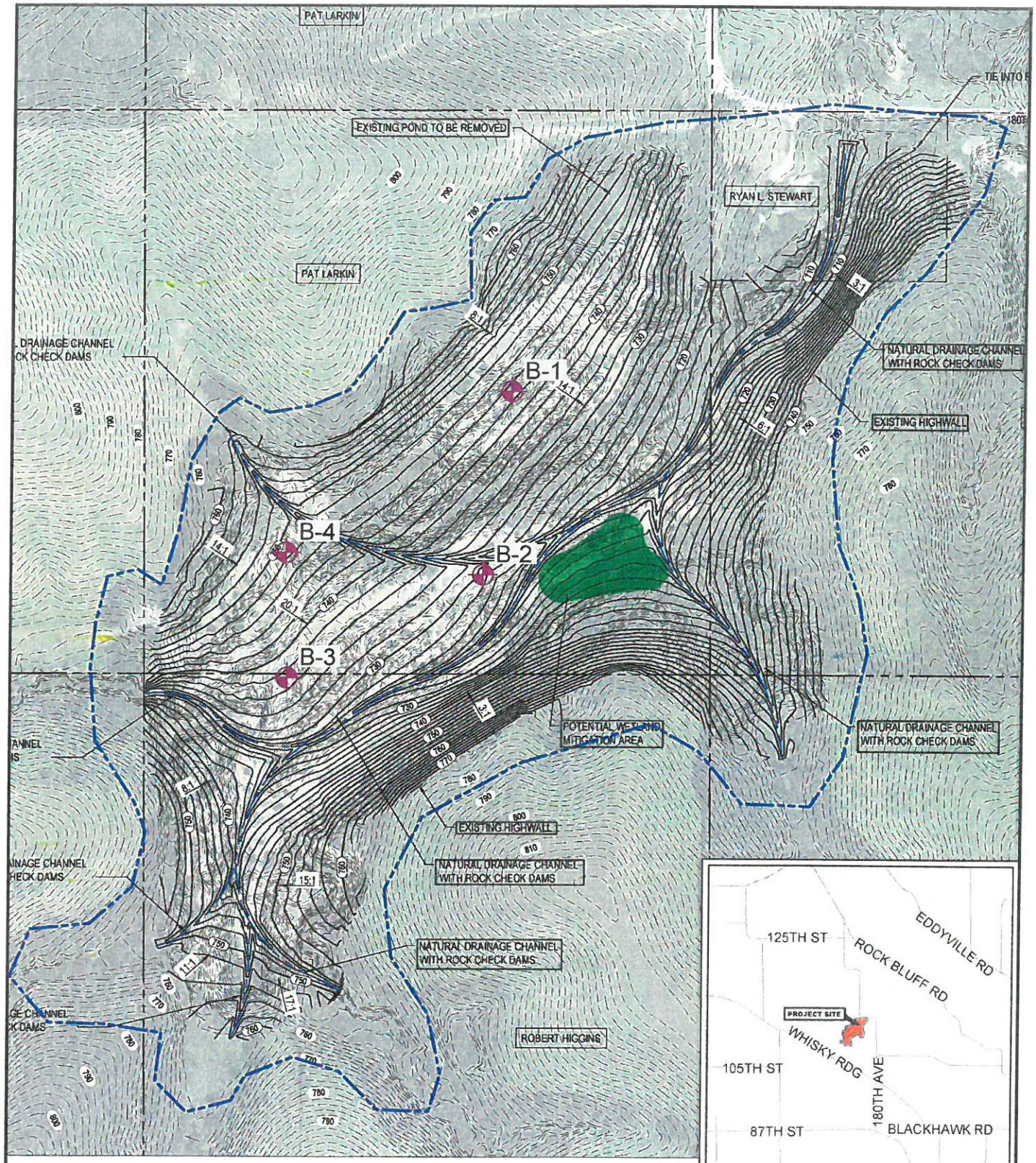
Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during grading, excavation, and other earth-related construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. Water quality and wetland delineation reports have been completed (Terracon Project No. 08137095, dated January 24, and February 4, 2014, respectively) and have been submitted under separate covers.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A
FIELD EXPLORATION



LEGEND

- BOUNDARY OF ASSESSED AREA
- APPROXIMATE BORING LOCATION

SITE VICINITY MAP 1"=2 MILE

BASE DRAWING FROM - OATES ASSOCIATES

NORTH

0 300'

APPROXIMATE DRAWING SCALE

Project No. 08135115	Date 04/15/14
Project Mngr. AJW	Drawn By KEK
File Name 08135115-01.dwg	
Layout Name A-1	

Terracon
Consulting Engineers and Scientists
800 SW 7TH STREET DES MOINES, IOWA 50309
PH (515) 244-3184 FAX (515) 244-5249

BORING LOCATION DIAGRAM
LARKIN AML RECLAMATION PROJECT
-
11724 180TH AVENUE
OTTUMWA, IOWA

EXHIBIT
A-1

Field Exploration Description

The boring locations were staked on-site by Terracon personnel using a handheld GPS device. Latitude and longitude coordinates are provided on the boring logs. A copy of the Boring Location Diagram indicating the approximate boring locations is included as Exhibit A-1.

The elevations were interpolated from plotting the boring locations on the Conceptual Grading Plan dated September 6, 2013 provided by Oates Associates. To provide access and a temporary stable drilling area, a bull dozer was used to level portions of the stockpiles. The ground surface elevations indicated on the boring logs are for relative reference only and should not be considered accurate. True surface elevations at the boring locations could differ due to changes in interpolation, construction of the temporary drilling areas, and other differences could occur from superposing approximate boring locations on the topographic plan. The locations and elevations of the borings are considered accurate only to the degree implied by the means and methods used to define them.

