Construction Specification
000 IA CS-00-1 Site Preparation

1. SCOPE

Site preparation work shall consist of clearing, grubbing, stripping, refuse removal, bank sloping and structure removal on the site as necessary to rid the site of all undesirable materials on or near the surface and prepare the site for the structure. All woody growth within the construction area shall be cleared and all stumps and roots one inch in diameter or larger shall be grubbed from the site. In addition, all areas within 25 feet of the footprint of the structure shall be cleared and grubbed except as directed by NRCS. The work shall also consist of the removal and disposal of structures (including fences) that must be removed to perform other items of work.

For wetland restoration, enhancement, or creation projects, the wetland area shall be disturbed as little as possible and existing naturally vegetated spillway areas shall not be disturbed.

2. FOUNDATION PREPARATION

The construction areas shall be stripped a minimum of 6 inches to remove all unsuitable materials such as organic matter, grasses, weeds, sod, debris, and stones larger than 6 inches in diameter.

In an earth embankment foundation area, all channel banks and sharp breaks shall be sloped to no steeper than 1.5 horizontal to 1 vertical.

The foundation area shall be thoroughly scarified before placement of fill material. The surface shall have moisture added or shall be compacted if necessary so that the first layer of fill material can be compacted and bonded to the foundation.

3. STRIPPED MATERIAL DISPOSAL

Suitable soil material shall be stockpiled for use as topsoil. The other stripped materials shall be buried, removed from the site, or disposed of as directed by the owner or NRCS. Whenever possible, material shall not be disposed of in the pool area created by the structure.

Stockpiled materials around a construction site should be placed so as not to hinder subsequent construction operations.

4. DISPOSAL OF REFUSE MATERIALS

Waste materials from clearing and structure removal shall be burned or buried at locations approved by the owner. Buried materials shall be covered with a minimum of 2 feet of earthfill. Whenever possible, material shall not be disposed of in any pool area created by the structure.

All refuse shall be disposed of in a manner which complies with all local and state regulations.

5. SALVAGE

Items to be salvaged shall be as shown on the drawings. Structures and fencing materials that are designated to be salvaged shall be carefully removed and neatly placed in the specified storage areas.

6. SPECIFIC SITE REQUIREMENTS

A. Measurement and Payment

Compensation for any work item described in the contract documents but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and bid items to which they are made subsidiary are identified in Items of Work and Construction Details section of this specification.
For items of work which lump sum prices are established in the contract, the quantity of work will not be measured for payment. Payment for each item will be made at the contract lump sum price and will constitute full compensation for completion of the work.

For items of work for which specific unit prices are established in the contract, the payment will be made based on the approved quantity measured by the engineer or weight tickets. Payment will constitute full compensation of the work completed as defined by each work item.

B. Items of Work and Construction Details

"Site Stripping and Preparation":

1. Bid Item No. 1

This item will consist of work to remove and dispose of existing material to remove vegetation on areas to be excavated or filled. Total depth of vegetative stripping and topsoil stripping shall equal a combined depth of 12", with the estimated cubic yards of top soil removal as shown in the plans. The topsoil replacement quantity shall be paid separately.

This item will also include any tree and brush removal along with any fences. These shall be considered incidental to site stripping.

This item will be paid out as CY of stripped material.

"Crop damage"

2. Bid item No.18

This item consists of crop damage that results from construction activities. It is recommended contractor remove corn residue rather than knock it down.

Payment for crop damage will be made to the nearest 0.1 acre as measured by the Engineer or their representative. The unit rate for crop damage will be determined by the Division near the completion of construction and added to the contract with a Change Order. Payment will be made to contractor who will pay landowner.

Construction Specification
000 IA CS-005 Pollution Control 2011

1. SCOPE

The work shall consist of installing measures or performing work to control erosion and minimize the production of sediment and other pollutants to water and air during construction operations.

2. MATERIALS

All materials furnished shall meet the requirements shown on the drawings or in the specifications.

3. EROSION AND SEDIMENT CONTROL MEASURES AND WORKS

The measures and works shall include, but are not limited to, the following:

Staging of Earthwork Activities: The excavation and moving of soil materials shall be scheduled so that areas unprotected from erosion will be minimized. These areas will be unprotected for the shortest time feasible.

Seeding: Structures and disturbed areas shall be seeded as soon as possible after construction is completed.

Temporary seedings may be used as an alternative to other stabilization measures as approved by NRCS.

Mulching: Construction areas that have been disturbed but have no construction activity scheduled for 21 days or more shall have erosion protection measures applied by the 14th day. This erosion protection may be mulching or other approved temporary measures. Construction areas shall not be left open during a winter shutdown period and shall be protected by mulching.

All seeding and mulching shall be completed in accordance with the seeding plan and Iowa Construction Specification IA-6, Seeding and Mulching for Protective Cover.

The following works may be temporary. If they are installed as a temporary measure, they shall be removed and the area restored to its original state when they are no longer needed or when permanent measures are installed.

Diversions: Diversions may be required to divert clean runoff water away from work areas and to collect runoff from work areas for treatment and safe disposition.

Stream Crossings: Culverts or bridges may be required where construction equipment must cross streams.

Sediment Basins: Sediment basins may be required to settle and filter out sediment from eroding areas to protect properties and streams below the construction site.

Sediment Filters: Straw bale filters, geotextile sediment fences, or other equivalent methods may be used to trap sediment from areas of limited runoff. Sediment filters shall be properly anchored to prevent erosion under them.

Waterways: Waterways may be required for the safe removal of runoff from fields, diversions, and other structures or measures

4. CHEMICAL POLLUTION

The Contractor shall provide watertight tanks or barrels or construct a sump sealed with plastic sheets to be used to dispose of chemical pollutants, such as drained lubricating or transmission oils, greases, soaps, concrete mixer wash water, asphalt, etc., produced as a by-product of the construction work.

At the completion of the construction work, sumps shall be removed and the area restored without causing pollution.

Sanitary facilities such as chemical toilets or septic tanks shall not be placed adjacent to live streams, wells, or springs. They shall be located at a distance sufficient to prevent contamination of any water sources. At the completion of construction work, facilities shall be disposed of without causing pollution.

5. AIR POLLUTION

The burning of brush or trash or disposal of other materials shall adhere to local and state regulations.

Fire prevention measures shall be taken to prevent the start or the spreading of wild fires, which result from project work. Fire breaks or guards shall be constructed at locations shown on the drawings.

All public access or haul roads used by the contractor during construction of the project shall be sprinkled or otherwise treated to fully suppress dust. All dust control methods shall insure safe operations at all times. If chemical dust suppressants are used, the material shall be a commercially available product specifically designed for dust suppression and the application shall follow manufacturer's requirements and recommendations. A copy of the product data sheet and manufacturer's recommended application procedures shall be provided to the Engineer five working days before use.

6. MAINTENANCE, REMOVAL, AND RESTORATION

All pollution control measures and works shall be adequately maintained in a functional condition as long as needed during the construction operation. All temporary measures shall be removed and the site restored to as near original conditions as practical.

7. SPECIFIC SITE REQUIREMENTS

A. Measurement and Payment

Compensation for any work item described in the contract documents but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and bid items to which they are made subsidiary are identified in Items of Work and Construction Details section of this specification.

For items of work which lump sum prices are established in the contract, the quantity of work will not be measured for payment. Payment for each item will be made at the contract lump sum price and will constitute full compensation for completion of the work.

For items of work for which specific unit prices are established in the contract, the payment will be made based on the approved quantity measured by the engineer or weight tickets. Payment will constitute full compensation of the work completed as defined by each work item.

B. Items of Work and Construction Details

1. Subsidiary Item - Pollution Control

This item shall consist of applying and performing all construction activities in a manner that will minimize water pollution, air pollution and soil erosion.

No separate payment will be made for Pollution Control. Compensation for this item will be other items as appropriate.

Construction Specification
000 IA-6 Seeding and Mulching for Protective Cover

1. SCOPE

The work shall consist of seeding, mulching, and fertilizing all disturbed areas and other areas as indicated on the drawings or otherwise designated.

2. SEEDBED PREPARATION AND APPLICATION

The entire area to be seeded shall be reasonably smooth and all washes and gullies shall be filled to conform to the desired cross-section before actual seedbed preparation is begun. At this stage of the operation, the required fertilizer and lime shall be applied uniformly and incorporated into the top 3 inches of the soil with suitable tillage equipment. The seedbed preparation operation shall be suspended when the soil is too wet or too dry. The seedbed shall be loosened to a depth of at least three inches.

On side slopes steeper than 2-1/2 horizontal to1 vertical, the 3 inch minimum depth of seedbed preparation is not required, but the soil shall be worked enough to insure sufficient loose soil to provide adequate seed cover.

Unless otherwise specified, the seeding operation shall be performed immediately after preparation of the seedbed. The seed shall be drilled or broadcast by equipment that will insure uniform distribution of the seed.

3. MATERIALS

The seeding, fertilizing, and mulching requirements are as specified on Form IA-CPA-4.

Straw from cereal grains or hay will be used as mulching material. It shall be relatively free of weeds.

4. MULCH APPLICATION

The required mulching shall be performed as soon as possible after seeding unless otherwise specified. The mulch shall be applied uniformly over the area. The type and rate shall be as specified. When mulching is required, all areas seeded during any one day shall be mulched within 24 hours. The mulch may be spread by any means that results in a uniform cover.

The mulch shall be anchored. Anchoring of the mulch may be performed by a mulch anchoring tool or regular farm disk weighted and set nearly straight, by installation of mulch netting, or by other methods approved by NRCS.

5. SPECIFIC SITE REQUIREMENTS

A. Measurement and Payment

Compensation for any work item described in the contract documents but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and bid items to which they are made subsidiary are identified in Items of Work and Construction Details section of this specification.

For items of work which lump sum prices are established in the contract, the quantity of work will not be measured for payment. Payment for each item will be made at the contract lump sum price and will constitute full compensation for completion of the work.

For items of work for which specific unit prices are established in the contract, the payment will be made based on the approved quantity measured by the engineer or weight tickets. Payment will constitute full compensation of the work completed as defined by each work item.

B. Items of Work and Construction Details

"Structure and Waterway/Channel Seeding":

1. Bid Item No. 2

This item will consist of seeding the dike except the upstream side slope below the weir elevation, auxiliary spillway, the tile outlet channel side slopes and any other disturbed areas noted on the plans or as determined by engineer.

All seed must be clean and weed free. Seeding rates are expressed in bulk pounds per acre. Seed quality shall not drop below 70% Pure Live Seed (PLS) where PLS = (percent germination plus percent dormant seed) times percent purity.

Seeding rates are as follows:

Smooth Brome grass	25 pounds/acre

Seed shall be applied with a drill and placed at ¼ to ½ inch deep.

Fertilizer shall be applied on the entire seeding area at the following rate:

Nitrogen (N)	30 pound/acre
Phosphorus (P_2O_5)	30 pounds/acre
Potassium (K_2O)	40 pounds/acre

Straw mulch shall be applied at a rate of 2 tons per acre on all areas receiving structure and channel seeding.

Seeding shall be completed during the following seeding periods:

Spring	March 1 to May 15
Summer	August 1 to September 15
Fall	November 15 to Freeze-up

If construction is completed during any other time of the year, the seeding shall be performed at the next seeding period.

