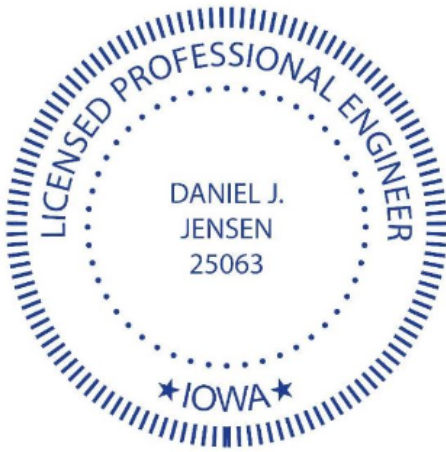



SUPPLEMENTAL MEASUREMENT PAYMENT / ITEMS OF  
WORK AND CONSTRUCTION SPECIFICATIONS

FOR

GRU881507A-FP - WETLAND  
GRUNDY COUNTY, IOWA

February 2023

	I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.	
		02/23/2023
	Signature	Date
	Printed or typed name <u>Daniel Jensen</u>	
	License Number <u>25063</u>	
My License Renewal Date is: <u>December 31, 2023</u>		
Pages, Sheets, or Divisions covered by this Seal: All		

PREPARED BY:

**SHIVEHATTERY**  
ARCHITECTURE+ENGINEERING

PROJECT #4202690



# NATURAL RESOURCES CONSERVATION SERVICE CONSTRUCTION SPECIFICATIONS

For

GRU881507A-FP – Wetland

Grundy County, Iowa

## List of Specifications

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These specifications are part of the construction plans. The work shall be performed in accordance with the drawings and specifications unless otherwise approved, in writing, by NRCS. For items of work requiring NRCS inspection, it is the responsibility of the contractor to keep the local NRCS office informed of the progress of work so that timely inspections may be performed. Work installed without NRCS inspection will not be certified as meeting NRCS standards.



# **NATURAL RESOURCES CONSERVATION SERVICE CONSTRUCTION SPECIFICATION**

## **IA-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 the Engineer. 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 Engineer. 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 earth fill. 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. SPECIAL SPECIFICATIONS**

#### **A. Measurement and Payment**

1. 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 Items of Work and Construction Details section of this specification.

2. 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 prices and will constitute full compensation for completion of the work.

**B. Items of Work and Construction Details**

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

**a. Bid item 1, Site Clearing, Preparation, & Waste Disposal**

- (1) This item will consist of the removal and proper off-site disposal of all woody growth within the grading limits and permanent pool area. Trees may also be burned and buried onsite in an engineer and landowner approved location and manner.
- (2) This item will consist of the removal and proper off-site disposal of all refuse and debris encountered on grade in areas being graded or seeded.
- (3) Lump sum item to be considered full compensation for all work related to site Clearing, Preparation, & Waste Disposal.

**b. Bid item 18, Crop Damage**

- (1) This item consists of crop damage that results from construction activities. It is recommended contractor remove corn residue rather than knock it down.
- (2) 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.

# NATURAL RESOURCES CONSERVATION SERVICE CONSTRUCTION SPECIFICATION

## IA-5 POLLUTION CONTROL

### 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 seeding may be used as an alternative to other stabilization measures as approved by the Engineer.

**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. SPECIAL SPECIFICATIONS**

##### **A. Measurement and Payment**

- a. 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 Items of Work and Construction Details section of this specification.
- b. 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 prices and will constitute full compensation for completion of the work.

##### **B. Items of Work and Construction Details**

1. Items of work to be performed in conformance with the specification and the construction details therefore are:
  - a. Subsidiary Item, Sediment Filters
    - (1) This item consists of all work to install, maintain and remove sediment filters for the project. Sediment filters to be removed once vegetation is established.
    - (2) No separate payment will be made for sediment filters. Compensation for this item will be incidental to other items of work.

- (3) Contractor shall perform all construction activities in a manner that will minimize water pollution, air pollution, and soil erosion. Sediment filters shall be placed as needed where off-site erosion could occur.
- b. Subsidiary Item, Pollution Control
  - (1) This item will consist of applying and performing all construction activities in a manner that will minimize water pollution, air pollution and soil erosion.
  - (2) No separate payment will be made for Pollution Control. Compensation for this item will be incidental to other items of work.

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSTRUCTION SPECIFICATION**

**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 to 1 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**

~~REMOVED: 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 the Engineer.

**5. SPECIAL SPECIFICATIONS**

**A. Measurement and Payment**

1. For items of work for which specific prices are established in the contract, each area treated is measured as specified in this specification section and the area calculated to the nearest 0.1 acre.
2. Payment for treatment is made at the contract unit price for the designated treatment, which will constitute full compensation for completion of the work.

B. Items of Work and Construction Details

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

**a. Bid Item 2, Buffer Seeding**

- (1) This item will consist of seeding any disturbed areas within the proposed easement outside the normal pool.
- (2) All seed must be cleaned and weed free. Seeding rates are expressed in bulk pounds per acre. Seed quality shall not drop below 70% Pure Life Seed (PLS) where PLS = (% germination + % dormant seed) times % purity.
- (3) Seeding mix design will be provided by the local NRCS office.
- (4) Seed shall be applied with a drill and placed at ¼ to ½ inch deep.
- (5) Fertilizer shall not be applied.
- (6) Straw mulch shall be applied at the rate of 2 tons per acre on all seeded areas. Mulch shall be crimped in place after spreading.
- (7) Seeding will be completed during the following seeding periods:

Spring	April 1 to July 1
Dormant	November 15 – Freeze Up
Frost*	February 1 – March 31

\*requires debarbed or smooth seed for frost seeding.  
If construction is completed during any other time of the year, the seeding shall be performed at the next seeding period.
- (8) If seeding is completed during the spring a companion crop of oats shall be seeded at a rate of one and one-half bushels per acre. If seeding is completed during the fall seeding period a companion crop of winter wheat shall be seeded at 30lbs/ac.
- (9) Measurement and payment will be based on the area successfully seeded calculated to the nearest one-tenth acre.

**b. Bid Item 22, Structure Seeding**

- (1) This item will consist of seeding the embankment except the upstream side slope below the weir elevation, waterways, channels, and any other disturbed areas as determined by the Engineer.
- (2) All seed must be cleaned and weed free. Seeding rates are expressed in bulk pounds per acre. Seed quality shall not drop below 70% Pure Life Seed (PLS) where PLS = (% germination + % dormant seed) times % purity.
- (3) Seeding rates are as follows:

Smooth Brome grass	25 lbs. / acre
--------------------	----------------
- (4) Seed shall be applied with a drill and placed at ¼ to ½ inch deep.
- (5) Fertilizer shall be applied on the entire seeding area at the following rate.

