CONSTRUCTION SPECIFICATIONS

DELAWARE WATERSHED
JOINT DISTRICT NO. 10

JACKSON COUNTY, KANSAS

REHABILITATION OF GRADE STABILIZAION
DETENTION DAM SITE C-58

Prepared by:

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SUPPLEMENTARY CONDITIONS

As required by the Permit to Construct issued by the Division of Water Resources the following specified conditions will apply.

The Division of Water Resources will be notified when:

1. Proposed construction of project is to commence.

2. The dam foundation has been prepared for placement of fill. No material shall be placed on any portion of the foundation until such portion of the foundation has been approved by a representative of the Division of Water Resources.

3. Installation of the principal spillway pipe or any other conduit that extends through the embankment and appurtenances is to be accomplished. A representative of the Division of Water Resources will be present to approve fill material and observe installation.

THEREFORE, these conditions shall become a part of the approved construction specifications and a required provision of the Permit to Construct. The CONTRACTOR will notify the ENGINEER in charge of the project several days in advance regarding the timing of the above stated works of improvement in order to allow the ENGINEER a sufficient time to give notification to the Division of Water Resources. **This being defined as no less than 48 hours.**

IN ADDITION, these considerations require that the designing ENGINEER and/or a representative shall provide continuous, on site inspection during construction.

Failure by the CONTRACTOR to comply with the above conditions could result in loss of construction time allotment and will be solely the responsibility of the CONTRACTOR.

CONSTRUCTION SPECIFICATION

1. SAFETY PLAN

1. SCOPE

This work shall consist of maintaining the construction site and operations in a safe condition.

2. ITEMS OF WORK

It shall be the responsibility of the Contractor to maintain the construction site and operations in a safe condition. Workers, the general public, and any public utility on the site must be protected from accidental damage. The Contractor must contact Kansas One Call at least one week prior to initiation of soil disturbing activities to have utilities identified and marked. The Contractor shall also contact the rural water districts or any other utility not typically members of Kansas One Call. (800-344-7233) The designer makes no representation as to the existence or non-existence of utilities on the construction site. The absence of utilities on drawings is no assurance that they are not present.

The Contractor must follow all applicable rules and regulations of the Occupational Safety and Health Administration (OSHA). Warning signs and protective fencing shall be installed as needed to provide public safety.

CONSTRUCTION SPECIFICATION

2. CLEARING AND GRUBBING

1. SCOPE

The work shall consist of the clearing and grubbing of designated areas by removal and disposal of trees, snags, logs, stumps, shrubs and rubbish.

2. MARKING

The limits of the areas to be cleared and grubbed will be marked by means of stakes, flags, tree markings or other suitable methods. Trees to be left standing and uninjured will be designated by special markings placed on the trunks at a height of about six feet above the ground surface.

3. REMOVAL

All trees not marked for preservation and all snags, logs, brush, stumps, shrubs and rubbish shall be removed from within the limits of the marked areas. Unless otherwise specified, all stumps, roots and root clusters having a diameter of one inch or larger shall be grubbed out to a depth of at least two feet below subgrade elevation for concrete structures and one foot below the ground surface at embankment sites and other designated areas.

4. DISPOSAL

All trees and brush and other materials removed from the clearing will be the property of the contractor unless.

Materials removed from the cleared and grubbed areas shall be burned or buried.

5. SALVAGE

Structures that are designated to be salvaged shall be carefully removed and neatly placed in the specified storage areas. Materials from fences designated to be salvaged shall be placed outside the work area on the property from which they were removed. Wire shall be

rolled into uniform rolls of convenient size and posts and rails shall be neatly piled. Trees that are designated to be salvaged will be carefully removed and placed in a specified area. Materials to be disposed of by burying shall be covered with earth to a depth of at least 2 feet. On areas not covered with water, at least the top 6 inches shall be topsoil. These areas shall be graded and finished in a workmanlike manner to prevent ponding of water.

6. ITEMS OF WORK AND CONSTRUCTION

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

a. Bid Item Clearing and Grubbing

(1) This item shall consist of clearing and grubbing of the dam site and borrow area to the limits as shown on the drawings or as directed by the engineer.

(2) Blasting will not be permitted in the vicinity of the principal spillway after the work has begun on the appurtenances, conduit, or inlet structure except as approved by the engineer.

(3) Measurement and payment shall be at the lump sum prices established in the contract. Such payment shall constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to the completion of the work.

b. Subsidiary Item Structure Removal

(1) This item shall consist of removing the fences in the construction area as shown on the drawings.

(2) No separate payment will be made for this item. Compensation for this item shall be included in the payment for Clearing and Grubbing.

CONSTRUCTION SPECIFICATION

3. STRUCTURE REMOVAL

1. SCOPE

The work shall consist of the removal, salvage and disposal of structures (including fences) from the designated areas.

2. MARKING

Method 1.Each structure unit to be removed will be marked by means of stakes, flags, painted markers or other suitable methods.

Method 2. The limits of the areas from which structures must be removed will be marked by means of stakes, flags, or other suitable methods. Structures to be preserved in place or salvaged will be designated by special markings.

3. REMOVAL

Method 1. All structures designated in the contract for removal shall be removed to specified extent and depth.

Method 2. Within the areas so marked all visible structures located and identified by survey stakes shall be removed to the specified extent and depth.

4. SALVAGE

Structures that are designated to be salvaged shall be carefully removed and neatly placed in the specified storage areas. Salvaged structures that are capable of being disassembled shall be dismantled into individual members or sections. Such structures shall be neatly match marked with paint prior to disassembly. All pins, nuts, bolts, washers, plates and other loose parts shall be marked or tagged to indicate their proper locations in the structure and shall be fastened to the appropriate structural member or packed in suitable containers. Materials from fences designated to be salvaged shall be placed outside the work area on the property from which they were

removed. Wire shall be rolled into uniform rolls of convenient size. Post and rails shall be neatly piled.

5. DISPOSAL OF REFUSE MATERIAL

Refuse materials resulting from structure removal shall be burned or buried at locations shown on the drawings or as specified in Section 7 of the specifications.

6. MEASURE AND PAYMENT

Method 1 For items of work for which specific unit prices are established in the contract, payment for the removal of each structure unit, except fences, will be made at the contract unit price. Fences removed or removed and salvaged will be measured to the nearest linear foot. Payment for fence removal or removal and salvage will be made at the contract unit prices appropriate to each type and size of fence.

Such payment will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

Method 2 For item of work for which specific lump sum prices are established in the contract, payment for structure removal will be made at the contract lump sum price.

Such payment will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

All Methods The following provisions apply to all methods of measurement and payment. 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 of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 7 of this specification.

7. ITEMS OF WORK AND CONSTRUCTION

Items of work to be performed in conformance with this

specification and construction detailed therefore are:

a. Bid Item-Structure Removal

(1) This item shall consist of removing the existing principal spillway pipeline, and drawdown pipeline. Marking of the work will be by Method 1. Removal of structures will be by Method 1. Measurement and payment shall be by method 2.

(2) Materials to be disposed of by burying shall be covered with earth to a depth of at least 2 feet.

(3) On areas not covered by permanent water, at least the top 6 inches of the 2 feet of cover shall be topsoil. These areas shall be graded and finished in a workmanlike manner to prevent the ponding of water

b. Subsidiary Item Structure Removal

(1) This item shall consist of removing the fences in the construction area as shown on the drawings.

(2) No separate payment will be made for this item. Compensation for this item shall be included in the payment for Clearing and Grubbing.

CONSTRUCTION SPECIFICATION

4. INSPECTION PLAN

1. SCOPE

The work conducted under this contract shall have continuous on-site inspection during construction to assure that all items of work are completed in conformance with the approved plans and specifications. The inspector must possess the knowledge, skills and experience necessary to conduct timely and effective inspection. The inspector must be acceptable to the Engineer and regulatory agencies with purview over the project.

2. ITEMS OF WORK

A. Pre-Construction Conference

A pre-construction conference shall be held at which the inspector, the engineer, the contractor and the owner shall have a representative. State and Federal agencies with interest in the project shall be informed of the conference and given the opportunity to attend. The Contractor shall notify the interested parties of the time and place of the meeting at least two weeks in advance. At the conference, the following items (at a minimum) shall be addressed:

1. Any questions regarding interpretation of the plans and specifications shall be answered.

2. Work hours and schedules shall be established.

3. Ingress and egress routes shall be established.

4. Construction staging areas and parking areas shall be defined.

5. Security precautions of the contractor and land owner shall be discussed.

6. Quality assurance testing and inspection needs shall be discussed.

7. A list of contact phone numbers for all interested parties shall be established.

8. Contractor notification requirements for regulatory agencies, the engineer and the inspector shall be delineated.

9. Any other items the attendees deem appropriate.

B. Job Diary During On Site Inspection

The quality assurance inspector shall maintain a job diary in which all inspection reports and data are recorded. A written report of each inspection shall be documented in the diary. Photographs shall also be taken of work in progress, as necessary, and kept with the job diary. The inspector shall also maintain a set of construction plans on which all as-built modifications are documented.

C. On Site Inspection Requirements

The following construction activities must have on-site inspection:

1. Completion of the foundation for earthfill and structures.

2. Completion of the excavation of core trench.

3. Backfilling of core trench.

4. Installation of pipelines and appertenances.

5. Backfilling around pipelines, structures, and appertenances.

6. Placing of concrete forms and reinforcing steel.

7. Mixing and placing of concrete.

8. Placement of rip-rap or other erosion protection device.

9. Installation of drain material and outlets.

10. Any other item of work that cannot be adequately inspected following completion or that cannot be readily removed or replaced if it fails to meet requirements of the contract.

D. Material Inspection Requirements

1. All materials used in construction must be inspected before they are installed in the works of improvement.

2. Most materials should be inspected upon delivery to the job site. In some cases, inspection and approval is appropriate before the materials are delivered, such as: rock rip-rap, drainfill, bedding materials, aggregates and similar items.

3. Materials delivered to the job site shall be inspected to verify that sizes, quantity, dimensions, materials quality and manufacturing standards conform to the project plans and specifications. All materials shall be carefully inspected to identify any defects or damage during handling or installation at the job site. All inspection findings shall be documented in the job diary including photographic evidence, as needed.

4. Materials found to be damaged or not in conformance with the plans and specifications shall be rejected.

E. Final Inspection Requirements

A final inspection and certification shall be conducted by the project engineer or his/her representative.

CONSTRUCTION SPECIFICATION

5. POLLUTION CONTROL

1

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 during construction operations in accordance with these specifications. The excavation and moving of soil materials shall be scheduled so the smallest possible areas will be unprotected from erosion for the shortest time feasible.

2. MATERIALS

A. Seed for Temporary Seeding - All seed shall conform to the current state rules and regulations governing quality and purity and shall be labeled in conformance with state regulations in effect on the date of invitation for bids. Bag label values will be evidence of purity and germination. The percent noxious weed seed allowable shall be as defined in the current state law for agricultural seed. No seed will be accepted with a date of test of more than 9 months prior to the date of delivery to the site.

Seed that has become wet, moldy, or otherwise damaged in transit or storage will not be accepted. Each type of seed shall be delivered in a separate sealed container and fully tagged unless the Contracting Officer or Engineer grants an exception.

B. Mulch for Temporary Mulching - All mulch shall consist of wheat, oat, or rye straw, hay, grass cut from native grasses or other plants approved by the Contracting Officer or Engineer. The mulch material shall be air dry, reasonably light in color, and shall not be musty, moldy, caked, or otherwise of low quality. The use of mulch that contains noxious weeds will not be permitted. The Contractor shall provide a method satisfactory to the Contracting Officer for determining weight of mulch furnished.

C. Other Mulch Materials - Mulching materials, such as

wood cellulose fiber mulch, mulch tackifiers, synthetic fiber mulch, netting, and mesh are other mulching materials that may be required for specialized locations and conditions. These materials, when specified, must be accompanied by the manufacturers' recommendations for methods of application.

D. Silt Fence - Filter fabric shall be standard strength or extra strength. Synthetic filter fabric should be a pervious sheet of polypropylene, nylon, polyester, or polyethylene yarn conforming to the following requirements:

- Filtering Efficiency: 75% - 85% (minimum)
- Tensile Strength at 20% (maximum) Elongation: Standard Strength - 30 lb/linear inch (minimum); Extra Strength - 50 lb/linear inch (minimum)
- Slurry Flow Rate: 0.3 gallon ft^2/minute (minimum)

Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable construction life at a temperature range of 0 to 120 F. The filter fabric shall be purchased in a continuous roll to avoid joints. Filter fabric shall be at least 26 inches wide (18 inches above ground and 8 inches below ground). Standard strength filter fabric must be supported by a wire mesh. The wire fence (14 gauge minimum), should be at least 22 inches wide and should have a maximum mesh spacing of 6 inches. Extra strength filter fabric does not require a wire mesh support fence.

Posts shall be at least 4 feet long, and should be composed of either 4-inch diameter pine (or equivalent) or 1.00 to 1.33 lb/linear ft steel. Steel posts should have projections for fastening wire and fabric to them.

E. Straw / Hay Bales for Barriers - Rectangular bales of hay or straw shall be used. The bales shall be in sound condition. Bales shall not contain noxious weeds.

3. SEEDING AND MULCHING METHODS

All seeding and mulching operations shall be performed in such manner that the seed or mulch is applied uniformly to the designated areas at the specified application rate.

4. MEASUREMENT AND PAYMENT

A. Method 1 - For items of work for which specific unit prices are established in the contract each item will be measured to the nearest unit applicable. Payment for each item will be made at the contract unit price for that item. Such payment will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

B. Method 2 - For items or work for which specific lump sum prices are established in the contract, payment for pollution control will be made at the contract lump sum price. Such payment will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

C. All Methods - The following provisions apply to all methods of measurement and payment. 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 or work to which it is made subsidiary. Such items, and the items to which they are made subsidiary, are identified in Section 5.

5. ITEMS OF WORK AND CONSTRUCTION DETAILS

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

A. Bid Item - Temporary Seeding For Protective Cover

(1) This item shall consist of seeding to reduce erosion and sedimentation on disturbed areas that will not be permanently seeded. The disturbed areas will be seeded to a temporary cover as follows:

a. Between February 15 to May 15 and September 1 to December 1, wheat shall be seeded at the rate of 60 pounds per acres. The seed shall be clean seed wheat of a variety common to the area, or,

b. Between May 15 and September 1, Sudan shall be seeded at the rate of 10 pounds per acre.

(2) If the plants do not grow quickly or thick enough to prevent erosion within 21 days of seeding, temporary mulching shall be applied.

(3) All accessible areas shall be seeded with a drill equipped with coulter openers spaced not more than 12 inches apart. Seed shall be placed ½ to 1½ inches deep. Small inaccessible or wet areas that cannot be seeded with a drill may be hand broadcast. All broadcast seeding shall be harrowed or hand-raked the same day the seed is spread.

(4) Measurement and Payment shall be by Method 1.

B. Bid Item - Temporary Mulching

(1) This item shall consist of applying mulch for soil stabilization or erosion control on disturbed areas when conditions are not favorable for establishment of a temporary vegetative cover because of time, temperature, soil and/or moisture conditions. Temporary mulching shall be applied at the rate of 2 tons per acre. It shall be tacked into place by a disk with straight, serrated blades, weighted to press the mulch into the soil a minimum of two (2) inches. The mulch shall be tacked the same day it is applied.

(2) If necessary, seeded areas should be covered with mulch to provide protection from the weather. Seeding on slopes or 2:1 or steeper, in adverse soil conditions, during excessively hot or dry weather, or where heavy rain is expected, shall be followed by spreading mulch.

(3) Measurement and payment shall be by Method 1.

C. Bid Item - Straw or Hay Bale Barriers or Silt Fences

(1) This item shall consist of the installation of straw or hay bale barriers or silt fences as shown in the plans, or as directed by the field engineer, to settle and trap sediment from overland flow immediately upstream of an area before flow becomes concentrated, or below disturbed areas where runoff may occur in the

form of overland flow. Installation of hay bales can be used at the toe of steep slopes, such as the back slope of the dam, to trap sediment, as temporary drop structures to stabilize channel flow lines or as a perimeter filter barrier.

(2) Straw or hay bales shall be installed as follows:

a. The bales will be installed in a trench, 4 inches minimum depth, the width of the bale.
b. They are to be tightly abutting with no gaps.
c. They are to be staked at least 6 inches into the ground using two (2) 1" X 2" stakes per bale.
d. Back filled and compacted with the excavated soil.

(3) Silt fences shall be installed as follows:

a. The maximum height of the silt fence should range between 18 and 36 inches above the ground surface (depending on the amount of upslope ponding expected).
b. Posts should be spaced 8 to 10 feet apart when a wire mesh support fence is used and no more than 6 feet apart when extra strength filter fabric (with no wire fence) is used. The posts should extend at least 18 inches into the ground.
c. A trench should be excavated 4 to 8 inches wide and 4 to 12 inches deep along the upslope side of the line of posts.
d. If standard strength filter fabric is to be used, the wire mesh support fence may be fasted to the upslope side of the posts using 1 inch heavy duty wire staples, tie wires, or hog rings. Extend the wire mesh support to the bottom of the trench. The filter fabric should then be stapled or wired to the fence, and 8 to 20 inches of the fabric should extend into the trench (see drawing on the plans).
e. Extra strength filter fabric does not require a wire mesh support fence. Staple or wire the filter fabric directly to the posts and extend 8 to 20 inches of the fabric into the trench.
f. Where joints in the fabric are required, the filter cloth should be spliced together only at a support post, with a minimum 6-inch overlap, and securely sealed.
g. Do not attach filter fabric to trees.
h. Backfill the trench with compacted soil or 0.75 inch

minimum diameter gravel placed over the filter fabric.

