2024 Batch and Build Projects

Standards and Specifications

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Practice Specification
Saturated Buffer (Code 604)

SCOPE

The work consists of furnishing materials, installing all components, and performing all clearing and grubbing, excavations, grading, and earthfill required to construct the Saturated Buffer as shown on the plans or as staked in the field.

It is the Landowner's responsibility to locate any existing subsurface drains that may be under, along, or crossing the saturated buffer prior to construction. The NRCS is not responsible for any subsurface drains damaged during construction.

MATERIALS

Earth materials used in backfilling around the structure and pipe must be suitable material obtained from excavated material or from other approved sources as shown on the plans, described in Section 8, or approved by the Inspector. The fill material must be free from brush, roots, frozen material, sod, stones over 6 inches in diameter, or other undesirable material.

All disturbed areas must be finished so they are suitable for the planned use after construction is completed. If needed, stockpile topsoil and spread over excavations and other areas to facilitate establishment of vegetation.

Pipe, pipe sizes, fittings, and other appurtenances must be as specified on the plans. These items must conform to the "materials" section of Practice Specification IA-620, Underground Outlet, or as shown in Section 8 of this specification.

Structures must be fabricated and installed as shown on the plans. Structures must be of durable material, structurally sound, and resistant to damage by rodents or other animals. Structures must 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:

Square PE Intake

Nominal Size	Maximum Thickness
6 inch	0.16 inch
8 inch	0.21 inch
10 inch	0.26 inch
12 inch	0.31 inch

All plastic and polyethylene structures must include ultra-violet stabilizer to protect them from solar degradation.

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

EXCAVATION

Remove all trees, stumps, roots, brush, and other undesirable materials from the work area as shown on the plans or as agreed upon with the Landowner and Inspector. Burning of trees and brush must comply with all applicable state and local regulations.

Cuts and fills should be made in such a manner that topography will be enhanced. Excess spoil material must be placed, spread, leveled, shaped, or hauled away as shown on the plans or as staked in the field.

All excavations must conform to the lines, grades, elevations, bottom width, and side slopes shown on the construction plans or as staked in the field. The conduit trench bottom must 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 fill or sand bedding in the trench to bring it up to the conduit grade.

If not otherwise shown on the plans, trench width at the top of the conduit must have a minimum clearance of 3 inches from outside edge of the conduit. The trench width at the top of the conduit must have a maximum clearance of 6 inches from the outside edge of the conduit unless an approved bedding material is used.

Plow installation is allowed. The minimum trench width must be 2 inches wider than the conduit on each side. Grade control and bedding conditions must be closely monitored during the plow installation.

All excavation for structure installation must be sloped to no steeper than 2:1.

STRUCTURE INSTALLATION

Install structures according to the lines, grades, and elevations shown on the plans and as staked in the field. Prefabricated structures must be handled in accordance with manufacturer recommendations to ensure the structure's integrity after installation.

Place backfill around the structure in 9-inch lifts and hand compacted. The moisture content of the fill material must 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.

The finished surfaces must present a workmanlike appearance.

PIPE INSTALLATION

Install pipe as shown on the plans and/or as staked in the field.

Unless otherwise specified, no filter or envelope is required around the distribution pipe. In stable soils, shape the bottom of the trench to form a semicircular, trapezoidal, or 90-degree "V" groove in its center. Shape the groove to fit the size of tile. The 90-degree "V" groove must 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 distribution pipe, use a sand-gravel mix or other approved material to stabilize the bottom of the trench.

When a filter is specified, the shape of the bottom of the trench and the gradation and thickness of the filter or envelope material to be placed around the conduit will be as shown on the plans. Place the filter or envelope material in the bottom of the trench. Install the conduit as shown on the plans. Place the filter or envelope material over the conduit.

The slope of the distribution lines is critical. Extra care must be taken to ensure that these lines are laid on a uniform grade throughout the length of the line or as shown on the plans. Anchor the pipe or place a vertical load on it, while exposed, at regular intervals to prevent uplift and separation from the bedding during backfill. Backfill the trench above the ground surface and round the top of the earthfill over the trench.

The minimum depth of backfill over the distribution conduit is 2.4 feet.