If seeding is completed during the spring seeding period, a companion crop of oats shall be seeded at a rate of 1-1/2 bushels per acre.

Measurement will be based on the areas successfully seeded to the nearest 0.1 acre.

“Buffer Seeding”:

2. Bid Item No. 3

This item will consist of seeding the areas designated on the plans as buffer seeding and include borrow areas, disturbed areas not seeded as part of structural seeding, and other areas within the easement. Buffer seeding is not required in area below normal pool elevation established by the weir elevation.

Some areas of the site may have existing CRP vegetation or steep slopes with existing vegetation. Local NRCS personnel will determine if these areas will be included as part of the buffer seeding areas for this project or will be left as is. This may affect the bid quantity and Contractor will verify with Engineer the number of acres that will require buffer seeding.

All seed must be clean and weed free. Seeding rates are expressed in pounds of pure live seed per acre. All seed must be yellow-tagged Iowa ecotype unless approved otherwise by IDALS-DSCWQ.

Seeding mixture shall include a minimum of 5 native grasses and 10 native forbs. The mixture shall provide a minimum of 30 grass seeds per square foot and 10 forbs seeds per square foot. Number of seeds will be based on Iowa Conservation Practice 327 “Native Species for Wildlife”. Contractor’s proposed seed mix shall be submitted to Engineer and local NRCS office for approval at least 2 weeks before seed is to be applied.

Seeding shall be completed during the following seeding periods:

Spring	April 1 to June 30
Fall	November 15 to Freeze-up

The seed bed shall be properly prepared prior to seeding:

(a) Any weed control measures shall be completed prior to seeding. If spraying is used, then a span of two weeks shall be allowed between spraying and seeding.
(b) If the land was in soybeans, no additional tillage is required. If the land was in corn or other vegetation, areas to be seeded shall be disked to thoroughly loosen and pulverize the soil to a depth of 3 inches. This may require multiple passes of equipment. If the land was used for pasture and has a smooth surface, the preparation in non-disturbed areas to be seeded shall include mowing any vegetation taller than 12 inches and applying an appropriate herbicide at the labeled rates to emergent growth 2 to 4 weeks after mowing. After the vegetation has died, the area shall be disked thoroughly loosen and pulverize the soil depth of 3 inches. If emergent growth occurs prior to seeding, the areas shall receive a second application of herbicide. Seeding shall not occur until the existing vegetation has died (about 1 week).
(c) If deeper disking is used at the site, a lighter disk or spring harrow shall be used to remove deep furrows.
(d) After disking operations and prior to seed application, the seedbed shall be firmed with a cultipacker or similar piece of equipment.
(e) No lime or fertilizer is to be applied.

Sow seed with 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. Overlap each successive seeding pass to ensure complete coverage.

Plant seed not more than 1/4 inch deep; some seed may be seen on the surface after seeding.

Broadcasting by centrifugal-type or hydroseeder broadcasters, or by hand shall be allowed in areas not accessible to drills or other equipment. Once broadcast, the seed must be covered with soil to a depth no greater than 1/4 inch by means of hand rakes or other approved methods.

Upon completion of the seeding operation, cultipack the seedbed to provide a positive seed-soil contact. If the drill seeder is equipped with an approved cultipacker or press wheels, separate operations shall not be necessary. The type of cultipacker/seeder to be used shall be subject to acceptance by Engineer.

No mulch shall be required.

Measurement will be based on the area successfully seeded and measured to the nearest 0.1 acre.

3. Weed Control (Not a Bid item)

Weed control may be needed in portions of this site depending upon the start date of the contract, the initiation of grading, and the seeding dates.

Weed control will be added to the contract with a change order to be negotiated between Contractor and Division based on conditions observed and the type of weed control used and will be paid only once. If delays require additional weed control, this will be paid for at Contractor's own expense.

Weed control may include placement of a cover crop such as oats or rye, spraying with appropriate chemicals, or disking. If thistles are present, only spraying is allowed for weed control and shall include appropriate chemicals designed to control thistles.

NATURAL RESOURCES CONSERVATION SERVICE
CONSTRUCTION SPECIFICATION

Construction Specification 8—Mobilization and Demobilization

1. SCOPE

The work consists of the mobilization and demobilization of the contractor's forces and equipment necessary for performing the work required under the contract. It does not include mobilization and demobilization for specific items of work for which payment is provided elsewhere in the contract. Mobilization will not be considered as work in fulfilling the contract requirements for commencement of work.

2. EQUIPMENT AND MATERIAL

Mobilization shall include all activities and associated costs for transportation of contractor's personnel, equipment, and operating supplies to the site; establishment of offices, buildings, and other necessary general facilities for the contractor's operations at the site; premiums paid for performance and payment bonds including coinsurance and reinsurance agreements as applicable; and other items specified in section 4 of this specification.

Demobilization shall include all activities and costs for transportation of personnel, equipment, and supplies not required or included in the contract from the site; including the disassembly, removal, and site cleanup of offices, buildings, and other facilities assembled on the site specifically for this contract.

This work includes mobilization and demobilization required by the contract at the time of award. If additional mobilization and demobilization activities and costs are required during the performance of the contract as a result of changed, deleted, or added items of work for which the contractor is entitled to an adjustment in contract price, compensation for such costs will be included in the price adjustment for the item or items of work changed or added.

3. PAYMENT

Payment will be made as the work proceeds, after presentation of paid invoices or documentation of direct costs by the contractor showing specific mobilization and demobilization costs and supporting evidence of the charges of suppliers, subcontractors, and others. When the total of such payments is less than the lump sum contract price, the balance remaining will be included in the final contract payment. Payment of the lump sum contract price for mobilization and demobilization will constitute full compensation for completion of the work.

Payment will not be made under this item for the purchase costs of materials having a residual value, the purchase costs of materials to be incorporated in the project, or the purchase costs of operating supplies.

4. ITEMS OF WORK AND CONSTRUCTION DETAILS

A. Measurement and Payment

Compensation for any work item described in the contract documents but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and bid items to which they are made subsidiary are identified in Items of Work and Construction Details section of this specification.

For items of work which lump sum prices are established in the contract, the quantity of work will not be measured for payment. Payment for each item will be made at the contract lump sum price and will constitute full compensation for completion of the work.

For items of work for which specific unit prices are established in the contract, the payment will be made based on the approved quantity measured by the engineer or weight tickets. Payment will constitute full compensation of the work completed as defined by each work item.

B. Items of Work and Construction Details

1. Bid Item No. 4

This item shall consist of mobilizing and demobilizing personnel and equipment in preparation to perform the work within the scope of this contract.

Any work that is necessary to provide access to the site including, but not limited to, grading, temporary culverts, and clearing will be included in this item. When construction is completed access areas will be restored, as close as practical, to its original condition.

Any fence removed for access and /or to provide work area shall be replaced with same or like materials as approved by the engineer.

The Contractor shall exercise caution to minimize the amount of damage caused by the grading and clearing operations.

Portable toilets shall be provided at the construction site and used for the sanitary facilities.

This item shall not include transportation of personnel, equipment and operating supplies within the work limits areas of this contract.

Payment will constitute full compensation for related subsidiary item, Pollution Control.

Payment will be made as the work proceeds and will paid out on the percent of the project complete as the work progresses. Payment of the lump sum contract price for mobilization and demobilization will constitute full compensation for the completion of the work.

Contractor is to contact “Iowa One Call” for utility locations a minimum of two (2) days prior to any excavation/construction. The ticket number must be provided to Engineer.

2. Subsidiary Item – Sign Installation

This item shall include all labor, materials, equipment and Iowa One Call notifications to install sign provided by Iowa Department of Agriculture and Land Stewardship, as shown on the plans or on next page.

NATURAL RESOURCES CONSERVATION SERVICE
CONSTRUCTION SPECIFICATION

IA-9 SUBSURFACE DRAIN INVESTIGATION, REMOVAL, AND REPAIR

1. SCOPE

The work shall consist of investigation, location, repair, and/or removal of subsurface drains (tile) near new or existing animal waste storage facilities or in wetland restoration, enhancement, or creation project areas, or other situations where subsurface drains may be present.

2. INVESTIGATION AND LOCATION

An inspection trench at least 10 inches wide shall be dug at the location shown on the drawings or as directed by the engineer or his representative. The trench shall be at least 6 feet deep measured from the original ground line, unless otherwise shown on the plans. The Engineer or his representative shall examine the trench and excavated material to identify tile lines.

Size, material, operating condition and direction of flow of each conduit shall be documented. Location and flow line elevation of each conduit shall be surveyed with horizontal and vertical control based on benchmarks shown on the plans.

The inspection trench shall be documented by surveying the natural ground and trench bottom location and elevations at the beginning, end, and every 50 feet for trenches longer than 50 feet.

Backfilling shall not be started without approval of the Engineer. See Section 5 for backfill specifications.

Trench shields, shoring and bracing, or other methods necessary to safeguard the workers and work, and to prevent damage to the existing improvements shall be furnished, placed, and subsequently removed by the contractor.

3. TILE REPAIR

Unless designated for removal, replace damaged conduit with new conduit having equal or greater capacity using material specified in Section 6 or 7. When replacing short sections of clay or concrete tile with single-wall corrugated polyethylene pipe, use the next larger nominal size.

Make connections with manufactured fittings and tight joints. Where joints have gaps that would allow soil to enter, cover the joint with a permanent type material such as coal tar pitch treated roofing paper, fiber glass sheet or mat, or plastic sheet.

If the investigation trench has been excavated below the existing drain grade, backfill the trench with gravel or well-pulverized soil in layers not over four (4) inches thick and tamp by hand or manually directed power tamper to provide a firm foundation for the conduit at the existing grade. Do not backfill with any soil containing broken tile fragments.

Using selected soil free of hard clods, rocks, or frozen soil, hand tamp the backfill material around the haunch of the pipe in layers not over four (4) inches thick to provide support. Hold the conduit in place

mechanically while placing excavated material around and over the conduit to ensure proper alignment and grade is maintained. Complete the backfill operation according to Section 5.

4. TILE REMOVAL

Remove conduits as shown on the plans or directed by the Engineer or his representative, including envelope filter material or other flow enhancing material when present.

Cap or plug the open ends of the disconnected conduit to prevent soil entry when the conduit will continue to function downstream, or otherwise shown on the plans. For a minimum distance of two feet around each sealed conduit end, backfill in layers not over four (4) inches thick and tamp by hand or manually directed power tamper to a density equal to or greater than the surrounding undisturbed soil. Do not backfill with any soil containing broken tile fragments, large stones, frozen material, or large dry clods.

Where tile are located beneath an existing animal waste facility, remove the tile or fill the entire length of tile with concrete or Portland cement grout as shown on the plans. When tile removal is specified, the owner shall contact the Iowa Department of Natural Resources (IDNR) for permission to remove the drainage tile under the structure. The structure shall be emptied of waste or lowered to a point below the tile prior to its removal. The structure must be retested for percolation and the results submitted to IDNR and approval received prior to reusing the structure.

If shown on the plans or directed by the engineer, reroute upstream drain lines so the capacity of the upstream drainage system is maintained. Install conduit in accordance with Iowa Construction Specification IA-46, Tile Drains for Land Drainage.