(4) Measurement and Payment shall be by Method 1.

D. Bid Item - Diversions

(1) This item shall consist of using diversions to divert water away from work areas and/or to collect runoff from work areas for treatment and safe disposition. Diversions shall be used in accordance with the Stormwater Pollution Prevention Plan and Drawings, or as directed by the field engineer.

(2) Method of payment shall be by Method 1. The length of diversions will be determined to the nearest linear foot by measurement of the diversion along the centerline of the channel.

E. Subsidiary Item - Stream Crossings

(1) This item shall consist of using stream crossings where fording of streams by equipment is necessary. Materials used in stream or channel crossings shall be selected to permit placement, operation, and removal of the crossings with a minimum deposition of sediment into the stream.

(2) No separate payment will be made for this item. Compensation for this item shall be included in the payment for Excavation, Common (Specification 21, Section 12.e.) and Earthfill, Embankment (Specification 23, Section 10.a.).

F. Subsidiary Item - Sediment Basins

(1) This item shall consist of using sediment basins to settle and filter out sediment from eroding areas to protect properties and streams below the construction site. The borrow pits will be used for sediment basins in accordance with the Stormwater Pollution Prevention Plan or as directed by the field engineer.

(2)No separate payment will be made for this item. Compensation for this item shall be included in the payment for Excavation, Common (Specification 21, Section 12.e.) and Earthfill, Embankment (Specification 23, Section 10.a.).

CONSTRUCTION SPECIFICATION

6. SEEDING AND MULCHING FOR PROTECTIVE COVER

1. SCOPE

The work shall consist of preparing the area for treatment, furnishing and placing seed in the designated areas as specified.

2. MATERIALS

Seed - All seed shall conform to the current rules and regulations of the state where it is being used and from the latest crop available. Seed shall be labeled in accordance with the state laws in effect on the date of invitations for bids and shall meet or exceed the standards for purity and germination listed in Project Documents.

Seed that has become wet, moldy, or otherwise damaged in transit or storage will not be accepted. The percent of noxious weed seed allowable shall be as defined in the current state laws relating to agricultural seeds. Each type of seed shall be delivered in separate sealed containers and fully tagged unless exception is granted in writing by the Engineer or Contracting Officer.

3. SEEDING MIXTURES AND DATES OF PLANTING

The per acre rate for seed mixture and date of seeding shall be as shown on the vegetative plan or as specified in Project Documents.

4. SEED BED PREPARATION AND TREATMENT

Areas to be treated shall be dressed to a smooth, firm surface. On sites where equipment can safely operate, (generally slopes 2:1 or flatter), the seedbed shall be adequately loosened (4 to 6 inches deep) and smoothed. Disking or cultipacking or both may be necessary. On areas where equipment cannot operate, the seedbed shall be prepared by hand by scarifying to provide a roughened surface so that broadcast seed will stay in place. If seeding is to be done immediately following construction, seedbed preparation may not be required except on

compacted, polished, or freshly cut area.

Rocks larger than 6 inches in diameter, trash, weeds, and other debris that will interfere with seeding or maintenance shall be removed or disposed of as directed by the Engineer or Contracting Officer.

Seedbed preparation shall be discontinued when soil moisture conditions are not suitable for the preparation of a satisfactory seedbed as determined by the Engineer or Contracting Officer.

5. SEEDING

All seeding or sprigging operations shall be performed in such a manner that the seed or sprigs are applied in the specified quantities uniformly on the designated areas. The method and rate of seed application shall be as specified in Section 8. Unless otherwise specified, seeding or sprigging shall be done within 2 days after final grading is complete.

6. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, each area will be measured to the nearest 0.1 acre. Payment will be made at the contract unit price for the designated treatment which shall constitute full compensation for all materials, labor, equipment, tools, and other items necessary and incidental to the completion of the work.

7. MULCHING

Mulch materials shall consist of good quality smooth brome grass, no older than the previous year's cutting. The mulch shall be applied at a rate of 2 tons per acre. The mulch will be anchored by using a straight, serrated disc weighted to press the mulch into the soil a minimum of two inches. Spacing between discs will not exceed 12 inches. No area will be mulched that cannot be anchored in the same day's operation.

8. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this

specification and the construction details therefore are:

Bid Item - Seeding and Mulching

(1) This item shall consist of preparing the seedbed and placing seed and mulch on the area shown on the drawings or as directed by the engineer.

(2) The seeding operation shall be done after final grading is completed. Seeding of Mixture #1 may be done from August 15 to October 1 and from December 1 to April 15. Seeding of Mixture #2 may only be done from December 1 to May 15.

(3) All equipment used on the slopes will be operated on or near the level contour of the slopes. If necessary, a cable or other means will be used to prevent rutting of the slopes during all seeding and mulching operations.

(4) Weeds will be removed from the seeding area if they will interfere with any operation in the seeding process.

(5) All accessible areas will be sown with a grass drill. Seed shall be placed 1/4 to 3/4 inch deep. The drill shall be equipped with coulter openers and depth bands spaced not more than 12 inches apart. Small inaccessible or wet areas that cannot be seeded with a grass drill, may be hand broadcast. All broadcast seeding shall be lightly harrowed or hand raked the same day the seed is spread.

(6) Seed mixtures shall be as follows:

Mixture #1
(Disturbed Area Above Permanent Water)

Species	Pounds per acre in "Pure Live Seed" (PLS)
Kaw big bluestem, Andropogon gerardi	1.2
Osage indiangrass, Sorghastrum nutans	1.2
El Reno sideoats grama, Bouteloua curtipendula	0.6
Barton western wheatgrass, Agropyron smithii	3.0
Blackwell switchgrass, Panicum virgatum	1.2
Texoka or Improved buffalograss, Buchloe dactyloides	2.5
Achenbach smooth brome, Bromus inermis	2.4

Total Rate	12.1

Mixture #2
(Overseeding Front Slope Berm)

Species	Pounds per Acre in "Pure Live Seed" (PLS)
Kanlow Switchgrass, Panicum virgatum	2.5
Praire Cordgrass, Spartina pectinata	2.5
Total Rate	5.0

Mixture #3
(Seeding area adjacent to the wetland area)
(Native grass filter area)

Species	Pounds per acre in "Pure Live Seed" PLS
Aldous little bluestem, Schizachyrium scoparium	1.6
Kaw big bluestem, Andropogon gerargi	2.4
Osage indiangrass, Sorghastrum nutans	2.4
El Reno sideoats grama, Bouteloua curtipendula	2.4
Blackwell switchgrass, Panicum virgatum	0.6
Western Wheatgrass, Agropyron smithii	2.0
Showy Partridge Pea, Chamaecrista fasciculata	0.1
Illinois Bundleflower, Desmanthus Illinoensis	0.2
Purple Prairie Clover, Dalea Purpurea	0.1
Maximillian Sunflower, Helianthus Maximiliani	0.1
Total Rate	11.9

(7) Fertilizer shall be applied either by a broadcast spreader or through a separate attachment on the grass drill (seed and fertilizer cannot be mixed in drill box).

Fertilizer shall be applied at the rate of 50 lb nitrogen per acre and 30 lb phosphate per acre.

CONSTRUCTION SPECIFICATION

10. WATER FOR CONSTRUCTION

1. SCOPE

The work shall consist of furnishing, transporting, and using water for construction purposes in accord with the applicable specifications.

2. FACILITIES AND EQUIPMENT

The Contractor shall build and maintain such access and haul roads as are needed, and shall furnish, operate, and maintain all pumps, piping, tanks, and other facilities needed to load, transport, and use the water as specified.

These facilities shall be equipped with meters, tanks, or other devices by which the volume of water supplied can be measured.

3. DUST ABATEMENT AND HAUL ROAD MAINTENANCE

Water for dust abatement and haul road maintenance shall be applied to haul roads and other dust-producing areas as needed to prevent excessive dust and to maintain the roads in good condition for efficient operation while they are in use.

4. EARTHFILL, DRAINFILL, ROCKFILL

Water for earthfill, drainfill, or rockfill shall be used in the fill materials as specified in the applicable construction specifications.

5. CONCRETE, MORTAR, GROUT

Water used in mixing or curing concrete, pneumatically applied mortar, or other Portland cement mortar or grout shall meet the requirements of the applicable construction specifications and shall be used in

conformance with those specifications. Payment for water used in these items is covered by the applicable concrete, mortar, or grout specification.

6. MEASUREMENT AND PAYMENT

For water items for which specific unit prices are established in the contract, the volume of water furnished and used in accordance with the specifications will be measured to the nearest 1000 gallons.

Except as otherwise specified, the measurement for payment will include all water needed at the construction site, except as noted in Section 5, to perform the work required under the contract in accordance with the specifications but will not include water wasted or used in excess of the amount needed. It will not include water used in concrete which is mixed elsewhere and transported to the site.

Payment for water will be made at the contract unit price. Such payment will constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to furnishing, transporting, and using the water.

7. ITEMS OF WORK AND CONSTRUCTION DETAILS

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

Bid Item - Water

(1) This item shall consist of furnishing, transporting, measuring, and applying water to the drainfill, foundation and earthfill surface as necessary to bring them to the specified moisture content and for dust abatement and haul road maintenance.The source and water rights for the quantity of water needed will be the responsibility of the contractor.

(2) Water shall not be added to the foundation or

earthfill materials without approval of the engineer. The amount of water added shall be only that amount that will provide a moisture content in the foundation or earthfill material to be within the required range plus a reasonable amount to compensate for evaporation and other unavoidable losses.

(3) Borrow operations will not start until the applied water has been absorbed uniformly by the soil. The length of absorption time shall be approved by the engineer. The surface of the borrow area shall be maintained in a manner that will prevent undue loss of moisture.

(4) Sources of earthfill materials which contain excessive moisture because of the addition of water under this specification shall not be abandoned in favor of other materials. Steps shall be taken by the contractor to reduce the moisture content of such materials.

(5) Water shall not be used for dust abatement or haul road maintenance without the approval of the engineer. Water used for haul road maintenance or dust control shall be properly applied to prevent slippery, muddy, or other hazardous conditions. Water shall be applied to other dust-producing areas as directed.

(6) Water shall be measured in units of gallons.

Water delivered by pipeline shall be measured by a water meter placed in the pipeline as close as possible to the point of delivery.

Water delivered in tanks during regular working hours shall be measured at the point of delivery by water meters in the outlet works or by calibrated tanks. These methods of measurement shall not be used interchangeably; however, the engineer may authorize the change from one system to the other.

Water delivered in tanks outside regular working hours shall be measured at the point of delivery by water meters in the outlet works.

Means shall be provided by the contractor to check the

accuracy of the water meters or the calibration of the tanks when requested by the engineer. Water meters shall have an accuracy of + or - 3 percent of the true quantity.

CONSTRUCTION SPECIFICATION

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 specifications. It shall include (1) building and maintaining all necessary temporary impounding works, channels, and diversions, (2) furnishing, installing and operating all necessary pumps, piping and other facilities and equipment, and (3) removing all such temporary works and equipment after they have served their purposes.

2. DIVERTING SURFACE WATER

The Contractor shall build, maintain and operate all cofferdams, channels, flumes, sumps, and other temporary diversion and protective works needed to divert streamflow and other surface water through or around the construction site and away from the construction work while construction is in progress. Unless otherwise specified, a diversion must discharge into the same natural drainage in which its headworks are located.

Unless otherwise specified, the Contractor shall furnish to the Contracting Officer in writing, his plan for diverting surface water before beginning the construction work for which the diversion is required. Acceptance of this plan will not relieve the Contractor of responsibility for completing the work as specified.

3. DEWATERING THE CONSTRUCTION SITE

Foundations, cutoff trenches and other parts of the construction site shall be dewatered and kept free of standing water or excessively muddy conditions as needed for proper execution of the construction work. The Contractor shall furnish, install, operate and maintain all drains, sumps, pumps, casings, wellpoints, and other equipment needed to perform the

dewatering as specified. Dewatering methods that cause a loss of fines from foundation areas will not be permitted.

Unless otherwise specified, the Contractor shall furnish to the Contracting Officer, in writing, his plan for dewatering before beginning the construction work for which the dewatering is required. Acceptance of this plan will not relieve the Contractor of responsibility for completing the work as specified.

4. DEWATERING BORROW AREAS

Unless otherwise specified in Section 8, the Contractor shall maintain the borrow areas in drainable condition or otherwise provide for timely and effective removal of surface and ground waters that accumulate within the borrow areas from any source.

Borrow material shall be processed as necessary to achieve proper and uniform moisture content for placement.

If pumping to dewater borrow areas is included as an item of work in the bid schedule, each pump used for this purpose shall be equipped with a water meter in the discharge line. Accuracy of the meters shall be such that the measured quantity of water is within 3 percent, plus or minus, of the true quantity. Means shall be provided by the Contractor to check the accuracy of the water meters when requested by the Contracting Officer.

5. 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.

6. REMOVAL OF TEMPORARY WORKS

After the temporary works have served their purposes, the Contractor shall remove them or level and grade them to the extent required to present a sightly appearance and to prevent any obstruction of the flow of water or any other interference with the operation of or access to the permanent works.

Except as otherwise specified, pipes and casings shall be removed from temporary wells and the wells shall be filled to ground level with gravel or other suitable material approved by the Contracting Officer.

7. MEASUREMENT AND PAYMENT

Method 1 Items of work listed in the bid schedule for removal of water, diverting surface water, dewatering construction sites, and dewatering borrow areas will be paid for at the contract lump sum prices. Such payment will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

Method 2 Items of work listed in the bid schedule for removal of water, diverting surface water, dewatering construction sites, and dewatering borrow areas will be paid for at the contract lump sum prices. Such payment will constitute full compensation for furnishing, installing, operating, and maintaining the necessary trenches, drains, sumps, pumps, and piping, and for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work, except that additional payment for pumping to dewater borrow areas will be made as described in the following paragraph.

If pumping to dewater borrow areas is listed as an item of work in the bid schedule, payment will be made at the contract unit price which shall be the price per 1,000 gallons shown in the bid schedule. Such payment will constitute full compensation for pumping only. Compensation for equipment and preparation and for other costs associated with pumping will be included in the lump sum payment for removal of water or the lump sum payment for dewatering borrow areas.

Payment will be made only for pumping that is necessary to dewater borrow areas that cannot be effectively drained by gravity or that must have the water table lowered to be usable. Pumping for other purposes will not be included for payment in this item.

All Methods The following provisions apply to all methods of measurement and payment. 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 of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 8 of this specification.

8. ITEMS OF WORK AND CONSTRUCTION DETAILS

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

Subsidiary Item - Removal of Water

(1) This item shall consist of the removal of water from the work site during construction.

(2) Surface and groundwater in the borrow area shall be effectively and timely removed as necessary to provide good trafficability and full utilization of the borrow materials.

(3) Materials used in stream or channel crossings shall be selected to permit placement, operation, and removal of the crossing with a minimum deposition of sediment into the stream.

(4) No separate payment will be made for this item. Compensation for this item shall be included in the payment for Excavation, Common; Reinforced Concrete, Appurtenances, Class 4000; Drain fill; Plastic Drainage Pipe, 4-inch Diameter; and 10 inch Diameter, as appropriate.

CONSTRUCTION SPECIFICATION

21. EXCAVATION

1. SCOPE

The work shall consist of the excavation required by the drawings and specifications and disposal of the excavated materials.

2. CLASSIFICATION

Excavation will be classified as common excavation or rock excavation in accordance with the following definitions or will be designated as unclassified.

Common excavation shall be defined as the excavation of all materials that can be excavated, transported, and unloaded by the use of heavy ripping equipment and wheel tractor-scrapers with pusher tractors or that can be excavated and dumped into place or loaded onto hauling equipment by means of excavators having a rated capacity of one cubic yard and equipped with attachments (such as shovel, bucket, backhoe, dragline or clam shell) appropriate to the character of the materials and the site conditions.

Rock excavation shall be defined as the excavation of all hard, compacted or cemented materials the accomplishment of which requires blasting or the use of excavators larger than defined for common excavation. The excavation and removal of isolated boulders or rock fragments larger than one cubic yard in volume encountered in materials otherwise conforming to the definition of common excavation shall be classified as rock excavation.

Excavation will be classified according to the above definitions by the Engineer, based on his judgment of the character of the materials and the site conditions.

The presence of isolated boulders or rock fragments larger than one cubic yard in size will not in itself be sufficient cause to change the classification of the surrounding material.

For the purpose of this classification, the following definitions shall apply:

Heavy ripping equipment shall be defined as a rear-mounted, heavy duty, single-tooth, ripping attachment mounted on a tractor having a power rating of 200-300 net horsepower (at the flywheel).

Wheel tractor-scraper shall be defined as a self-loading (not elevating) and unloading scraper having a struck bowl capacity of 12-20 yards.

Pusher tractor shall be defined as a track type tractor having a power rating of 200-300 net horsepower (at the flywheel) equipped with appropriate attachments.

3. UNCLASSIFIED EXCAVATION

Items designated as "Unclassified Excavation" shall include all materials encountered regardless of their nature or the manner in which they are removed. When excavation is unclassified, none of the definitions or classifications stated in Section 2 of this specification shall apply.