Make lateral connections with manufactured appurtenances (wyes, tees, couplings, etc.) comparable in strength and durability with the type of conduit being used. Pipe connections to the structure must be watertight.

OUTLET

Use a continuous section of non-perforated conduit at least 20 feet long at the outlet. Bury at least two-thirds of the outlet pipe in the ditch bank with the end of the pipe placed above the toe of the ditch, or protect the side slope from potential erosion due to discharge of the pipe. Acceptable materials for use of the outlet conduit include the following:

1. Corrugated metal pipe, galvanized or aluminum, 16 gauge minimum;
2. Smooth steel pipe with a minimum wall thickness of 3/16 inch;
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 pipe (PE).

All plastic (PVC) and polyethylene pipe (PE) outlets must include ultra-violet stabilizer. Do not use PVC and PE pipe outlets where vegetation on the ditch bank may be burned and will likely damage the pipe.

All outlet pipes must have a flap-gate type animal guard.

SEEDING

Establish a protective cover of vegetation on the entire soil saturation area and all surfaces disturbed by construction as shown on the plans or staked in the field. Plant species must be water tolerant and suitable for wet soil conditions. Seeding and mulching must be performed in accordance with the IA-CPA-4, Seeding Plan, and Construction Specification IA-6, Seeding and Mulching for Protective Cover.

Specific Site Requirements

Practice Specification
Denitrifying Bioreactor (Code 605)

SCOPE

The work consists of constructing a denitrifying bioreactor as required by the construction plans.

UTILITIES

The contractor is responsible for calling Iowa One Call at least 48 hours prior to beginning any excavation work. The landowner is responsible for locating other infrastructure such as tile lines and structures. The landowner will obtain all necessary permissions from regulatory agencies, or document that no permits are required.

GENERAL

Carry out construction operations in a manner and sequence that erosion and air and water pollution are minimized and held within legal limits.

The completed job must present a workmanlike appearance and conform to the line, grades, and elevations shown on the drawings or as staked in the field.

Carry out all operations in a safe and skillful manner. Observe safety and health regulations and use appropriate safety measures.

Save documentation of materials used (geotextile tags, seed tags, photographs of pipe labeling, etc.) and provide to NRCS.

Remove all trees, stumps, brush, and debris from the site and disposed of so they will not interfere with construction or proper functioning of the structure.

EXCAVATION

Unless otherwise specified, begin excavation for and subsequent installation of the pipe and structures at the outlet end and progress upstream.

Excess spoil material must be placed, spread, leveled, shaped, or hauled away as shown on the construction plans or as staked in the field. Finish the completed job to a degree so the surface can be traveled with farm-type equipment unless otherwise specified in the construction plans.

All excavations must conform to the lines, grades, elevations, bottom width, and side slopes shown on the construction plans or as staked in the field.

Trench shields, shoring, bracing, or other methods necessary to safeguard the workers and prevent damage to the existing improvements shall be furnished, placed, and subsequently removed by the contractor. Occupational Safety and Health Administration (OSHA) requirements relating to trench safety shall be followed.

MEDIA CHAMBER

Line the bottom and sides of the media chamber with plastic as shown on the construction drawings Plastic must have a minimum thickness of 4 mil.

If a soil cap is to be constructed over the top of the chamber, use geotextile to separate the media from the soil. Geotextile must be non-woven, class II, and meet the requirements of Iowa Construction Specification IA-95, Geotextile.

Carbon source media must meet the following requirements:

1. Wood material must be chipped, not shredded. At minimum, 90% of the chips by weight must be 1-inch to 2-inch in length (longest direction).
2. Wood chips must be free from objectionable material such as dirt, fines, stones, leaves, long stringy material, etc. Decomposed or partially decomposed wood chips shall not be used.
3. Wood must not be treated for ground contact.

4. Wood made from high tannin content species such as oak, cedar, or redwood is to be avoided. NRCS will reject any proposed wood chips with more than 50% by volume oak wood chip materials. The contractor is advised to check with NRCS in advance for acceptance of the media to be used in the bioreactor.

Spread the media evenly around the chamber. There must be no air pockets, bridging, or uneven surface of the media. Media must be placed in a manner that avoids damage to the distribution and collection pipes in the chamber.