The borings were drilled with an ATV-mounted (rubber tire) rotary drill rig using continuous-flight hollow-stem augers to advance the boreholes. Representative samples were obtained using split-barrel sampling procedures. In the split-barrel sampling procedure, a standard 2-inch (outside diameter) split-barrel sampling spoon is driven into the ground with an automatic 140-pound hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the standard penetration resistance value (N). These "N" values are indicated on the boring logs at the depths of occurrence. The samples were sealed and transported to the laboratory for testing and classification.

The drill crew prepared a field log of each boring to record data including visual classifications of the materials encountered during drilling as well as the driller's interpretation of the subsurface conditions between samples. The boring logs included with this report represent our interpretation of the subsurface conditions at the boring locations based on field and laboratory data and observation of the samples.

BORING LOG NO. 1

PROJECT: Larkin AML Reclamation Project

CLIENT: Oates Associates Collinsville, Illinois

SITE: 11724 180th Avenue Ottumwa, Iowa

LOCATION See Exhibit A-1

Latitude: 41.0471° Longitude: -92.5119°

Approximate Surface Elev: 750 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
		FILL - FAT CLAY, with shale, trace sand, gray and dark gray
6.0	744+/-	
		FILL - FAT CLAY, with shale, trace sand, gray and gray brown
19.0	731+/-	
		FILL - FAT CLAY, with shale and gravel, trace sand, dark gray and brown gray
24.0	726+/-	
		FILL - CLAYEY SHALE*, trace coal and sand, gray brown, brown gray, dark gray and gray
33.0	717+/-	
		CLAYEY SHALE*, gray brown to brown gray, highly weathered
40.5	709.5+/-	
		Boring Terminated at 40.5 Feet

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE ID	WATER CONTENT (%)
		Hand			A	22
5		Split Spoon	13	2-2-3 N=5	1	25
		Hand			B	14
10		Split Spoon	14	2-2-3 N=5	2	16
15		Split Spoon	16	2-3-4 N=7	3	15
20		Split Spoon	16	3-4-6 N=10	4	18
		Hand			C	18
25		Split Spoon	16	2-2-6 N=8	5	19
30		Split Spoon	16	3-3-4 N=7	6	14
35		Split Spoon	18	6-12-16 N=28 6500 (HP)	7	19
40		Split Spoon	18	5-7-8 N=15 4000 (HP)	8	20

Stratification lines are approximate. In-situ, the transition may be gradual.

*Classification of rock materials has been estimated by the drill crew based on disturbed samples. Core samples and/or petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-2 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:
Auger samples collected from 0 to 6, 6 to 14 and 19 to 24 feet.

WATER LEVEL OBSERVATIONS

None Encountered While Drilling

Terracon
600 SW 7th St., Suite M
Des Moines, Iowa

Boring Started: 3/20/2014 | Boring Completed: 3/20/2014

Drill Rig: 897 | Driller: JG

Project No.: 08135115 | Exhibit: A-3

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 08135115.GPJ TEMPLATE UPDATE 3-31-14.GPJ 4/21/14

BORING LOG NO. 2

PROJECT: Larkin AML Reclamation Project

CLIENT: Oates Associates, Collinsville, Illinois

SITE: 11724 180th Avenue, Ottumwa, Iowa

LOCATION See Exhibit A-1

Latitude: 41.046° Longitude: -92.5121°

Approximate Surface Elev: 740 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0		**FILL - FAT CLAY**, with shale, trace coal and sand, gray, brown gray, maroon and dark gray
7.0	733+/-	**FILL - CLAYEY SHALE***, trace sand and coal, dark gray
24.0	716+/-	**FILL - FAT CLAY**, with shale, trace sand, gray brown and dark gray
29.0	711+/-	**FILL - CLAYEY SHALE***, trace sand and coal, gray
32.0	708+/-	**FILL - SHALE***, dark gray Cave-in at about 36 feet after drilling.
39.0	701+/-	**FILL - FAT CLAY**, with shale, dark gray, brown and gray brown
40.5	699.5+/-	***Boring Terminated at 40.5 Feet***

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE ID	WATER CONTENT (%)
		Hand			A	19
5		Split Spoon	16	2-4-6 N=10	1	18
10		Split Spoon	16	2-5-5 N=10	2	22
15		Split Spoon	18	3-6-6 N=12	3	18
20		Split Spoon	18	1-4-5 N=9	4	22
25		Split Spoon	18	2-3-4 N=7	5	27
		Hand			B	25
30		Split Spoon	18	2-6-9 N=15	6	12
35		Split Spoon	18	4-23-17 N=40	7	19
40		Split Spoon	18	2-6-7 N=13	8	27

Stratification lines are approximate. In-situ, the transition may be gradual.

*Classification of rock materials has been estimated by the drill crew based on disturbed samples. Core samples and/or petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method: Hollow Stem Auger

Abandonment Method: Boring backfilled with soil cuttings upon completion

See Exhibit A-2 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes: Auger samples collected from 0 to 24 and 24 to 29 feet.