4. BLASTING

The transportation, handling, storage, and use of dynamite and other explosives shall be directed and supervised by a person of proven experience and ability in blasting operations.

Blasting shall be done in such a way as to prevent damage to the work or unnecessary fracturing of the foundation and shall conform to any special requirements on Section 12 of this specification.

5. USE OF EXCAVATED MATERIALS

Method 1 To the extent they are needed, all suitable materials from the specified excavations shall be used in the construction of required permanent earthfill or rockfill. The suitability of materials for specific

purposes will be determined by the Engineer. The Contractor shall not waste or otherwise dispose of suitable excavated materials.

Method 2 Suitable materials from the specified excavations may be used in the construction of required earthfill or rockfill. The suitability of materials for specific purposes will be determined by the Engineer.

6. DISPOSAL OF WASTE MATERIALS

Method 1 All surplus or unsuitable excavated materials will be designated as waste and shall be disposed of at the locations shown on the drawings.

Method 2 All surplus or unsuitable excavated materials will be designated as waste and shall be disposed of by the Contractor at sites of his own choosing away from the site of the work upon approval of project engineer.

7. BRACING AND SHORING

Excavated surfaces too steep to be safe and stable if unsupported shall be supported as necessary to safeguard the work and workmen, to prevent sliding or settling of the adjacent ground, and to avoid damaging existing improvements.

The width of the excavation shall be increased if necessary to provide space for sheeting, bracing, shoring, and other supporting installations. The Contractor shall furnish, place and subsequently remove such supporting installations.

8. STRUCTURE AND TRENCH EXCAVATION

Structure or trench excavation shall be completed to the specified elevations and to sufficient length and width to include allowance for forms, bracing and supports, as necessary, before any concrete or earthfill is placed or any piles are driven within the limits of the excavation.

9. 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. The extent and depth of borrow pits within the limits of the designated borrow areas shall be as directed by the Engineer.

Borrow pits shall be excavated and finally dressed in a manner to eliminate steep or unstable side slopes or other hazardous or unsightly conditions.

Borrow area within the reservoir limits should be excavated to the original ground line to obtain suitable material. No silt should be used as borrow material.

10. OVEREXCAVATION

Excavation in rock beyond the specified lines and grades shall be corrected by filling the resulting voids with Portland cement concrete made of materials and mix proportions approved by the Engineer. Concrete that will be exposed to the atmosphere when construction is completed shall contain not less than 6 sacks of cement per cubic yard of concrete. Concrete that will be permanently covered shall contain not less than 4-1/2 sacks of cement per cubic yard. The concrete shall be placed and cured as specified by the Engineer.

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

11. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are

established in the contract, the volume of each type and class of excavation within the specified pay limits will be measured and computed to the nearest cubic yard by the method of average cross-sectional end areas. Regardless of quantities excavated, the measurement for payment will be made to the specified pay limits, except that excavation outside the specified lines and grades directed by the Engineer to remove unsuitable material will be included.

Excavation required because unsuitable conditions result from the Contractor's improper construction operations, as determined by the Contracting Officer will not be included for measurement and payment.

Method 1 The pay limits shall be as designated on the drawings.

Method 2 The pay limits shall be defined as follows:

a. The upper limit shall be the original ground surface as it existed prior to the start of construction operations except that where excavation is performed within areas designated for previous excavation or fill the upper limit shall be the modified ground surface resulting from the specified previous excavation or fill.

b. The lower and lateral limits shall be the neat lines and grades shown on the drawings.

Method 3 The pay limits shall be defined as follows:

a. The upper limit shall be the original ground surface as it existed prior to the start of construction operations except that where excavation is performed within areas designated for previous excavation or fill the upper limit shall be the modified ground surface resulting from the specified previous excavation or fill.

b. The lower and lateral limits shall be the true surface of the completed excavation as directed by the Engineer.

Method 4 The pay limits shall be defined as follows:

a. The upper limit shall be the original ground surface as it existed prior to the start of construction operations except that where excavation is performed within areas designated for previous excavation or fill the upper limit shall be the modified ground surface resulting from the specified previous excavation or fill.

b. The lower limit shall be at the bottom surface of the proposed structure.

c. The lateral limits shall be 18 inches outside of the outside surfaces of the proposed structure or shall be vertical planes 18 inches outside of and parallel to the footings, whichever gives the larger pay quantity, except as provided in d, below.

d. For trapezoidal channel linings or similar structures that are to be supported upon the sides of the excavation without intervening forms, the lateral limits shall be at the under side of the proposed lining or structure.

e. For the purposes of the definitions in b, c, and d, above, any specified bedding or drainfill directly beneath or beside the structure will be considered to be a part of the structure.

ALL METHODS The following provisions apply to all methods of measurement and payment.

Payment for each type and class of excavation will be made at the contract unit price for that type and class of excavation. Such payment will constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to the performance of the work, except that extra payment for backfilling overexcavation will be made in accordance with the following provisions:

Payment for backfilling overexcavation, as specified in Section 10 of this specification, will be made only if the excavation outside specified lines and grades is directed by the Engineer to remove unsuitable material and if the unsuitable condition is not a result of the Contractor's improper construction operations as

determined by the Contracting Officer.

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 of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 12 of this specification.

12. ITEMS OF WORK AND CONSTRUCTION DETAILS

All excavations shall be constructed to lines and grades shown on the drawings or as directed by the engineer. Foundation and abutment surfaces shall not be steeper than 1 horizontal to 1 vertical unless otherwise specified.

In Section 5, Use of Excavated Materials, Method 1 shall apply.

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

a. Subsidiary Item - Excavation, Common, Stripping

(1) This item shall consist of stripping the entire area to be occupied by the earthfill or such portions thereof as may be directed by the engineer to depths up to 12 inches below the original ground surface as it existed prior to the start of construction.
(2) Stripping in all areas except Zone IV of the embankment shall be sufficient to remove topsoil, rubbish, organic matter, and other perishable and objectionable material not suitable as determined by the engineer for the foundation of the earthfill.

Stripping under Zone IV of the embankment shall consist of scalping vegetative matter from the ground surface and removing rubbish and other unsuitable material as directed by the engineer.

(3) No separate payment will be made for

stripping within the limits described. Compensation for such excavation will be included in the payment for Earthfill, Embankment; Earthfill, Random; and Earthfill, Miscellaneous, as appropriate.

b. Subsidiary Item - Excavation, Auxiliary Spillway, Common

(1) This item shall consist of the common excavation which is required to construct the auxiliary spillway.

(2) Excavated surfaces shall be within -0.5 to + 0.0 foot of planned elevation throughout, unless otherwise directed by the Engineer.

(3) No separate payment will be made for this item. Compensation for such excavation will be included in the payment for Earthfill, Embankment; Earthfill, Hand Compacted; and Earthfill, Random, as appropriate.

c. Bid Item Excavation, Auxiliary Spillway, Rock

(1) This item shall consist of all rock excavation which is required to construct the auxiliary spillway.

Subsidiary to this work is Disposal of Waste Materials.

(2) Blasting will not be permitted in the Vicinity of the principal spillway after work has begun on the appurtenances, conduit or inlet except as approved by the engineer.

(3) Excavation materials unsuitable for direct placement in Zone 1 of the earthfill shall be placed in Zone IV, stockpiled in designated areas, or placed in the waste area as directed by the engineer.

(4) Measurement and payment will be by Method 2.

d. Subsidiary Item - Excavation, Borrow, Common

(1) This item shall consist of all common excavation required from the borrow areas for obtaining fill materials needed for construction of the permanent fill.

(2) All surface materials suitable for topsoiling shall be stripped from the borrow areas and placed in pre-designated locations.

(3) The stripped area laid bare at one time shall be limited to the borrow pits being presently worked.

(4) All borrow areas not covered by permanent water shall be graded and finished in a workmanlike manner to prevent the ponding of water.

(5) No separate payment will be made for borrow excavation. Compensation for borrow excavation will be included in the payment for Supplementary Borrow Material, In Place.

e. Bid Item - Excavation, Common

(1) This item shall consist of all common excavation which is required to construct the approach channel, outlet channel, and stilling basin and prepare the area to be occupied by the earthfill to depths greater than 12 inches below the original ground surface as it existed prior to the start of construction. Such preparation includes cleaning out the stream channel and shaping its banks, shaping the abutments, constructing the cutoff trench and principal spillway trench, and stripping below the 12 inches stated above.

Subsidiary items to this work are Removal of Water, Protection of Excavated Surfaces, and Disposal of Waste Material as appropriate.

(2) Excavated surfaces shall be within -0.5 to +

0.0 foot of planned elevation throughout, unless otherwise directed by the Engineer.

(3) The principal spillway trench excavation shall exclude that portion of the excavation lying within the limits of the cutoff trench.

(4) Excavated materials unsuitable for direct placement in Zone I of the earthfill shall be placed in the waste areas as directed by the engineer.

(5) Measurement and payment shall be by Method 3.

f. Subsidiary Item - Excavation, Structure, Common

(1) This item shall consist of the common excavation required for the installation of the drain outlet works, drawdown pipe, inlet base, pipe support, and rock fence barriers.

(2) Excavated materials unsuitable for direct placement in Zone I of the earthfill shall be placed in the waste areas as directed by the engineer.

(3) No separate payment will be made for this item. Compensation shall be included in the payment for Principal Spillway Pipe Support, Drawdown Inlet; PVC Drainage Pipe, and Rock Fence Barriers.

g. Subsidiary Item - Protection of Excavated Surfaces

(1) This item shall consist of protecting the surface of all excavations upon which earthfill will be placed.

(2) All necessary precautions shall be taken to preserve the excavated surfaces in the soundest condition. Excavated surfaces shall be protected from drying that may cause the formation of shrinkage cracks. Such protection may include but not be limited to (1) leaving a temporary cover of unexcavated material, (2) covering with mulch, (3) placing a protective coating of impervious sprayed material, (4) keeping moist by sprinkling with

water, or (5) covering with a sheet of plastic. The method of protection shall be approved by the engineer.

(3) No separate payment will be made for this item. Compensation for this item shall be included in the payment for Excavation, Common.

h. Bid Item - Disposal of Waste Materials

(1) In Section 2, Disposal of Waste Materials, Method 1 shall apply.

(2) Compaction of waste materials will not be required.

(3) A minimum of 6 inches of topsoil shall be placed on all waste areas.

(4) The surface of waste areas shall be left in a neat and sightly condition and sloped to provide positive drainage.

(5) Measurement and payment for waste excavation and disposal will be by Common Excavation paid at the contract unit price.

CONSTRUCTION SPECIFICATION

23. EARTHFILL

1. SCOPE

The work shall consist of the construction of earth embankments and other earthfills required by the drawings and specifications.

2. MATERIALS

All fill materials shall be obtained from required excavations and designated borrow areas. The selection, blending, routing and disposition of materials in the various fills shall be subject to approval by the Engineer.

Fill materials shall contain no sod, brush, roots or other perishable materials. Rock particles larger than the maximum size specified for each type of fill shall be removed prior to compaction of the fill. Material for hand compaction fill shall be well-pulverized and shall contain no earth particle larger than 3 inches in largest dimension. The types of materials used in the various fills shall be as listed and described in the specifications and drawings.

3. FOUNDATION PREPARATION

Foundations for earthfill shall be stripped to remove vegetation and other unsuitable materials or shall be excavated as specified.

Except as otherwise specified, earth foundation surfaces shall be graded to remove surface irregularities and shall be scarified parallel to the axis of the fill or otherwise acceptably scored and loosened to a minimum depth of 2 inches. The moisture content of the loosened material shall be controlled as specified for the earthfill, and the surface materials of the foundation shall be compacted and bonded with the first layer of earthfill as specified for subsequent layers of earthfill.

Earth abutment surfaces shall be free of loose, uncompacted earth in excess of two inches in depth normal to the slope and shall be at such a moisture content that the earthfill can be compacted against them to effect a good bond between the fill and the abutments.

Rock foundation and abutment surfaces shall be cleared of all loose materials by hand or other effective means and shall be free of standing water when fill is placed upon them. Occasional rock outcrops in earth foundations for earthfill, except in dams and other structures designed to restrain the movement of water, shall not require special treatment if they do not interfere with compaction of the foundation and initial layers of the fill or the bond between the foundation and the fill.

Foundation and abutment surfaces shall be not steeper than 1 horizontal to 1 vertical unless otherwise specified. Test pits or other cavities shall be filled with compacted earthfill conforming to the specifications for the earthfill to be place upon the foundation.

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 the Engineer. Fill shall not be placed upon a frozen surface, nor shall snow, ice, or frozen material be incorporated in the fill.

Materials placed by dumping in piles or windrows shall be spread uniformly to not more than the specified thickness before being compacted. Hand compacted fill, including fill compacted by manually directed power tampers, shall be placed in layers whose thickness before compaction does not exceed four (4) inches.

Adjacent to structures, fill shall be placed in a manner which will prevent damage to the structures and will allow the structures to assume the loads from the fill gradually and uniformly. The height of the fill adjacent to a structure shall be increased at approximately the same rate on all sides of the structure.

Earthfill in dams, levees and other structures designed to restrain the movement of water shall be placed so as to meet the following additional requirements:

a. The distribution of materials throughout each zone shall be essentially uniform, and the fill shall be free from lenses, pockets, streaks or layers of material differing substantially in texture, moisture content, or gradation from the surrounding material.

b. If the surface of any layer becomes too hard and smooth for proper bond with the succeeding layer, it shall be scarified parallel to the axis of the fill to a depth of not less than 2 inches before the next layer is placed.

c. The top surfaces of embankments shall be maintained approximately level during construction, except that a crown or cross-slope of approximately 2 percent shall be maintained to insure effective drainage, and except as otherwise specified for drainfill or sectional zones.

d. Dam embankments shall be constructed in continuous layers from abutment to abutment except where openings to facilitate construction or to allow the passage of stream flow during construction are specifically authorized in the contract.

e. Embankments built at different levels as described under (c) or (d) above shall be constructed so that the slope of the bonding surfaces between embankment in place and embankment to be placed is not steeper than 3 feet horizontal to 1 foot vertical. The bonding surface of the embankment in place shall be stripped of all material not meeting the requirements of this specification, and shall be scarified, moistened and recompacted when the new fill is placed against it as needed to insure a good bond with the new fill and to obtain the specified moisture content and density at contact of the in place and new fills.

f. Finished earthfill surfaces at the end of the project shall be constructed to within -0.0 to +0.5 foot of planned elevation at any point on the embankment surface. The elevation difference shall not exceed 0.2 foot per 100 ft along any slope line. Slopes shall be nearly uniform (within 0.5 ft) from top to bottom.

5. CONTROL OF MOISTURE CONTENT

During placement and compaction of fill, the moisture content of the materials being placed shall be maintained within the specified range.

The moisture content at the time of compaction shall be such that, when kneaded in the hand, a ball will form which does not separate readily.

The application of water to the fill materials shall be accomplished at the borrow areas insofar as practicable. Water may be applied by sprinkling the materials after placement on the fill, if necessary. Uniform moisture distribution shall be obtained by disking.

Material that is too wet when deposited on the fill shall either be removed or be dried to the specified moisture content prior to compaction.

If the top surface of the preceding layer of compacted fill or a foundation or abutment surface in the zone of contact with the fill becomes too dry to permit suitable bond it shall either be removed or scarified and moistened by sprinkling to an acceptable moisture content prior to placement of the next layer of fill.

6. COMPACTION

Earthfill shall be compacted according to the following requirements for the class of compaction specified:

Class A compaction. Each layer of fill shall be compacted as necessary to make the density of the fill matrix not less than the minimum density specified. The fill matrix is defined as the portion of the fill material finer than the maximum particle size used in the compaction test method specified.

Class B compaction. Each layer of fill shall be compacted to a mass density not less than the minimum density specified.

Class C compaction. Each layer of fill shall be compacted by the controlled movement of rubber-tired hauling and spreading equipment over the fill area so that every point on the surface of each lift will be traversed by not less than one

tread track of loaded equipment in a direction parallel to the centerline of the fill, or with a sheep's foot roller exerting a minimum pressure of 200 pounds per square inch passing over the entire surface until the feet cease to push into the fill material and walk across the compacted surface.

Fill adjacent to structures shall be compacted to a density equivalent to that of the surrounding fill by means of hand tamping or manually directed power tampers or plate vibrators. Unless otherwise specified, heavy equipment including backhoe mounted powertampers, or vibrating compactors and manually directed vibrating rollers, shall not be operated within 2 feet of any structure. Towed or self-propelled vibrating rollers shall not be operated within 5 feet of any structure. Compaction by means of drop weights operating from a crane or hoist will not be permitted.

The passage of heavy equipment will not be allowed: (1) over cast-in-place conduits prior to 14 days after placement of the concrete; (2) over cradled or bedded precast conduits prior to 7 days after placement of the concrete cradle or bedding; or (3) over any type of conduit until the backfill has been placed above the top surface of the structure to a height equal to one-half the clear span width of the structure or pipe or 2 feet, whichever is greater.

When the required strength of the concrete is not specified as described above, compaction of fill adjacent to structures shall not be started until the following time intervals have elapsed after placement of the concrete.