Mound the top surface of the media chamber with the material specified in the plans to allow for settlement of the media and to shed water. Mound the center of the trench as shown on the plans but no less than 10% of the total depth of the media material.

WATER CONTROL STRUCTURE AND PIPE

The materials and manufacture of the water control structure, pipe, anti-seep collars, coupling bands, coatings, and other appurtenances must be as shown on the construction drawings and conform to materials and applicable reference specifications as shown in Iowa Construction Specification IA-620, Underground Outlet.

Place the water control structure and pipe couplers on a stable base. The stable base may be compacted earth, compacted sand, or a concrete pad. Extend the stable base no less than 1 foot around the structure.

Install the structure with all stop boards in their tracks. Place impervious backfill material around the structure and appurtenances by hand and in layers not more than 6 inches thick before compaction. Thoroughly compact each layer, by means of hand tamping, to the same density as the surrounding materials. Increase the height of fill at approximately the same rate on all sides of the structure.

Lay the pipe to the lines, grades, and elevations shown on the drawings. Bed the pipe firmly and uniformly throughout its entire length. Use hand tamping methods around pipes that are within 20 feet of the water control structure. Beyond that distance, the pipe may be laid with a tile plow or trencher designed for proper bedding of the pipe, and the disturbed soil allowed to naturally subside back into place.

OUTLET

Where the construction plans call for a free outlet, use a continuous section of non-perforated conduit at the outlet, unless a headwall is used. All outlets must have an animal guard, installed to allow passage of debris.

The continuous section of non-perforated conduit must be long enough to satisfy all requirements of Conservation Practice Standard 606 – Subsurface Drain:

- At least two-thirds of the pipe must be buried in the ditch bank.
- The cantilever section must extend to the toe of the ditch side slope or to the side slope protected from erosion.
- The continuous section must be at least 20 feet long.

Acceptable materials for use at the outlet include the following:

- Corrugated metal pipe, galvanized or aluminum, 16-gauge, minimum thickness,
- Smooth steel pipe with 3/16 of an inch minimum thickness,
- Smooth plastic pipe, polyvinyl chloride (PVC), with a SDR of 35 or less or schedule 40 or heavier, and
- Dual wall corrugated polyethylene pipe.

All plastic and polyethylene pipe outlets must include an ultra-violet stabilizer.

VEGETATION

Establish a protective cover of vegetation on all surfaces of the areas disturbed by construction. Perform seeding and mulching in accordance with the Seeding Plan, IA-CPA-4, and Construction Specification IA-6, Seeding and Mulching for Protective Cover.

Establish vegetation as soon after construction as possible.

9. Specific Site Requirements

Reset

Practice Specification
Underground Outlet (Code 620)

SCOPE

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

MATERIALS

Materials for underground outlets must meet the requirements as shown in the plans and specifications. They must 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 Pipe

3 through 24 inch Corrugated Polyethylene (PE) Pipe and Fittings	ASTM F667
12 to 60 in. Annular Corrugated Profile-Wall Polyethylene (PE) Pipe	ASTM F2306
2 to 60 in. Annular Corrugated Profile Wall Polyethylene (PE) Pipe	ASTM F2648
3 to 24 in. Lined Flexible Corrugated Polyethylene Pipe	ASTM F3390
Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings (4-36 inch)	ASTM F949
Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings	ASTM D2729
Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings	ASTM D3034
Poly (Vinyl Chloride) (PVC) Plastic Pipe (Sch Series)	ASTM D1785
Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)	ASTM D 2241

Clay Pipe

Clay Drain Tile	ASTM C4
Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated	ASTM C700

Concrete Pipe

Concrete Drain Tile (4-36 inch)	ASTM C412
Concrete Pipe for Irrigation or Drainage	ASTM C118
Nonreinforced Concrete Sewer, Storm Drain and Culvert Pipe	ASTM C14
Reinforced Concrete Culvert, Storm Drain and Sewer Pipe	ASTM C76
Perforated Concrete Pipe	ASTM C444

Other Pipe

Styrene-Rubber (SR) Plastic Drain Pipe and Fittings	ASTM D2852
Corrugated Aluminum Pipe for Sewers and Drains	ASTM B745
Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains	ASTM A760

Inlet

Fabricate and install the inlet as shown on the plans. Inlets must be of durable material, structurally sound, and resistant to damage by rodents or other animals. Inlets must 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:

Square Intake Wall Thickness

Nominal Size	Minimum Thickness
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 must include ultra-violet stabilizer to protect from solar degradation.