- |   |                |
|---|----------------|
| Nitrogen                                    | 30 lbs. / acre |
| Phosphorus (P <sub>2</sub> O <sub>5</sub> ) | 30 lbs. / acre |
| Potassium (K <sub>2</sub> O)                | 40 lbs. / acre |
- (6) Straw mulch shall be applied at the rate of 2 tons per acre on all seeded areas.
- (7) Seeding will 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.
- (8) If seeding is completed during the spring or summer seeding period, a companion crop of oats shall be seeded at a rate of one and one-half bushels per acre. If seeding is completed during the fall seeding period a companion crop of winter wheat shall be seeded at 30lbs/ac.
- (9) Measurement and payment will be based on the area successfully seeded calculated to the nearest one-tenth acre

**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. 3 - Mobilization/Demobilization**

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.

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

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. When the engineer is not present to survey, the trench should be measured and approximate locations marked on the as-built plan.

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 to 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, fiberglass 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 plan. 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 by 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 is 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 structure, 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. MATERIAL**

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.

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 <sup>1</sup>
Corrugated Profile Wall (Dual Wall) Polyethylene (PE) Pipe, 12 to 60 inch	ASTM F 2306 <sup>5</sup>
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.

<sup>1</sup>Pipe conforming to AASHTO M 252 (2 to 10 inch), or AASHTO M 294 (12 to 60 inch) is applicable.

## 7. SPECIAL SPECIFICATIONS

### A. Measurement and Payment

1. For items of work for which specific unit prices are established in the contract, the actual length of pipe removed will be computed to the nearest foot along the centerline of pipe, and shall include the length of the aprons. Payment will be made to constitute full payment for all labor, materials, equipment, and all other items necessary and incidental to the completion of the work.
2. 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 the Items of Work and Construction Details section of this specification.

### B. ITEMS OF WORK AND CONSTRUCTION DETAILS

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

a. **Bid Item No. 4 – Drainage Tile Investigation and Removal**

(1) This item shall consist of the excavation necessary to locate and remove all tile under the embankment, to remove tile at the other tile locations shown on the plans, and locate the field tile lines in the pool area. This item shall also consist of backfilling tile trenches.

(2) The extent of tile investigation and removal shall be as required to locate and extend tiles as shown on the plans.

(3) Any tiles found shall be traced to the upstream inlet or wetland boundary, whichever is encountered first.

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

(5) Payment for Drainage Tile Investigation and Removal shall be made on an actual linear foot of trench basis.

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSTRUCTION SPECIFICATION**

**IA-11 REMOVAL OF WATER**

**1) SCOPE**

The work shall consist of the removal of surface water and ground water as needed to perform the required construction in accordance with the plans and specifications.

**2) DIVERTING SURFACE WATER**

The Contractor shall build, maintain and operate all cofferdams, channels, diversions, flumes, sumps, and other temporary protective works needed to divert surface water away from the construction site while construction is in progress.

**3) DEWATERING THE CONSTRUCTION SITE**

Foundations, cutoff trenches, borrow areas and other parts of the construction site shall be dewatered as needed for proper execution of the construction work. The Contractor shall furnish, install, operate and maintain all works and equipment needed to perform the dewatering.

**4) EROSION AND POLLUTION CONTROL**

Removal of water from the construction site, including the borrow areas shall be accomplished in such a manner that erosion and the transmission of sediment and other pollutants are minimized.

**5) REMOVAL OF TEMPORARY WORKS**

After temporary works have served their purposes and before the Contractor leaves the site, they shall be removed.

**6) SPECIAL SPECIFICATIONS**

**A. Measurement and Payment**

- a. 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 Items of Work and Construction Details section of this specification.

**A. Items of Work and Construction Details**

- 1. Items of work to be performed in conformance with this specification and the construction details therefore are:
  - a. Subsidiary Item, Dewatering
    - (1) This item shall include all costs to divert, pump, dam or other means to dewater the site as needed to complete construction activities.
    - (2) No separate payment will be made for removal of water. Compensation for this item shall be made subsidiary to other bid items requiring removal of water in order to complete.

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSTRUCTION SPECIFICATION**

**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. SPECIAL SPECIFICATIONS**

**A. Measurement and Payment**

1. 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 specification Section.
2. For items of work for which specific unit prices are established in the contract, the volume of core trench excavation acceptably removed, will be computed to the nearest cubic yard. Measurement will be calculated based on the cross-sectional area shown in the drawings and the actual linear feet of core trench excavated. Payment will be made to constitute full payment for all labor, materials, equipment, and all other items necessary and incidental to the completion of the work.

B. Items of Work and Construction Details

1. Items of work to be performed in conformance with this specification and the construction details therefore are:
  - a. Subsidiary Item, Excavation for Earthfill
    - a. This item will consist of the excavation of material in locations shown on the plans for use as Earthfill.
    - b. All excavation required for the project will be balanced onsite in areas designated as Earthfill. A shrinkage factor of 25% was used to estimate earthwork.
    - c. No separate payment will be made for excavation. Compensation for this item will be included in the payment for Bid item 5, Earthfill.

# **NATURAL RESOURCES CONSERVATION SERVICE CONSTRUCTION SPECIFICATION**

## **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. SPECIAL SPECIFICATIONS**

### **A. Measurement and Payment**

1. 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 specification Section.
2. For items of work for which specific unit prices are established in the contract, the volume of earthfill acceptably placed, will be computed to the nearest cubic yard. Measurement will be calculated based on pre and post survey events to be provided by the Owner and completed by the Engineer. Payment will be made to constitute full payment for all labor, materials, equipment, and all other items necessary and incidental to the completion of the work.

### **B. Items of Work and Construction Details**

1. Items of work to be performed in conformance with this specification and the construction details therefore are:
  - a. **Bid item 5, Earthfill, Embankment Fill**
    - a. This item shall consist of excavating, placing, and compacting the earthfill necessary to construct the embankment, submerged berms, and adjacent fill areas shown on the plans.
    - b. Earthfill approved soil material shall be taken from excavation and designated borrow areas unless other areas are approved by the engineer.
    - c. Compaction shall be Method 2.
    - d. Rocks larger than 6" shall be removed prior to compaction.

**b. Bid Item 8, Scarify/Recompact Pool Excavation Areas.**

- a. This item shall consist of scarifying, moisture content adjustment, watering and compacting the all areas within the normal pool where excavation has occurred.
- b. Scarification shall occur to a depth of 8" (Minimum.) using a disk cultivator or approved equal. Re-disk until no soil clumps exceed 4 inches.
- c. Add water until soil is at approximately optimum moisture content prior to re-compaction. Compaction shall be NRCS Method 2. Re-disk after watering to incorporate water to soil uniformly.
- d. Maintain moisture content until topsoil is placed. Desiccation of the surface will not be allowed. Re-scarification and compaction shall occur if the excessive drying occurs as determined by the Engineer.
- e. Rocks larger than 6" shall be removed prior to compaction.