5. BACKFILL

Compact soil around disturbed tile as specified in Section 3 (Tile Repair) and Section 4 (Tile Removal). Keep the backfill within 5 feet of the conduit free from large stones, frozen material, and large dry clods. Unless otherwise shown on the plans, backfill the remainder of the trench as follows:

For trenches located under or near structures, backfill in 12-inch layers and compact each layer to a density equal to or greater than the surrounding undisturbed soil.

For other locations, backfill the remainder of each trench with the excavated soil material which shall extend above the ground surface and be well rounded over the trench.

6. MATERIALS

Unless otherwise shown on the plans, conduit and fittings used for repair shall conform to the specifications listed in Table 1. Perforated pipe shall have a water inlet area of at least 1 square inch per foot, provided by perforations spaced uniformly along the long axis of the pipe. The perforations shall be circular or slots. Circular perforations shall not exceed 3/16 inch in diameter. Slots shall not be more than 1/8 inch wide.

Table 1. Acceptable pipe for subsurface drain repair

Kind of Pipe[#]	Specification
Corrugated Polyethylene (PE) Pipe and Fittings, 3 to 6 inch	ASTM F 405
Corrugated Polyethylene (PE) Pipe and Fittings, 3 to 24 inch	ASTM F 667
Corrugated Profile Wall (Dual Wall) Polyethylene (PE) pipe, 2 to 60 inch	ASTM F 2648[$]
Corrugated Profile Wall (Dual Wall) Polyethylene (PE) pipe, 12 to 60 inch	ASTM F 2306[$]
Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80 and 120	ASTM D 1785
PVC Pressure-Rated Pipe (SDR Series)	ASTM D 2241
Clay drain tile	ASTM C 4
Concrete drain tile	ASTM C 412

[#]Pipe sizes are nominal and the ranges are inclusive

[$]Pipe conforming to AASHTO M 252 (3 to 10 inch), or AASHTO M 294 (12 to 60 inch) is acceptable.

7. SPECIFIC SITE REQUIREMENTS

A. Measurement and Payment

Compensation for any work item described in the contract documents but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and bid items to which they are made subsidiary are identified in Items of Work and Construction Details section of this specification.

For items of work which lump sum prices are established in the contract, the quantity of work will not be measured for payment. Payment for each item will be made at the contract lump sum price and will constitute full compensation for completion of the work.

For items of work for which specific unit prices are established in the contract, the payment will be made based on the approved quantity measured by the engineer or weight tickets. Payment will constitute full compensation of the work completed as defined by each work item.

B. Items of Work and Construction Details

1. Bid Item No. 5

This item will consist of the excavation necessary to locate and remove all tile under the embankment and to locate and determine the tie-in locations for the tile locations shown on the plans. This item shall also include backfilling of the trenches.

This item does not include the additional excavation required to excavate the embankment core trench, if included in the project. Excavation of the core trench is covered under Specification IA-21, Excavation.

The extent of the tile investigation shall be as shown on the drawings. If extra work is required to locate additional tile not shown on the drawings, the Contractor can request additional compensation, but it must be first approved by the Division.

The investigation should reveal where the tile crosses the embankment footprint or where it is located if it does not cross the embankment footprint

Payment for Drainage Tile Investigation and removal shall be paid by linear foot of tile removal as indicated on the plans.

Construction Specification
000 IA-21 Excavation

1. SCOPE

The work shall consist of the excavation required by the drawings and specifications and disposal of the excavated materials. The cutoff trench and any other required excavations shall be dug to the lines and grades shown on the drawings or as staked in the field. Structure or trench excavations will conform to all safety requirements of OSHA.

2. USE OF EXCAVATED MATERIALS

Suitable materials from the specified excavations shall be used in the construction of required permanent earth fill. The suitability of materials for specific purposes shall be determined by the NRCS Inspector.

3. DISPOSAL OF WASTE MATERIAL

All surplus or waste material shall be disposed of in areas shown on the drawings or as approved by the NRCS Inspector. The waste material shall be smoothed and sloped to provide drainage.

4. STRUCTURE AND TRENCH EXCAVATION

Structure or trench excavations will conform to all safety requirements of OSHA.

5. BORROW EXCAVATION

When the quantities of suitable materials obtained from specified excavations are insufficient to construct the specified fills, additional materials shall be obtained from the designated borrow areas as shown on the drawings or as approved by NRCS and the landowner. On wetland projects, borrow shall not be taken from the wetland area within 10 feet of the embankment or as shown on the drawings.

Borrow areas shall be excavated and grading completed in a manner to eliminate steep or unstable side slopes or hazardous or unsightly conditions.

6. OVER-EXCAVATION

Excavation beyond the specified lines and grades shall be corrected by filling the resulting voids with compacted earthfill, except that if the earth is to become the subgrade for riprap, sand or gravel bedding or drainfill, the voids shall be filled with material conforming to the specifications for the riprap, bedding or drainfill, as appropriate.

7. SPECIFIC SITE REQUIREMENTS

A. Measurement and Payment

Compensation for any work item described in the contract documents but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and bid items to which they are made subsidiary are identified in Items of Work and Construction Details section of this specification.

For items of work which lump sum prices are established in the contract, the quantity of work will not be measured for payment. Payment for each item will be made at the contract lump sum price and will constitute full compensation for completion of the work.

For items of work for which specific unit prices are established in the contract, the payment will be made based on the approved quantity measured by the engineer or weight tickets. Payment will constitute full compensation of the work completed as defined by each work item.

The volume of excavation as provided in the bid quantities has been determined from the topographic information shown on the Drawings using a computer program. Payment will be made based on the planned quantities provided unless additional excavation is directed by the Engineer. Excavation resulting from the contractor's improper construction operations, as determined by the Engineer, is not included for measurement and payment.

B. Items of Work and Construction Details

"Excavation (General)":

1. Bid Item No. 6

This item will consist of excavation and grading of material needed for the following typical items as shown on Plan Sheet 1 and 2:

- Establishing pool grade
- Upstream channels to daylight tile
- Diversion channel
- Grassed waterway
- Blind inlets
- Core Trench

Excavations required for the placement of toe drain, tile exploration, new tile installation, concrete mat placement, are not included in this bid quantity and will not be measured for payment. The cost of excavation for these items are incidental and should be included as part of their corresponding bid items. Please note the quantities provided for stripping should be accounted for with Bid Item 1 – Topsoil Stripping.

This item does not include the excavation for site stripping or topsoil, which is covered under Specification IA-CS-001. "Site Preparation".

This item includes the hauling of excavated material to be used as earthfill or spoil.

The material excavated with suitable quality shall be used within the dike as directed by engineer.

Suitable excess excavated material shall be disposed of along top of banks for tile outlet channels or in designated areas by Engineer or Engineer's Representative.

See Specification IA-CS-023 for compaction method.

Payment will be based on plan quantity. If unsuitable material is found at the bottom of the core trench, the over excavation shall be measured and paid in a change order.

Payment will constitute full compensation for the following related Subsidiary items: Pollution Control; Removal of Water; and Structure Excavation.

2. Subsidiary Item – Borrow Excavation

This item will consist of excavation of the borrow area for placement of cohesive material in the embankment core and compacted clay liner, if included and as shown in the plans. The cost for excavation and transporting of borrow shall be included in corresponding bid Items listed in Specification IA-CS-023 “Earthfill”.

Borrow from any other area will not be allowed unless directed and approved by the Engineer.

The topsoil from the borrow area shall be removed to a minimum depth of 6" and stockpiled. When the borrow operations have been completed, grades shall be returned to that indicated on the plans and the topsoil shall be uniformly spread over the entire borrow area to a depth of 6".

No separate payment will be made for strip or respread of topsoil over borrow area.

3. Subsidiary Item – Structure Excavation

This item shall consist of the excavation necessary to install the steel sheet pile, riprap, corrugated metal pipe (CMP) conduit, CMP tile outlets and water control structure in the locations and as shown on the drawings.

No separate payment will be made for Structure Excavation. Compensation for this item will be included in payment with the corresponding bid items for CMP conduit; CMP water control structure; steel sheet pile; and riprap.

Construction Specification
000 IA-23 Earthfill

1. SCOPE

The work shall consist of the construction of earth fills required by the drawings and specifications. The completed work shall conform to the lines, grades, and elevations shown on the drawings or as staked in the field.

2. MATERIALS

All fill materials shall be obtained from required excavations and designated borrow areas. Fill materials shall contain no sod, brush, roots or other bio-degradable materials. Rocks larger than 6 inches in diameter shall be removed prior to compaction of the fill.

3. FOUNDATION PREPARATION

Foundations for earthfill shall be stripped a minimum of 6 inches to remove vegetation and other unsuitable materials. Foundation surfaces shall be scarified to a minimum depth of 2 inches prior to placing fill material.

Foundation and abutment surfaces shall not be sloped steeper than 1.5 horizontal to 1 vertical unless otherwise shown on the drawings.

4. PLACEMENT

Fill shall not be placed until the required excavation and foundation preparation have been completed and the foundation has been inspected and approved by NRCS. Fill shall not be placed upon a frozen surface, nor shall snow, ice, or frozen material be incorporated in the fill.

Adjacent to structures or pipes, fill shall be placed in a manner which will prevent damage. The height of the fill adjacent to structures or pipes shall be increased at approximately the same rate on all sides.

The materials used throughout the earth fill shall be essentially uniform. Selective placement shall be as shown on the drawings or approved by NRCS.

If the surface of any layer becomes too hard and smooth for proper bond with the succeeding layer, it shall be scarified to a minimum depth of 2 inches before the next layer is placed.

The top surfaces of embankments shall be maintained approximately level during construction, except that a cross-slope of approximately 2% shall be maintained to ensure effective drainage.

When moving fill material from the borrow area(s) to the embankment by use of bulldozers only, the following steps shall be followed:

- Immediately after the borrow material is pushed to the embankment, it shall be spread in horizontal lifts placed parallel to the centerline of the embankment.
- Compactive effort will then be applied by operating equipment parallel to the centerline of the fill or embankment.
- Lift thicknesses shall be in strict compliance with Clause 6, below.

Sectional fills are not allowed unless they are shown on the construction drawings.

5. CONTROL OF MOISTURE CONTENT

The moisture content of the fill material shall be adequate for obtaining the required compaction. Material that is too wet shall be dried to meet this requirement, and material that is too dry shall have water added and mixed until the requirement is met.

The moisture content of the fill material shall be such that a ball formed with the hands does not crack or separate when struck sharply with a pencil and will easily ribbon out between the thumb and finger.

Earth foundations under and adjacent to concrete structures shall be prevented from drying and cracking before concrete and backfill are placed.

The application of water to the fill materials shall be accomplished at the borrow areas insofar as possible.

6. COMPACTION

Earth fill shall be compacted by one of the following methods as specified on the plans or in Section 8, Special Specifications. If no method is specified, compaction will be in accordance with Method 1.

- Method 1 - Earthfill shall be placed so that the wheels or tracks of the loaded hauling equipment, traveling in a direction parallel to the centerline of fill, pass over the entire surface of each layer being placed. Low ground pressure vehicles shall not be used for this purpose.
- Method 2 - Two (2) complete passes of a tamping-type roller will be made over each layer. The roller shall be capable of exerting a minimum force of two hundred (200) pounds per square inch.
- Method 3 - Minimum density shall be 90% of the maximum density as determined by ASTM D 698 and as shown on the plans.