Structure	Time Interval
Retaining walls and counterforts (impact basins)	14 days
Walls backfilled on both sides simultaneously	7 days
Conduits and spillway risers, cast-in-place (with inside forms in place)	7 days
Conduits and spillway risers, cast-in-place (inside forms removed)	14 days

Conduits, precast, cradled	2 days
Conduits, precast, bedded	1 day
Cantilever outlet bents (backfilled) both sides simultaneously.	3 days

7. REWORKING OR REMOVAL AND REPLACEMENT OF DEFECTIVE FILL

Fill placed at densities lower than the specified minimum density or at moisture contents outside the specified acceptable range of moisture content or otherwise not conforming to the requirements of the specifications shall be reworked to meet the requirements or removed and replaced by acceptable fill. The replacement fill and the foundation, abutment and fill surfaces upon which it is placed shall conform to all requirements of this specification for foundation preparation, approval, placement, moisture control and compaction.

8. TESTING

During the course of the work, the Engineer will perform such tests as are required to identify materials, to determine compaction characteristics, to determine moisture content, and to determine density of fill in place. These tests performed by the Engineer will be used to verify that the fills conform to the requirements of the specifications. At a minimum, moisture content and density of fill shall be tested every 1500 cubic yards placed in all fills designated Class A compaction. Such tests are not intended to provide the Contractor with the information required by him for the proper execution of the work and their performance shall not relieve the Contractor of the necessity to perform tests for that purpose.

Densities of fill requiring Class A compaction will be determined by the Engineer in accordance with ASTM Method D 1556, D 2167, D 2922 or D 2937 except that the volume and moist weight of included rock particles larger than those used in the compaction test method specified for the type of fill will be determined and deducted from the volume and moist weight of the total sample prior to computation of density or if using the nuclear gauge, added to the specified

density to bring it to the measure of equivalent composition for comparison. The density so computed will be used to determine the percent compaction of the fill matrix. Unless otherwise specified, moisture content will be determined by one of the following methods: ASTM Method D 2216, D 3017 or D 4643.

9. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the volume of each type and compaction class of earthfill within the specified zone boundaries and pay limits will be measured and computed to the nearest cubic yard by method of average cross-sectional end areas. Unless otherwise specified, no deduction in volume will be made for embedded conduits and appurtenances.

The pay limits shall be as defined below, with the further provision that earthfill required to fill voids resulting from overexcavation of the foundation, outside the specified lines and grades, will be included in the measurement for payment only where such overexcavation is directed by the Engineer to remove unsuitable material and where the unsuitable condition is not a result of the Contractor's improper construction operations as determined by the Contracting Officer.

Method 1 The pay limits shall be as designated on the drawings.

Method 2 The pay limits shall be the measured surface of the foundation when approved for placement of the fill and the specified neat lines of the fill surface.

Method 3 The pay limits shall be the measured surface of the foundation when approved for placement of the fill and the measured surface of the completed fill.

Method 4 The pay limits shall be the specified pay limits for excavation and the specified neat lines of the fill surface.

Method 5 The pay limits shall be the specified pay limits for excavation and the measured surface of the completed fill.

Method 6 Payment for each type and compaction class of earthfill will be made at the contract unit price for that type and compaction class of fill. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the performance of the work.

Method 7 Payment for each type and compaction class of earthfill will be made at the contract unit price for that type and compaction class of fill. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the performance of the work, except furnishing, transporting, and applying water to the foundation and fill materials. Water applied to the foundation and fill materials will be measured and payment will be made as specified in Construction Specification 10.

All Methods The following provisions apply to all methods of measurement and payment. 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 of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 10 of this specification.

10. ITEMS OF WORK AND CONSTRUCTION DETAILS

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

a. Bid Item - Earthfill, Embankment

(1) This item shall consist of the construction of the earthfill required for the principal spillway trench and Zone 1 and Zone 2 of the embankment as shown on the drawings.

Subsidiary items to this work are Excavation, Common Stripping; Excavation, Auxiliary Spillway, Common; Excavation, Borrow, Common; and Salvaging and Spreading Topsoil.

(2) The earth foundation surface shall, after stripping and before placing the first layer of earthfill, be graded to remove surface irregularities; be moisture conditioned to

facilitate compaction and affect a good bond with the earthfill; and be compacted by four passes of the tamping roller to be used in Zone 1 of the dam.

If the tamping roller does not penetrate the foundation surface on the initial pass, the surface shall be scarified parallel to the axes of the fill to a minimum depth of 2 inches.

(3) No embankment material shall be placed upon the earth surface of excavations, foundation preparation, or previous embankment when such surfaces have dried sufficiently to form shrinkage cracks. Such earth surfaces being readied for embankment shall have all loose, hard, dry, and cracked material removed.

(4) Rock surfaces in the bottom of the cutoff trench, before placing the first layer of fill, shall be thoroughly cleaned of all loose materials. Voids and crevices in the rock shall be tamped full with a well moistened, plastic soil.

(5) The most impervious soils shall be placed in the central portion of the embankment. The more pervious soils shall be placed so that the permeability of the embankment will gradually increase from Zone 1 toward the upstream and downstream slopes of the embankment.

Selectively place the soil with the most durable rock fragments and/or a tendency toward a low liquid limit to the outside of Zone 1 inside the topsoil.

(6) Durable rock fragments are those that do not break down or disintegrate significantly during excavation and compaction operation or from the action of natural weathering processes.

(7) Openings through the dam embankment for construction purposes will be allowed subject to approval by the engineer. Such openings in the embankment to allow passage of the stream flow or to facilitate other construction shall be included in the contractor's plan for diverting surface water.

(8) There will be no deduction from the total embankment volume for the volume of embedded portions of the principal spillway inlet, conduit and appurtenances, drains, and the hand compacted fill specified in Section 10, Item b, of this specification that is within the neat lines of the embankment.

(9) Finished earthfill surfaces at the end of the project shall be constructed to within -0.0 to +0.5 foot of planned elevation at any point on the embankment surface. The elevation difference shall not exceed 0.2 foot per 100 ft along any slope line. Slopes shall be nearly uniform (within 0.5 ft) from top to bottom.

(10) Payment For Zone 1 and Zone 2 will be made at the contract unit price for Earthfill, Embankment.

b. Bid Item - Earthfill, Hand Compacted

(1) This item shall consist of placing the hand compacted fill over and around the principal spillway conduit, drain outlet pipe, and drawdown pipe to the lines and grades shown on the drawings; placing hand compacted fill around the principal spillway inlet and pipe support to the extent specified in Section 6 of this specification; and constructing the embankment local berm around the principal spillway inlet.

Subsidiary items to this work are Excavation, Auxiliary Spillway, Common, and Excavation, Borrow, Common.

(2) The gradation and density requirements of hand compacted fill shall be as specified for Zone 1 of the embankment except that the maximum rock fragment shall be 2 inches. The fill materials shall consist of the higher plastic soils on the site and have soil particle diameter not greater than 3 inches. Such protective measures as necessary will be taken to insure that the fill does not dry sufficiently to form cracks after placement. The fill shall be placed in layers not more than 4 inches thick before compaction.

(3) Manually directed power tampers or plate vibrator shall include only small hand-held or hand-directed compactors powered by compressed air, internal combustion engines, or electricity, such as the Barco Rammer, BR-5; Wacker Rammer, GVR 20, GVR 100-C, GVR 300; Wacker Vibro-Plate, VPG 160, VPG 3000; or Jay Tamper J-12, J-36. Manually directed power tampers or plate vibrators specifically exclude any type of vibrating roller or tractor mounted compactors operated by mechanical winch or hydraulic system.

(4) For items of work for which specific lump sum prices are established in the contract, the quantity of hand compacted fill will not be measured for payment. Payment for hand compacted fill will be made at the contract lump sum price for the item and will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

c. Bid Item - Earthfill, Miscellaneous

(1) This item shall consist of placing earthfill to the lines and grades as shown on the drawings for auxiliary spillway dikes, auxiliary spillway wing dikes, downstream channel fill, and downstream local berm.

Subsidiary items to this work are Excavation, Common Stripping; Excavation, Auxiliary Spillway, Common; Excavation, Borrow, Common; and Salvaging and Spreading Topsoil.

(2) Foundation preparation shall be in accordance with Section 10, Item a, of this specification.

(3) Compaction class, equipment, and material for the construction of the auxiliary spillway floor, exit channel, auxiliary spillway dikes, auxiliary spillway wing dikes, downstream local berm, and downstream toe berm shall be as specified for Zone 1 of the embankment.

(4) For items of work for which specific lump sum prices are established in the contract, the quantity of miscellaneous fill will not be measured for payment. Payment for miscellaneous fill will be made at the contract lump sum price for the item and will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

d. Subsidiary Item - Earthfill, Miscellaneous Trenches

(1) This item shall consist of placing earthfill in the drawdown and drain trenches up to the stripping line. The drain outlet trench shall be filled to the principal spillway trench grade when it is within the principal spillway trench. The earthfill shall conform to the

gradation and compaction requirements of the embankment zone through which the trench passes.

(2) No separate payment will be made for this item. Compensation for this item shall be included in the payment for downstream release pipeline, drainage diaphragm, foundation drain, or blanket drain.

e. Bid Item - Earthfill, Random

(1) This item shall consist of the construction of Zone IV of the embankment. Any earth and rock material from the required excavations or borrow area shall be used insofar as they can be compacted and do not hinder construction operations; otherwise, the very wet and excessively large material shall be placed in a stockpile or a waste area as directed by the engineer.

Subsidiary items to this work are Excavation, Common, Stripping; Excavation, Auxiliary Spillway, Common; Excavation, Borrow, Common; and Salvaging and Spreading Topsoil.

(2) Compaction shall be accomplished by the controlled movement of the hauling and spreading equipment over the fill area so that every point on the surface of each lift will be traversed by not less than one tread track of the equipment.

(3) At the time of compaction, the material shall be sufficiently moist to prevent dusty conditions and sufficiently dry to be workable without excessive rutting as determined by the engineer.

(4) Openings through the embankment for construction purposes will be allowed subject to the approval by the engineer. Such openings in the embankment to allow passage of the stream flow or to facilitate other construction shall be included in the contractor's plan for diverting surface water.

(5) There will be no deduction from the total embankment volume for the volume of embedded portions of the principal spillway inlet, conduit and appurtenances, and the hand compacted fill within the neat lines of the embankment.

(6) Payment for Zone IV will be made at the contract unit price for Earthfill, Random.

(7) Measurement shall be by Method 2 and payment shall be by Method 7.

CONSTRUCTION SPECIFICATION

24. DRAINFILL

1. SCOPE

The work shall consist of furnishing, placing and compacting drainfill required in the construction of structure drainage systems.

2. MATERIALS

Method 1 Drainfill materials shall conform to the requirements of Material Specification 521. At least 30 days prior to delivery of the materials to the site the Contractor shall inform the Contracting Officer in writing of the source from which he intends to obtain them. The Contractor shall provide the Engineer free access to the source for the purpose of obtaining samples for testing.

Method 2 Drainfill materials shall be sand, gravel, or crushed stone or mixtures thereof obtained from the specified sources. They shall be selected as necessary to avoid the inclusion of organic matter, clay balls, excessive fine particles or other substances that would interfere with their free-draining properties.

3. BASE PREPARATION

Foundation surfaces and trenches shall be clean and free of organic matter, loose soil, foreign substance, and standing water when the drainfill is placed. Earth surfaces upon or against which drainfill will be placed shall not be scarified.

4. PLACEMENT

Drainfill shall not be placed until the subgrade has been inspected and approved by the Engineer. Drainfill shall not be placed over or around pipe or drain tile until the installation of the pipe or tile has been inspected and approved.

Drainfill shall be placed uniformly in layers not more than 12 inches deep before compaction. When compaction is accomplished by manually controlled equipment, the layers shall be not more than 8 inches deep. The material shall be placed in a manner to avoid segregation of particle sizes and to insure the continuity and integrity of all zones. No foreign materials shall be allowed to become intermixed with or otherwise contaminate the drainfill.

Traffic shall not be allowed to cross over drains at random. Equipment crossovers shall be maintained, and the number and location of such crossovers shall be established and approved prior to the beginning of drainfill placement. Each crossover shall be cleaned of all contaminating materials and shall be inspected and approved by the Engineer before additional drainfill is placed.

Any damage to the foundation surface or the sides or bottoms of trenches occurring during placement of drainfill shall be repaired before drainfill placement is continued.

The upper surface of drainfill constructed concurrently with adjacent zones of earthfill shall be maintained at an elevation at least one foot above the upper surface of the adjacent fill.

Drainfill over or around pipe or drain tile shall be placed in a manner to avoid any displacement in line or grade of the pipe or tile.

Drainfill shall not be placed adjacent to structures until the concrete has attained the strength specified in Section 9 of this specification. The strength shall be determined by compression testing of test cylinders cast by the Engineer for this purpose and cured at the work site in the manner specified in ASTM Method C 31 for determining when a structure may be put in service.

When the required strength of the concrete is not specified as described above, placement of drainfill adjacent to structures shall not be started until the following item intervals have elapsed after placement of the concrete.

Structure	Time Interval
Retaining walls and counterforts (impact basins)	14 days
Walls backfilled on both sides simultaneously	7 days
Conduits and galleries, cast-in-place (with inside forms in place)	7 days
Conduits and galleries, cast-in-place (inside forms removed)	14 days
Conduits, precast, cradled	2 days
Conduits, precast, bedded	1 day
Cantilever outlet bents backfilled on both sides simultaneously	3 days

5. CONTROL OF MOISTURE

The moisture content of drainfill materials shall be controlled as specified in Section 9. When the addition of water is required, it shall be applied in such a way as to avoid excessive wetting to adjacent earth fill. Except as specified in Section 9, control of moisture content will not be required.

6. COMPACTION

Drainfill shall be compacted according to the following requirements for the class of compaction specified:

Class A compaction. Each layer of drainfill shall be compacted to a relative density of not less than 70 percent as determined by ASTM Method D 4254.

Class I compaction. Each layer of drainfill shall be compacted by at least 2 passes, over the entire surface, of a steel-drum vibrating roller weighing not less than 5 tons and exerting a vertical vibrating force of not less than 20,000 pounds at least 1200

times per minute, or by an approved equivalent method.

Class II compaction. Each layer of drainfill shall be compacted by one of the following methods or by an approved equivalent method:

a. At least 2 passes, over the entire surface, of a pneumatic-tired roller exerting a pressure of not less than 75 pounds per square inch. A pass is defined as at least one complete coverage of the roller wheel, tire or drum over the entire surface of the layer.

b. At least 4 passes, over the entire surface, of the track of a crawler-type tractor weighing not less than 20 tons.

c. Controlled movement of the hauling equipment so that the entire surface is traversed by not less than one tread track of the loaded equipment.

Class III compaction. No compaction will be required beyond that resulting from the placing and spreading operations.

When compaction other than Class III compaction is specified materials placed in trenches or other locations inaccessible to heavy equipment shall be compacted by means of manually controlled pneumatic or vibrating tampers or by approved equivalent methods.

Heavy equipment shall not be operated within 2 feet of any structure. Vibrating rollers shall not be operated within 5 feet of any structure. Compaction by means of drop weights operating from cranes or hoists will not be permitted.

7. TESTING

The Engineer will perform such tests as are required to verify that the drainfill materials and the drainfill in place meet the requirements of the specifications. These tests are not intended to provide the Contractor with information he needs to assure that the materials and workmanship meet the requirements of the specifications, and their performance will not relieve the Contractor of the responsibility of performing his own tests for that purpose.

8. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the volume of drainfill within the neat lines shown on the drawings will be measured and computed to the nearest cubic yard. Where the Engineer directs placement of drainfill outside the neat lines to replace unsuitable foundation material, the volume of such drainfill will be included, but only to the extent that the unsuitable condition is not a result of the Contractor's improper construction operations as determined by the Contracting Officer.

Payment for drainfill will be made at the contract unit price for each type of drainfill, complete in place. Except as otherwise specified in Section 9, such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the performance of the work.

Compensation for any item of work described in the contract but not listed in the bid schedule will be 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 Section 9 of this specification.

9. ITEMS OF WORK AND CONSTRUCTION DETAILS

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

Bid Item - Drainfill

(1) This item shall consist of constructing the drains as shown on the drawings. Subsidiary items to this work are Excavation, Structure, Common; Earthfill, Miscellaneous Trenches; and Removal of Water.

(2) Compaction of drainfill shall be Class III, except Drainfill in the drainage diaphragm may be hydraulically compacted.

(3) The drainfill material in the drainage diaphragm shall be saturated in two phases.

When the drainage diaphragm has been filled to the principal spillway bedding grade, it shall be water flooded so that it becomes saturated and then allowed to drain. When the drainage diaphragm has been completed, the above procedure shall be repeated.

(4) No deduction in drainfill volume will be made for embedded conduits.

(5) The drainfill material shall be as described in Method 1.

(6) Drainfill shall be protected by an impermeable material which has been approved by the engineer where concrete is to be cast over it.

CONSTRUCTION SPECIFICATION

26. SALVAGING AND SPREADING TOPSOIL

1. SCOPE

The work shall consist of salvaging topsoil from the dam foundation area and borrow areas and spreading it on all earthfill embankment and all other disturbed areas above permanent waterline to a depth of six inches, unless otherwise specified on plans.

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 the designated areas and shall be stockpiled at locations shown on the drawings or approved by the Engineer. Objectionable materials encountered during excavation shall be removed and buried at locations shown on the drawings or approved by the Engineer or otherwise removed from the construction site.

4. SPREADING

Method 1 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.

After placement is completed the surface of the topsoil shall be finished to a reasonably smooth surface.

Method 2 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 compacting equipment.

After placement is completed the surface of the topsoil shall be finished to a reasonably smooth surface.