**c. Subsidiary Item, Backfill Required Excavation**

- a. This item shall consist of backfilling the areas excavated to install other components related to the project such as piping or structures and to locate and remove the tile line.
- b. Compaction adjacent to the structures shall be as indicated above. All other compaction shall be Method 1 or equivalent.
- c. No separate payment will be made for Backfill of Structure Excavation. Compensation for this item will be included in payment for Corrugated Metal Pipe, Water Control Structure, Riser Inlet Structure, Tile Investigation and Removal, and Corrugated Plastic Tubing Tile Drains.

# NATURAL RESOURCES CONSERVATION SERVICE CONSTRUCTION SPECIFICATION

## IA-26 TOPSOILING

### 1. SCOPE

The work shall consist of salvaging topsoil from borrow areas or required excavations and spreading it on the exposed disturbed areas.

### 2. QUALITY OF TOPSOIL

Topsoil shall consist of friable surface soil reasonably free of grass, roots, weeds, sticks, stones, or other foreign materials.

### 3. EXCAVATION

After the site has been cleared and grubbed, the topsoil shall be removed from borrow areas and required excavation areas to the depth as shown on the drawings. Topsoil shall be stockpiled at locations approved by engineer.

### 4. SPREADING

Spreading shall not be done when the ground or topsoil is frozen, excessively wet, or otherwise in a condition detrimental to the work. Surfaces designated to be covered shall be lightly scarified just prior to the spreading operation. Where compacted fills are designated to be covered by topsoil, the topsoil shall be placed concurrently with the fill and shall be bonded to the compacted fill with the equipment.

Topsoil shall be placed to the minimum depth shown on the drawings. After the spreading operation is completed, the surface shall be finished to a reasonably smooth surface.

### 5. SPECIAL SPECIFICATIONS

#### A. Measurement and Payment

1. 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 specification Section.
2. For items of work for which specific unit prices are established in the contract, top soiling shall be on a plan "P" cubic yard basis. Plan basis, designated with a "P" in the proposal means that the plan quantity listed in the proposal will be used to measure and pay for the bid item regardless of the actual quantity. Payment will be made to constitute full payment for all labor, materials, equipment, and all other items necessary and incidental to the completion of the work.

#### B. Items of Work and Construction Details

##### 1. Bid item 6, Topsoil, Strip, Salvage and Re-spread, 6" (P)

- a. This item will consist of stripping, salvaging, stockpiling and spreading salvaged (stockpiled) 6" of topsoil as the surface layer of all disturbed areas within the proposed easement, excluding the embankment footprint.

- b. Measurement and payment for top soiling shall be on a plan “P” cubic yard basis. Plan basis, designated with a “P” in the proposal means that the plan quantity listed in the proposal will be used to measure and pay for the bid item regardless of the actual quantity.

**2. Bid item 7, Topsoil, Strip, Salvage and Re-spread, 12” (P)**

- a. This item will consist of stripping, salvaging, stockpiling and spreading salvaged (stockpiled) 12” topsoil as the surface layer within the embankment footprint.
- b. Measurement and payment for top soiling shall be on a plan “P” cubic yard basis. Plan basis, designated with a “P” in the proposal means that the plan quantity listed in the proposal will be used to measure and pay for the bid item regardless of the actual quantity.

# **NATURAL RESOURCES CONSERVATION SERVICE CONSTRUCTION SPECIFICATION**

## **IA-31 CONCRETE**

### **1. SCOPE**

The work shall consist of furnishing, forming, placing, finishing, and curing Portland cement concrete including steel reinforcement.

### **2. MATERIALS**

Portland cement shall conform to ASTM C 150 and shall be Type I or Type II.

Fine Aggregates shall conform to ASTM C 33 and shall be composed of clean, uncoated grains of material.

Coarse Aggregates shall be gravel or crushed stone conforming to ASTM C 33 and shall be clean, hard, durable and free from clay or coating of any character. The maximum size of coarse aggregate shall be 1 1/2 inches or as shown on the drawings.

Water shall be clean and free from injurious amounts of oil, acid, salt, alkali, organic matter, or other deleterious substances.

Air entraining agent shall conform to ASTM C 260.

Fly ash may be used as a partial substitution for Portland cement and shall be in strict compliance with ASTM C 618, Class F or C. The loss by ignition shall not exceed 4.0 percent.

Blast-furnace slag may be used as a partial substitution for Portland cement and shall be in conformance with ASTM C 989 for ground granulated blast-furnace slag (GGBF slag).

Water-reducing admixtures shall conform to ASTM C 494 and may be the following types:

1. Type A - Water-reducing admixture
2. Type D - Water-reducing and retarding admixture
3. Type F - Water-reducing, high range admixture (superplasticizer).
4. Type G - water-reducing, high range, and retarding admixture (superplasticizer).

Type D or G admixture may be used when the air temperature is over 80 degrees F. at the time of mixing and/or placement.

Calcium Chloride or other antifreeze compounds or accelerators will not be allowed.

Preformed expansion joint filler shall be a commercially available product made of bituminous, sponge rubber or closed cell foam materials with a minimum thickness of 1/2 inch.

Reinforcing steel shall be free from loose rust, oil, grease, paint, or other deleterious matter. Reinforcing steel shall conform to one or more of the following:

1. Reinforcing Bars - ASTM A 615 or A 996, Grade 40 or greater, deformed.
2. Welded Wire Fabric - ASTM A 185 or A 497.

Waterstops shall be either metallic or nonmetallic. Metallic waterstops shall be fabricated from sheets of copper or galvanized steel. Nonmetallic waterstops shall be made of natural or synthetic rubber or vinyl chloride polymer or copolymer. Rubber, polymer and copolymer waterstops shall have ribbed or bulb-type anchor flanges and a hollow tubular center bulb, unless otherwise shown on the drawings. All waterstops shall be of the sizes shown on the drawings.

Curing compound shall be a liquid membrane-forming compound suitable for spraying on the concrete surface. The curing compound shall meet the requirements of ASTM C 309 Type 2 (white pigmented).

### 3. CONCRETE DESIGN MIX

The contractor will be responsible for the determining the design mix proportions in accordance with the requirements included in this paragraph and shall provide a copy of the mix to the NRCS Engineer at least 3 days prior to placing any concrete. The concrete mix shall be of such proportions as to provide a minimum strength of 3500 p.s.i. in 28 days, unless otherwise shown on the drawings. The air content shall be 4 to 8 percent of the volume of the concrete at the time of placement. The slump shall be 2 to 5 inches except when superplasticizer is used. The slump shall be 3 inches or less prior to the addition of superplasticizer admixture and shall not exceed 7 1/2 inches following addition and mixing. The fine aggregate shall be 30-50 percent of the total combined aggregate based on oven dry weights. The contractor shall provide tests to verify that the design mix meets the requirements. In lieu of this, one of the following mix proportions per cubic yard may be used:

<u>Mix Number</u>	<u>Minimum Cement, Pounds</u>	<u>Fly Ash, Pounds</u>	<u>GGBF Slag, Pounds</u>	<u>Maximum ** Water, Gallons</u>
1	564	0	0	33
2	470	45-90	0	31-34
3	517	129	0	31 *
4	366	114	91	31 *
5	259	103	155	31 *

\*\* Total of available aggregate moisture, mixing water added at the plant and mixing water added at the job site (one gallon equals 8.33 pounds).