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

Minimum Number of Holes

Inlet Size	Minimum Number of 1” Diameter Holes per Foot of Inlet
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 will 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-inch in diameter or less to provide drainage around the inlet.

Appurtenances (i.e. tees and elbows) for polyvinyl chloride (PVC) inlets must 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) will have a minimum length of 10 feet.

The inlet must be offset from the main conduit except as noted below. A minimum of 8 feet of non-perforated conduit will be installed between the inlet and the main conduit. The minimum diameter of the offset line is 3 inches. When conduit capacity is based on orifice flow from the inlet, such inlets will 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 topmost inlet in a terrace system is placed directly on the main conduit, the conduit must be non- perforated from the inlet to the toe of the terrace back slope.

Outlet

Use a continuous section of non-perforated conduit at least 20 feet long at the outlet. Two-thirds of the outlet pipe must 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 must include ultra-violet stabilizer. PVC and PE pipe outlets must not be used where burning vegetation on the outlet ditch bank is likely to create a fire hazard.

Connections with the outlet pipe must be made watertight.

Equip the outlet with a flap gate rodent guard.

TRENCH EXCAVATION

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

The trench bottom will 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 must be shaped to form a semicircular, trapezoidal, or 90-degree "V" groove in its center. The groove must be shaped to fit the size of conduit. The 90-degree "V" groove must 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 will be at least two (2) inches wider than the conduit on each side to allow sufficient bedding to support the pipe.

INSTALLATION

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

Conduit lines must 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 must be protected during installation.

All appurtenant structures, including trash and rodent guards, must be installed promptly and provisions must be made for protecting them during installation. All conduit ends except the outlet and inlets with screens must 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, must have smooth edges and fit tightly.

TRENCH BACKFILL

Conduits must be bedded and backfilled throughout the base width of the basin embankment or terrace ridge. Friable soil material must be placed in 4 inch layers and hand tamped to a depth of

2 feet above the conduit. The sides of the remaining trench must 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 will be filled with water during the water packing procedure. The initial backfill, before wetting, must 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 must be allowed to dry until firm before final backfill is begun. Final backfill will 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 must 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 must 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 must 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 must be placed so that deflection or displacement of the conduit will not occur. The remainder of the trench above the conduit must be backfilled as rapidly as consistent with the soil conditions. Backfill must 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.

FINISH

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

Specific Site Requirements

Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

STRUCTURE FOR WATER CONTROL

CODE 587

(no)

DEFINITION

A structure in a water management system that conveys water, controls the direction or rate of flow, maintains a desired water surface elevation, or measures water.

PURPOSE

Apply this practice as a component of a water management system to:

- control the stage, discharge, distribution, delivery, or direction of water flow

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to a permanent structure needed as an integral part of a water control system to serve one or more of the following functions:

- Convey water from one elevation to a lower elevation within, to, or from a water conveyance system such as a ditch, channel, canal, or pipeline. Typical structures include drops, chutes, turnouts, surface water inlets, head gates, pump boxes, and stilling basins.
- Control the elevation of water in drainage or irrigation ditches. Typical structures include checks, flashboard risers, and check dams.
- Control the division or measurement of irrigation water. Typical structures include division boxes and water measurement devices.
- Keep trash, debris or weed seeds from entering pipelines. Typical structures include trash racks and debris screens.
- Control the direction of channel flow resulting from tides and high water or backflow from flooding. Typical structures include tide and water management gates.
- Control the water table level, remove surface or subsurface water from adjoining land, flood land for frost protection, or manage water levels for wildlife or recreation. Typical structures include water level control structures,flashboard risers, pipe drop inlets, and box inlets.
- Convey water over, under, or along a ditch, canal, road, railroad, or other barriers. Typical structures include bridges, culverts, flumes, inverted siphons, and long span pipes.
- Modify water flow to provide habitat for fish, wildlife, and other aquatic animals. Typical structures include chutes, cold water release structures, and flashboard risers.
- Provide silt management in ditches or canals. Typical structures include sluice gates and sediment traps.
- Supplement a resource management system on land where organic waste or commercial fertilizer is applied.
- Create, restore, or enhance wetland hydrology.