WATER LEVEL OBSERVATIONS

None Encountered While Drilling

Terracon
600 SW 7th St., Suite M
Des Moines, Iowa

Boring Started: 3/21/2014 | Boring Completed: 3/21/2014

Drill Rig: 897 | Driller: JG

Project No.: 08135115 | Exhibit: A-3

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 08135115.GPJ TEMPLATE UPDATE 3-31-14.GPJ 4/21/14

BORING LOG NO. 3

PROJECT: Larkin AML Reclamation Project

CLIENT: Oates Associates Collinsville, Illinois

SITE: 11724 180th Avenue Ottumwa, Iowa

LOCATION See Exhibit A-1

Latitude: 41.0453° Longitude: -92.5138°

Approximate Surface Elev: 740 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
		FILL - CLAYEY SHALE*, trace sand and coal, gray and dark gray
7.0	733+/-	
		FILL - FAT CLAY, with shale, trace sand and coal, dark gray, brown and gray
24.0	716+/-	
		FILL - FAT CLAY, with shale, trace sand and gravel, dark gray
29.0	711+/-	
		FILL - SHALE*, gray, dark gray, gray brown
32.0	708+/-	
		LEAN TO FAT CLAY (CL/CH), trace sand, brown gray and dark gray brown, stiff, RESIDUAL SHALE
		Cave-in at about 38 feet after drilling.
40.5	699.5+/-	***Boring Terminated at 40.5 Feet***

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE ID	WATER CONTENT (%)
5			18	2-3-4 N=7	1	17
					A	17
10			18	8-3-4 N=7	2	13
					B	17
15			14	2-2-3 N=5	3	21
20			8	5-6-6 N=12	4	19
25			12	4-3-6 N=9	5	17
30			16	8-6-5 N=11	6	14
35			18	2-3-6 N=9 3500 (HP)	7	19
40			18	2-2-6 N=8 3000 (HP)	8	23

Stratification lines are approximate. In-situ, the transition may be gradual.

*Classification of rock materials has been estimated by the drill crew based on disturbed samples. Core samples and/or petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method: Hollow Stem Auger

Abandonment Method: Boring backfilled with soil cuttings upon completion.

See Exhibit A-2 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes: Auger samples collected from 0 to 10 and 10 to 24 feet.

WATER LEVEL OBSERVATIONS

None Encountered While Drilling

Terracon
600 SW 7th St., Suite M
Des Moines, Iowa

Boring Started: 3/21/2014 | Boring Completed: 3/21/2014

Drill Rig: 897 | Driller: JG

Project No.: 08135115 | Exhibit: A-3

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 08135115.GPJ TEMPLATE UPDATE 3-31-14.GPJ 4/21/14

BORING LOG NO. 4

PROJECT: Larkin AML Reclamation Project

CLIENT: Oates Associates
Collinsville, Illinois

SITE: 11724 180th Avenue
Ottumwa, Iowa

LOCATION See Exhibit A-1

Latitude: 41.0461° Longitude: -92.5138°

Approximate Surface Elev: 740 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
		FILL - CLAYEY SHALE*, trace sand, gray and gray brown
8.0	732+/-	
		FILL - CLAYEY SHALE*, trace sand, dark gray
12.0	728+/-	
		FILL - FAT CLAY, with shale, trace sand and coal, gray and dark gray
26.0	714+/-	
		SHALE*, gray, highly weathered
29.3	710.5+/-	Cave-in at about 28 feet after drilling.
		Auger refusal on apparent shale at 29.3 Feet

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE ID	WATER CONTENT (%)
5		18	2-2-4 N=6	1	21
				A	21
10		18	1-3-5 N=8	2	23
				B	20
15		14	1-2-3 N=5	3	25
20		18	1-3-4 N=7	4	23
25		18	1-3-3 N=6	5	22
		4	50/4"	6	5

WATER LEVEL OBSERVATIONS

Stratification lines are approximate. In-situ, the transition may be gradual.
*Classification of rock materials has been estimated by the drill crew based on disturbed samples. Core samples and/or petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-2 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:
Auger samples collected from 0 to 10 and 10 to 19 feet.

WATER LEVEL OBSERVATIONS
None Encountered While Drilling

Terracon
600 SW 7th St., Suite M
Des Moines, Iowa

Boring Started: 3/21/2014
Boring Completed: 3/21/2014
Drill Rig: 897
Driller: JG
Project No.: 08135115
Exhibit: A-3

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 08135115.GPJ TEMPLATE UPDATE 3-31-14.GPJ 4/21/14

APPENDIX B
LABORATORY TESTING

Laboratory Testing

In the laboratory, moisture content tests were performed on recovered samples. The results of the laboratory tests are shown on the boring logs in Appendix A at their corresponding sample depths.

Eight (8) samples were tested for chemical analytical testing. The chemical analytical tests are summarized in the table below and are included as Exhibit B-2.

Sample Location	Moisture Content (%)	pH of Sample	Sample Buffer Index	Acid/Base Accounting	
				Total Sulfur (weight %)	Pyritic Sulfur (weight %)
Boring 1 (4 to 5½ ft)	25	3.5	4.1	1.70	0.100
Boring 1 (6 to 14 ft)	14	3.8	5.0	0.870	0.090
Boring 2 (4 to 5½ ft)	18	2.4	3.9	1.45	0.090
Boring 2 (14 to 15½ ft)	18	3.6	4.2	1.85	1.50
Boring 3 (4 to 5½ ft)	17	2.8	5.0	1.01	0.590
Boring 3 (14 to 15½ ft)	21	4.6	6.8	0.870	0.800
Boring 4 (4 to 5½ ft)	21	3.0	5.2	1.36	1.12
Boring 4 (9 to 10½ feet)	23	2.8	4.8	2.12	0.990

The samples were classified in the laboratory based on visual observation, texture, plasticity, and the laboratory testing described above. The descriptions of the soils indicated on the boring log are in general accordance with the General Notes in Appendix C and the Unified Soil Classification System (USCS). A summary of the USCS is included in Appendix C. Classification of rock materials is based on the driller's observation of drilling characteristics during field operations and visual identification of disturbed samples. Core samples or petrographic analysis may indicate other rock types. A summary of sedimentary rock classification is included in Appendix C.