\* Requires water reducing admixture.

### 4. MIXTURES AND MIXING

Ready-mixed concrete shall be batched, mixed and transported in accordance with ASTM C 94. Concrete shall be uniform and thoroughly mixed when delivered to the forms. No mixing water in excess of the amount shown for the design mix or in an amount that would cause the maximum slump to be exceeded shall be added to the concrete during mixing, hauling or after arrival at the point of delivery. The concrete shall be batched and mixed so that the temperature of the concrete at the time of placing shall be between 50 and 90 degrees F.

### 5. BATCH TICKET

The contractor shall obtain from the supplier a delivery ticket for each batch of concrete before unloading at the site. The following information shall be included on the ticket: name of concrete supplier, job name or location, date, truck number, amount of concrete, time loaded or time of first mixing cement, aggregate, and mixing water added at the plant, type and amount of cement, type and amount of admixtures, oven dry weights of fine and coarse aggregate, and moisture content(%) or weight of water contained in the aggregates.

The following information shall be added to the batch ticket on site: mixing water added on site, time concrete arrived on site and time concrete was unloaded.

Upon completion of the concrete placement, copies of all batch tickets shall be provided to NRCS.

## **6. REINFORCING STEEL**

Before reinforcement is placed, the surfaces of the bars or mesh shall be cleaned to remove any loose, flaky rust, mill scale, oil, grease, or other foreign substances. After placement, the reinforcement shall be maintained in a clean condition until it is completely embedded in the concrete.

Reinforcing bars shall be cut and bent according to ACI Standard 315.

Tack welding of bars shall not be permitted. Reinforcement shall be accurately placed as shown on the drawings and secured in position in a manner that will prevent its displacement during placement of concrete. Metal chairs, metal hangers, metal spacers or concrete chairs shall be used to support reinforcement. Precast concrete chairs shall be manufactured from concrete equal in quality to the concrete being placed. Precast concrete chairs shall be moist at the time concrete is placed

Splices of reinforcing bars shall be made only at the locations shown on the drawings, unless otherwise approved by the NRCS Engineer. All reinforcing splices and placement shall be in accordance with ACI 318 and shown on the drawings.

After placement of the reinforcement, concrete shall not be placed until the reinforcement has been inspected and approved by NRCS.

## **7. PREPARATION OF FORMS AND SUBGRADE**

Prior to placement of concrete, the forms and subgrade shall be free of woodchips, sawdust, debris, water, ice, snow, extraneous oil, mortar, or other harmful substances or coatings. Any oil on the reinforcing steel or other surfaces required to be bonded to the concrete shall be removed. All surfaces shall be firm and damp prior to placing concrete. Placement of concrete on mud, dried earth, uncompacted fill, or frozen subgrade will not be permitted.

The forms and associated false-work shall be substantial and unyielding and shall be constructed so that the finished concrete will conform to the specified dimensions and elevations. Forms will be mortar tight. Forms with torn surfaces, worn edges, dents or other defects will not be used. Forms shall be coated with a non-staining form release agent before being set into place. Excess form coating material shall not stand in puddles in the forms or come in contact with the steel reinforcement or hardened concrete against which fresh concrete is to be placed.

Form accessories to be partially or wholly embedded in the concrete, such as ties and hangers, shall be of a commercially manufactured type. Non fabricated wire shall not be used. Form ties shall be constructed so that the ends or end fasteners can be removed without causing spalling at the surface of the concrete.

Metal form ties used within the forms on structures with a total volume of concrete exceeding fifteen cubic yards shall be equipped with cones or other devices that permit their removal to a depth of at least one inch without damage to the concrete. The holes resulting from cones and other devices shall be patched in accordance with Section 9.

Form ties except those specifically covered by the preceding paragraph shall be broken off flush with the formed surface. Any surface areas which have been spalled or otherwise damaged shall be repaired in accordance with Section 9.

Steel tying and form construction adjacent to new concrete shall not be started until concrete has cured at least 12 hours.

Concrete joints shall be of the type and at the locations shown on the drawings.

Splices in metal waterstops shall be brazed, welded or overlapped and bolted. Splices in nonmetallic waterstops shall be cemented or joined as recommended by the manufacturer.

## **8. PLACING CONCRETE**

Concrete shall not be placed until the subgrade, forms, and steel reinforcement have been inspected and approved by the NRCS Inspector. Any deficiencies are to be corrected before the concrete is delivered for placement.

Concrete shall be delivered to the site and discharged into the forms within 1 1/2 hours after the introduction of the cement to the aggregates. When a superplasticizer is used, the concrete shall be discharged within the manufacturer's recommended time limit for discharge after addition of the admixture. In hot weather or under conditions contributing to quick setup of the concrete, discharge of the concrete shall be accomplished in 45 minutes unless a set-retarding admixture is used, in which case the manufacturer's recommended time limit will apply.

Addition of water at the job site may be done at the beginning of placement of each load of concrete in order to obtain allowable slump, provided that the maximum water content and water/cement ratio in the design mix is not exceeded. Addition of water will not be permitted after placement of the load has started.

The concrete shall be deposited as closely as possible to its final position in the forms and shall be worked into corners and around reinforcement and other embedded items in a manner which prevents segregation. Formed concrete shall be deposited in layers 24 inches or less in depth and shall be continuously deposited so that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of "cold joints". Concrete containing superplasticizer shall be placed in lifts not exceeding 5 feet in depth. If the surface layer of concrete sets during placement to the degree that it will not flow and merge with the succeeding layer when tamped or vibrated, the contractor shall discontinue placing concrete and install a construction joint. Construction joints shall be completed as shown on the drawings or by one of the following methods:

1. The joint shall be constructed using a 6 inch wide by 1/4 inch steel plate. The surfaces of the construction joint shall be prepared by washing and scrubbing with a wire brush or wire broom to expose coarse aggregate. The steel plate shall be embedded 3" in the concrete.
2. The joint surface shall be cleaned to expose coarse aggregate by sandblasting or air-water cutting after the concrete has gained sufficient strength to prevent displacement of the coarse aggregate or cement fines. The surface of the concrete shall not be cut so deep as to undercut the coarse aggregate. The joint shall be washed to remove all loose material after cutting.

The surfaces of all construction joints shall be kept continuously moist for at least 1 hour prior to placement of the new concrete. The new concrete shall be placed directly on the cleaned and washed surface. New concrete shall not be placed until the hardened concrete has cured at least 12 hours.

Concrete shall not be dropped more than 5 feet vertically unless suitable equipment is used to prevent segregation. Concrete containing superplasticizer shall not be dropped more than 12 feet vertically.