NRCS, IA
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CRITERIA

General Criteria Applicable to All Purposes

All structures designed under this standard must comply with applicable Federal, Tribal, State, and local laws, rules, and regulations. Obtain all required permits before construction begins.

Seed or sod the exposed surfaces of earthen embankments, earth spillways, borrow areas, and other areas disturbed during construction in accordance with the criteria in Critical Area Planting (342).

Fence the structure, if needed, to protect the vegetation. Structures must not have an adverse effect on septic filter fields.

The capacity of the water control structure(s) must be consistent with the level of protection desired and equal to or more than the capacity of other related components of the overall plan. Related components such as earth embankments, dikes, diversions, irrigation canals, etc., must meet the criteria of the applicable standard.

Where manufactured structures are used, the manufacturer must provide the hydraulic design.

The water level upstream of water control structures must not be raised on adjacent landowners unless authorized through a written easement, permit, or equivalent legal document.

Additional Criteria for Structures Designed for Wetland Restoration, Enhancement, or Creation

Where water control structures are provided for wetland water level control, protect existing drains downstream of the site by flow control devices. Inflow will be limited to the capacity originally apportioned to the drain.

Materials must meet the requirements for Underground Outlet (620) for fill heights over the conduit of 10 feet or less. Materials for all other conditions must meet Pond (378) requirements.

If needed to prevent clogging of the conduit, install an appropriate trash guard at the inlet or riser. Install animal guards on conduit outlets of 10 inches in diameter or smaller.

Use a drainage diaphragm or anti-seep collars for seepage control if the conduit:

- Has a smooth exterior and is larger than 8 inches in diameter.
- Has a corrugated exterior and is larger than 12 inches in diameter.
- Is installed at a depth of 5 feet or more below management pool level.

Drainage diaphragms and anti-seep collars must meet the requirements in Pond (378).

Safety

Design measures necessary to prevent serious injury or loss of life in accordance with requirements of Title 210, National Engineering Manual (NEM), Part 503, Safety.

Cultural Resources

Evaluate the existence of cultural resources in the project area and any project impacts on such resources. Provide conservation and stabilization of archeological, historic, structural, and traditional cultural properties when appropriate.

CONSIDERATIONS

Consider the following items when planning, designing, and installing this practice:

- Effects on the water budget, especially on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, and ground water recharge.
- Potential for a change in the rate of plant growth and transpiration because of changes in the volume of soil water.
- Effects on downstream flows or aquifers that would affect other water uses or users.
- Effects on the field water table to ensure that it will provide a suitable rooting depth for the anticipated crop.
- Potential use for irrigation management to conserve water.
- Effect of construction on aquatic life.
- Effects on stream system channel morphology and stability as it relates to erosion and the movement of sediment, solutes, and sediment-attached substances carried by runoff.
- Effects on the movement of dissolved substances below the root zone and to ground water.
- Effects of field water table on salt content in the root zone.
- Short term and construction-related effects of this practice on the quality of downstream water.
- Effects of water level control on the temperatures of downstream waters and their effects on aquatic and wildlife communities.
- Effects on wetlands or water-related wildlife habitats.
- Effects on the turbidity of downstream water resources.
- If watercourse fisheries are important, special precautions or design features may be needed to facilitate continuation of fish migrations.

PLANS AND SPECIFICATIONS

Prepare plans and specifications that describe the requirements for applying the practice according to this standard. As a minimum, include—

- A plan view of the layout of the structure for water control.
- Typical profiles and cross sections of the structure for water control.
- Structural drawings adequate to describe the construction requirements.
- Requirements for vegetative establishment and mulching, as needed.
- Safety features.

The following list of Construction Specifications is intended as a guide to selecting the appropriate specifications for each specific project. The list includes most, but may not contain all, of the specifications that are needed for a specific project:

IA-1 Site Preparation

IA-5 Pollution Control

IA-6 Seeding and Mulching for Protective Cover

IA-21 Excavation

IA-23 Earthfill

IA-31 Concrete

IA-45 Plastic (PVC, PE) Pipe

IA-46 Tile Drains for Land Drainage

IA-95 Geotextile

OPERATION AND MAINTENANCE

Prepare an operation and maintenance plan for the operator.