5. MEASUREMENT AND PAYMENT

Method 1 The total areas of the surfaces covered by topsoil will be computed to the nearest square yard. Payment for salvaging and placing topsoil will be made at the contract unit price. Such payment will constitute full compensation for all materials, labor and equipment and all other items necessary and incidental to the completion of the work, including excavating, stockpiling, hauling, and spreading.

Method 2 The total area of the surfaces covered by topsoil will be computed to the nearest square yard except that the areas of the surfaces of embankments, levees, dikes and other earthfills will not be included for payment. Payment for salvaging and placing topsoil will be made at the contract unit price. Such payment will constitute full payment for all materials, labor and equipment and all other items necessary and incidental to the completion of the work, including excavating, stockpiling, hauling, and spreading.

Payment for topsoil spread on the surfaces of embankments, levees, dikes and other earthfills will be considered as included in the payment for the item of earthfill under which the embankment, levee, dike, or other earthfill is constructed.

Method 3 For items of work for which specific unit prices are established in the contract, the volume of topsoil salvaged and spread will be measured by cross section surveys of the stockpile from which it is taken if it is stockpiled, otherwise, of the area from which it is borrowed; and will be computed to the nearest cubic yard by the method of average cross-sectional end areas. Payment for salvaging and spreading topsoil will be made at the contract unit price. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the performance of the work including excavation, stockpiling, hauling, and spreading.

All Methods The following provisions apply to all methods of measurement and payment. 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 of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 6 of this specification.

6. ITEMS OF WORK AND CONSTRUCTION DETAILS

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

a. Bid Item Salvaging and Spreading Topsoil

(1) This item shall consist of the salvaging of selected topsoil from required excavations and placing and spreading it as described in Method 1, on the auxiliary spillway as shown on the drawings and to the depth specified.

(2) Topsoil shall be lightly compacted and dressed to a reasonably smooth, firm surface.

(3) The finished surface of topsoil placed on the auxiliary spillway level crest section shall be within ± 0.1 foot of the planned elevation. The

surface of topsoil placed on the auxiliary spillway inlet or outlet channel shall be within ± 0.5 foot of the planned elevation. The channel shall be essentially level from side to side; the maximum variation in the channel surface at a cross section shall be ± 0.2 foot. The surface of topsoil on excavated slopes shall be within -0.0 to + 0.5 foot of planned elevation.

(4) Measurement and payment shall be as described in Section 5.

b. Subsidiary Item - Salvaging and Spreading Topsoil

(1) This item shall consist of the salvaging of selected topsoil from required excavations and the placing and spreading (Method 2) of it on earthfill areas and any other disturbed areas as shown on the drawings and to the depth specified.

(2) Topsoil shall be compacted in accordance with the requirements for the zone of compacted earth to which it is bonded except the outermost 12 inches of topsoil shall be only lightly compacted.

(3) The finished surface of topsoil placed on earthfill areas shall be within -0.0 to +0.5 foot of the planned elevation. All slopes shall be nearly uniform (within 0.5 ft) from top to bottom.

(4) No separate payment will be made for this item. Compensation for this item will be included in the payment for Earthfill, Embankment; Earthfill, Miscellaneous; and Earthfill, Random.

CONSTRUCTION SPECIFICATION

32. CONCRETE FOR MINOR STRUCTURES

1. SCOPE

The work shall consist of furnishing, forming, placing, finishing and curing Portland cement concrete as required to install the structures as shown on the drawings and described in the specifications.

2. MATERIALS

Portland cement shall conform to the requirements of ASTM Specification C 150 for Type I or II Portland cement.

Aggregate shall conform to the requirements of ASTM Specification C-33 for the specified sizes. The grading of coarse aggregates shall be of size 57 or 67.

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

3. CLASS OF CONCRETE

Concrete for minor structures shall be Class 3000. The mix shall contain a minimum of 6 bags of Portland cement per cubic yard and have a maximum net water content of 6½ gallons of water per bag of cement.

4. DESIGN OF THE CONCRETE MIX

The proportion of the aggregates shall be such as to produce a concrete mixture that will work readily into the corners and angles of the forms and around reinforcement when consolidated, but will not segregate or exude free water during consolidating. The slump the time of placement shall be between 2 and 5 inches.

5. PREPARATION OF FORMS AND SUBGRADE

Forms shall be wood, steel or other approved material and shall be mortar tight. The forms shall be constructed so that the finished concrete will conform to the specified dimensions and contours. Forms shall be coated with a non-staining form release agent before being set into place. The forms and subgrade shall be free of chips, sawdust, debris, water, ice, snow, oil or other harmful substances.

6. CONVEYING

Concrete shall be delivered to the site and placed into the forms with 1½ hours after the introduction of the cement to the aggregates. When the temperature exceeds 90 degrees F, the concrete will be placed in the forms within 45 minutes.

7. PLACING

Concrete shall not be placed until the subgrade, forms and steel reinforcement have been inspected and approved. No concrete shall be placed except in the presence of the engineer. The contractor shall give reasonable notice to the engineer each time he intends to place concrete. Concrete shall not be dropped more than five feet vertically unless suitable equipment is used to prevent segregation. Immediately after the concrete is place in the forms, it shall be consolidated by spading, hand tamping or vibration as necessary to insure smooth surfaces and dense concrete. All exposed surfaces of the concrete shall be accurately screeded to grade and then float finished.

8. CURING

Concrete shall be prevented from drying for a curing period of at least 7 days after it is placed. Exposed surfaces shall be kept continuously moist for the entire period or until curing compound is applied.

9. REMOVAL AND REPLACEMENT OR REPAIR

When concrete is honeycombed, damaged or otherwise defective, the contractor shall remove and replace the structure or member containing the defective concrete or if approved by the engineer shall correct or repair the defective parts.

10. CONCRETING IN COLD WEATHER

Concrete shall not be mixed nor placed when the daily minimum temperature is less than 40 degrees F unless facilities are provided to prevent the concrete from freezing. The use of accelerators or antifreeze compounds will not be allowed.

11. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, concrete will be measured to the neat lines shown on the drawings and the volume of concrete will be computed to the nearest 0.1 cubic yard.

Payment will be made at the contract unit price. Such payment shall constitute full compensation for all labor, materials, equipment and other items necessary and incidental to the completion of the work.

ITEMS OF WORK AND CONSTRUCTION DETAILS

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

Bid Item Reinforced Concrete, Class 3000

(1) These items shall consist of the cast-in-place concrete structures shown on the drawings.

(2) Payment for minor concrete structures will be at the contract lump sum price.

CONSTRUCTION SPECIFICATION

51. CORRUGATED METAL PIPE CONDUITS

1. SCOPE

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

2. MATERIAL

Pipe and fittings shall conform to the requirements of Material Specification 551, Coated Corrugated Steel Pipe, or Material Specification 552, Aluminum Corrugated Pipe, whichever is specified.

Unless otherwise specified in section 11 of this specification, perforated pipe furnished shall conform to the requirements for Class I perforations as described in ASTM A 760 or A 762.

3. COUPLING BANDS AND HARDWARE

Pipe joint coupling bands shall be provided meeting the requirements specified in section 11 of this specification.

Hardware consisting of coupling bands and band fastening devices, such as connecting bolts, rods, lugs, and angles used in conjunction with zinc-coated iron or steel pipe, shall be galvanized by the hot-dip method. Hardware used in conjunction with aluminum pipe and aluminum or aluminum-zinc alloy-coated iron and steel pipe shall be of the same material as the pipe except that hot-dip galvanized or cadmium-plated fasteners may be used. The surface of all band-fastening devices for pipe specified with bituminous or polymer coating shall be coated with asphalt-mastic material meeting the requirements of ASTM A 849. The coupling band shall be coated similar to that specified for the pipe unless otherwise specified in section 11 of this specification.

Coupling bands shall be installed to provide straight alignment of the connecting pipe ends. Unless otherwise specified in section 11 of this specification, the bandwidth shall be as specified in ASTM A 760 and A

762. The bands shall be positioned to overlap adjacent pipe ends equally. The coupling bands shall be corrugated to match the corrugations of the pipe section ends being connected.

4. FABRICATION

Fabrication of appurtenant sections shall be performed as shown on the drawings and described in section 11 of this specification. The items may consist of inlet sections, outlet sections, end sections, elbows, skew or beveled sections, rod reinforced ends, cut-off collars, or headwalls. Fabrication of these appurtenant sections shall be made from metallic-coated material identical to that from which the attached pipe is fabricated. Fabrication shall be of a quality and finished workmanship equal to that required for the pipe.

5. HANDLING THE PIPE

The contractor shall furnish equipment as necessary to install the pipe without damaging the pipe or coating. The pipe shall be transported and handled in a manner to prevent damage to the pipe and coating.

6. LAYING AND BEDDING THE PIPE

Unless otherwise specified, the pipe shall be installed in accordance with the manufacturer's recommendations. Pipe shall be installed so no reversal of grade between joints results unless otherwise shown on the drawings. The pipe shall be installed with the outside laps of circumferential joints pointing upstream and with longitudinal laps at the sides near the vertical mid-height of the pipe.

Field welding of corrugated galvanized iron or steel pipe is not permitted. The pipe sections shall be joined with fabricator-supplied coupling bands meeting the specified joint requirements. The coupling shall be installed as recommended by the fabricator.

The pipe shall be firmly and uniformly bedded throughout its full length to the depth and in the manner specified on the drawings.

Perforated pipe shall be installed with the perforations down and oriented symmetrically about a

vertical centerline. Perforations shall be clear of any obstructions at the time the pipe is installed in its final position.

The pipe shall be loaded sufficiently during backfilling to prevent displacement from line and grade and to maintain full contact with the bedding during the placement operations.

7. STRUTTING

When required, struts or horizontal ties shall be installed in the manner specified on the drawings. Struts and ties shall remain in position until the backfill has been placed above the top of the pipe to a height of 5 feet or the pipe diameter, whichever is greater, or to the surface of the completed earth backfill when the fill height is less than 5 feet above the top of the pipe. The contractor shall remove the struts or ties following completion of the earth backfill requirements that apply.

8. EMBEDMENT IN CONCRETE

Special treatment shall be provided to the pipe surface when embedded or attached to concrete and the pipe material is aluminum or aluminum-coated and aluminum-zinc alloy-coated. Potential contact surfaces in contact with concrete and masonry surfaces shall be coated with two coats of a bituminous paint of the cutback type. Placement of the pipe shall be such that direct metal-to-metal contact with other metallic material, such as embedded steel reinforcement or water control gates, is prevented.

9. REPAIR OF DAMAGED COATING

Any damage to the metallic coating shall be repaired by cleaning the damaged surface area by sand blasting, power disk sanding, or wire brushing. All loose and cracked coating, dirt, and any products of corrosion shall be removed before application of paint. Oil and grease material shall be removed by use of a solvent. The surface shall be clean and dry during the painting period and until the coating has completely dried.

Painting shall be accomplished by one of the following options based upon installed exposure conditions of the pipe as determined by the engineer.

Normal exterior or interior atmospheric exposure:

(a) Zinc dust - zinc oxide primer, ASTM D 79 and D 520

(b) Single package, moisture cured urethane prime in silver metallic color, or

(c) Zinc-rich cold galvanized compound, brush, or aerosol application

Submergence in water exposure:

(a) Zinc dust - zinc oxide primer, ASTM D 79 and D 520

(b) Zinc dust paint, ASTM D 4146

When the metallic coating is damaged in any individual area larger than 12 square inches or if more than 0.2 percent of the total surface area of a single pipe section is damaged, that section of pipe will be rejected.

Breaks or scuffs in bituminous coatings that are less than 36 square inches in area shall be repaired by applying two coats of hot-asphaltic paint or a coating of cold-applied bituminous mastic. The repair coating shall be a minimum of 0.05 inch thick after hardening and shall bond securely and permanently to the pipe and coating. The material shall meet the minimum physical requirements for bituminous coating in ASTM A 849 and A 885. Whenever individual breaks exceed 36 square inches in area or when the total area of breaks exceeds 0.5 percent of the total surface area of an individual pipe section, that section of pipe will be rejected.

Bituminous coating damaged by welding of coated pipe or pipefittings shall be repaired as specified in this section for breaks or scuffs in bituminous coatings.

Breaks or scuffs in polymer coatings that are less than 36 square inches in area shall be repaired by the application of a polymer material similar to and compatible with the durability, adhesion, and appearance of the original polymer coating, as described in ASTM A 849, paragraph 6.8. The repair coating shall be a minimum thickness of 0.010 inch (10 mils) after drying. Whenever individual breaks exceed 36 square inches in area or when the total area of

breaks exceeds 0.5 percent of the total surface area of the individual pipe section, that section of pipe will be rejected.

10. MEASUREMENT AND PAYMENT

Method 1 For items of work for which specific unit prices are established in the contract, the quantity of each type, class, size, and gauge of pipe is determined to the nearest 0.1 foot by measurement of the laid length of the pipe along the centerline of the pipe. Payment for each type, class, size, and gauge of pipe is made at the contract unit price for that type, class, size and gauge of pipe. Such payment constitutes full compensation for furnishing, transporting, and installing the pipe and fittings and all other items necessary and incidental to the completion of the work except items designated as *special fittings*. Special fittings are those sections of pipe requiring special fabrication to meet layout requirements. Payment for special fittings is made at the contract unit price for special fittings (CMP).

Method 2 For items of work for which specific unit prices are established in the contract, the quantity of each type, class, size, and gauge of pipe is determined as the sum of the nominal laying lengths of the pipe sections installed. Payment for each type, class, size, and gauge of pipe is made at the contract unit price for that type, class, size, and gauge of pipe. Such payment constitutes full compensation for furnishing, transporting, and installing the pipe and fittings and all other items necessary and incidental to the completion of the work except items designated as *special fittings*. Special fittings are those sections of pipe requiring special fabrication to meet layout requirements. Payment for special fittings is made at the contract unit price for special fittings (CMP).

Method 3 For items of work for which specific lump sum prices are established in the contract, payment for corrugated metal pipe structures is made at the contract lump sum price. Such payment constitutes full compensation for furnishing, fabricating, transporting, and installing the pipe structure complete with metal pipe, fittings, and appurtenances, and all other items necessary and incidental to completion of the work, which includes, except as otherwise specified, required excavation, dewatering, and earth backfill.

All Methods The following provisions apply to all methods of measurement and payment. 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 items to which they are made subsidiary are identified in section 11 of this specification.

11. ITEMS OF WORK AND CONSTRUCTION DETAILS

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

a. Bid Item – Principal Spillway Pipe

(1) This item shall consist of furnishing and installing the pipe and appurtenances for the principal spillway to achieve a water-tight conduit, as shown on the drawings.

(2) The pipe shall conform to Material Specification 551 and shall be Class II, Series C, Shape 1, 16 gauge, zinc-coated.

b. Bid Item – Pipe Support

(1) This item shall consist of furnishing and installing the pipe support as shown on the drawings.

(2) Pipe shall conform to Material Specification 551 and shall be Class II, Series C, Shape 1, 16 gauge, zinc-coated.

1CONSTRUCTION SPECIFICATION

61. LOOSE ROCK RIPRAP

1. SCOPE

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

2. MATERIALS

Rock for loose rock riprap shall conform to the requirements of Material Specification 523 or, if so specified shall be obtained from designated sources. It shall be free from dirt, clay, sand, rock fines and other materials not meeting the required gradation limits.

At least 30 days prior to delivery of rock from other than designated sources, the Contractor shall designate in writing the source from which he intends to obtain the rock and information satisfactory to the Contracting Officer that the material meets the requirements of the contract. The Contractor shall provide the Engineer free access to the source for the purpose of obtaining samples for testing. The size and grading of the rock shall be as specified in Section 9 of this specification.

Rock from designated sources shall be excavated, selected and processed as necessary to meet the grading requirements in Section 9 of this specification. The equipment and methods used for stockpiling and removing the materials must be such that no degradation or segregation will result and that no appreciable amount of foreign material will be incorporated into the riprap. The rock shall conform to the specified grading limits when installed in the riprap.

Filter or bedding materials when required, shall, unless otherwise specified, conform to the requirements of Material Specification 521.

3. SUBGRADE PREPARATION

The subgrade surfaces on which the riprap or bedding course 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 conform to the requirements of the specified class of fill.

Riprap shall not be placed until the foundation preparation is completed and the subgrade surfaces have been inspected and approved by the Engineer.

4. EQUIPMENT-PLACED ROCK RIPRAP

The rock shall be placed by equipment on the surfaces and to the depths specified. Riprap shall be placed by backhoe, orange peel, clam or drag buckets. The riprap shall be constructed to the full course 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 filling the voids between the larger rocks to provide the minimum practical percentage of voids.

Dumping of riprap at the top of slopes and rolling into place will not be permitted. Drifting, manipulating and moving riprap down the slopes by means of dozers or other blade equipment will not be permitted. A tolerance of plus two inches from the slope lines and grades will be allowed in the finished surface of the riprap. An occasional large stone will be permitted to protrude above the prescribed surface.

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 the permanent works.

5. HAND-PLACED RIPRAP

The 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.

6. FILTER LAYERS OR BEDDING

When the drawings specify filter layers or bedding beneath riprap, the filter or bedding material shall be spread uniformly on the prepared subgrade surfaces to the depth specified. Compaction of filter layers or bedding will not be required, but the surface of such layers shall be finished reasonably free of mounds, dips or windrows.