Immediately after the concrete is placed in the forms, it shall be consolidated by vibration, spading or hand tamping as necessary to insure smooth surfaces and dense concrete. Care should be taken not to over-vibrate concrete containing superplasticizer. Vibration shall not be supplied directly to the reinforcing steel, the forms or concrete which has hardened to the degree that it does not insure a monolithic bond with the preceding layer. The use of vibrators to transport concrete in the forms or conveying equipment will not be permitted.

## **9. FORM REMOVAL AND FINISHING**

Forms shall be left in place for at least 24 hours after placing concrete. Forms shall be removed in such a way as to prevent damage to the concrete. Supports shall be removed in a manner that will permit concrete to take the stresses due to its own weight uniformly and gradually.

Immediately after removal of the forms, concrete which is honey combed, damaged or otherwise defective shall be repaired or replaced. All cavities or depressions resulting from form tie removal shall be patched with a non-shrink grout, mortar mix or epoxy-type sealer. Non-shrink grout consists of 1 part cement and 2-1/2 parts sand that will pass a No. 16 sieve. Only enough water shall be added to produce a filling which is at the point of becoming rubbery when the material is solidly packed.

All repaired and patched areas shall be cured as required in Section 10.

## **10. CURING**

Concrete shall be cured for a period of not less than 7 consecutive days by one of the following approved methods:

- A. Membrane Curing: Concrete shall be cured with white pigmented curing compound. The compound shall be sprayed on moist concrete as soon as free water has disappeared, but shall not be applied to any surface until patching, repairs and finishing of that surface are completed. Curing compound shall not be applied to surfaces requiring bond to subsequently placed concrete, such as construction joints, shear plates, reinforcing steel, and other embedded items. Surfaces subjected to heavy rainfall or running water within 3 hours after curing compound has been applied or surfaces damaged by subsequent construction operations during the curing period, shall be reapplied in the same manner as the original application.
- B. Moist Curing: Concrete shall be cured by maintaining all surfaces continuously wet for the entire curing period.
- C. Cover: Adequately cover an exposed structure with burlap mats, or other material and continually soak with water.

## **11. BACKFILLING**

Backfilling may begin when the curing period has ended. Backfill against the structure will be placed in no more than 4-inch layers and compacted by hand tamping or with manually directed power tampers or plate vibrators. Layers compacted in this manner shall extend not less than 2 feet from any part of the concrete structure.

## **12. HOT AND COLD WEATHER CONCRETING**

When the atmospheric temperature may be expected to drop below 40° F. at the time concrete is delivered to the work site, during placement, or at any time during curing period, concrete shall be mixed, placed and protected in accordance with ACI Standard 306, "Recommended Practice for Cold Weather Concreting."

When climatic or other conditions are such that the temperature of the concrete may reasonably be expected to exceed 90° F. at the time of delivery to the work site, during placement or during the first 24 hours after placement, concrete shall be mixed, placed and protected in accordance with ACI Standard 305, "Recommended Practice for Hot Weather Concreting."

### **13. SPECIAL SPECIFICATIONS**

#### **A. Measurement and Payment**

1. 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 Items of Work and Construction Details section of this specification.

#### **B. Items of Work and Construction Details.**

1. Items of work to be performed in conformance with this specification and the construction details therefore are:
  - a. Subsidiary Item – Concrete
    - (1) This item shall consist of furnishing and placing poured concrete and reinforced concrete as shown on the drawings for the water control structure, flared end section footing, drain tile outlets, aluminum toe wall and any other item where concrete is shown on the plans.
    - (2) No separate payment will be made for Concrete.

# NATURAL RESOURCES CONSERVATION SERVICE CONSTRUCTION SPECIFICATION

## IA-46 TILE DRAINS FOR LAND DRAINAGE

### 1. SCOPE

The work shall consist of furnishing and installing drainage pipe (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 conduit shall be constructed to the line, depth, cross section, and grade shown on the drawings, or as directed by the Engineer. 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 soils can cause the plow to jump and 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 conduit 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 conduit. The conduit shall then be laid and the envelope or filter material placed over the conduit.

## **6. PLACEMENT AND JOINT CONNECTIONS**

All drains shall be laid to grade.

Joints between lateral concrete and clay drain tiles shall vary with soil type as follows:

Peat and muck - 1/4 inch preferred, 3/8 inch maximum

Clay - 1/8 inch preferred, 1/4 inch maximum

Silt and loam - 1/16 inch preferred, 1/8 inch maximum

Sand - tightest possible fit.

Joints 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 conduit unless otherwise shown on the drawings.

Existing drain 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 the Engineer.

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 and 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 conduit is placed in the excavated groove, friable material from the sides of the trench shall be placed around the conduit, completely filling the trench to a depth of not less than six

(6) Inches over the top of the conduit. 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. Conduit 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 depth of 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**

1. For items of work for which specific unit prices are established in the contract, the length of tile drain piping will be computed to the nearest foot along the centerline of pipe including the outlet section. Payment will be made to constitute full payment for all labor, materials, equipment, and all other items necessary and incidental to the completion of the work.
2. 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 Items of Work and Construction Details section of this specification.

B. ITEMS OF WORK AND CONSTRUCTION DETAILS

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

a. **Bid Item 13– Non-Perforated HDPE Field Tile, Dual Wall, 15-Inch**

- (1) This item will consist of furnishing and installing dual wall non-perforated 15-inch diameter corrugated polyethylene tubing used as drain tile as shown on the drawings.
- (2) HDPE Pipe shall meet ASTM F 2648 or ASTM F3390 (Flexible Dual Wall Piping)
- (3) Joints shall be gasketed and shall be water tight.
- (4) Minimum Cover over all tile shall be 3 feet.
- (5) Coupling bands, repair of damaged tile, prefabricated fittings and other appurtenances are subsidiary to this item and shall not warrant separate payment.
- (6) Measurement and payment for Bid item 13 (Non-Perforated HDPE Field Tile, 15”) shall be on an installed linear foot basis, and shall include all necessary fittings and adapters.

b. **Bid Item 19– 12” Hickenbottom Riser or equal**

- (1) This item will consist of furnishing and installing a 12” HDPE Hickenbottom intake or approved equal and connection to the existing or proposed tile as detailed. In the plans.
- (2) Coupling bands, repair of damaged tile, prefabricated fittings and other appurtenances are subsidiary to this item and shall not warrant separate payment.
- (3) Measurement and payment for Bid item 19 shall be for each intake installed and accepted.

c. **Bid Item 20– Non-Perforated HDPE Field Tile, 12-Inch**

- (1) This item will consist of furnishing and installing dual wall non-perforated 12-inch diameter corrugated polyethylene tubing used as drain tile as shown on the drawings.
- (2) HDPE Pipe shall meet ASTM F 2648 or ASTM F3390 (Flexible Dual Wall Piping)
- (3) Joints shall be gasketed and shall be water tight.
- (4) Minimum Cover over all tile shall be 3 feet.
- (5) Coupling bands, repair of damaged tile, prefabricated fittings and other appurtenances are subsidiary to this item and shall not warrant separate payment.
- (6) Measurement and payment for Bid item 19 (Non-Perforated HDPE Field Tile, 12”) shall be on an installed linear foot basis, and shall include all necessary fittings and adapters.

d. Subsidiary Item: Pre-fabricated HDPE Bends and Fittings

- (1) This item will consist of furnishing and installing necessary prefabricated HDPE tile bends, angles, couplers, or other required appurtenances to install the HDPE Pipe as shown on the plans.
- (2) No separate payment will be made for prefabricated bends, fittings, angles or other required appurtenances. Payment for this item of work is made subsidiary to Bid Item 13 and 19.