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1201 Lincoln Hwy. ~ Nevada, IA 50201 ~ 800-362-0855 ~ Fax 515-382-3885
www.mvtl.com

MEMBER ACIL

SUBMITTED BY: 004072 AJ WOLFE Terracon Consultants 600 SW 7th St. Suite M P.O. Box 4921 Des Moines IA 50306	DATE RECEIVED: Mar 31 2014 DATE REPORTED: Apr 17 2014 WORK ORDER NO: 201491-00032	SUBMITTED FOR:

	SAMPLE ID PREV CROP LAB NUMBER	BORING 1, SAMPLE 1 4-5.5FT 14-M278					SAMPLE ID PREV CROP LAB NUMBER	BORING 1, SAMPLE B 6-19FT 14-M279				
		V-LOW	LOW	OPT	HIGH	V-HIGH		V-LOW	LOW	OPT	HIGH	V-HIGH
ORGANIC MATTER												
NITROGEN NO3-N ppm												
PHOSPHORUS P2O5-P ppm												
ZINC (ppm)												
SULFUR ppm SO4-S												
ACIDITY pH	3.5	B ppm	Fe ppm	Mn ppm	Cu ppm	Na ppm	3.8	B ppm	Fe ppm	Mn ppm	Cu ppm	Na ppm
BUFFER INDEX	4.1						5.0					
CCE %		SALTS mmhos/cm		Cl lbs/A				SALTS mmhos/cm		Cl lbs/A		
		CEC	% BASE SATURATION					CEC	% BASE SATURATION			
CALCIUM ppm			Ca	Mg	K	Na	H		Ca	Mg	K	Na	H
MAGNESIUM ppm												
		SAND %	SILT %	CLAY %				SAND %	SILT %	CLAY %		
		TEXTURE						TEXTURE				

ALL GUIDELINES ARE ON A BROADCAST BASIS	CROP FERTILIZER GUIDELINES			CROP FERTILIZER GUIDELINES		
CROP AND YIELD GOAL						
NITROGEN (lbs/A)						
P2O5 (lbs/A) ISU/ISU						
K2O (lbs/A) ISU/ISU						
ZINC (lbs/A)						
SULFUR (lbs/A)						
LIME NEEDS AS	to pH 6.5	20220 lbs of lime for 6" plow depth.		to pH 6.5	13690 lbs of lime for 6" plow depth.	
100% ENP (lbs/A)	to pH 6.9	25030 lbs of lime for 6" plow depth.		to pH 6.9	17590 lbs of lime for 6" plow depth.	

ADDITIONAL RECOMMENDATIONS AND COMMENTS - Analyses are by NCR-13 methodology. Phosphorus results are determined colorimetrically. See additional comments at http://www.mvtl.com

NITROGEN (lbs/A)						
P2O5(lbs/A) MVTL						
K2O(lbs/A) MVTL						

MVTL guarantees the accuracy of the analysis done on the sample submitted for testing. It is not possible for MVTL to guarantee that a test result obtained on a particular sample will be the same on any other sample unless all conditions affecting the sample are the same, including sampling by MVTL. As a mutual protection to clients, the public and ourselves, all reports are submitted as the confidential property of clients, and authorization for publication of statements, conclusions or extracts from or regarding our reports is reserved pending our written approval.

Exhibit B-2

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SUBMITTED BY: 004072 AJ WOLFE Terracon Consultants 600 SW 7th St. Suite M P.O. Box 4921 Des Moines IA 50306	DATE RECEIVED: Mar 31 2014 DATE REPORTED: Apr 17 2014 WORK ORDER NO: 201491-00032	SUBMITTED FOR:

	SAMPLE ID PREV CROP LAB NUMBER	BORING 2, SAMPLE 1 4-5.5FT 14-M280					SAMPLE ID PREV CROP LAB NUMBER	BORING 2, SAMPLE 3 14-15.5F 14-M281				
		V-LOW	LOW	OPT	HIGH	V-HIGH		V-LOW	LOW	OPT	HIGH	V-HIGH
ORGANIC MATTER												
NITROGEN NO3-N ppm												
PHOSPHORUS P2O5-P ppm												
ZINC (ppm)												
SULFUR ppm SO4-S												
ACIDITY pH	2.4	B ppm	Fe ppm	Mn ppm	Cu ppm	Na ppm	3.6	B ppm	Fe ppm	Mn ppm	Cu ppm	Na ppm
BUFFER INDEX	3.9						4.2					
CCE %		SALTS mmhos/cm		Cl lbs/A				SALTS mmhos/cm		Cl lbs/A		
		CEC	% BASE SATURATION					CEC	% BASE SATURATION			
CALCIUM ppm			Ca	Mg	K	Na	H		Ca	Mg	K	Na	H
MAGNESIUM ppm												
		SAND %	SILT %	CLAY %				SAND %	SILT %	CLAY %		
		TEXTURE						TEXTURE				
ALL GUIDELINES ARE ON A BROADCAST BASIS		CROP FERTILIZER GUIDELINES						CROP FERTILIZER GUIDELINES				
CROP AND YIELD GOAL												
NITROGEN (lbs/A)												
P2O5 (lbs/A) ISU/ISU												
K2O (lbs/A) ISU/ISU												
ZINC (lbs/A)												
SULFUR (lbs/A)												
LIME NEEDS AS	to pH 6.5	21670 lbs of lime for 6" plow depth.					to pH 6.5	19500 lbs of lime for 6" plow depth.				
100% ENP (lbs/A)	to pH 6.9	26680 lbs of lime for 6" plow depth.					to pH 6.9	24200 lbs of lime for 6" plow depth.				