7. TESTING

The Engineer will perform such tests as are required to verify that the riprap, filter, and bedding materials and the completed work meet the requirements of the specifications. These test are not intended to provide the Contractor with the information he needs to assure that the materials and workmanship meet the requirements of the specifications, and their performance will not relieve the Contractor of the responsibility of performing his own tests for that purpose.

8. MEASUREMENT AND PAYMENT

Method 1 For items of work for which specific unit prices are established in the contract, the volume of each type of riprap, including filter layers and bedding, will be measured within the specified limits and computed to the nearest cubic yard by the method of average cross-sectional end areas. Payment for each type of riprap, including filter layers and bedding, will be made at the contract unit price for that type of riprap. Such payment will be considered full compensation for all labor, materials, equipment and all other items necessary and incidental to the completion of the riprap, filter layers and bedding.

Method 2 For items of work for which specific unit prices are established in the contract, the volume of each type of riprap and the volume of each type of filter layer or bedding will be measured within the specified limits and computed to the nearest cubic yard by the method of average cross-sectional end areas. Payment for each type of riprap will be made at the contract unit price for that type of riprap. Payment for each type of filter or bedding will be made at the contract unit price for that type of filter or bedding. Such payment will be considered full compensation

for all labor, materials, equipment and all other items necessary and incidental to the completion of the riprap, filter layers and bedding.

Method 3 For items of work for which specific unit prices are established in the contract, the quantity of each type of riprap placed within the specified limits will be measured to the nearest ton by actual weight, and the volume of each type of filter layer or bedding will be measured within the specified limits and computed to the nearest cubic yard by the method of average cross-sectional end areas. For each load of rock placed as specified, the Contractor shall furnish to the Engineer a statement-of-delivery ticket showing the weight, to the nearest 0.1 ton, of rock in the load.

Payment for each type of riprap will be made at the contract unit price for that type of riprap. Payment for each type of filter or bedding will be made at the contract unit price for that type of filter or bedding. Such payment will be considered full compensation for all labor, materials, equipment and all other items necessary and incidental to the completion of the riprap, filter layers and bedding.

Method 4 For items of work for which specific unit prices are established in the contract, the quantity of each type of riprap placed within the specified limits will be measured to the nearest ton by actual weight, and the volume of each type of filter material or bedding delivered and placed within the specified limits will be measured to the nearest cubic yard by measurement of the hauling equipment. For each load of material placed as specified, the Contractor shall furnish to the Engineer a statement-of-delivery ticket showing the weight, to the nearest 0.1 cubic yard, of filter material or bedding in the load.

Payment for each type of riprap will be made at the contract unit price for that type of riprap. Payment for each type of filter or bedding will be made at the contract unit price for that type of filter or bedding. Such payment will be considered full compensation for all labor, materials, equipment and all other items necessary and incidental to completion of the riprap, filter layers and bedding.

All Methods The following provisions apply to all methods of measurement and payment. 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 of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 9 of this specification.

9. ITEMS OF WORK AND CONSTRUCTION DETAILS

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

a. Bid Item – Rock Riprap on Upstream Slope

(1) This item shall consist of furnishing and placing rock riprap on the upstream embankment slope as shown on the drawings.

(2) No filter material is required under the riprap.

(3) The riprap materials shall be reasonably well graded by weight within the limits stated below to meet the following requirements.

Gradation, By Equivalent Diameter

Diameter (in)	% Finer by Weight
12	100
8	60-85
6	30-50
3	0-15

Earth and other non-rock material shall not exceed 5%.

(4) Hand placing will be required to the extent necessary to prevent damage to the permanent works.

b. Bid Item – Rock Riprap of Stilling Basin

(1) This item shall consist of furnishing and placing rock riprap around the principal spillway stilling basin as shown on the construction drawings.

(2) The rock riprap shall be equipment placed.

(3) The riprap shall be placed on a bedding of gravel or geotextile as specified on the construction drawings

(4) The riprap material shall be well graded by weight within the limits stated on the construction drawings.

CONSTRUCTION SPECIFICATIONS

62. GEOTEXTILE INSTALLATION

1. SCOPE

The work shall consist of furnishing and installing nonwoven geotextile as filter or bedding material as shown on the construction plans.

2. MATERIALS

The geotextile shall be nonwoven needle punched as stated on the plans. The geotextile shall meet the Natural Resource Conservation Service (NRCS) Class I requirements. The geotextile shall be resistant to chemical attack, rot and mildew and shall have no tears or defects that will adversely alter its physical properties. The fabric shall meet the physical requirements specified below.

Property	**Test Method**	**Requirement**
Weight		8 oz/yd^2 minimum
Tensile Strength	ASTM D4632 Grab Test	180 lbs minimum *
Elongation Failure	ASTM D4632 Grab Test	>50 percent*
Static (CBR) Puncture	ASTM D6241	460 lbs minimum*
Trapezoidal Tear	ASTM D4533	75 lbs minimum*
Ultraviolet Light	ASTM D4355 150 hour exposure	70 percent residual tensile strength
Apparent Opening Size (AOS)	ASTM D4751	#70 sieve maximum
Permittivity	ASTM D4491	0.70 sec^{-1} minimum
Riprap Dropping Height		3 feet maximum

* Minimum average roll value (weakest principal direction)

3. STORAGE

The geotextile shall be stored in a dry, clean location out of direct sunlight, not subject to temperature extremes, and with the manufacturer's protective cover undisturbed.

4. SUBGRADE PREPARATION

The surface shall be graded and compacted as per the plans, relatively smooth with no clods, holes,

depressions, projections, muddy conditions, and standing or flowing water.

5. PLACEMENT

The geotextile shall be unrolled and loosely laid, without stretching, along the placement area. The geotextile shall conform to the surface irregularities when the riprap is placed over it. The geotextile may be folded and overlapped to permit proper placement in designated areas. The geotextile shall be joined by overlapping a minimum of 18 inches. The riprap shall not be pushed or rolled over the geotextile. Any torn or punctured geotextile shall not be allowed.

6. MEASUREMENT and PAYMENT

Payment shall be by lump sum and shall cover all materials, labor, and equipment to furnish and install the nonwoven geotextile under the riprap surrounding the stilling basin.

7. ITEMS OF WORK AND CONSTRUCTION DETAIL

This item shall consist of furnishing and installing the nonwoven geotextile under the riprap on the stilling basin.

CONSTRUCTION SPECIFICATIONS

64. ROLLED EROSION CONTROL PRODUCTS

1. SCOPE

The work shall consist of furnishing and installing rolled erosion control products (RECP) as shown on the construction plans. The contractor shall provide manufacturer's testing results showing that the furnished RECP meets all applicable requirements of this specification.

2. MATERIALS

2.1 TEMPORARY RECP's

Temporary RECP's are for applications where natural vegetation alone will provide sufficient permanent erosion protection, furnish a temporary RECP with the necessary longevity and performance properties to effectively control erosion and assist in the establishment of vegetation under the anticipated immediate site conditions. The temporary RECP shall conform to one of the following specifications and corresponding properties found in Table 1.

A. *Mulch Control Netting*
A planar woven natural fiber or extruded geosynthetic mesh used as a temporary degradable RECP to anchor loose fiber mulches.

B. *Open Weave Textile*
A temporary degradable RECP composed of processed natural or polymer yarns woven into a matrix, used to provide erosion control and facilitate vegetation establishment.

C. *Erosion Control Blanket (ECB)*
A temporary degradable RECP composed of processed natural or polymer fibers mechanically, structurally or chemically bound together to form a continuous matrix to provide erosion control and facilitate vegetation establishment.

Table 1. Standard Specification for Temporary Rolled Erosion Control Products

For use where natural vegetation alone will provide permanent erosion protection

ULTRA SHORT-TERM – Typical 3 month functional longevity

Type	Product Description	Material Composition	Slope Applications*		Channel Applications*	Minimum Tensile Strength[1]
			Maximum Gradient	C Factor[2, 5]	Permissible Shear Stresss[3, 4, 6]	
1.A	Mulch Control Nets	A photodegradable synthetic mesh or woven biodegradable natural fiber netting.	5:1 (H:V)	< 0.10 @ 5:1	≤ 0.25 lbs/ft^2 (12 Pa)	5 lbs/ft (0.073 kN/m)
1.B	Netless Rolled Erosion Control Blankets	Natural and/or polymer fibers mechanically interlocked and/or chemically adhered together to form a RECP.	4:1 (H:V)	< 0.10 @ 4:1	≤ 0.5 lbs/ft^2 (24 Pa)	5 lbs/ft (0.073 kN/m)
1.C	Single-net Erosion Control Blankets & Open Weave Textiles	Processed degradable natural and/or polymer fibers mechanically bound together by a single rapidly degrading, synthetic or natural fiber netting or an open weave textile of processed rapidly degrading natural or polymer yarns or twines woven into a continuous matrix.	3:1 (H:V)	< 0.15 @ 3:1	≤ 1.5 lbs/ft^2 (72 Pa)	50 lbs/ft (0.73 kN/m)
1.D	Double-net Erosion Control Blankets	Processed degradable natural and/or polymer fibers mechanically bound together between two rapidly degrading, synthetic or natural fiber nettings.	2:1 (H:V)	< 0.20 @ 2:1	≤ 1.75 lbs/ft^2 (84 Pa)	75 lbs/ft (1.09 kN/m)

Table 1. Continued

SHORT TERM – Typical 12 month function longevity

Type	Product Description	Material Composition	Slope Applications*		Channel Applications*	Minimum Tensile Strength[1]
			Maximum Gradient	C Factor[2, 5]	Permissible Shear Stresss[3, 4, 6]	
2.A	Mulch Control Nets	A photodegradable synthetic mesh or woven biodegradable natural fiber netting.	5:1 (H:V)	< 0.10 @ 5:1	≤ 0.25 lbs/ft^2 (12 Pa)	5 lbs/ft (0.073 kN/m)
2.B	Netless Rolled Erosion Control Blankets	Natural and/or polymer fibers mechanically interlocked and/or chemically adhered together to form a RECP.	4:1 (H:V)	< 0.10 @ 4:1	≤ 0.5 lbs/ft^2 (24 Pa)	5 lbs/ft (0.073 kN/m)
2.C	Single-net Erosion Control Blankets & Open Weave Textiles	An erosion control blanket composed of processed degradable natural or polymer fibers mechanically bound together by a single degradable synthetic or natural fiber netting to form a continuous matrix or an open weave textile composed of processed degradable natural or polymer yarns or twines woven into a continuous matrix.	3:1 (H:V)	< 0.15 @ 3:1	≤ 1.5 lbs/ft^2 (72 Pa)	50 lbs/ft (0.73 kN/m)
2.D	Double-net Erosion Control Blankets	Processed degradable natural and/or polymer fibers mechanically bound together between two degradable, synthetic or natural fiber nettings.	2:1 (H:V)	< 0.20 @ 2:1	≤ 1.75 lbs/ft^2 (84 Pa)	75 lbs/ft (1.09 kN/m)

EXTENDED TERM – Typical 24 month functional longevity

Type	Product Description	Material Composition	Slope Applications*		Channel Applications*	Minimum Tensile Strength[1]
			Maximum Gradient	C Factor[2, 5]	Permissible Shear Stresss[3, 4, 6]	
3.A	Mulch Control Nets	A slow degrading synthetic mesh or woven natural fiber netting.	5:1 (H:V)	< 0.10 @ 5:1	≤ 0.25 lbs/ft^2 (12 Pa)	25 lbs/ft (0.36 kN/m)
3.B	Erosion Control Blankets & Open Weave Textiles	An erosion control blanket composed of processed slow degrading natural or polymer fibers mechanically bound together between two slow degrading synthetic or natural fiber nettings to form a continuous matrix or an open weave textile composed of processed slow degrading natural or polymer yarns or twines woven into a continuous matrix.	1.5:1 (H:V)	< 0.25 @ 1.5:1	≤ 2.00 lbs/ft^2 (96 Pa)	100 lbs/ft (1.45 kN/m)

Table 1. Continued

LONG TERM – Typical 36 month functional longevity

Type	Product Description	Material Composition	Slope Applications*		Channel Applications*	Minimum Tensile Strength[1]
			Maximum Gradient	C Factor[2, 5]	Permissible Shear Stresss[3, 4, 6]	
4	Erosion Control Blankets & Open Weave Textiles	An erosion control blanket composed of processed slow degrading natural or polymer fibers mechanically bound together between two slow degrading synthetic or natural fiber nettings to form a continuous matrix or an open weave textile composed of processed slow degrading natural or polymer yarns or twines woven into a continuous matrix.	1:1 (H:V)	< 0.25 @ 1:1	≤ 2.25 lbs/ft^2 (108 Pa)	125 lbs/ft (1.82 kN/m)

Notes

* "C" factor and shear stress for Types 1.A., 2.A. and 3.A mulch control nettings must be obtained with netting used in conjunction with pre-applied mulch material.

[1] Minimum Average Roll Values when tested in the machine direction using ECTC Modified ASTM D 5035.

[2] "C" Factor calculated as ratio of soil loss from RECP protected slope (tested at specified or greater gradient, h:v) to ratio of soil loss from unprotected (control) plot in large-scale testing.These performance test values should be supported by periodic bench scale testing under similar test conditions using ECTC Test Method # 2.

[3] Minimum shear stress RECP (unvegetated) can sustain without physical damage or excess erosion [> 12.7 mm (0.5 in) soil loss] during a 30-minute flow event in large-scale testing. These performance test values should be supported by periodic bench scale testing under similar test conditions and failure criteria using ECTC Test Method #3.

[4] The permissible shear stress levels established for each performance category are based on historical experience with products characterized by Manning's roughness coefficients in the range of 0.01 - 0.05.

[5] Acceptable large-scale test methods may include ASTM D6459 or other independent testing deemed acceptable by the engineer.

[6] Acceptable large-scale testing protocol may include ASTM D6460 or other independent testing deemed acceptable by the engineer.

2.2 PERMANENT RECP's

For applications where natural vegetation alone will not sustain expected flow conditions and/or provide sufficient long-term erosion protection, furnish a permanent RECP with the necessary performance properties to effectively control erosion and reinforce vegetation under the expected long-term site conditions. The permanent RECP shall conform to one of the specifications and corresponding properties found in Table 2.

Turf Reinforcement Mat (TRM)
A rolled erosion control product composed of non-degradable synthetic fibers, filaments, nets, wire mesh and/or other elements, processed into a permanent, three-dimensional matrix of sufficient thickness. TRMs, which may be supplemented with degradable components, are designed to impart immediate erosion protection, enhance vegetation establishment and provide long-term functionality by permanently reinforcing vegetation during and after maturation. TRMs are designed for permanent protection in hydraulic applications where design discharges exert velocities and shear stresses that exceed the limits of mature natural vegetation. The TRM shall be resistant to chemical attack, rot and mildew and shall possess strength and elongation properties that limit stretching and can be maintained in a water-saturated condition. The TRM shall have light penetration of at least 20% passing by ASTM D6567.

Table 2. Standard Specification for Permanent Rolled Erosion Control Products

Type[1]	Product Description	Minimum Tensile Strength[2,3]	Minimum Thickness (ASTM D 6525)	UV Stability (ASTM D 4355 @ 500 Hours)	Channel Applications Permissible Shear Stress[4,]
5.A	Turf Reinforcement Mat	125 lbs/ft (1.82 kN/m)	0.25 inches (6.35 mm)	80%	≤ 6.0 lbs/ft^2 (288 Pa)
5.B	Turf Reinforcement Mat	150 lbs/ft (2.19 kN/m)	0.25 inches (6.35 mm)	80%	≤ 8.0 lbs/ft^2 (384 Pa)
5.C	Turf Reinforcement Mat	175 lbs/ft (2.55 kN/m)	0.25 inches (6.35 mm)	80%	≤ 10.0 lbs/ft^2 (480 Pa)

Notes:

[1] For TRMs containing degradable components, all property values must be obtained on the non-degradable portion of the matting alone.

[2] Minimum Average Roll Values, machine direction only for tensile strength determination using ASTM D6818 (Supercedes Mod. ASTM D5035 for RECPs)

[3] Field conditions with high loading and/or high survivability requirements may warrant the use of a TRM with a tensile strength of 44 kN/m (3,000 lb/ft) or greater.

[4] Shear stress that fully vegetated TRM can sustain without physical damage or excess erosion [> 12.7 mm (0.5 in.) soil loss] during a 30-minute flow event in large scale testing.

[5] Acceptable large-scale testing protocol may include ASTM D6460 or other independent testing deemed acceptable by the engineer.

2.3 GROUND ANCHORING DEVICES

Ground anchoring devices shall be used to secure the RECP tightly to the subgrade in the number and spacings shown on the construction plans. The devices shall be U-shaped wire staples or metal pins with flat washers.

A. Length: 8 to 18 inches depending on soil type under mat. Sufficient ground penetration to resist pullout. Use longer anchors for loose soil.

B. Wire staples: minimum 8 guage.

C. Metal pins: minimum 0.20 inch diameter with 1.5 inch diameter steel flat washers.

3. STORAGE AND HANDLING

Product labels shall clearly show the manufacturer, product designation, and roll number. Each roll shall have a protective cover (wrapping) that is maintained in tact during storage. The RECP shall be stored off ground in a clean, dry location out of direct sunlight and protected from chemicals, fuel, and temperatures above 160°F.

4. SUBGRADE PREPARATION

The area to be covered with RECP shall be topsoiled, graded, and compacted per the plans and Specification 26 with no clods, holes, projections, or muddy conditions. The surface shall be seeded per Specification 6. No mulch shall be applied.