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSTRUCTION SPECIFICATION**

**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:

- A. 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.
- B. 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.
- C. Welded or lock seams in helical corrugated pipe are considered to be watertight.
- D. 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.
- E. 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.

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. galvanized rods and lugs. <sup>1/</sup>	35	48
Hugger band without rods and lugs but including O-ring gaskets. <sup>1/</sup>	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 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

<sup>1/</sup> Use is limited to sites where soft foundation and conduit elongation is not anticipated.

#### 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.

#### 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:

- A. Metallic Coating - by thoroughly wire brushing the damaged area and cleaning with solvent, and then painting two coats of one of the following paints:
  - (1) Zinc Dust - Zinc Oxide Primer conforming to ASTM D 79 and D 520.
  - (2) Single package, moisture cured urethane prime in silver metallic color.
  - (3) Zinc-rich cold galvanized compound, brush, or aerosol applications.
- B. 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. SPECIAL SPECIFICATIONS

### A. Measurement and Payment

1. For items of work for which specific unit prices are established in the contract, the length of pipe will be computed to the nearest foot along the centerline of pipe, and shall include the length of the aprons. Payment will be made to constitute full payment for all labor, materials, equipment, and all other items necessary and incidental to the completion of the work.

### B. Items of Work and Construction Details

#### 1. **Bid item 12 – 48” CMP WATER CONTROL STRUCTURE:**

- a. This item will consist of furnishing and installing the water control structure and all associated appurtenances.
- b. Structure shall be CRCS 12GA Aluminized CMP.
- c. Structure shall include a fabricated stoplogs, channel, lifting hooks, stop log storage structure, locks, and grate lid as detailed on the plans. Submit shop drawings for review and approval prior to manufacturing.
- d. Fabrication and installation shall be per both IA-51 and IA-620.
- e. Lump sum payment will constitute full compensation for this bid item as related subsidiary items.

#### 2. **Bid item 14– 18” Corrugated Metal Pipe, 16GA, Tile Outlet:**

- a. This item will consist of furnishing and installing the 18” CMP tile outlet section and concrete collar as shown on the plans.
- b. CMP shall be corrugated spiral pipe, 16GA, Aluminized CMP.
- c. Linear foot measurement and payment will constitute full compensation for this bid item and related subsidiary items.
- d. Subsidiary Item: Internally mounted rodent guard where applicable.

**3. Bid item 15– 15” Corrugated Metal Pipe, 16GA, Tile Outlet:**

- a. This item will consist of furnishing and installing the 15” CMP tile outlet section and concrete collar as shown on the plans.
- b. CMP shall be corrugated spiral pipe, 16GA, Aluminized CMP.
- c. Linear foot measurement and payment will constitute full compensation for this bid item and related subsidiary items.
- d. Subsidiary Items: Internally mounted rodent guard, anti-seepage collars, concrete collars.

**4. Bid item 16– 12” Corrugated Metal Pipe, 16GA, Drawdown Pipe:**

- a. This item will consist of furnishing and installing the 12” CMP pipe for the drawdown structure.
- b. CMP shall be corrugated spiral pipe, 16GA, Aluminized CMP.
- c. Linear foot measurement and payment will constitute full compensation for this bid item and related subsidiary items.
- d. Subsidiary Items: Internally mounted rodent guard, anti-seepage collars, concrete collars, connection bands.

**5. Bid Item 17- 12” Flared End Section**

- a. This item will consist of furnishing and installation of the flared end section and reinforced concrete footings as shown on the plans for the drawdown pipe outlet.
- b. Payment will constitute full compensation for this lump sum bid item and related subsidiary items.

**6. Subsidiary Item: Anti-Seepage Collars**

- a. This item will consist of furnishing and install the anti-seepage collars as shown on the plans.
- b. No separate payment will be made for the anti-seepage collars. Payment for this item will be considered subsidiary to the associated CMP pipe bid items.

**NATURAL RESOURCES CONSERVATION SERVICE**  
**CONSTRUCTION SPECIFICATION**  
**IA-61 LOOSE ROCK RIPRAP**

**SCOPE**

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

**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.

**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.

**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 insure 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.

**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.

**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.

## 1. SPECIAL SPECIFICATIONS

### A. Measurement and Payment

1. For items of work for which specific unit prices are established in the contract, the weight of rip rap, acceptably placed, will be computed to the nearest ton based on weight tickets provided by the Contractor to the Engineer. Payment will be made to constitute full payment for all labor, materials, equipment, and all other items necessary and incidental to the completion of the work.
2. Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item 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

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

#### A. **Bid Item 9- Rip-Rap, Class 'E' with Geotextile Fabric:**

- (1) This item shall consist of furnishing and placing Rock Riprap at the rock letdown at the river's edge and adjacent to the drop spillway.
- (2) Rock Riprap shall meet the requirements of IDOT Class 'E' revetment.
- (3) Measurement and payment for Rock Riprap shall be on a per ton basis, rounded to the nearest ton. Weigh tickets shall be provided to the Engineer for all Rock Riprap.
- (4) Subsidiary Item - Geotextile Fabric, IA-95: No separate payment will be made for geotextile.

#### B. **Bid Item 10 - 3" Roadstone, Construction Entrance:**

- (1) This item shall consist of furnishing and placing 3" roadstone at the construction entrance.
- (2) Roadstone shall be IDOT Gradation Number 13. Nominal maximum size of 3 inches screened over a 3/4" screen.
- (3) Measurement and payment for 3" roadstone shall be on a per ton basis, rounded to the nearest ton. Weigh tickets shall be provided to the Engineer.

#### C. **Bid Item 11- Erosion Stone**

- (1) This item shall consist of furnishing and placing Erosion Stone at the tile outlet.
- (2) Erosion Stone shall meet the requirements of Iowa DOT.
- (3) Measurement and payment for Erosion Stone shall be on a per ton basis, rounded to the nearest ton. Weigh tickets shall be provided to the Engineer for all Rock Riprap.
- (4) Subsidiary Item - Geotextile Fabric, IA-95: No separate payment will be made for geotextile.