ADDITIONAL RECOMMENDATIONS AND COMMENTS - Analyses are by NCR-13 methodology. Phosphorus results are determined colorimetrically. See additional comments at http://www.mvtl.com

NITROGEN (lbs/A)						
P2O5(lbs/A) MVTL						
K2O(lbs/A) MVTL						

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Exhibit B-2

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SUBMITTED BY: 004072 AJ WOLFE Terracon Consultants 600 SW 7th St. Suite M P.O. Box 4921 Des Moines IA 50306	DATE RECEIVED: Mar 31 2014 DATE REPORTED: Apr 17 2014 WORK ORDER NO: 201491-00032	SUBMITTED FOR:

	SAMPLE ID PREV CROP LAB NUMBER	BORING 3, SAMPLE 1 4-5.5FT 14-M282					SAMPLE ID PREV CROP LAB NUMBER	BORING 3, SAMPLE 3 14-15.5F 14-M283				
		V-LOW	LOW	OPT	HIGH	V-HIGH		V-LOW	LOW	OPT	HIGH	V-HIGH
ORGANIC MATTER												
NITROGEN NO3-N ppm												
PHOSPHORUS P2O5-P ppm												
ZINC (ppm)												
SULFUR ppm SO4-S												
ACIDITY pH	2.8	B ppm	Fe ppm	Mn ppm	Cu ppm	Na ppm	4.6	B ppm	Fe ppm	Mn ppm	Cu ppm	Na ppm
BUFFER INDEX	5.0						6.8					
CCE %		SALTS mmhos/cm		Cl lbs/A				SALTS mmhos/cm		Cl lbs/A		
		CEC	% BASE SATURATION					CEC	% BASE SATURATION			
CALCIUM ppm			Ca	Mg	K	Na	H		Ca	Mg	K	Na	H
MAGNESIUM ppm												
		SAND %	SILT %	CLAY %				SAND %	SILT %	CLAY %		
		TEXTURE						TEXTURE				
ALL GUIDELINES ARE ON A BROADCAST BASIS		CROP FERTILIZER GUIDELINES						CROP FERTILIZER GUIDELINES				
CROP AND YIELD GOAL												
NITROGEN (lbs/A)												
P2O5 (lbs/A) ISU/ISU												
K2O (lbs/A) ISU/ISU												
ZINC (lbs/A)												
SULFUR (lbs/A)												
LIME NEEDS AS 100% ENP (lbs/A)	to pH 6.5 13690 lbs of lime for 6" plow depth. to pH 6.9 17590 lbs of lime for 6" plow depth.						to pH 6.5 621 lbs of lime for 6" plow depth. to pH 6.9 2722 lbs of lime for 6" plow depth.					

ADDITIONAL RECOMMENDATIONS AND COMMENTS - Analyses are by NCR-13 methodology. Phosphorus results are determined colorimetrically. See additional comments at http://www.mvtl.com

NITROGEN (lbs/A)						
P2O5(lbs/A) MVTL						
K2O(lbs/A) MVTL						

MVTL guarantees the accuracy of the analysis done on the sample submitted for testing. It is not possible for MVTL to guarantee that a test result obtained on a particular sample will be the same on any other sample unless all conditions affecting the sample are the same, including sampling by MVTL. As a mutual protection to clients, the public and ourselves, all reports are submitted as the confidential property of clients, and authorization for publication of statements, conclusions or extracts from or regarding our reports is reserved pending our written approval.

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SUBMITTED BY: 004072	DATE RECEIVED: Mar 31 2014	SUBMITTED FOR:
AJ WOLFE	DATE REPORTED: Apr 17 2014	
Terracon Consultants	WORK ORDER NO: 201491-00032	
600 SW 7th St. Suite M		
P.O. Box 4921		
Des Moines IA 50306		

	SAMPLE ID PREV CROP LAB NUMBER	BORING 4, SAMPLE 1 4-5.5FT 14-M284					SAMPLE ID PREV CROP LAB NUMBER	BORING 4, SAMPLE 2 9-10.5FT 14-M285				
		V-LOW	LOW	OPT	HIGH	V-HIGH		V-LOW	LOW	OPT	HIGH	V-HIGH
ORGANIC MATTER												
NITROGEN NO3-N ppm												
PHOSPHORUS P2O5-P ppm												
ZINC (ppm)												
SULFUR ppm SO4-S												
ACIDITY pH	3.0	B ppm	Fe ppm	Mn ppm	Cu ppm	Na ppm	2.8	B ppm	Fe ppm	Mn ppm	Cu ppm	Na ppm
BUFFER INDEX	5.2						4.8					
CCE %		SALTS mmhos/cm		Cl lbs/A				SALTS mmhos/cm		Cl lbs/A		
		CEC	% BASE SATURATION					CEC	% BASE SATURATION			
CALCIUM ppm			Ca	Mg	K	Na	H		Ca	Mg	K	Na	H
MAGNESIUM ppm												
		SAND %	SILT %	CLAY %				SAND %	SILT %	CLAY %		
		TEXTURE						TEXTURE				
ALL GUIDELINES ARE ON A BROADCAST BASIS		CROP FERTILIZER GUIDELINES						CROP FERTILIZER GUIDELINES				
CROP AND YIELD GOAL												
NITROGEN (lbs/A)												
P2O5 (lbs/A) ISU/ISU												
K2O (lbs/A) ISU/ISU												
ZINC (lbs/A)												
SULFUR (lbs/A)												
LIME NEEDS AS	to pH 6.5	12240 lbs of lime for 6" plow depth.					to pH 6.5	15140 lbs of lime for 6" plow depth.				
100% ENP (lbs/A)	to pH 6.9	15940 lbs of lime for 6" plow depth.					to pH 6.9	19240 lbs of lime for 6" plow depth.				