5. PLACEMENT

A. Excavate downstream anchor trench per plans.

B. Excavate top of slope and toe of slope anchor trenches per plans.

C. Begin RECP installation at downstream end trench.

D. Secure first blanket or mat in top slope trench with ground anchors per plans and unroll down the slope.

E. Secure first blanket or mat in downstream trench with ground anchors per plans and fill downstream trench with compacted soil.

F. Secure first run of RECP in toe slope trench with ground anchors per plans.

G. Install ground anchors in a diamond pattern throughout the RECP as shown on plans.

H. Continue installation moving upstream overlapping each run 6 inches and anchoring each seam with one row of ground anchors spaced 12 inches apart along each seam (see plans).

I. As each run is completed fill top slope and toe slope trench as per plans.

J. At each end of roll seam overlap 12 inches and secure to ground with two rows of anchors on 12 inch centers (see plans).

K. Equipment shall be kept off the installed RECP to avoid damage or disturbance.

6. MEASUREMENT and PAYMENT

The area of the installed RECP will be measured to the nearest square yard. Payment will be at the contract unit price per square yard for the measured area and shall cover all materials labor and equipment to install the RECP.

7. ITEMS OF WORK

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

a. Bid Item – Turf Reinforcement Mat

This item shall consist of furnishing the materials, labor, and equipment to install turf reinforcing mat on the repaired channel bank in the area designated on the construction plans. The TRM shall meet the requirements in Table 2 for type 5.C turf reinforcement mat.

b. Bid Item – Erosion Control Blanket

This item shall consist of furnishing the materials, labor, and equipment to install erosion control blanket on all repaired channel banks with slope of 2.5 H to 1V or steeper that are not protected by either stone riprap or turf reinforcement mat, as shown on the construction plans. The ECB shall meet the requirements in Table 1 for type 2.D or 3.B erosion control blanket.

CONSTRUCTION SPECIFICATION

66. ROCK FENCE BARRIER

1. SCOPE

The work shall consist of the construction of rock fence barriers.

2. MATERIALS

Rock for rock fence barriers shall conform to the requirements of Material Specification 529 or, if so specified shall be obtained from designated sources. It shall be free from dirt, clay, sand, rock fines and other materials not meeting the required gradation limits.

At least 30 days prior to delivery of rock from other than designated sources, the Contractor shall designate in writing the source from which he intends to obtain the rock and information satisfactory to the Contracting Officer that the material meets the requirements of the contract. The Contractor shall provide the Engineer free access to the source for the purpose of obtaining samples for testing. The size and grading of the rock shall be as specified in Section 9 of this specification.

Rock from designated sources shall be excavated, selected and processed as necessary to meet the grading requirements in Section 9 of this specification. The equipment and methods used for stockpiling and removing the materials must be such that no degradation or segregation will result and that no appreciable amount of foreign material will be incorporated into the riprap. The rock shall conform to the specified grading limits when installed in the riprap.

3. SUBGRADE PREPARATION

The subgrade surfaces on which the rock fence barrier 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 conform to the requirements of class A fill.

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

4. EQUIPMENT-PLACED ROCK

The rock shall be placed by equipment on the surfaces and to the depths specified. Rock shall be placed by backhoe, orange peel, clam or drag buckets. The rock shall be placed 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 rock in place shall be reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact one to another with the smaller rocks filling the voids between the larger rocks to provide the minimum practical percentage of voids.

Dumping of rock at the top of slopes and rolling into place will not be permitted. Drifting, manipulating and moving riprap down the slopes by means of dozers or other blade equipment will not be permitted. A tolerance of plus six inches from the slope lines and grades will be allowed in the finished surface of the rock barriers. An occasional large stone will be permitted to protrude above the prescribed surface.

5. MEASUREMENT AND PAYMENT

Payment for rock fence barriers will be made at the contract lump sum price. Such payment will be considered full compensation for all labor, materials, equipment and all other items necessary and incidental to the completion of the rock fence barriers.

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All Methods The following provisions apply to all methods of measurement and payment. 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 of work to which it is made subsidiary. Such items and the

items to which they are made subsidiary are identified in Section 9 of this specification.

6. ITEMS OF WORK AND CONSTRUCTION DETAILS

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

a. Bid Item - Rock Fence Barriers

(1) This item shall consist of furnishing and placing rock to form rock fence barriers as shown on the drawings.

(2) No filter material is required.

(3) The rock shall be reasonably well graded by weight within the limits stated below to meet the following requirements.

Gradation, Percentage of Stones
Of Various Size (inches)

Size (in)	Approx. Weight (pounds)	% Finer by Weight
30	1900	100
24	1000	80-100
12	125	40-60
8	35	10-30
4	5	0-10

Earth and other non-rock material smaller than 1.5 inches shall not exceed 5%.

CONSTRUCTION SPECIFICATION

81. METAL FABRICATION AND INSTALLATION

1. SCOPE

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

2. MATERIALS

Unless otherwise specified, materials shall conform to the requirements of Material Specification 581. Steel shall be structural quality unless otherwise specified. Castings shall be thoroughly cleaned and subjected to careful inspection before installation. Finished surfaces shall be smooth and true to assure proper fit. Galvanizing shall conform to the requirements of Material Specification 582.

3. FABRICATION

Fabrication of structural steel shall conform to the requirements of Section 1.23 of the "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings (Riveted, Bolted and Arc-Welded Construction)," American Institute of Steel Construction.

Fabrication of structural aluminum shall conform to the requirements in the Aluminum Construction Manual, "Specifications for Aluminum Structures," Section 6 and Section 7, The Aluminum Association, October 1994.

4. ERECTION

The frame of metal structures shall be carried up true and plumb. Temporary bracing shall be placed wherever necessary to resist all loads to which the structure may be subjected, including those applied by the installation and operation of equipment. Such bracing

shall be left in place as long as may be necessary for safety.

As erection progresses the work shall be securely bolted up, or welded, to resist all dead load, wind and erection stresses. The Contractor shall furnish such fitting up bolts, nuts and washers as may be required.

No riveting or welding shall be done until as much of the structure as will be stiffened thereby has been properly aligned.

Rivets driven in the field shall be heated and driven with the same care as those driven in the shop. All field welding shall be done in conformance to the requirements for shop fabrication, except those that expressly apply to shop conditions only.
Galvanized items shall not be cut, welded or drilled after the zinc coating is applied.

5. PROTECTIVE COATINGS

Items specified to be galvanized shall be completely fabricated for field assembly before the application of the zinc coatings.

6. MEASUREMENT AND PAYMENT

Method 1 The work will not be measured. Payment for metal fabrication and installation will be made at the contract lump sum price. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the completion of the work, including connectors and appurtenances such as rivets, bolts, nuts, pins, studs, washers, hangers and weld metal.

Method 2 The weight of metal installed complete in place shall be determined to the nearest pound. Unless otherwise provided, the weight of metal shall be computed by the method specified in Section 3 of the "Code of Standard Practice for Steel Buildings and Bridges," American Institute of Steel Construction,

except that the following unit weights shall also be used, as appropriate, as the basis of computation:

Material	Unit Weight Pounds per Cubic Foot
Aluminum alloy	173.0
Bronze or copper alloy	536.0
Iron, malleable	470.0
Iron, wrought	487.0

Payment for furnishing, fabricating and installing metalwork will be made at the contract unit price for the specified types of labor, materials, equipment and all other items necessary and incidental to the completion of the work.

Method 3 The work will not be measured. Payment for furnishing, fabricating and installing each item of metalwork will be made at the contract price for that item. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the completion of the work, including connectors and appurtenances such as rivets, bolts, nuts, pins, studs, washers, hangers and weld metal.

All Methods The following provisions apply to all methods of measurement and payment. 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 of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 7 of this specification.

7. ITEMS OF WORK AND CONSTRUCTION DETAILS

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

a. Bid Item - Trash Rack

(1) This item shall consist of the fabrication and installation of the trash rack as shown on the drawings.

(2) The trash rack shall be fabricated of new structural steel.

(3) The trash rack shall be galvanized after fabrication in accordance with Material Specification 582.

(4) The fitting and welding of the various members shall be carried out in accordance with AWS D1.1 and D1.3.

(5) No material certification is required.

(6) Measurement and payment shall be by Method 1.

b. Subsidiary Item - Metalwork, Miscellaneous

(1) This item shall consist of furnishing, fabricating, and installing the animal guard for the drain outlet pipe.

(2) The metalwork shall be constructed of new structural steel and be of the size and shape shown on the drawings or specified herein.

(3) Each piece of metalwork and associated bolts shall be galvanized after fabrication in accordance with Material Specification 582. Bolts, screws, and other fasteners larger than 1/2 inch may be coated with electrodeposited cadmium, Type OS, conforming to the requirements of ASTM B 766.

(4) The fittings and welding of the various members shall be carried out in accordance with AWS D1.1 and D1.3.

(5) No material certification is required for this item.

(6) No separate payment will be made for this item. Compensation for this item shall be included in the payment for plastic pipeline, 4-inch Diameter.

CONSTRUCTION SPECIFICATION

92. LIVESTOCK EXCLUSION FENCES

1. SCOPE

The work shall consist of furnishing and installing farm field fences, including gates and fittings.

2. MATERIALS

Materials for farm field fences shall conform to the requirements of Material Specification 591. All wooden posts shall be of the same species.

3. SETTING POSTS

Concrete or wood posts shall set in holes and backfilled with earth except where otherwise specified. Steel posts shall be driven unless otherwise specified.

Posts holes shall be at least 6 inches larger than the diameter or side dimension of the posts.

Earth backfill around posts shall be thoroughly tamped in layers not thicker than 4 inches and shall completely fill the post hole up to the ground surface. Concrete backfill around posts shall be rodded into place in layers not thicker than 12 inches at the bottom of the hole then tamped with earth and crowned around the post at the ground surface.

No stress shall be applied to posts set in concrete until at least 24 hours after the concrete has set.

4. CORNER ASSEMBLY

Unless otherwise specified, corner assemblies shall be installed at all points where the fence alignment changes 15 degrees or more.

5. END PANELS

End panels shall be built at gates and fence ends.

6. PULL POST ASSEMBLY

Pull post assemblies shall be installed at the following locations:

a. In straight fence sections, at intervals of no more than 660 feet.

b. At any point where the vertical angle described by two adjacent reaches of wire is upward and exceeds 10 degrees (except as provided in Section 9 of this specification).

c. At the beginning and end of each curve.

7. ATTACHING FENCING TO POSTS

The fencing shall be stretched and attached to posts as follows:

a. The fencing shall be placed on the side of the post opposite the area being protected, except on curves.

b. The fencing shall be placed on the outside of curves.

c. The fencing shall be fastened to each end post, corner post and pull post by wrapping each horizontal strand around the post and tying it back on itself with not less than three tightly wound wraps.

d. The fencing shall be fastened to wooden line posts by means of staples. Woven wire fencing shall be attached at alternate horizontal strands. Each strand of barbed wire shall be attached to each post. Staples shall be driven diagonally with the grain of the wood and at a slight downward angle and shall not be driven so tightly as to bind the wire against the post.

e. The fencing shall be fastened to steel or concrete line posts with either two turns of 14 gauge galvanized steel or iron wire or the post manufacturer's special wire fasteners.

f. Wire shall be spliced by means of a Western Union splice or by suitable splice sleeves applied with a tool designed for the purpose. The Western Union splice shall have not less than 8 wraps of each end about the other. All wraps shall be tightly wound and closely spaced. Splices made with splice sleeves shall have a tensile strength no less than 80 percent of the strength of the wire.

8. STAYS

Stays shall be attached to the fencing in a manner to insure maintenance of the proper spacing of the fence wire strands.

9. CROSSINGS AT DEPRESSIONS AND WATERCOURSES

Where fencing is installed parallel to the ground surface, the line posts subject to upward pull shall be anchored by means of extra embedment or by special anchors as detailed on the drawings.

a. If the fence wire is installed parallel to the ground surface, the line posts subject to upward pull shall be anchored by means of extra embedment or by special anchors as detailed on the drawings.

b. If the wire fence is installed with the top wire straight and parallel to the ground surface on either side of the depression, extra length posts shall be used to allow normal post embedment. Unless otherwise specified, excess space between the bottom of the fence and the ground shall be closed with extra strands of barbed wire.

10. MEASUREMENT AND PAYMENT

Method 1 The length of each type and kind of fence will be measured to the nearest foot along the profile of the fence, including gate openings. Payment for each type and kind of fence will be made at the contract unit price for that type and kind of fence. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the performance of the work including fabricating and installing gates.

Method 2 The length of each type and kind of fence will be measured to the nearest foot along the profile of the fence, excluding gate openings. Payment for each type and kind of fence will be made at the contract unit price for that type and kind of fence. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the completion of the work, except fabricating and installing gates. Payment for each type and size of gate will be made at the contract price each for fabricating and installing that type and size of gate.

All Methods The following provisions apply to all methods of measurement and payment. 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 of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 11 of this specification.

11. ITEMS OF WORK AND CONSTRUCTION DETAILS

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

a Bid Item - Special Area Fence (Barbed Wire)

This item shall consist of construction of a new barbed wire fence and gates at the location shown on the drawings or as determined by the engineer.

Subsidiary items to this work are the establishment of reference markers and the

fabrication and installation of stiles. The fence shall be as detailed on the drawings except that wood line posts may be used as an alternate to steel line posts.

(1) Class 1 Zinc coating of barbed wire, stays, fasteners and tension wire is substituted for specification 591 requirements.

(2) Steel line posts shall be Style 1 (T-Section) or Style 2 (U-Section) with a steel anchor plate. The anchor plate shall be securely fastened to the post to prevent displacement when the posts are driven, shall weigh not less than 0.67 pounds, and shall be 20+ or - square inches in area.

The minimum weight per linear foot of steel post without anchor plate shall be 1.33 pounds for Style 1 and 1.12 pounds for Style 2. Steel posts shall be painted.

(3) Wood posts shall be of Osage Orange.

(4) Wood line posts shall be 6 inches in diameter and of the length and depth of embedment shown on the drawings for steel line posts. Backfill may be either tamped earth or concrete. Every fourth line post shall be a wood post to provide lateral support.

(5) Wooden corner, brace, and end posts shall have a minimum 6 inch diameter top and a minimum length of 9 feet. Posts will be set 4' in the ground. Place wooden posts by the following manner: First 12" of hole, fill with concrete, allow set up time of 24 hours. Then tamp, 4" earth per tamp, to top of hole. Crown earth around the post.

(6) Gates, as required, will be commercially constructed of tubular steel and shall be standard 15 ga., 50" high, 16'long gates. They will be attached to the pull post section with commercial hinges and a chain closure. A rest for the closure end will be as shown on the plans.

The top wire of the fence shall be below the crest of the emergency spillway of the structure where the fence

crosses the entrance and exit channel of the emergency spillway.

(7) The requirements for material certifications for the following materials are hereby waived. No certification of materials will be necessary for the listed items when present in the contract:

Wood post, Barbed Wire, Steel Fence Posts, Wire Stays, Wires, Tension Wires, Staples, Gate Closer, Horizontal Brace Pipe, Concrete

(8) Each horizontal strand of fence placed around an end, corner, or pull post shall be wrapped with at least two full loops.

(9) Pull post assemblies (3-post) shall be installed at any point in the fence line where an upward angle will require additional embedment to properly anchor the upward pull of the stretched wire. Changes in slope exceeding 10 percent are to be considered for this assembly. The center post of the pull post assembly shall be set as near the point where the slope breaks as possible.

(10) One 9-foot, 6-inch diameter wooden post shall be set in the fence line at the top of the slope where the downward pull of the stretched fence is the greatest. Fence wires are to be fastened to the post with staples and two wraps of 14-gauge or heavier galvanized wire.

(11) Bracing is required at all corners, double horizontal brace assemblies, end panels, and pull post assemblies. A single piece of steel pipe will be used for the horizontal brace member.

(12) Use double horizontal brace assemblies on all corners and end panels when the fence interval between end panels, corners, or pull post assemblies exceeds 330 feet.

(13) Posts installed within the rock barriers will be of 2 3/8" oil pipe casing 10' long filled with concrete.

(14) Crossings at depressions and watercourses shall be anchored in the following method: A 3/8" cable shall

be placed around a sufficient size rock (min. 60#) and attached with a clamp then attached to the 5 strands of fence wire.

(15) Measurement and payment will be by Method 2.

CONSTRUCTION SPECIFICATION

93. IDENTIFICATION MARKERS OR PLAQUES

1. SCOPE

The work shall consist of furnishing and installing identification markers or plaques at the designated locations.

2. MATERIALS

The markers or plaques shall be constructed of the specified materials, and shall meet all requirements for lettering, painting, finishing, and related items as shown on the drawings or as specified in Section 6 of this specification.

3. CONSTRUCTION METHODS

The markers or plaques shall be installed at locations and in the manner or condition specified.

4. MONUMENTS

Unless otherwise specified the markers or plaques shall be mounted on concrete monuments or on existing structures. The monuments shall be of the type, kind, and size and located as specified.

5. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, payment for each type, kind, and size of marker or plaque complete in place, will be made at the contract unit price for that type, kind, and size.

For items of work for which specific lump prices are established in the contract, payment for identification markers or plaques will be made at the contract lump sum price.

Such payment will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

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 of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 6 of this specification.

6. ITEMS OF WORK AND CONSTRUCTION DETAILS

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

Bid Item - Identification Marker - Establishment

(1) This item shall consist of all work and materials (except the bench mark cap) required for the establishment of permanent reference markers.