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSTRUCTION SPECIFICATION**

**IA-81 METAL FABRICATION AND INSTALLATION**

**1. SCOPE**

The work shall consist of furnishing, fabricating, and installing metalwork including metal parts of composite structures.

**2. MATERIALS**

Steel shall be of structural quality. Finished surfaces shall be smooth and true to assure proper fit.

Bolts, nuts, washers, rods, rivets, etc., shall be of a material equal to the steel being fastened.

**3. PROTECTIVE COATINGS**

Protective coatings will consist of either galvanizing or painting and shall be applied by the fabricator.

Galvanizing shall consist of a zinc coating by the hot dip process, except that bolts, nuts, and washers may have a electrodeposited zinc coating.

Paint System for this specification shall consist of the application of one coat of Epoxy Polyamide Primer (lead and chromate free) and one or more coats of Epoxy Polyamide (intermediate or finish), lead free. When finished, it will have a minimum dry film thickness of 8.0 mils.

**4. FABRICATION**

Materials shall be carefully fabricated as shown on the drawings. The fabrication shall be smooth and true to assure proper fit. Galvanized items shall not be cut, welded, or drilled after the zinc coating is applied.

**5. ERECTION**

The metal shall be erected true and plumb, closely conforming to the drawings.

**6. SPECIAL SPECIFICATIONS**

**A. Measurement and Payment**

1. Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item 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**

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

**A. Bid Item 21, Aluminum Toe Wall Drop Structure**

- (1) This item will consist of furnishing and installing the aluminum toe wall outlet structure. This item includes all aluminum, steel, hardware, bolts, nuts, washers, welding, concrete, aggregates, reinforcing steel, excavation, backfill and miscellaneous appurtenances associated with the aluminum toe wall outlet structure as detailed in the plans.
- (2) Concrete shall have a minimum compressive strength at 28 days equal to 3500 psi.
- (3) All reinforcing steel bars shall be Grade 60 - #4 bars.
- (4) Aluminum sheets shall be structural plate (2 1/2" x 9" corrugations) 0.100" thickness and shall be Alloy 5052 conforming to ASTM B 209 or AASHTO M21.
- (5) Aluminum angles shall be Alloy 6061-T6 conforming to ASTM B 308.
- (6) Bolts shall be 3/4" diameter galvanized carbon steel conforming to ASTM A 307.
- (7) Seam sealant shall be knife-grade asphalt mastic or polymer adhesive sealant tape, Manus-Bond 64-A, or equal.
- (8) Drainfill aggregate shall meet the standard gradation of ASTM C 33 size 57 or 67.
- (9) Contractor shall submit a shop drawing to the engineer for approval prior to fabrication. Basis for design is NRCS Drawing IA-1410.
- (10) Lump Sum Item: this bid item will not be measured. Lump sum payment will constitute satisfactory installation of the toe wall and associated components as detailed in the plans.

**B. Subsidiary Items, Steel**

- (1) This item will consist of furnishing and installing the steel channel, reinforcing, and steel used for fabrication of the stoplog channel, steel grating used in covering the water control structure and other steel shown on the plans.
- (2) No separate payment will be made for Steel. Payment for this item will be considered subsidiary to the associated items of work.

**(b) Subsidiary Items, Aluminum**

- (1) This item will consist of furnishing and installing the aluminum shown on the plans.
- (2) No separate payment will be made for Aluminum. Payment for this item will be considered subsidiary to associated items of work.

(c) Subsidiary Items, Concrete & Reinforcing

- (1) This item will consist of furnishing and installing concrete and reinforcing shown on the plans per IA-31.
- (2) No separate payment will be made for Concrete and reinforcing. Payment for this item will be considered subsidiary to associated bid items.

# NATURAL RESOURCES CONSERVATION SERVICE CONSTRUCTION SPECIFICATION

## 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:

- a. 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.
- b. 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.
- c. 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 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.

## **1. SPECIAL SPECIFICATIONS**

### **A. Measurement and Payment**

1. For items of work for which specific unit prices are established in the contract, the weight of rip rap, acceptably placed, will be computed to the nearest ton based on weight tickets provided by the Contractor to the Engineer. Payment will be made to constitute full payment for all labor, materials, equipment, and all other items necessary and incidental to the completion of the work.
2. Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item 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**

1. Items of work to be performed in accordance with this specification and the construction details therefore are:
  - (a) Subsidiary Item - Geotextile Fabric
    - (1) This item shall consist of furnishing and placing geotextile on all earth surfaces that contact the rock riprap or stone as shown on the drawings.
    - (2) Geotextile shall be Class I, nonwoven
    - (3) The geotextile shall be placed with the long dimension parallel to the channel.
    - (4) Geotextile shall not be measured and shall be considered subsidiary to Riprap and stone bid items.

**TABLE 1. REQUIREMENTS FOR WOVEN GEOTEXTILES <sup>1/</sup>**

<b>Property</b>	<b>Test Method</b>	<b>Class I</b>	<b>Class II</b>	<b>Class III</b>	<b>Class IV</b>
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 <sup>-1</sup> )	ASTM D4491			as specified	
	ASTM D4751			as specified	
Apparent opening size (AOS) <sup>2/</sup>					
Percent open area (POA) (%)	USACE <sup>3/</sup> 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 <sup>1/</sup>**

<b>Property</b>	<b>Test Method</b>	<b>Class I <sup>2/</sup></b>	<b>Class II <sup>2/</sup></b>	<b>Class III <sup>2/</sup></b>	<b>Class IV <sup>2/</sup></b>
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 <sup>-1</sup> )	ASTM D4491		0.70 minimum or as specified		
Apparent opening size (AOS) (mm) <sup>3/</sup>	ASTM D4751		– 0.22 maximum 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.

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSTRUCTION SPECIFICATIONS**

**IA-620 UNDERGROUND OUTLET**

**1. SCOPE**

This work shall consist of installation of underground outlets and any appurtenant water control structures in accordance with an approved plan and design.

**2. MATERIALS**

Materials for underground outlets shall meet the requirements as shown in the plans and specifications. They shall be field inspected for any deficiencies such as thin spots or cracking prior to installation.