The maximum thickness of a lift of fill before compaction shall be 9 inches, unless otherwise indicated on the drawings.

Fill adjacent to structures, pipe conduits, and appurtenances shall be placed in layers not more than 4 inches thick and compacted to a density equivalent to that of the surrounding fill. Methods used to obtain compaction for fine or coarse grained materials are as follows:

- For fine grained materials, hand tamping or manually directed power tampers may be used. Hand compaction only shall be used to compact the earthfill under the bottom half of circular pipes. Manually directed power tampers shall not be used in tight spaces where applying full compactive effort will result in direct contact of the tamper plate with the pipe. Care should be taken so that compaction around the spillway pipe does not cause uplift of the pipe resulting in a void beneath the pipe.
- For coarse grained materials (sands and gravels), vibratory plate compactors shall be used for obtaining compaction. However, hand tamping shall be used to compact the material under the bottom half of circular pipes.

In all cases, follow manufacturer instructions for the specific compaction equipment being used. Heavy equipment shall not be operated within 2 feet of any structure or pipe.

Compacting of fill adjacent to concrete structures shall not be started until the concrete is 7 days old.

7. ISLANDS, MOUNDS, AND LOAFING AREAS ON WETLAND RESTORATION, ENHANCEMENT, OR CREATION PROJECTS

Islands shall be randomly located within the wetland area at locations shown on the drawings or as staked in the field. The orientation of island shorelines shall be random with attention given to prevailing

winds to limit wave damage. In general, the side of the island with the longest dimension shall be parallel to the prevailing wind direction. Side slopes of islands shall be as shown on the drawings, but in no case shall be steeper than 6 horizontal to 1 vertical. Island shapes shall be irregular.

Loafing areas shall be constructed in the areas shown on the drawings or as staked in the field and shall be graded to drain runoff water. The elevation of at least one loafing area should be above the maximum water level whenever possible.

Excavated material not suitable for embankments, wetland dikes, or islands can be used to create mounds or blended into surrounding topography to create a natural appearance. Spoil material shall not be spread on existing wetland areas.

Organic soils shall not be used to construct islands, loafing areas, dikes, or embankments.

8. SPECIFIC SITE REQUIREMENTS

A. Measurement and Payment

For items of work which specific unit prices are established in the contract, the volume of earthfill will be computed to the nearest cubic yard by the method of average cross-sectional end areas. No deduction in volume will be made for embedded items, such as, conduits inlet structures and their appurtenances. The pay limits for computation shall be as shown on the drawings with the further provisions that earthfill voids resulting from over excavation of the foundation, outside specified lines and grades, will be included in the measurement for payment only under the following conditions:

- Where such over excavation is directed by the engineer to remove unsuitable material, and
- Where the unsuitable condition is not a result of the contractor's improper construction operations as determined by the engineer.

Earthfill beyond the specified lines and grades to backfill excavation required for compliance with OSHA requirements will be considered subsidiary to the earthfill bid item(s).

Payment for each type and compaction class of earthfill and earth backfill is made at the contract unit price for that type and compaction class of earthfill. Such payment will constitute full compensation for all labor, material, equipment, and all other items necessary and incidental to the performance of the work.

Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in this specific section.

B. Items of Work and Construction Details

Items of work to be performed in conformance with this specification and the construction details therefore are:

“Earthfill (General)”:

1. Bid Item No. 6

This item shall consist of the earthfill necessary to construct the general grading required at the site. Cohesive material found during general grading can be used for these areas. Sand and gravel found on site shall not be used for this earthfill.

Compaction shall be Method 1.

Rocks larger than 6" shall be removed prior to compaction.

Payment for these items shall be based on plan quantity unless additional length or location of tile varies from what is shown on the plans. The plan quantity is based on neat lines and does not account for any shrinkage.

Payment will constitute full compensation for the following related Subsidiary items: Pollution Control, Removal of Water, and Backfill Required Excavation.

"Earthfill (Compacted)": Not Applicable to this Project

2. Bid Item No.

This item will consist of earthfill placement and compaction necessary to construct the portion of the embankment designated the embankment core, including the core trench. Cohesive material taken from the designated borrow area should be used for this area. Sand and gravel found on site shall not be used for fill for these items.

Compaction shall be Method 2.

Rocks larger than 6" shall be removed prior to compaction.

Payment for this item shall be based on plan quantity. The plan quantity is based on neat lines and does not account for any shrinkage.

Payment will constitute full compensation for the following related Subsidiary items: Pollution Control, Removal of Water, and Backfill Required Excavation.

3. Subsidiary Item – Backfill Required Excavation

This item shall consist of backfilling the areas excavated to install the other components related to the project such as piping or structures and to locate and remove the tile lines.

Compaction adjacent to the structures shall be as indicated above. All other compaction shall be Method 1 or equivalent.

No separate payment will be made for Backfill of Structure Excavation. Compensation for this item will be included in payment for Corrugated Metal Pipe; CMP Drawdown Structure; Riser Inlet Structure, Tile Investigation and Removal and Dual Wall HDPE.

Construction Specification
000 IA-45 Plastic (PVC, PE) Pipe

1. SCOPE

The work shall consist of furnishing and installing plastic pipe and the necessary fittings specified herein or as shown on the drawings. This specification does not cover subsurface drainage systems.

2. MATERIALS

Corrugated Polyethylene (PE) Tubing. Corrugated PE tubing and fittings shall conform to the requirements of the applicable specification listed below:

Kind of Pipe	Specification
Corrugated Polyethylene(PE) Tubing and Fittings,	
Nominal Sizes 3 to 6 inch, inclusive	ASTM F 405
Large Diameter Corrugated Polyethylene Tubing and Fittings,	
Nominal Sizes 8 to 24 inch, inclusive	ASTM F 667
Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe	ASTMF 894

Poly(Vinyl Chloride) (PVC) Plastic Pipe. PVC pipe and fittings shall conform to the requirements of the applicable specification listed below:

Kind of Pipe	Specification
PVC Plastic Pipe, Schedules 40, 80 and 120	ASTM D 1785
PVC Pressure-Rated Pipe (SDR Series)	ASTM D 2241
PVC Pressure Pipe, 4 in. through 12 in., for Water Distribution	AWWA C900
PVC Water Transmission Pipe, Nominal Diameters 14 in through 36 in	AWWA C905

PVC and PE Plastic Pipe. Plastic pipes meant for non-potable, livestock water supply shall conform to the requirements of the applicable specification listed below:

Kind of Pipe	Specification
Polyethylene (PE) Plastic Pipe, (SIDR-PR) Based on	
Controlled Inside Diameter	ASTM D 2239
PVC Pressure-Rated Pipe (SDR Series)	ASTM D 2241

3. FITTINGS AND JOINTS

Pipe joints shall conform to the details shown on the drawings. Pipe shall be installed and joined in accordance with the manufacturer's recommendations.

Joints may be bell and spigot type with elastomeric gaskets, coupling type with elastomeric gasket on each end, or solvent cemented. Gaskets shall conform to ASTM D 1869. Solvent cemented joints shall not be used for pond spillway pipes. Solvent cemented joints for PVC pipe and fittings shall be in

accordance with ASTM D 2855. When a lubricant is required to facilitate joint assembly, it shall be a type having no detrimental effect on the gasket or pipe material.

Mechanical joints (split couplings and snap couplings) may be used when joining PE pipe and fittings when the pipe is used for non-pressure flow and a free draining sand or gravel bedding material is provided. Elastomeric-sealed mechanical joints shall be used when joining PE pipe and fittings under pressure flow or where seepage cannot be tolerated. Where non-pressure pipe is specified, the fittings shall be of the same or similar materials as the pipe and shall provide the same durability and strength as the pipe.

A special case of livestock water supply involves pipes through a dam or embankment. Only PE pipe meeting the above specification may be used. PE pipe, of 1 ¼, 1 ½, or 2-inch diameter shall be installed so that there are no joints within the embankment area.

Where pressure pipe is specified, fittings shall have a design capacity equal to or exceeding that specified for the pipe to which it is attached. Fittings shall be cast iron, steel, one piece injection molded plastic fitting or fabricated from plastic pipe and one piece injection molded plastic fittings. Pressure pipe fittings shall conform to the requirements of the applicable specification listed below.

Kind of Fitting	Specification
Threaded PVC Plastic Pipe Fittings, Schedule 80	ASTM D 2464
PVC Plastic Pipe Fittings, Schedule 40	ASTM D 2466
PVC Plastic Pipe Fittings, Schedule 80	ASTM D 2467
Butt Heat Fusion (PE) Plastic Fittings for PE Plastic Pipe and Tubing	ASTM D 3261
Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals	ASTM D 3139
PVC Pressure Pipe, 4 in. through 12 in., for Water Distribution	AWWA C900
PVC Water Transmission Pipe, Nominal Diameters 14 in through 36 in	AWWA C905

4. HANDLING AND STORAGE

Pipe shall be delivered to the job site and handled by means which provide adequate support to the pipe and does not subject it to undue stresses or damage. When handling and placing plastic pipe, care shall be taken to prevent impact blows, abrasion damage, and gouging or cutting (by metal surfaces or rocks). All special handling requirements of the manufacturer shall be strictly observed. Special care shall be taken to avoid impact when the pipe must be handled at temperatures of 40 degrees F (4.4 degrees C) or less.

Pipe shall be stored on a relatively flat surface so that the barrels are evenly supported. Unless the pipe is specifically coated to withstand exposure to ultraviolet radiation, it shall be covered with an opaque material when stored outdoors for a period of 15 days or longer.

5. TRENCHING

Plastic pipe conduits shall be installed in trenches or plowed in according to the following methods:

1. **Trencher Constructed -** When conditions permit, trenching for pipelines, which are buried from 5 to 6 feet deep, are usually done with a narrow 4 to 6 inch wide chain trencher. Where there is little gravel and the ground is not too wet, these trenchers bring up well pulverized soil that makes good backfill material. Where rocks are not present, any of this material may be backfilled directly around the pipe. There is no practical way to compact the fill in these narrow trenches. The owner must be made aware that this material normally consolidates to its maximum extent in two to five years, but depressions or low spots can be hazards to livestock, humans and equipment.

2. **Backhoe Constructed Trench** – Backhoe trenches are usually a minimum of 12 inches wide. The material frequently comes out of the trench as clods, large chunks, and rocks. Immediately backfill over the pipe with 4 to 6 inches of soil that is free of these clods, large chunks, and rocks. If adequate excavated material is not available, then material such as sand or fine gravel should be imported and placed around the pipe to a depth of 4 to 6 inches over the top of the pipe. Fill the trench with the remaining excavated material.
3. **Plowing** – Plowing, or ripping, is a trenchless method for installing plastic pipe. It is a multi-stage process consisting of positioning a vibrating or static (non-vibrating) plow equipped with a trailing product guide which feeds pipe to the depth setting of the plow as it moves forward. The pipe is inserted into the ground continuously along a predetermined path and depth. The vertical depth of installation is controlled by hydraulic adjustment of the plow shear head and the surface contours. The depth of insertion must be continually adjusted to compensate for changes in terrain.

6. LAYING AND BEDDING THE PIPE

Plastic pipe conduits and fittings shall be installed as shown on the drawings and specified herein. The pipe shall be laid so that there is no reversal of grade between joints, unless otherwise shown on the drawings. The pipe shall be placed with the bell end upstream, unless otherwise specified. The pipe shall be carefully placed on the bedding or into the pipe trench.