As a minimum, include the following items in the operation and maintenance plan:

- Periodic inspections of all structures, earthen embankments, spillways, and other significant appurtenances.
- Prompt removal of trash from pipe inlets and trash racks.
- Prompt repair or replacement of damaged components.
- Prompt removal of sediment when it reaches predetermined storage elevations.
- Periodic removal of trees, brush, and undesirable species.
- Periodic inspection of safety components and immediate repair if necessary.
- Maintenance of vegetative protection and immediate seeding of bare areas as needed.
- Describe water level management and timing when applicable.

REFERENCES

USDA NRCS. National Engineering Handbook (NEH), Part 636, Structural Engineering. Washington, DC.

USDA NRCS. NEH, Part 650, Engineering Field Handbook. Washington, DC.

USDA NRCS. National Engineering Manual. Washington, DC.

Construction Specification
000 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 NRCS. The work shall also consist of the removal and disposal of structures (including fences) that must be removed to perform other items of work.

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

2. FOUNDATION PREPARATION

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

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

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

3. STRIPPED MATERIAL DISPOSAL

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

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

4. DISPOSAL OF REFUSE MATERIALS

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

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

5. SALVAGE

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

Specific Site Requirements

Reset

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

1. SCOPE

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

2. SEEDBED PREPARATION AND APPLICATION

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

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

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

3. MATERIALS

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

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

4. MULCH APPLICATION

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

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

Specific Site Requirements

Two example seeding mixes are attached. No fertilization required for establishment under this given scenario.

Reset

NATURAL RESOURCES CONSERVATION SERVICE
CONSTRUCTION SPECIFICATION

IA-9 SUBSURFACE DRAIN INVESTIGATION, REMOVAL, AND REPAIR

1. SCOPE

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

2. INVESTIGATION AND LOCATION

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

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

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

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

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

3. TILE REPAIR

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

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

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

Using selected soil free of hard clods, rocks, or frozen soil, hand tamp the backfill material around the haunch of the pipe in layers not over four (4) inches thick to provide support. Hold the conduit in place mechanically while placing excavated material around and over the conduit to ensure proper alignment and grade is maintained. Complete the backfill operation according to Section 5.

4. TILE REMOVAL

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

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

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

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

5. BACKFILL

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

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

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

6. MATERIALS

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

Table 1. Acceptable pipe for subsurface drain repair

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

[#] Pipe sizes are nominal and the ranges are inclusive
[$] Pipe conforming to AASHTO M 252 (3 to 10 inch), or AASHTO M 294 (12 to 60 inch) is acceptable

7. SPECIAL SPECIFICATIONS

None

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

1. SCOPE

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

2. MATERIALS

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

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

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

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

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

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

3. FITTINGS AND JOINTS

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

Joints may be bell and spigot type with elastomeric gaskets, coupling type with elastomeric gasket on each end, or solvent cemented. Gaskets shall conform to ASTM D 1869. Solvent cemented joints shall not be used for pond spillway pipes. Solvent cemented joints for PVC pipe and fittings shall be in accordance with ASTM D 2855. When a lubricant is required to facilitate joint assembly, it shall be a type having no detrimental effect on the gasket or pipe material.

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

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

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

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

4. HANDLING AND STORAGE

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

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

5. TRENCHING

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

1. **Trencher Constructed** - When conditions permit, trenching for pipelines, which are buried from 5 to 6 feet deep, are usually done with a narrow 4 to 6 inch wide chain trencher. Where there is little gravel and the ground is not too wet, these trenchers bring up well pulverized soil that makes good backfill material. Where rocks are not present, any of this material may be backfilled directly around the pipe. There is no practical way to compact the fill in these narrow trenches. The owner must be made aware that this material normally consolidates to its maximum extent in two to five years, but depressions or low spots can be hazards to livestock, humans and equipment.
2. **Backhoe Constructed Trench** – Backhoe trenches are usually a minimum of 12 inches wide. The material frequently comes out of the trench as clods, large chunks, and rocks. Immediately backfill over the pipe with 4 to 6 inches of soil that is free of these clods, large chunks, and rocks. If adequate excavated material is not available, then material such as sand or fine gravel should be imported and placed around the pipe to a depth of 4 to 6 inches over the top of the pipe. Fill the trench with the remaining excavated material.
3. **Plowing** – Plowing, or ripping, is a trenchless method for installing plastic pipe. It is a multi-stage process consisting of positioning a vibrating or static (non-vibrating) plow equipped with a trailing product guide which feeds pipe to the depth setting of the plow as it moves forward. The pipe is inserted into the ground continuously along a predetermined path and depth. The vertical depth of installation is controlled by hydraulic adjustment of the plow shear head and the surface contours. The depth of insertion must be continually adjusted to compensate for changes in terrain.