ADDITIONAL RECOMMENDATIONS AND COMMENTS - Analyses are by NCR-13 methodology. Phosphorus results are determined colorimetrically. See additional comments at http://www.mvtl.com

NITROGEN (lbs/A)						
P2O5(lbs/A) MVTL						
K2O(lbs/A) MVTL						

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Exhibit B-2

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1201 Lincoln Hwy. ~ Nevada, IA 50201 ~ 800-362-0855 ~ Fax 515-382-3885
www.mvtl.com

MEMBER ACIL

Report Date: 17 Apr 2014
Work Order #: 201491-00032
Account #: 004072

AJ WOLFE
Terracon Consultants
600 SW 7th St. Suite M
P.O. Box 4921
Des Moines IA 50306

Date Received: 31 Mar 2014

Soil Sample Identification: BORING 1 SAMPLE 1
Soil Laboratory Number: 14-V6

ANALYSES	Results		Date Analyzed	Analyst
Acid/Base Total Sulfur	1.70	wt %	3 Apr 2014	OL
Acid/Base Pyritic Sulfur	0.100	wt %	7 Apr 2014	OL
Neutralization Potential	-18.6			OL
Calcium Carbonate Equiv	-2.27	wt %	7 Apr 2014	OL
Actual Acid Potential	3.12			OL
Maximum Acid Potential	53.12			OL

All potentials expressed as ton $CaCO_3$ equivalent per 1000 tons of sample.

Deficiency in ton $CaCO_3$ equivalent per 1000 tons of sample = 21.7

Analyses done in accordance with NCR-13 Methods. Phosphorus determined colorimetrically.

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Report Date: 17 Apr 2014
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Account #: 004072

AJ WOLFE
Terracon Consultants
600 SW 7th St. Suite M
P.O. Box 4921
Des Moines IA 50306

Date Received: 31 Mar 2014

Soil Sample Identification: BORING 1 SAMPLE B
Soil Laboratory Number: 14-V7

ANALYSES	Results		Date Analyzed	Analyst
Acid/Base Total Sulfur	0.870	wt %	3 Apr 2014	OL
Acid/Base Pyritic Sulfur	0.090	wt %	7 Apr 2014	OL
Neutralization Potential	-3.21			OL
Calcium Carbonate Equiv	-0.70	wt %	7 Apr 2014	OL
Actual Acid Potential	2.81			OL
Maximum Acid Potential	27.19			OL

All potentials expressed as ton $CaCO_3$ equivalent per 1000 tons of sample.

Deficiency in ton $CaCO_3$ equivalent per 1000 tons of sample = 6.02

Analyses done in accordance with NCR-13 Methods. Phosphorus determined colorimetrically.

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600 SW 7th St. Suite M
P.O. Box 4921
Des Moines IA 50306

Date Received: 31 Mar 2014

Soil Sample Identification: BORING 2 SAMPLE 1
Soil Laboratory Number: 14-V8

ANALYSES	Results		Date Analyzed	Analyst
Acid/Base Total Sulfur	1.45	wt %	3 Apr 2014	OL
Acid/Base Pyritic Sulfur	0.090	wt %	7 Apr 2014	OL
Neutralization Potential	-21.0			OL
Calcium Carbonate Equiv	-2.52	wt %	7 Apr 2014	OL
Actual Acid Potential	2.81			OL
Maximum Acid Potential	45.31			OL

All potentials expressed as ton $CaCO_3$ equivalent per 1000 tons of sample.

Deficiency in ton $CaCO_3$ equivalent per 1000 tons of sample = 23.8

Analyses done in accordance with NCR-13 Methods. Phosphorus determined colorimetrically.

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AJ WOLFE
Terracon Consultants
600 SW 7th St. Suite M
P.O. Box 4921
Des Moines IA 50306

Date Received: 31 Mar 2014

Soil Sample Identification: BORING 2 SAMPLE 3
Soil Laboratory Number: 14-V9

ANALYSES	Results		Date Analyzed	Analyst
Acid/Base Total Sulfur	1.85	wt %	3 Apr 2014	OL
Acid/Base Pyritic Sulfur	1.50	wt %	7 Apr 2014	OL
Neutralization Potential	-14.8			OL
Calcium Carbonate Equiv	-1.89	wt %	7 Apr 2014	OL
Actual Acid Potential	46.9			OL
Maximum Acid Potential	57.81			OL

All potentials expressed as ton CaCO3 equivalent per 1000 tons of sample.

Deficiency in ton CaCO3 equivalent per 1000 tons of sample = 61.7

Analyses done in accordance with NCR-13 Methods. Phosphorus determined colorimetrically.

MVTL guarantees the accuracy of the analysis done on the sample submitted for testing. It is not possible for MVTL to guarantee that a test result obtained on a particular sample will be the same on any other sample unless all conditions affecting the sample are the same, including sampling by MVTL. As a mutual protection to clients, the public and ourselves, all reports are submitted as the confidential property of clients, and authorization for publication of statements, conclusions or extracts from or regarding our reports is reserved pending our written approval.