Care shall be taken to prevent distortion and damage during unusually hot (over 90 degrees F) or cold weather (under 40 degrees F). After the pipe has been assembled in the trench, it shall be allowed to reach ground temperature before backfilling to prevent pull out of joints due to thermal contraction.

The pipe ends and the couplings shall be free of foreign material when assembled. During the placement of the pipe, each open end of the pipeline shall be closed off by a suitable cover or plug at the end of work on the pipeline each day and until work resumes or installation is complete.

Perforated pipe shall be laid with the perforations down and oriented symmetrically about the vertical centerline. Perforations shall be clear of any obstructions when the pipe is laid.

Pipe shall be firmly and uniformly supported throughout the entire length. Bell-holes shall be made in the bedding under bells or couplings and other fittings to prevent the pipe from being supported by fittings.

1. Earth Bedding. When bedding is specified, the pipe shall be firmly and uniformly bedded in a shaped bedding groove that closely conforms to the bottom of the pipe for a depth equal to a minimum of 1 inch or 5 percent of the diameter of the pipe, whichever is greater. The bedding material shall be free of rocks or stones greater than 0.5 inch diameter and earth clods greater than 2 inch diameter.

2. Sand or Gravel Bedding. When sand or gravel bedding is specified, the pipe shall be firmly and uniformly placed on a sand or gravel bed. Sand or gravel fill shall be carefully placed and compacted as specified herein and as shown on the drawings.

A few installations of above ground pipelines have been noted. These installations are normally laid directly on the ground and very close to an existing fence line for protection. Only those pipelines designed to withstand exposure to ultraviolet radiation may be utilized for these installations.

Adequate thrust control shall be incorporated in these installations.

7. BACKFILL

The pipe shall be held down during backfilling to the top of the pipe to prevent its being lifted from its original placement.

Within 2 feet of the pipe, backfill shall be carefully placed and compacted by means of hand tamping or manually directed power tampers or plate vibrators to form a continuous uniform support around the pipe. Maximum thickness of layers before compaction within 2 feet of the pipe shall be 4 inches and at more than 2 feet from the pipe a maximum thickness before compaction shall be 9 inches. Unless otherwise specified, the initial backfill shall be compacted to a density equivalent to that of the adjacent fill or foundation materials.

The water content of cohesive backfill material shall be such that, kneaded in the hand, the soil will form a ball which does not readily separate. For non-cohesive sand and gravel backfill material, water content is not a concern for thin lifts.

8. SPECIFIC SITE REQUIREMENTS

A. Measurement and Payment

Compensation for any work item described in the contract documents but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and bid items to which they are made subsidiary are identified in Items of Work and Construction Details section of this specification.

For items of work which lump sum prices are established in the contract, the quantity of work will not be measured for payment. Payment for each item will be made at the contract lump sum price and will constitute full compensation for completion of the work.

For items of work for which specific unit prices are established in the contract, the payment will be made based on the approved quantity measured by the engineer or weight tickets. Payment will constitute full compensation of the work completed as defined by each work item.

B. Items of Work and Construction Details

PVC Plastic (PVC, PE) pipe:

1. Bid Item No. 8

This item will consist of furnishing and installing the PVC or PE pipe to be used where watertight connections are necessary, or where seepage is not allowed, as shown on the drawings.

Measurement and payment for the PVC or PE pipe shall be on an installed linear foot basis, and shall include all necessary fittings and adapters, elbows, trash guards, rodent guards, watertight joints, excavation and backfill.

2 Bid Item No. 9

This item will consist of providing and installing the Drawdown Structure, stop logs, and gravel base as shown on the drawings.

Provide detailed shop drawings of the Drawdown Structure and all appurtenances.

Contractor shall furnish two metal lifting rods with hook end and handles capable of lifting supplied stop logs while standing on the surface above the drawdown structure. The length of the lifting rod shall allow for storage in the drawdown structure while allowing for reaching the lower stop log.

Measurement and payment for Drawdown Structure shall be on a lump sum basis.

Subsidiary items include gravel base, excavation and backfill, and control of water.

NATURAL RESOURCES CONSERVATION SERVICE
CONSTRUCTION SPECIFICATION

IA-46 TILE DRAINS FOR LAND DRAINAGE

1. SCOPE

The work shall consist of furnishing and installing drainage tubing and tile and the necessary fittings and appurtenances.

2. MATERIALS

Concrete drain tile shall conform to the requirements of ASTM C 412 and clay drain tile shall conform to the requirements of ASTM C 4.

Corrugated polyethylene (PE) pipe (tubing) and fittings shall conform to ASTM F 405 (3" to 6") or F 667 (3" to 24"), as appropriate. Corrugated profile wall (dual wall) polyethylene (PE) pipe shall meet or exceed the requirements of ASTM F 2648 (2" to 60") or ASTM F 2306 (12" to 60"). Pipe conforming to AASHTO M 252 (3" to 10") or AASHTO M 294 (12" to 60") is acceptable. Perforated tubing shall have a water inlet area of at least 1 square inch per foot, provided by perforations spaced uniformly along the long axis of the tubing. The perforations shall be circular or slots. Circular perforations shall not exceed 3/16 inch in diameter. Slots shall not be more than 1/8 inch wide.

3. EXCAVATION

Unless otherwise specified, excavation for and subsequent installation of each drain line shall begin at the outlet end and progress upstream.

The trench or excavation for the tile shall be constructed to the line, depths, cross sections, and grade shown on the drawings or as directed by the NRCS Inspector. The trench bottom shall be smooth and free of exposed rock. If rock is encountered in the trench bottom, over-excavate the trench and place at least 6 inches of compacted earth or sand bedding in the trench to bring it up to the conduit grade.

If not otherwise shown on the drawings, trench width at the top of the conduit shall be the minimum required to permit installation and provide bedding conditions suitable to support the load on the conduit, but with not less than three (3) inches of clearance on each side of the conduit. Maximum trench width shall be the conduit diameter plus 12 inches measured at the top of the conduit, unless approved bedding is installed.

Trench shields, shoring and bracing, or other methods, necessary to safeguard the workers and work, and to prevent damage to the existing improvements shall be furnished, placed, and subsequently removed by the contractor.

Plow installation is allowed. Minimum trench width shall be two (2) inches wider than the conduit on each side. Grade control and bedding conditions shall be closely inspected during plow installation. Boulders, cobbles, or cemented soil scan cause the plow to jump or lose grade. These hardpoints can also puncture or dimple and deform the pipe.

4. PREPARING THE BEDDING

Unless otherwise specified, no filter or envelope is required. In stable soils the bottom of the trench shall be shaped to form a semicircular, trapezoidal, or 90 degree "V" groove in its center. The groove shall be shaped to fit the size of tile. The 90-degree "V" groove shall not be used on conduits greater than 6 inches in diameter.

If the bottom of the trench does not provide a sufficiently stable or firm foundation for the drain tile, a sand-gravel mix or other approved materials shall be used to stabilize the bottom of the trench.

5. FILTER OR ENVELOPE MATERIAL

When a filter is specified, the shape of the bottom of the trench, gradation and the thickness of the filter or envelope material to be placed around the tile will be as shown on the drawings. The envelope or filter material shall be placed in the bottom of the trench just prior to the laying of the tile. The tile shall then be laid and the envelope or filter material placed over the tile.

6. PLACEMENT AND JOINT CONNECTIONS

All drains shall be laid to grade.

Joints between lateral drain tile shall vary with soil type as follows:

a. Peat and muck - 1/4 inch preferred, 3/8 inch maximum
b. Clay - 1/8 inch preferred, 1/4 inch maximum
c. Silt and loam - 1/16 inch preferred, 1/8 inch maximum
d. Sand - tightest possible fit.

Joint between main drain tile which serve only to collect and transport drainage water from lateral tile lines should be the tightest fit possible.

Where the joint width exceeds the maximum above, the joint shall be covered with a permanent type material such as coal tar pitch treated roofing paper, fiber glass sheet or mat, or plastic sheet.

After placement and blinding of plastic tubing, but prior to backfilling, sufficient time shall elapse to allow the tubing to reach the ambient temperature of the trench. All split fittings shall be securely tied with nylon cord before backfill is placed. When corrugated plastic tubing is used, no more than 5% stretch will be allowed.

7. CONNECTIONS

Lateral connections will be made with manufactured appurtenances (wyes, tees, etc.) comparable in strength and durability with the specified tile or tubing unless otherwise shown on the drawings.

Existing tile lines not shown on the drawings but encountered during installation shall be bridged across the trench or connected into the new line, as directed by NRCS.

Connections with the outlet pipe shall be made watertight.

8. OUTLETS

A continuous section of non-perforated conduit at least 20 feet long shall be used at the outlet. At least two-thirds of the outlet pipe shall be buried in the ditch bank, and the cantilever section must extend to the toe of the ditch side slope or the side slope protected from erosion. Acceptable materials for use at the outlet include the following:

a. Corrugated metal pipe, galvanized or aluminum, 16 gauge minimum;
b. Smooth steel pipe with a minimum wall thickness of 3/16 inch;
c. Smooth plastic pipe, polyvinyl chloride (PVC), with a SDR of 26 or less or schedule 40 or heavier; or
d. Corrugated profile wall (dual wall) polyethylene pipe (PE).

All plastic (PVC) and polyethylene pipe (PE) outlets shall include ultra-violet stabilizer. PVC or PE pipe outlets shall not be used where burning vegetation on the outlet ditch bank is likely to create a fire hazard.

The outlet shall be equipped with a flap-gate type rodent guard.

9. BLINDING

After the tubing or tile is placed in the excavated groove, friable material from the sides of the trench shall be placed around the tubing, completely filling the trench to a depth of not less than three inches over the top of the tubing. For material to be suitable it must not contain hard clods, rocks, frozen soil, or fine material which will cause a silting hazard to the drain. Tubing placed during any one day shall be blinded by the end of the day's work.

10. BACKFILLING

The backfilling of the trench shall be completed as rapidly as consistent with the soil conditions. Automatic backfilling machines may be used. Backfill shall extend above the ground surface and be well rounded over the trench.

Unless otherwise shown on the plans, in mineral soils, the minimum cover over subsurface drains shall be 2.4 feet. In organic soils, the minimum depth of cover after initial subsidence shall be 3.0 feet.

11. SPECIAL SPECIFICATIONS

A. Measurement and Payment

Compensation for any work item described in the contract documents but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and bid items to which they are made subsidiary are identified in Items of Work and Construction Details section of this specification.

For items of work which lump sum prices are established in the contract, the quantity of work will not be measured for payment. Payment for each item will be made at the contract lump sum price and will constitute full compensation for completion of the work.

For items of work for which specific unit prices are established in the contract, the payment will be made based on the approved quantity measured by the engineer or weight tickets. Payment will constitute full compensation of the work completed as defined by each work item.

B. Items of Work and Construction Details

1. Bid Items No. **10-12**

This item will consist of furnishing and installing corrugated Polyethylene pipe used as a drain tile as shown on the drawings.

Measurement and payment for the corrugated Polyethylene pipe shall be on an installed linear foot basis, and shall include all necessary fittings and adapters.