6. LAYING AND BEDDING THE PIPE

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

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

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

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

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

1. Earth Bedding. When bedding is specified, the pipe shall be firmly and uniformly bedded in a shaped bedding groove that closely conforms to the bottom of the pipe for a depth equal to a minimum of 1 inch or 5 percent of the diameter of the pipe, whichever is greater. The bedding material shall be free of rocks or stones greater than 0.5 inch diameter and earth clods greater than 2 inch diameter.
2. Sand or Gravel Bedding. When sand or gravel bedding is specified, the pipe shall be firmly and uniformly placed on a sand or gravel bed. Sand or gravel fill shall be carefully placed and compacted as specified herein and as shown on the drawings.

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

Adequate thrust control shall be incorporated in these installations.

7. BACKFILL

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

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

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

Specific Site Requirements

Construction Specification
000 IA-95 Geotextile

1. SCOPE

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

2. MATERIAL QUALITY

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

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

3. STORAGE

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

4. SURFACE PREPARATION

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

5. PLACEMENT

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

The geotextile shall be joined by overlapping a minimum of 18 inches (unless otherwise specified), and secured against the underlying foundation material. Securing pins, approved and provided by the geotextile manufacturer, shall be placed along the edge of the panel or roll material to adequately hold it in place during installation. Pins shall be steel or fiberglass formed as a "U", "L", or "T" shape or contain "ears" to prevent total penetration. Steel washers shall be provided on all but the "U" shaped pins. The upstream or up-slope geotextile shall overlap the abutting down-slope geotextile. At vertical laps, securing

pins shall be inserted through both layers along a line through approximately the midpoint of the overlap. At horizontal laps and across slope laps, securing pins shall be inserted through the bottom layer only. Securing pins shall be placed along a line approximately 2 inches in from edge of the of the placed geotextile at intervals not to exceed 12 feet unless otherwise specified. Additional pins shall be installed as necessary and where appropriate, to prevent any undue slippage or movement of the geotextile. The use of securing pins will be held to the minimum necessary. Pins are to be left in place unless otherwise specified.

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

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

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

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

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

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

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

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

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

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

The geotextile shall be unrolled in a direction parallel to the roadway centerline in a loose manner permitting conformation to the surface irregularities when the roadway fill material is placed on its surface. In no case shall material be dropped on uncovered geotextile from a height of more than 5 feet. Unless otherwise specified, the minimum overlap of geotextile panels joined without sewing shall be 24 inches. The geotextile may be temporarily secured with pins recommended or provided by the manufacturer, but they shall be removed before the permanent covering material is placed.

Table 1. Requirements for Woven Geotextiles[1/]

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

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

Table 2. Requirements for Nonwoven Geotextiles[1/]

Property	Test Method	Class I [2/]	Class II [2/]	Class III [2/]	Class IV [2/]
Grab tensile strength (pounds)	ASTM D4632 grab test	202 minimum	157 minimum	112 minimum	202 minimum
Elongation at failure (%)	ASTM D4632	50 minimum	50 minimum	50 minimum	50 minimum
Trapezoidal tear strength (pounds)	ASTM D4533	79 minimum	56 minimum	40 minimum	79 minimum
Puncture strength (pounds)	ASTM D6241	433 minimum	309 minimum	223 minimum	433 minimum
Ultraviolet light (retained strength) (%)	ASTM D4355	50 minimum	50 minimum	50 minimum	50 minimum
Permittivity (sec^{-1})	ASTM D4491	0.70 minimum or as specified			
Apparent opening size (AOS) (mm) [3/]	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.

Specific Site Requirements