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AJ WOLFE
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600 SW 7th St. Suite M
P.O. Box 4921
Des Moines IA 50306

Date Received: 31 Mar 2014

Soil Sample Identification: BORING 3 SAMPLE 1
Soil Laboratory Number: 14-V10

ANALYSES	Results		Date Analyzed	Analyst
Acid/Base Total Sulfur	1.01	wt %	3 Apr 2014	OL
Acid/Base Pyritic Sulfur	0.590	wt %	7 Apr 2014	OL
Neutralization Potential	-6.18			OL
Calcium Carbonate Equiv	-1.00	wt %	7 Apr 2014	OL
Actual Acid Potential	18.4			OL
Maximum Acid Potential	31.56			OL

All potentials expressed as ton $CaCO_3$ equivalent per 1000 tons of sample.

Deficiency in ton $CaCO_3$ equivalent per 1000 tons of sample = 24.6

Analyses done in accordance with NCR-13 Methods. Phosphorus determined colorimetrically.

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P.O. Box 4921
Des Moines IA 50306

Date Received: 31 Mar 2014

Soil Sample Identification: BORING 3 SAMPLE 3
Soil Laboratory Number: 14-V11

ANALYSES	Results		Date Analyzed	Analyst
Acid/Base Total Sulfur	0.870	wt %	3 Apr 2014	OL
Acid/Base Pyritic Sulfur	0.800	wt %	7 Apr 2014	OL
Neutralization Potential	2.72			OL
Calcium Carbonate Equiv	-0.09	wt %	7 Apr 2014	OL
Actual Acid Potential	25.0			OL
Maximum Acid Potential	27.19			OL

All potentials expressed as ton CaCO3 equivalent per 1000 tons of sample.

Deficiency in ton CaCO3 equivalent per 1000 tons of sample = 22.3

Analyses done in accordance with NCR-13 Methods. Phosphorus determined colorimetrically.

MVTL guarantees the accuracy of the analysis done on the sample submitted for testing. It is not possible for MVTL to guarantee that a test result obtained on a particular sample will be the same on any other sample unless all conditions affecting the sample are the same, including sampling by MVTL. As a mutual protection to clients, the public and ourselves, all reports are submitted as the confidential property of clients, and authorization for publication of statements, conclusions or extracts from or regarding our reports is reserved pending our written approval.

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600 SW 7th St. Suite M
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Des Moines IA 50306

Date Received: 31 Mar 2014

Soil Sample Identification: BORING 4 SAMPLE 1
Soil Laboratory Number: 14-V12

ANALYSES	Results		Date Analyzed	Analyst
Acid/Base Total Sulfur	1.36	wt %	3 Apr 2014	OL
Acid/Base Pyritic Sulfur	1.12	wt %	7 Apr 2014	OL
Neutralization Potential	0.87			OL
Calcium Carbonate Equiv	-0.28	wt %	7 Apr 2014	OL
Actual Acid Potential	35.0			OL
Maximum Acid Potential	42.50			OL

All potentials expressed as ton $CaCO_3$ equivalent per 1000 tons of sample.

Deficiency in ton $CaCO_3$ equivalent per 1000 tons of sample = 34.1

Analyses done in accordance with NCR-13 Methods. Phosphorus determined colorimetrically.

MVTL guarantees the accuracy of the analysis done on the sample submitted for testing. It is not possible for MVTL to guarantee that a test result obtained on a particular sample will be the same on any other sample unless all conditions affecting the sample are the same, including sampling by MVTL. As a mutual protection to clients, the public and ourselves, all reports are submitted as the confidential property of clients, and authorization for publication of statements, conclusions or extracts from or regarding our reports is reserved pending our written approval.

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600 SW 7th St. Suite M
P.O. Box 4921
Des Moines IA 50306

Date Received: 31 Mar 2014

Soil Sample Identification: BORING 4 SAMPLE 2
Soil Laboratory Number: 14-V13

ANALYSES	Results		Date Analyzed	Analyst
Acid/Base Total Sulfur	2.12	wt %	3 Apr 2014	OL
Acid/Base Pyritic Sulfur	0.990	wt %	7 Apr 2014	OL
Neutralization Potential	-2.72			OL
Calcium Carbonate Equiv	-0.65	wt %	7 Apr 2014	OL
Actual Acid Potential	30.9			OL
Maximum Acid Potential	66.25			OL

All potentials expressed as ton $CaCO_3$ equivalent per 1000 tons of sample.

Deficiency in ton $CaCO_3$ equivalent per 1000 tons of sample = 33.6

Analyses done in accordance with NCR-13 Methods. Phosphorus determined colorimetrically.