Payment will also include all subsidiary items required for installation such as trench excavations, backfill, site preparation, and removal of water, and concrete collar at joints. Additional fill required to provide adequate cover as needed is included in Earthfill, General.

Construction Specification
000 IA-51 Corrugated Metal Pipe Conduits

1. SCOPE

The work shall consist of furnishing and placing circular, arched or elliptical corrugated metal pipe and the necessary fittings.

2. MATERIALS

Metallic-coated steel corrugated pipe and fittings shall be zinc-coated or aluminized, Type 2, and shall conform to the requirements of ASTM A 760 and A 929 for the specified type and size of pipe. Aluminum corrugated pipe shall conform to the requirements of ASTM B 745 for the specified type and size of pipe. All pipe is subject to the following additional requirements:

1. When polymer coating is specified, pipe, coupling bands and anti-seep collars shall be coated in accordance with ASTM A 762. All riveted joints shall be caulked as described in paragraph B.
2. Pipe with annular corrugations shall be furnished with caulked seams. Riveted pipe joints shall be caulked with a bituminous mastic material during fabrication to provide a watertight joint. All circumferential and longitudinal seams shall be caulked before riveting. This shall be accomplished by applying a uniform bead of the mastic compound to the inner lap surface before riveting such that when the rivets are in place, all voids are filled and a coating of mastic is between the lap surfaces. The inner surface of coupling bands shall be asphalt coated in the field prior to installation. A neoprene gasket having a minimum thickness of 3/8 inch and a minimum width of 7 inches may be used in lieu of mastic coated coupling bands.
3. Welded or lock seams in helical corrugated pipe are considered to be watertight.
4. When close riveted pipe is specified: (1) the pipe shall be fabricated so that the rivet spacing in the circumferential seams shall not exceed 3 inches, except that 12 rivets will be sufficient to secure the circumferential seams in 12-inch pipe, and (2) in those portions of the longitudinal seams that will be covered by the coupling bands, the rivets shall have finished flat heads or the rivets and holes shall be omitted and the seams shall be connected by welding to provide a minimum of obstruction to the seating off the coupling bands.
5. Double riveting or double spot welding of pipe less than 42 inches in diameter may be required. If specified, the riveting or welding shall be done in the manner specified for pipe 42 inches or greater in diameter.

3. COUPLING BANDS

Coupling bands shall meet the requirements of the table below or have detailed drawings submitted for approval by the State Conservation Engineer. Coupling bands shall be of the same minimum thickness (gage) as the pipe being connected.

4. FABRICATION

Fabrication of all appurtenances shall be done as shown on the drawings. All appurtenances shall be made of metallic-coated steel when corrugated steel pipe is used and aluminum when used with aluminum pipe. Dissimilar metals shall not be installed in contact with each other.

Description of Coupling Band	Maximum Fill Height, Ft.	Maximum Pipe Diam., In.
24-inch wide coupling band with four 1/2-inch Diam. galvanized rods with tank lugs for annular or helical corrugated metal pipe. Bands shall have a minimum lap of 3 inches.	All	All
Hugger band from Armco Steel Corp. for helical corrugated metal pipe with reformed ends; and for annular corrugated pipe. Bands include O-ring gaskets and two 1/2-inch Diam.	35	48
Hugger band without rods and lugs but	20	24
Angles riveted or welded to a coupling band and drawn tight with bolts. Bands shall be a minimum of 7 corrugations wide and have a minimum lap of 2 inches.	35	15
Flanged couplings for helical corrugated 25 12 pipe welded to the ends of the pipe and field assembled by a minimum of 3/8-inch Diam. bolts. A joint sealer shall be placed between the flanges to ensure water tightness	25	12
1/ Use is limited to sites where soft foundation and conduit elongation is not anticipated.		

5. REPAIR OF DAMAGED COATINGS

The Contractor shall place the pipe without damaging the pipe or coatings. The pipe shall be transported and handled in a manner to prevent damage to the pipe or coating. Breaks, scuffs, or other damage to the various coatings shall be repaired as follows:

1. Metallic Coating - by thoroughly wire brushing the damaged area and cleaning with solvent, and then painting two coats of one of the following paints:
   a. Zinc Dust - Zinc Oxide Primer conforming to ASTM D 79 and D 520.
   b. Single package, moisture cured urethane prime in silver metallic color.
   c. Zinc-rich cold galvanized compound, brush, or aerosol applications.
2. Polymer Coating - apply two coats of polymer material similar to and compatible with the durability, adhesion and appearance of the original polymer coating. The repair coating shall be a minimum thickness of 0.010 (10 mils) after drying and shall bond securely to the pipe.

6. LAYING AND BEDDING THE PIPE

The pipe shall be laid to the line and grade shown on the drawings and shall be firmly and uniformly bedded throughout its entire length. Details of the bedding are as shown on the drawings.

The pipe shall be laid with the outside laps of circumferential joints pointing upstream and with longitudinal laps on the sides at approximately the vertical mid-height of the pipe. Field welding of corrugated galvanized steel pipe will not be permitted. The pipe sections shall be joined with coupling bands.

7. BACKFILLING

Special care shall be taken during backfill operations not to disturb the grade and alignment.

The pipe shall be tied down or loaded sufficiently during backfilling around the sides to prevent its being lifted from the bedding.

Backfill material shall have sufficient moisture so that optimum compaction can be obtained. Backfill around the pipe shall be placed in layers not more than 4 inches thick before compaction.

Each layer of backfill shall be compacted with power tampers, hand tampers, or plate vibrators to the same density requirements as specified for the adjacent embankment. Backfill over and around the pipe shall be brought up uniformly on all sides. The passage of earth moving equipment will not be allowed over the pipe until backfill has been placed above the top of the pipe surface to a depth of two (2) feet.

8. SPECIFIC SITE REQUIREMENTS

A. Measurement and Payment

Compensation for any work item described in the contract documents but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and bid items to which they are made subsidiary are identified in Items of Work and Construction Details section of this specification.

For items of work which lump sum prices are established in the contract, the quantity of work will not be measured for payment. Payment for each item will be made at the contract lump sum price and will constitute full compensation for completion of the work.

For items of work for which specific unit prices are established in the contract, the payment will be made based on the approved quantity measured by the engineer or weight tickets. Payment will constitute full compensation of the work completed as defined by each work item.

B. Items of Work and Construction Details

"Tile Outlets":

1. Bid Item No. 13-14

This item will consist of furnishing and installing the CMP pipe and fittings shown on the plans for tile outlets, including animal guard at outlet end of pipe.

The corrugated metal pipe shall be 16-gauge minimum, zinc coated or aluminum coated with annular or helical corrugations.

Connect dissimilar pipes with manufactured adapters or couplings if available. A concrete collar shall be used as shown on the plans. Connections shall be watertight.

Installation shall be so at least two-thirds of the outlet pipe shall be buried in the ditch bank, and the cantilever section must extend to the toe of the ditch side slope or the side slope protected from erosion.

Measurement and payment shall be on an installed item basis will constitute full compensation for this bid item and related subsidiary items.

Payment will constitute full compensation for the following related items: Pollution Control, Removal of Water, Animal Guard, Riprap, and Geotechnical Fabric.

2. Subsidiary Item – CMP Animal Guard

This item will consist of furnishing and installing the CMP animal guard, for each size tile such as AgriDrain RG series or IDALS approved equal.

No separate payment will be made for the CMP animal guard. Compensation for this item shall be included in the payment for CRCS and CMP tile outlet pipes.

Construction Specification
000 IA-61 Loose Rock Riprap

1. SCOPE

The work shall consist of the construction of loose rock riprap revetments, structures and blankets, including filter layers or bedding where specified.

2. MATERIALS

Rock for loose rock riprap, filter layers or bedding shall come from sources approved by NRCS. The rock shall be excavated, selected and handled as necessary to meet the quality and grading requirements of this specification and the construction drawings.

Individual rock fragments shall be dense, sound and free from cracks, seams and other defects conducive to accelerated weathering. The rock fragments shall be angular to sub rounded in shape. The least dimension of an individual rock fragment shall not be less than 1/3 the greatest dimension of the fragment unless otherwise specified on the construction drawings.

3. SUBGRADE PREPARATION

The subgrade surfaces on which the riprap or bedding is to be placed shall be cut or filled and graded to the lines and grades shown on the drawings. When fill to subgrade lines is required, it shall consist of approved materials and shall be compacted to a density equal to the adjacent existing soil material.

Rock materials shall not be placed until the foundation preparation is completed and the subgrade surfaces have been inspected and approved by NRCS.

4. EQUIPMENT-PLACED ROCK RIPRAP

Rock shall be placed by equipment on the surfaces and to the depths specified. The riprap shall be constructed to the full thickness in one operation and in such a manner as to avoid serious displacement of the underlying materials. The rock shall be delivered and placed in a manner that will ensure that the riprap in place shall be reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact, one to another, with the smaller rocks and spalls filling the voids between the larger rocks. Placement of rock shall begin at the bottom of the slope or downstream end of the structure.

Riprap shall be placed in a manner to prevent damage to structures. Hand placing will be required to the extent necessary to prevent damage to adjacent structures.

5. HAND-PLACED RIPRAP

Rock shall be placed by hand on the surfaces and to the depths specified. It shall be securely bedded with the larger rocks firmly in contact, one to another. Spaces between the larger rocks shall be filled with smaller rocks and spalls. Smaller rocks shall not be grouped as a substitute for larger rock. Flat slab rock shall be laid on edge unless otherwise specified. Placement of rock shall begin at the bottom of the slope or downstream end of the structure.

6. FILTER LAYERS OR BEDDING

When the drawings specify filter layers or bedding beneath riprap, the filter or bedding material shall be spread uniformly on the prepared subgrade surfaces to the depth specified. Compaction of filter layers or

bedding will not be required, but the surface of such layers shall be finished reasonably free of mounds, dips or windrows.

7. SPECIFIC SITE REQUIREMENTS

A. Measurement and Payment

Compensation for any work item described in the contract documents but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and bid items to which they are made subsidiary are identified in Items of Work and Construction Details section of this specification.

For items of work which lump sum prices are established in the contract, the quantity of work will not be measured for payment. Payment for each item will be made at the contract lump sum price and will constitute full compensation for completion of the work.

For items of work for which specific unit prices are established in the contract, the payment will be made based on the approved quantity measured by the engineer or weight tickets. Payment will constitute full compensation of the work completed as defined by each work item.

B. Items of Work and Construction Details

1. Bid Item No. 15

This item shall consist of installing erosion stone at the locations shown in the drawings.

Erosion stone must meet the Iowa DOT Specifications 4130 to be considered acceptable.

Erosion stone gradation should be with a nominal size of 6 inches, with 100% passing the 9 inch screen and 100% being retained by the 3 inch screen.

Payment will be based on actual tonnage delivered to the site based on weight tickets, to the nearest 0.1 ton, subject to the approval of the engineer.

2. Bid Item No. Not Applicable

This item shall consist of installing coarse aggregate and fine aggregate granular material for the blind inlet as shown on Sheet 13. The excavation and tile quantities are included with other bid items. The geotextile fabric is incidental.

Payment will be paid as a lump sum for each blind inlet installed.

3. Subsidiary Item – Geotextile Fabric

Geotextile Fabric, IA-95

Construction Specification
000 IA-95 Geotextile

1. SCOPE

This work shall consist of furnishing all materials, equipment, and labor necessary for the installation of geotextile.