**Conduit**

The following reference specifications pertain to products currently acceptable for use as underground outlets:

**Plastic**

Corrugated Polyethylene (PE) Pipe and Fittings (3-6 inch) .....	ASTM F 405
3 through 24 inch Corrugated Polyethylene (PE) Pipe and Fittings.....	ASTM F 667
Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings (4-36 inch) .....	ASTM F 949
Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.....	ASTM D 2729
Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.....	ASTM D 3034
Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series) .....	ASTM D 2241
Polyethylene Plastics Pipe and Fittings Materials .....	ASTM D 335

**Clay**

Clay Drain Tile .....	ASTM C 4
Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated.....	ASTM C 700
Vitrified Clay Pipe, test methods.....	ASTM C 301

**Concrete**

Concrete Drain Tile (4-36 inch).....	ASTM C 412
Concrete Pipe for Irrigation or Drainage .....	ASTM C 118
Concrete Pipe, Manhole Sections, or Tile (test methods).....	ASTM C 497
Concrete Sewer, Storm Drain and Culvert Pipe .....	ASTM C 14
Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.....	ASTM C 76
Perforated Concrete Pipe .....	ASTM C 444
Portland Cement .....	ASTM C 150

**Other**

Styrene-Rubber (SR) Plastic Drain Pipe and Fittings.....	ASTM D 2852
Corrugated Aluminum Pipe for Sewers and Drains .....	ASTM B 745
Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains.....	ASTM A 760

## Inlet

The inlet shall be fabricated and installed as shown on the plans. Inlets must be of durable material, structurally sound, and resistant to damage by rodents or other animals. Inlets shall be of rigid material, which does not require supplemental support to remain in a vertical position. Materials, which meet these requirements, include the following:

1. Corrugated metal pipe, galvanized or aluminum, 16 gauge minimum,
2. Smooth steel pipe, with 3/16 inch minimum wall thickness,
3. Smooth plastic pipe, polyvinyl chloride (PVC), with an SDR of 43 or less,
4. High-density polyethylene pipe (PE). Round pipe shall have an SDR of 43 or less. Square intakes shall have minimum wall thickness as shown in the following table:

<u>Nominal Size</u>	<u>Minimum Thickness</u>
6 inch	0.16 inch
8 inch	0.21 inch
10 inch	0.26 inch
12 inch	0.31 inch

All plastic and polyethylene inlets shall include ultra-violet stabilizer to protect from solar degradation.

Perforations in the inlet shall be smooth and free of burrs. Unless otherwise specified, the above ground portion of the inlet shall have holes evenly spaced around the perimeter of the inlet in accordance with the following table:

<u>Inlet Size</u>	<u>Minimum Number of 1" Diameter Holes per Foot of Inlet</u>
4 inch	20
5 inch	24
6 inch	30
8 inch	40
10 inch	50
12 inch	60

If slots or round holes other than 1 inch in diameter are provided, the total cross sectional area of the openings per foot shall be equivalent to that provided by 1 inch diameter round holes meeting the above criteria.

The below ground portion of the inlet may be perforated with holes 5/16 of an inch in diameter or less to provide drainage around the inlet.

Appurtenances (i.e. tees and elbows) for polyvinyl chloride (PVC) inlets shall be schedule 40 or heavier.

Additional subsurface drainage tubing or tile may be used in conjunction with the surface inlet to improve access and farmability around the inlet. These underground extensions (when used) shall have a minimum length of 10 feet.

The inlet shall be offset from the main conduit except as noted below. A minimum of 8 feet of non-perforated conduit shall be installed between the inlet and the main conduit. The minimum diameter of the offset line shall be 3 inches. When conduit capacity is based on orifice flow from the inlet, such inlets shall be fabricated so that an orifice can easily be installed.

Only the top inlet in a terrace system may be placed directly on the main conduit. If the top most inlet in a terrace system is placed directly on the main conduit, the conduit shall be non-perforated from the inlet to the toe of the terrace back slope.

### **Outlet**

A continuous section of non-perforated conduit at least 20 feet long shall be used at the outlet. 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 shall be protected from erosion. Acceptable materials for use at the outlet include the following:

1. Corrugated metal pipe, galvanized or aluminum, 16 gauge minimum;
2. Smooth steel pipe, with 3/16 inch minimum wall thickness;
3. Smooth plastic pipe, polyvinyl chloride (PVC), with a SDR of 26 or less or schedule 40 or heavier; or
4. Corrugated profile wall (dual wall) polyethylene (PE) pipe meeting or exceeding the requirements of ASTM F 2648 (2" to 60"), ASTM F 2306 (12" to 60"). Pipe conforming to AASHTO M 252 (3" to 10"), or AASHTO M 294 (12" to 60") is acceptable.

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

Connections with the outlet pipe shall be made watertight.

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

## **3. TRENCH EXCAVATION**

Trench excavation shall be sufficient to provide required cover after other construction is completed.

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. 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 conduit. The 90-degree "V" groove shall not be used on conduits greater than 6 inches in diameter.

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

Plow installation is allowed except under the base width of the terrace or embankment. Trench width shall be at least two (2) inches wider than the conduit on each side to allow sufficient bedding to support the pipe.

## **4. INSTALLATION**

The underground outlet system shall be installed to the line and grade shown in the plans or as staked in the field. Conduit lines shall be installed and properly blinded or bedded prior to placement of any other earthfill over the lines.

Conduit lines shall be joined with standard factory couplers, if applicable, to produce a continuous system. Internal couplers may be used if they do not cause excessive flow restrictions. Conduit ends shall be protected during installation.

All appurtenant structures, including trash and rodent guards, shall be installed promptly and provisions shall be made for protecting them during installation. All conduit ends except the outlet and inlets with screens shall be capped with standard factory end caps or concrete. When corrugated plastic tubing is used, no more than 5% stretch will be allowed.

Orifice plates, when specified, shall have smooth edges and fit tightly.

## **5. TRENCH BACKFILL**

Conduits shall be bedded and backfilled throughout the base width of the basin embankment or terrace ridge. Friable soil material shall be placed in 4 inch layers and hand tamped to a depth of 2 feet above the conduit. The sides of the remaining trench shall be sloped no steeper than 3 horizontal to 1 vertical and backfill placed in 9 inch layers and machine compacted.

Water packing may be used as an alternative to mechanical compaction. If the conduit is non-perforated, it shall be filled with water during the water packing procedure. The initial backfill, before wetting, shall be of sufficient depth to ensure complete coverage of the pipe after consolidation has taken place. Water packing is accomplished by adding water in such quantity as to thoroughly saturate the initial backfill without inundation. The wetted fill shall be allowed to dry until firm before final backfill is begun. Final backfill shall be accomplished by placing friable soil material in 4 inch layers and hand tamping to a depth of 2 feet above the conduit. The sides of the remaining trench shall be sloped no steeper than 3 horizontal to 1 vertical and backfill placed in 9 inch layers and machine compacted.

Conduit which is not under the embankment or terrace ridge shall be backfilled with select bedding material containing no hard objects larger than 1½ inches in diameter to a minimum depth of 6 inches over the conduit. The conduit shall be held in place mechanically while select backfill material is placed around and over the conduit. This is to ensure that the proper conduit grade is maintained. All backfill material shall be placed so that deflection or displacement of the conduit will not occur. The remainder of the trench above the conduit shall be backfilled as rapidly as consistent with the soil conditions. Backfill shall extend above the ground surface and be well rounded over the trench. Large stones, frozen material, and large clods are not allowed in the backfill material.

## **6. FINISH**

Work areas shall be smoothed and left in a workmanlike manner. Vegetation or other protective cover shall be established as specified.

## **7. SPECIAL SPECIFICATIONS**