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Exhibit B-2

APPENDIX C
SUPPORTING DOCUMENTS

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING

Auger	Split Spoon
Shelby Tube	Macro Core
Ring Sampler	Rock Core
Grab Sample	No Recovery

WATER LEVEL

- Water Initially Encountered
- Water Level After a Specified Period of Time
- Water Level After a Specified Period of Time

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

(HP)	Hand Penetrometer
(T)	Torvane
(b/f)	Standard Penetration Test (blows per foot)
(PID)	Photo-Ionization Detector
(OVA)	Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance Includes gravels, sands and silts.			CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance			
Descriptive Term (Density)	Standard Penetration or N-Value Blows/Ft.	Ring Sampler Blows/Ft.	Descriptive Term (Consistency)	Unconfined Compressive Strength, Qu, psf	Standard Penetration or N-Value Blows/Ft.	Ring Sampler Blows/Ft.
Very Loose	0 - 3	0 - 6	Very Soft	less than 500	0 - 1	< 3
Loose	4 - 9	7 - 18	Soft	500 to 1,000	2 - 4	3 - 4
Medium Dense	10 - 29	19 - 58	Medium-Stiff	1,000 to 2,000	4 - 8	5 - 9
Dense	30 - 50	59 - 98	Stiff	2,000 to 4,000	8 - 15	10 - 18
Very Dense	> 50	≥ 99	Very Stiff	4,000 to 8,000	15 - 30	19 - 42
			Hard	> 8,000	> 30	> 42

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

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UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or $1 > Cc > 3$ [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel [F,G,H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or $1 > Cc > 3$ [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G,H,I]
			Fines Classify as CL or CH		SC	Clayey sand [G,H,I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A" line [J]		CL	Lean clay [K,L,M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K,L,M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OL	Organic clay [K,L,M,N]
						Organic silt [K,L,M,O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K,L,M]
			PI plots below "A" line		MH	Elastic Silt [K,L,M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OH	Organic clay [K,L,M,P]
						Organic silt [K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

A Based on the material passing the 3-in. (75-mm) sieve

B If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

C Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

D Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

E $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

F If soil contains ≥ 15% sand, add "with sand" to group name.

G If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

H If fines are organic, add "with organic fines" to group name.

I If soil contains ≥ 15% gravel, add "with gravel" to group name.

J If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

K If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

L If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

M If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

N PI ≥ 4 and plots on or above "A" line.

O PI < 4 or plots below "A" line.

P PI plots on or above "A" line.

Q PI plots below "A" line.

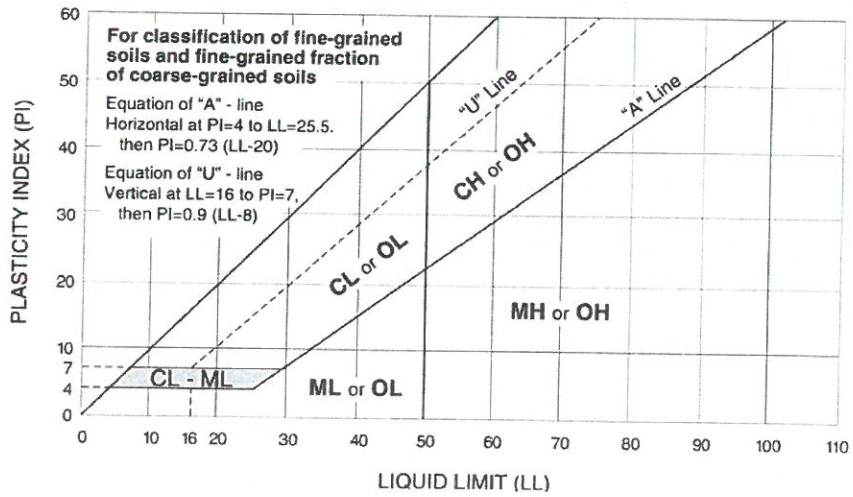

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Exhibit C-2

GENERAL NOTES
Sedimentary Rock Classification

DESCRIPTIVE ROCK CLASSIFICATION:

Sedimentary rocks are composed of cemented clay, silt and sand sized particles. The most common minerals are clay, quartz and calcite. Rock composed primarily of calcite is called limestone; rock of sand size grains is called sandstone, or shale. Modifiers such as shaly, sandy, Dolomitic, calcareous, carbonaceous, etc. are used to describe various constituents. Examples: sandy shale; calcareous sandstone.

Limestone	Light to dark colored, crystalline to fine-grained texture, composed of $CaCo_3$, reacts readily with HCl.
Dolomite	Light to dark colored, crystalline to fine-grained texture, composed of $CaMg(CO_3)_2$, harder than limestone, reacts with HCl when powdered.
Chert	Light to dark colored, very fine-grained texture, composed of micro-crystalline quarts (SiO_2), brittle breaks into angular fragments, will scratch glass.
Shale	Very fine-grained texture, composed of consolidated silt or clay, bedded in thin layers. The unlaminated equivalent is frequently referred to as siltstone, claystone or mudstone.
Sandstone	Usually light colored, coarse to fine texture, composed of cemented sand size grains of quartz, feldspar, etc. Cement usually is silica but may be such minerals as calcite, iron-oxide, or some other carbonate.
Conglomerate	Rounded rock fragments of variable mineralogy varying in size from near sand to boulder size but usually pebble to cobble size (½ inch to 6 inches). Cemented together with various cementing agents. Breccia is similar but composed of angular, fractured rock particles cemented together.

DEGREE OF WEATHERING:

Slight	Slight decomposition of parent material on joints. May be color change.
Moderate	Some decomposition and color change throughout.
High	Rock highly decomposed, may be extremely broken.

HARDNESS (for engineering description of rock – not to be confused with Moh's scale for minerals)

Hard	Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen.
Moderately hard	Can be scratched with knife or pick. Gouges or grooves to ¼ in. deep can be excavated by hard blow of point of a geologist's pick. Hand specimens can be detached by moderate blow.
Medium	Can be grooved or gouged 1/16 in. deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1-in. maximum size by hard blows of the point of a geologist's pick.
Soft	Can be gouged or grooved readily with knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.
Very soft	Can be carved with knife. Can be excavated readily with point of pick. Pieces 1-in. or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail.

Classification of rock materials has been estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.

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PLANS