2. MATERIAL QUALITY

Geotextile shall be manufactured from synthetic long chain or continuous polymeric filaments or yarns, having a composition of at least 95 percent, by weight, of polypropylene, polyester or polyvinylidene chloride. The geotextile shall be formed into a stable network of filaments or yarns that retain their relative position to each other, are inert to commonly encountered chemicals and are resistant to ultraviolet light, heat, hydrocarbons, mildew, rodents and insects. Unless otherwise specified, the class and type of geotextile shall be as shown on the drawings and shall meet the requirements for materials that follow:

1. Woven Geotextile shall conform to the physical properties listed in Table 1. The woven geotextile shall be manufactured from monofilament yarns that are woven into a uniform pattern with distinct and measurable openings. The geotextile shall be manufactured so that the yarns will retain their relative position with regard to each other. The yarns shall contain stabilizers and/or inhibitors to enhance their resistance to ultraviolet light or heat exposure. The edges of the material shall be salvaged or otherwise finished to prevent the outer yarn from unraveling.
2. Nonwoven Geotextile shall conform to the physical properties listed in Table 2. Nonwoven geotextile shall be manufactured from randomly oriented fibers that have been mechanically bonded together by the needle-punched process. In addition, one side may be slightly heat bonded. Thermally bonded, nonwoven geotextile, in addition to mechanically bonded, nonwoven geotextile, may be used for Road Stabilization. The filaments shall contain stabilizers and/or inhibitors to enhance their resistance to ultraviolet light or heat exposure.
3. The geotextile shall be shipped in rolls wrapped with a protective covering to keep out mud, dirt, dust, debris and direct sunlight. Each roll of geotextile shall be clearly marked to identify the brand, type and production run.

3. STORAGE

Prior to use, the geotextile shall be stored in a clean dry place, out of direct sunlight, not subject to extremes of either hot or cold, and with the manufacturer's protective cover in place. Receiving, storage, and handling at the job site shall be in accordance with the requirements in ASTM D 4873.

4. SURFACE PREPARATION

The surface on which the geotextile is to be placed shall be graded to the neat lines and grades as shown on the drawings. The surface shall be reasonably smooth and free of loose rock and clods, holes, depressions, projections, muddy conditions and standing or flowing water (unless otherwise shown on the drawings).

5. PLACEMENT

Prior to placement of the geotextile, the soil surface will be inspected for quality assurance of design and construction. The geotextile shall be placed on the approved prepared surface at the locations and in accordance with the details shown on the drawings. The geotextile shall be unrolled along the placement area and loosely laid (not stretched) in such a manner that it will conform to the surface irregularities

when material is placed on or against it. The geotextile may be folded and overlapped to permit proper placement in the designated area.

The geotextile shall be joined by overlapping a minimum of 18 inches (unless otherwise specified), and secured against the underlying foundation material. Securing pins, approved and provided by the geotextile manufacturer, shall be placed along the edge of the panel or roll material to adequately hold it in place during installation. Pins shall be steel or fiberglass formed as a “U”, “L”, or “T” shape or contain “ears” to prevent total penetration. Steel washers shall be provided on all but the “U” shaped pins. The upstream or up-slope geotextile shall overlap the abutting down-slope geotextile. At vertical laps, securing Natural Resources Conservation Service pins shall be inserted through both layers along a line through approximately the midpoint of the overlap. At horizontal laps and across slope laps, securing pins shall be inserted through the bottom layer only. Securing pins shall be placed along a line approximately 2 inches in from edge of the of the placed geotextile at intervals not to exceed 12 feet unless otherwise specified. Additional pins shall be installed as necessary and where appropriate, to prevent any undue slippage or movement of the geotextile. The use of securing pins will be held to the minimum necessary. Pins are to be left in place unless otherwise specified.

Should the geotextile be torn or punctured, or the overlaps disturbed, as evidenced by visible geotextile damage, subgrade pumping, intrusion, or grade distortion, the backfill around the damaged or displaced area shall be removed and restored to the original approved condition. The repair shall consist of a patch of the same type of geotextile being used, overlaying the existing geotextile. The patch shall extend a minimum of 2 feet from the edge of any damaged area.

The geotextile shall not be placed until it can be anchored and protected with the specified covering within 48 hours or protected from exposure to ultraviolet light. Geotextile shall be placed in accordance with the following applicable specification according to the use indicated in drawings:

Slope protection – Class I or II as indicated in Tables 1 and 2.

The geotextile shall not be placed until it can be anchored and protected with the specified covering within 48 hours or protected from exposure to ultraviolet light. Rock shall not be pushed or rolled over the geotextile.

Class I, unprotected – limit height for dropping stone onto bare geotextile to 3 feet.

Class II, protected – require the use of 6 inches a clean pit-run gravel over the geotextile to cushion the stone and limit the height of drop to 3 feet.

On slopes with strong seepage flow, the geotextile must be in intimate contact with the soil to prevent erosion of the soil surface. Use 6 inches of a clean pit-run gravel over the geotextile to hold it in place and minimize voids under the riprap. Embedment of the geotextile in a trench to form a cutoff at regular intervals down the slope will prevent erosion under the fabric. Place cutoffs more closely together in highly erodible soils and wider apart in more stable soils

Subsurface drains – Class III as indicated in Tables 1 and 2.

The geotextile shall not be placed until drainfill or other material can be used to provide cover within the same working day. Drainfill material shall be placed in a manner that prevents damage to the geotextile. In no case shall material be dropped on uncovered geotextile from a height of more than 5 feet.

Road stabilization – Class IV as indicated in Tables 1 and 2.

The geotextile shall be unrolled in a direction parallel to the roadway centerline in a loose manner permitting conformation to the surface irregularities when the roadway fill material is placed on its surface. In no case shall material be dropped on uncovered geotextile from a height of more than 5 feet. Unless otherwise specified, the minimum overlap of geotextile panels joined without sewing shall be 24 inches.

The geotextile may be temporarily secured with pins recommended or provided by the manufacturer, but they shall be removed before the permanent covering material is placed.

Table 1. Requirements for Woven Geotextiles[1/]

Property	Test Method	Class I	Class II	Class III	Class IV
Grab tensile strength (pounds)	ASTM D4632	247 minimum	180 minimum	180 minimum	315 minimum
Elongation at failure (%)	ASTM D4632	< 50	< 50	< 50	< 50
Trapezoidal tear strength (pounds)	ASTM D4533	90 minimum	67 minimum	67 minimum	112 minimum
Puncture strength (pounds)	ASTM D6241	495 minimum	371 minimum	371 minimum	618 minimum
Ultraviolet light (% retained strength)	ASTM D4355	50 minimum	50 minimum	50 minimum	70 minimum
Permittivity (sec^{-1})	ASTM D4491	as specified			
Apparent opening size (AOS)[2/]	ASTM D4751	as specified			
Percent open area (POA)(%)	USACE [3/]CWO-02215-86	as specified			

[1/] All values are minimum average roll values (MARV) in the weakest principal direction, unless otherwise noted.
[2/] Maximum average roll value.
[3/] Note: CWO is a USACE reference.

Table 2. Requirements for Nonwoven Geotextiles[1/]

Property	Test Method	Class I[2/]	Class II[2/]	Class III[2/]	Class IV[2/]
Grab tensile strength (pounds)	ASTM D4632 grab test	202 minimum	157 minimum	112 minimum	202 minimum
Elongation at failure (%)	ASTM D4632	50 minimum	50 minimum	50 minimum	50 minimum
Trapezoidal tear strength (pounds)	ASTM D4533	79 minimum	56 minimum	40 minimum	79 minimum
Puncture strength (pounds)	ASTM D6241	433 minimum	309 minimum	223 minimum	433 minimum
Ultraviolet light (% retained strength)	ASTM D4355	50 minimum	50 minimum	50 minimum	50 minimum
Permittivity (sec^{-1})	ASTM D4491	0.7 minimum or as specified			
Apparent opening size (AOS)[3/]	ASTM D4751	0.22 minimum or as specified			

[1/] All values are minimum average roll values (MARV) in the weakest principal direction, unless otherwise noted.
[2/] Needle punched geotextiles may be used for all classes. Heat-bonded or resin-bonded geotextiles may be used for class IV only.
[3/] Maximum average roll value.

6. SPECIFIC SITE REQUIREMENTS

A. Measurement and Payment

Compensation for any work item described in the contract documents but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and bid items to which they are made subsidiary are identified in Items of Work and Construction Details section of this specification.

For items of work which lump sum prices are established in the contract, the quantity of work will not be measured for payment. Payment for each item will be made at the contract lump sum price and will constitute full compensation for completion of the work.

For items of work for which specific unit prices are established in the contract, the payment will be made based on the approved quantity measured by the engineer or weight tickets. Payment will constitute full compensation of the work completed as defined by each work item.

B. Items of Work and Construction Details

1. Bid Item No. 17 - Geotextile

This item shall consist of furnishing and placing geotextile underneath the Tied Concrete Block Mat along seams, as shows in the plans.

Geotextiles shall conform to the requirements of IDOT Engineering Fabric for embankment erosion control.

The geotextile shall be placed with the long dimension parallel to the channel.

Measurement and payment shall be on an installed square-foot basis will constitute full compensation for this bid item and related subsidiary items

2. Bid Item No. 16 Tied Concrete Block Mats

This item shall consist of furnishing and placing Tied Concrete Block Mats as shown on the drawings. The unit cost shall include the cost of excavation of placement, excavated tie-ins, underlayment, and anchors. The sizes shall be as shown on the plans or as approved by the Engineer. Shop drawings or order sheets, along with specification sheets for underlayment shall be submitted for approval prior to purchasing materials. Brome grass seed shall be placed in the area prior to laying down the mat.

Measurement and payment shall be on an installed square-foot basis will constitute full compensation for this bid item and related subsidiary items.

2. Bid Item No. Mulch Blanket NOT APPLICABLE

This item shall consist of furnishing and placing the mulch blanket as shown on the drawings. The unit cost shall include the cost of anchors and any overlap. The proposed material must be approved by the Engineer and installed in accordance with the manufacturer's recommendations. Brome grass seed shall be placed in the area prior to laying down the blanket.

Measurement and payment shall be on an installed square-yard basis will constitute full compensation for this bid item and related subsidiary items.

BID ITEM 13:

Flexamat Plus Specification

1. DESCRIPTION

A Tied Concrete Block Mat with Triple Layered Underlayment. This work shall consist of furnishing and placing the system in accordance with this specification and conforming with the lines, grades, design, and dimensions shown on the plans.

2. MATERIALS

Flexamat Plus is manufactured from individual concrete blocks tied together with high strength knitted polypropylene bi-axial geogrid. Each block is tapered, beveled and interlocked and includes connections that prevent lateral displacement of the blocks within the mats when they are lifted for placement.

Tied Concrete Block Mats with Triple Underlayment shall be Flexamat Plus, manufactured by Motz Enterprises, Inc.

2.1. **Blocks.** Furnish blocks manufactured with concrete conforming to the cement requirements of ASTM C150 and to the aggregate requirements of ASTM C33. Blocks shall have a minimum weight of 3 lb. per block and placed no further than 2 in. apart. Material weight per square foot shall not exceed 10 lbs. Blocks shall have a 2.25" profile, a flat-top pyramid shape, and a coarse finish without protrusions. Concrete shall have a minimum compressive strength requirement of Table1 and certified by a third party.

Table 1
Concrete Compressive Strength Requirements

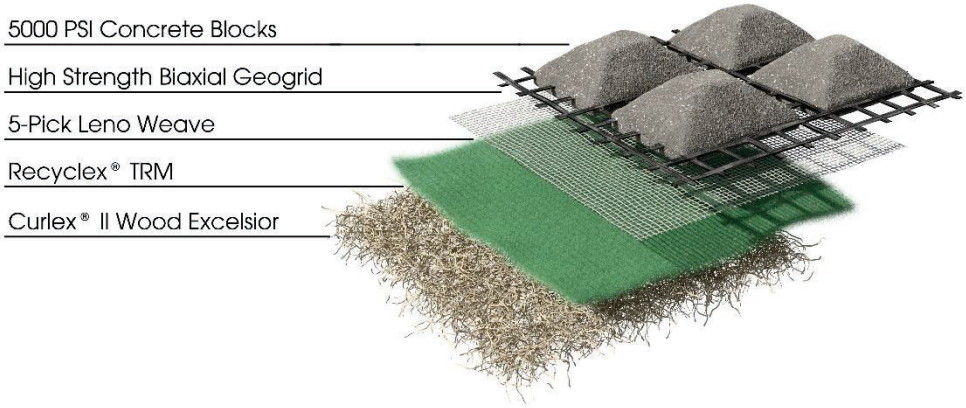
Age	Required Compressive Strength psi
28 - Day	5000 psi

2.2. **Polypropylene Bi-Axial Geogrid.** The interlocking geogrid shall be an open knitted fabric composed of high tenacity, multifilament polypropylene yarns knitted and coated in tension with an acrylic based coating which is designed to resist degradation in environments with exposure to water and low pH (,4 pH) and high pH (>9 pH). Carbon black UV inhibitor shall be blended into the extruded yarns at a rate no less than 0.8% by weight. When combined with the revetment mat, this will yield a high tenacity, low elongating, and continuous filament polypropylene geogrid that is embedded within the base of the concrete blocks. Ensure the geogrid meets the requirements of Table 2.

Table 2
Polypropylene Bi-Axial Geogrid

Property	Unit	Test	Requirement
Mass/Unit Area	oz/yd^2	ASTM D5261	6.5 oz/yd^2
Aperture Size	English units	Measured	1.4x 1.4 inch
Ultimate Wide Width Tensile Strength (MD x CMD)	lb/ft	ASTM D6637	2,055 lb/ft
Elongation at Ultimate Tensile Strength (MD x CMD)	%	ASTM D6637	6%
Wide Width Tensile Strength @ 2% (MD x CMD)	lb/ft	ASTM D6637	822 lb/ft
Wide Width Tensile Strength @ 5% (MD x CMD)	lb/ft	ASTM D6637	1,640 lb/ft
Tensile Modulus @ 2% (MD x CMD)	lb/ft	ASTM D6637	41,100 lb/ft
Tensile Modulus @ 5% (MD x CMD)	lb/ft	ASTM D6637	32,800 lb/ft

2.3. **Underlayment Materials.** A four-layered system includes, in order from top to bottom, 1) Concrete block mat 2) 5-Pick Leno Weave 3) Recyclex TRM-V and 4) Curlex® II. The underlayment materials shall be packaged within the roll of the Flexamat Plus.



Five-Pick Leno Weave:
This Five-Pick Weave provides added strength and support to the underlayments.

Index Property	Units	Value
GSM	g/m²	118 (-3˜ +3)
Density	Picks/10cm	62 x 24 (+/- 2)
Warp Strength	N/5cm	≥ 350
Warp Elongation	%	20 - 50
Weft Strength	N/5cm	≥ 280
Weft Elongation	%	20 - 50
Warp Shrinkage	%	≤ 7
Weft Shrinkage	%	≤ 9

Recyclex® TRM:
Recyclex TRM – V is a permanent non-degradable Turf Reinforcement Mat (TRM), consists of 100% post-consumer recycled polyester (green or brown bottles) with 80% five-inch fibers or greater fiber length. It is of consistent thickness with fibers evenly distributed throughout the entire area of the TRM. The top and bottom of each TRM is covered with heavy duty polypropylene net. Fibers are tightly crimped and curled to allow fiber interlock, and to

retain 95% memory of the original shape after loading by hydraulic events. Fibers have a specific gravity greater than 1.0; therefore, the blanket will not float during hydraulic events. Recyclex TRM – V meets Federal Government Executive Order initiatives for use of products made from, or incorporating, recycled materials. Recyclex TRM – V shall be manufactured in the U.S.A. and the fibers shall be made from 100% recycled post-consumer goods.

Index Property	Test Method	Value
Thickness	ASTM D 6525	0.294 in (7.47 mm)
Light Penetration	ASTM D 6567	57%
Resiliency	ASTM D 6524	86%
Mass per Unit Area	ASTM D 6566	0.50 lb/yd^2 (271 g/m^2)
MD-Tensile Strength Max.	ASTM D 6818	295.2 lb/ft (4.32 kN/m)
TD-Tensile Strength Max.	ASTM D 6818	194.4 lb/ft (2.85 kN/m)
MD-Elongation	ASTM D 6818	32.2%
TD-Elongation	ASTM D 6818	40.8%
Swell	ECTC Procedure	8%
Water Absorption	ASTM D 1117/ECTC	33.8%
Specific Gravity	ASTM D 792	1.21
UV Stability	ASTM D 4355 (1,000 hr)	80% minimum
Porosity	Calculated	97.5%
Bench-Scale Rain Splash	ECTC Method 2	SLR = 5.86 @ 2 in/hr [1,2]
Bench-Scale Rain Splash	ECTC Method 2	SLR = 5.00 @ 4 in/hr [1,2]
Bench-Scale Rain Splash	ECTC Method 2	SLR = 6.33 @ 6 in/hr [1,2]
Bench-Scale Shear	ECTC Method 3	2.41 lb/ft^2 @ 0.5 in soil loss [2]
Germination Improvement	ECTC Method 4	432%

[1] SLR is the Soil Loss Ratio, as reported by NTPEP/AASHTO. [2] Bench-scale index values should not be used for design purposes

Curlex® II:

Curlex II erosion control blanket (ECB) consists of a specific cut of naturally seed free Great Lakes Aspen curled wood excelsior with 80% six-inch fibers or greater fiber length. It is of consistent thickness with fibers evenly distributed throughout the entire area of the blanket. The top and bottom of each blanket is covered with degradable polypropylene netting.

Index Property	Test Method	Value
Thickness	ASTM D 6525	0.418 in (10.62 mm)
Light Penetration	ASTM D 6567	34.6%
Resiliency	ASTM D 6524	64%
Mass per Unit Area	ASTM D 6475	0.57 lb/yd^2 (309 g/m^2)
MD-Tensile Strength Max.	ASTM D 6818	127.0 lb/ft (1.9 kN/m)
TD-Tensile Strength Max.	ASTM D 6818	50.9 lb/ft (0.7 kN/m)
MD-Elongation	ASTM D 6818	28.64%
TD-Elongation	ASTM D 6818	29.84%
Swell	ECTC Procedure	89%
Water Absorption	ASTM D 1117/ECTC	199%
Bench-Scale Rain Splash	ECTC Method 2	SLR = 6.84 @ 2 in/hr [2,3]
Bench-Scale Rain Splash	ECTC Method 2	SLR = 7.19 @ 4 in/hr [2,3]
Bench-Scale Rain Splash	ECTC Method 2	SLR = 7.56 @ 6 in/hr [2,3]
Bench-Scale Shear	ECTC Method 3	2.6 lb/ft^2 @ 0.5 in soil loss [3]
Germination Improvement	ECTC Method 4	645%

[1] Weight is based on a dry fiber weight basis at time of manufacture. Baseline moisture content of Great Lakes Aspen excelsior is 22%.

[2] SLR is the Soil Loss Ratio, as reported by NTPEP/AASHTO. [3] Bench-scale index values should not be used for design purposes.

2.4. Mats will be rolled for shipment. Upon delivery, rolls may be left exposed for up to 30 days. If exposure will exceed 30 days, cover or tarp the rolls to minimize UV exposure.

Chipping or missing concrete resulting in a weight loss exceeding 15% of the average weight of a concrete unit is grounds for rejection by the engineer. Replace, repair or patch the damaged areas per the manufacturer's recommendations.

3. PERFORMANCE

Full-Scale laboratory testing performed by an independent 3rd party testing facility with associated engineered calculations certifying the hydraulic capacity of the proposed Tied-Concrete Block Erosion Control Mat meets the following requirements:

Test	Tested Value	Bed Slope	Soil Classification	Limiting Value
ASTM 6460	Shear Stress	30%	Sandy Loam (USDA)	24lb./ft^2
ASTM 6460	Velocity	20%	Loam (USDA)	30 ft./sec

4. ALTERNATIVE PRODUCTS

Such products must be pre-approved in writing by the Engineer prior to bid date. Alternative product packages must be submitted to the Engineer a minimum of fifteen (45) days prior to bid date. Submittal packages for alternate products must include, as a minimum, the following:

4.1. Alternative Product Properties – Product must be comprised of materials as detailed in Section 2, including both in composition, underlayment layers and performance requirements.

4.2. Full-Scale laboratory testing performed by an independent 3rd party testing facility with associated engineered calculations certifying the hydraulic capacity of the proposed Tied-Concrete Block Erosion Control Mat meets the performance requirements listed in Section 3 of this specification.

4.3. A list of 15 comparable projects in terms of project size, application and material dimensions in the United States, where the results of the specific alternative material's use can be verified and reviewed for system integrity and sustained after a minimum of 10 years of service life.

5. EQUIPMENT

Provide the proper equipment to place the mat that will not damage the mat material or disturb the topsoil subgrade and seed bed.

6. CONSTRUCTION

Prior to installing Flexamat Plus, prepare the subgrade as detailed in the plans. All subgrade surfaces to be smooth and free of rocks, roots, debris, or other protrusions that would prevent intimate contact between the block and the subgrade. When seeding is shown on the plans, provide subgrade material that can sustain growth.

Ensure the prepared subgrade provides a smooth, firm, and unyielding foundation for the mats. The subgrade shall be graded into a parabolic or trapezoidal shape to concentrate flow to middle of mat or mats.

When vegetation is required, distribute seed on the prepared topsoil subgrade before installation of the concrete mats in accordance with the specifications.

Install mats to the line and grade shown on the plans and per the manufacturer's guidelines. The manufacturer or authorized representative will provide technical assistance during preparation and installation of the concrete block mats as needed.

Provide a minimum 18 in. deep concrete mat embedment toe trench at all edges exposed to concentrated flows. Recess exterior edges subject to sheet flow a minimum of 6 in.

Provide fastening or anchoring as recommended by the manufacturer or engineer for the site conditions.

7. MEASUREMENT

This Item will be measured by the square foot as shown on the plans, complete in place.

8. PAYMENT

The work performed, and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Flexamat Plus". This price is full compensation for loading and transporting, placing concrete block mats; excavation and disposal; furnishing topsoil and bedding; and equipment, labor, materials, tools, and incidentals.