(2) The required number and approximate location of the markers are shown on the drawings or as directed by the engineer.

(3) Markers shall be cast-in-place, reinforced, concrete cylinders installed flush with the ground line and with a standard bench mark cap mounted on the top.

(4) The concrete mix shall be proportioned as follows: 1 part cement, 2 parts sand, and 3 parts gravel (maximum size 1 1/2 inches).

Sufficient water will be added to obtain a slump between 3 and 5 inches. The concrete shall be placed within 1 hour after mixing.

(5) The concrete cylinder shall have a minimum diameter of 12 inches and a minimum depth of 3.5 feet except that a lesser depth may be approved by the engineer where rock is encountered. The top 18 inches shall be formed in such a manner that a smooth surface is achieved. No surface finish will be required for the lower 2 feet of the marker.

(6) The bench mark cap will be furnished without cost to the contractor.

(7) Material certification is not required for any materials in the permanent reference markers.

(8)Payment will be made for this item of work at the lump sum price per marker.

CONSTRUCTION SPECIFICATION

220. PLASTIC PIPELINES AND CONDUIT

1. SCOPE

The work shall consist of furnishing and installing PVC pipe or conduit complete with appurtenances and fittings as specified on the drawings.

2. MATERIALS

PVC pipe, appurtenances and fittings shall conform to the requirements of Material Specification 310 and as specified in Section 9 of this specification.

3. HANDLING THE PIPE

Pipe stored outdoors for prolonged periods shall be covered. Pipe must be delivered to the job site by means which shall provide adequate support and not subject it to undue stresses. The load shall be so supported that the bottom rows of pipe are not damaged by crushing. All special requirements of the manufacturer shall be strictly observed. Pipe shall be unloaded carefully and stored as close to the final point of placement as practical.

4. JOINTS AND CONNECTIONS

Pipe joints shall conform to the details shown on the drawings and shall be in accordance with the specified instructions and recommendations of the pipe manufacturer. A copy of the instructions and recommendations shall be submitted to the engineer prior to the start of the installation.

All fittings, such as couplings, reducers, bends, tees and crossing shall be made of material that is recommended for use with the pipe and shall be installed in accordance with the recommendations of the pipe manufacturer.

Fittings made of steel or other metals subject to corrosion shall be adequately protected by wrapping with plastic tape or coating with high corrosion preventive qualities. Where plastic tape is used for corrosion protection, all surfaces to be wrapped shall be thoroughly cleaned and then coated with a primer compatible with the tape prior to wrapping.

All field cut pipe ends shall have all burrs removed prior to making the joints.

5. LAYING AND BEDDING

The pipe shall be uniformly and continuously supported. Blocking or mounding shall not be used to bring the pipe to final grade. Bell-holes shall be made in the bedding under bells or couplings and other fittings to prevent from being supported by fittings. The pipe shall be laid to the line and grade shown on the drawings. The pipe shall be placed with care and shall not be dropped or dumped on the drain fill or into the pipe trench. The pipe shall not be dragged in a manner which will cause scratching of the pipe surface. Pipe with scratches or gouges (penetration of more than 10% of wall thickness) shall be rejected.

The ends of the pipe and the couplings shall be free of foreign material when assembled. At the termination of pipe laying, the open end of the pipeline shall be closed off by a suitable cover or plug until operations are resumed.

The pipe shall be firmly and uniformly bedded throughout its entire length. The subgrade upon which the pipe is placed and the bottom of the pipe trench where drain filter material is not used shall consist of a fine grained material and shall be free from rocks, clods, or other sharp edged objects. When rock, hard pan or boulders or any other material which might damage the pipe are encountered, the trench shall be undercut a minimum of six inches below final grade and backfilled with an approved material. Extra care will be taken in the selection and placement of these materials to provide uniform bedding.

6. PRESSURE TESTING

When required, the completed pipeline shall be thoroughly and completely tested for pressure strength and leakage. When cemented or chemically welded joints are used, the assembled pipeline shall be allowed to lie in the trench for approximately 12 hours before flushing and testing to insure complete setting of the joints. The line shall be filled with water taking care to bleed all entrapped air. The pressure shall be slowly built up to not more than 30% above the maximum design working pressure. After the specified pressure has been reached, the pressure shall be maintained constant and the pipe and fittings examined for leaks. All visible leaks shall be promptly repaired. The installation will be considered acceptable when the specified test pressure has been maintained without loss for a period of two hours. The pipeline must function properly at design capacity. At or below design capacity, there shall be no objectionable surge or water hammer. Objectionable flow conditions shall include continuing unsteady delivery of water, damage to the pipeline or detrimental overflow from control valves.

7. BACKFILLING

Prior to backfilling the pipe shall be allowed to come to within a few degrees of the temperature that it will have after complete covering. The method of compaction shall be as specified in Section 9 of this specification.

The initial backfill material shall be selected soil free from rocks or stones larger than one inch in diameter and earth clods greater than approximately two inches in diameter. At the time of placement, the moisture content of the material shall be such that the required degree of compaction can be obtained with the backfill method to be used. The initial backfill material shall be so placed that the pipe will not be displaced, excessively deformed, or damaged.

When hand or mechanically backfilling, the initial fill shall be compacted firmly around and above the pipe as required to provide adequate lateral support to the pipe.

Final backfill material shall be free of large rocks, frozen clods and other debris greater than 3 inches in diameter. The material shall be placed and spread in approximately uniform layers in such a manner that there will be no unfilled spaces in the backfill and the backfill will be level with the natural ground or at the design grade required to provide the minimum depth of cover after settlement has taken place. Rolling equipment shall not be used to consolidate the final backfill until the specified minimum depth of cover has been placed.

All special backfilling requirements of the pipe manufacturer shall be met.

8. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the quantity of each type and size of pipe will be determined to the nearest foot by measurement along the centerline of the pipe. Payment for each type and size of pipe will be made at the contract unit price for that size and type of pipe.

Such payment will constitute full compensation for furnishing, transporting, and installing in place, including the necessary fittings, appurtenances, and all other items necessary and incidental to the completion of the work. 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 items of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 9 of this specification.

9. ITEMS OF WORK AND CONSTRUCTION DETAILS

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

a. Bid Item – Drainage Pipe

(1) This item shall consist of furnishing and installing the drainage pipe and slotted pipe complete with all fittings and all other items

necessary and incidental to the installation as shown on the drawings.

(2) The pipe shall be of size, thickness, length and dimension ratio as shown on the drawings.

(3) The backfill around the pipe shall be hand compacted as described in Specification 23 under Earthfill Hand Compacted.

(4) Measurement and payment shall be as described in Section 8 of this section

MATERIAL SPECIFICATION

310. PLASTIC PIPE AND CONDUIT

1. SCOPE

This specification covers the quality of polyvinyl chloride, polyethylene, and acrylonitrile-butadiene styrene plastic pipes and fittings.

2. MATERIAL

The pipe shall be homogeneous throughout and free from visible cracks, holes, foreign inclusion or other defects. The pipe shall be as uniform as commercially practicable in color, opacity, density and other physical properties.

Polyvinyl Chloride (PVC) shall meet requirements of ASTM D1784: 12454-B, 12454-C and 14333-D.

Acrylonitrile-Butadiene Styrene(ABS) shall meet most current version of ASTM D3965: Type 1, Grade 1 or 2.

Polyethylene(PE) shall meet requirements of ASTM D1248: P33 and P23.

3. PIPE

The pipe shall be furnished in accordance with one of the following as specified in Section 9 of Construction Specification 220 or as shown on the drawings.

When couplings with gaskets are specified or shown on drawings, the pipe shall have tapered ends.

A. Polyvinyl Chloride (PVC)

PVC High Pressure Pipe

(a) PVC Standard Dimension Ratio (SDR) Cast Iron Outside Diameter Pipe Shall be manufactured under the most current issue of AWWA Standard C900 or C905.

(b) PVC Standard Dimension Ratio Pipe (SDR) Iron Pipe Size (IPS) shall meet all applicable requirements of ASTM D2241.

(c) PVC Schedule 40, 80, 120 Pipe (OD) shall meet all applicable requirements of ASTM D1785.

B. Acrylonitrile-Butadiene-Styrene (ABS)

ABS High Pressure Irrigation or Stock Water Pipe

(a) ABS High Pressure Irrigation Pipe (PIP) shall meet all applicable requirements of ASTM D2282.

(b) ABS Standard Dimension Ratio Pipe (SDR, IPS) shall meet all applicable requirements of ASTM D 2282.

(c) ABS Schedule 40, 80 Pipe (OD) shall meet all applicable requirements of ASTM D1527.

C. Polyethylene (PE)

PE High Pressure Irrigation or Stock Water Pipe

(a) PE High Head Irrigation Pipe (PIP) shall meet all applicable requirements of ASTM D2239.

(b) PE Schedule 40, 80 Pipe (OD) shall meet all applicable requirements of ASTM D2447.

(c) PE Schedule 40 Pipe (ID) shall meet all applicable requirements of ASTM D2104.

4. MARKING

High pressure plastic pipe shall be adequately marked at intervals of not more than 5 feet. Markings shall include the following:

1. The nominal pipe size and the size system that applies.

2. The type of plastic pipe material in accordance with the designation code; e.g., PVC 1120.

3. The pressure rating in p.s.i. for water at 73.4 degrees F.; e.g.,200 p.s.i.

4. The Product Standard (PS) or ASTM specification designation with which the pipe complies for IPS-sized pipe or the designation PIP for pipe in this size system; e.g., PS 256 or PIP.

5. For potable water the National Sanitation Foundation (NSF) marking.

6. The manufacturer's name (or trademark) and code.

Other types of pipe shall be marked according to appropriate National Bureau of Standards (NBS) Voluntary Product Standards or ASTM specifications.

5. FITTINGS

Fittings for PVC and ABS Schedule 40, 80 (OD) pipe shall meet the following applicable specifications or the most current version of:

ASTM D2464 - PVC Fittings Threaded, Schedule 80

ASTM D2465 - ABS Fittings Threaded, Schedule 80

ASTM D2466 - PVC Fittings Socket, Schedule 40

ASTM D2467 - PVC Fittings Socket, Schedule 80

ASTM D2468 - ABS Fittings Socket, Schedule 40

ASTM D2469 - ABS Fittings Socket, Schedule 80

ASTM D2672 - PVC Belled End Sockets

Fittings including joints for other types of pipe shall be capable of withstanding pressures equal or greater than the pipe they are to be used with. Fittings shall have a flow opening at least equal to that of the pipe and shall be capable of serving their function during the full life expectancy of the pipe. These fittings shall be fittings recommended for use with the pipe by the manufacturer.

Field manufacture or fabrication of belled end joints will not be allowed.

Rubber rings used in "O" ring type joints shall conform to ASTM Specification D1869. Twin type gasket couplings shall have grooves to retain the gaskets and have a positive pipe stop that will automatically and accurately position the pipe ends within the coupling. For joints using elastomeric seals the joints shall meet the requirements of ASTM Specification D3139 or D3212.

6. SOLVENTS

Solvents for solvent welded joints on PVC pipe shall conform to ASTM Specification D2564.

7. POTABLE USE PIPELINE

Pipelines specified on the drawings for use as potable waterline shall be constructed with "National Sanitation Foundation" (NSF) approved materials.

MATERIAL SPECIFICATION

521. AGGREGATE FOR DRAINFILL AND FILTERS

1. SCOPE

This specification covers the quality of mineral aggregates for the construction of drainfill and filters.

2. QUALITY

Drainfill and filter aggregates shall be sand, gravel or crushed stone or mixtures thereof. They shall be composed of clean, hard, durable mineral particles free from organic matter, clay balls, soft particles or other substances that would interfere with their free-draining properties.

Aggregates of crushed limestone shall be thoroughly washed and screened. Course aggregate containing crushed limestone shall have not more than 3 percent by weight of particles finer than the No. 4 sieve. Crushed limestone shall not be used for fine aggregates except in combination with other materials such that not more than 5 percent of the portion finer than the No. 4 sieve shall be crushed limestone.

Aggregates shall be tested for soundness by Kansas Department of Transportation Test Method KTMR-21 "Soundness and Modified Soundness of Aggregates by Freezing and Thawing." The report shall show the percentage loss of weight and the results of the qualitative examination.

3. GRADING

Drainfill and filter aggregates shall conform to the specified grading limits after being placed in the work, and after being compacted if compaction is specified. Grading shall be determined by ASTM Method C 136. The percentage of material finer than the No. 200 sieve shall be determined by the method in ASTM Designation C 117.

4. STORING AND HANDLING

Drainfill and filter aggregates shall be stored and handled by methods that prevent segregation of particle sizes or contamination by mixing with other materials.

MATERIAL SPECIFICATION

523. ROCK FOR RIPRAP

1. SCOPE

This specification covers the quality of rock to be used in the construction of rock riprap.

2. QUALITY

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 subrounded in shape. The least dimension of an individual rock fragment shall be not less than one-third the greatest dimension of the fragment.

Except as provided below, the rock shall have the following properties:

a. Bulk specific gravity (saturated surface-dry basis) not less than 2.5.

b. Absorption not more than 4 percent.

c. Soundness: Weight loss in 25 cycles of freezing and thawing not more than 15 percent.

The bulk specific gravity and absorption shall be determined by ASTM Method C 127. The test for soundness shall be performed by Kansas Department of Transportation Test Method KTMR-21 "Soundness and Modified Soundness of Aggregates by Freezing and Thawing." The report shall show the percentage loss of weight and the results of the qualitative examination.

Rock that fails to meet the requirements stated in a, b, and c above, may be accepted only if similar rock from the same source has been demonstrated to be sound

after 5 years or more of service under conditions of weather, wetting and drying, and erosive forces similar to those anticipated for the rock to be installed under this specification.

3. GRADING

The rock shall conform to the specified grading limits after it has been placed in the barrier.

MATERIAL SPECIFICATION

529. ROCK FOR ROCK FENCE BARRIERS

1. SCOPE

This specification covers the quality of rock to be used in the construction of rock fence barriers.

2. QUALITY

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 subrounded in shape. The least dimension of an individual rock fragment shall be not less than one-third the greatest dimension of the fragment.

Except as provided below, the rock shall have the following properties:

a. Bulk specific gravity (saturated surface-dry basis) not less than 2.5.

b. Absorption not more than 4 percent.

c. Soundness: Weight loss in 25 cycles of freezing and thawing not more than 15 percent.

The bulk specific gravity and absorption shall be determined by ASTM Method C 127. The test for soundness shall be performed by Kansas Department of Transportation Test Method KTMR-21 "Soundness and Modified Soundness of Aggregates by Freezing and Thawing." The report shall show the percentage loss of weight and the results of the qualitative examination.

Rock that fails to meet the requirements stated in a, b, and c above, may be accepted only if similar rock from the same source has been demonstrated to be sound after 5 years or more of service under conditions of weather, wetting and drying, and erosive forces similar to those anticipated for the rock to be installed under this specification.

3. GRADING

The rock shall conform to the specified grading limits after it has been placed in the barrier.

MATERIAL SPECIFICATION

581. METAL

1. SCOPE

This specification covers the quality of steel and aluminum alloys.

2. STRUCTURAL STEEL

Structural steel shall conform to the requirements of ASTM Specification A 36.

High-strength low-alloy structural steel shall conform to ASTM Specification A 242 or A 588.

Carbon steel plates of structural quality to be bent or formed cold shall conform to ASTM Specification A 283, Grade C.

Carbon steel sheets of structural quality shall conform to ASTM Specification A 1011, Grade D or A 1008, Grade D.

Carbon steel strip of structural quality shall conform to ASTM Specification A 1011, Grade C.

3. COMMERCIAL OR MERCHANT QUALITY STEEL

Commercial or merchant quality steel shall conform to requirements of the applicable ASTM specifications listed below:

Product	ASTM Specification
Carbon steel bars	A 575, Grade M 1015 to Grade M 1031
Carbon steel sheets	A 1011
Carbon steel strip	A 1011
Zinc-coated carbon steel sheets	A 653

4. ALUMINUM ALLOY

Aluminum alloy products shall conform to the requirements of the applicable ASTM specifications listed below. Unless otherwise specified, alloy 6061-T6 shall be used.

Product	ASTM Specification
Standard structural shape	B 308
Extruded structural pipe and tube	B 429
Extruded bars, rods, shapes and tube	B 221
Drawn seamless tubes	B 210
Rolled or cold-finished bars, rods and wire	B 211
Sheet and plate	B 209

5. BOLTS

Steel bolts shall conform to the requirements of ASTM Specification A 307. If high-strength bolts are specified they shall conform to the requirements of ASTM Specification A 325.

When galvanized or zinc-coated bolts are specified, the zinc coating shall conform to the requirements of ASTM Specification A 153; except that bolts 1/2 inch or less in diameter may be coated with electrodeposited zinc or cadmium coating conforming to the requirements of ASTM Specification B 633, Service Condition SC 3 or ASTM Specification B 766, Type TS, unless otherwise specified.

6. RIVETS

Unless otherwise specified, steel rivets shall conform to the requirements of ASTM Specification A 502, Grade 1. Unless otherwise specified, aluminum alloy rivets shall be Alloy 606-T6 conforming to the requirements of ASTM Specification B 316.

7. WELDING ELECTRODES

Steel welding electrodes shall conform to the requirements of American Welding Society specification AWS A5.1. "Specification for Mild Steel Covered Arc-Welding Electrodes," except that they shall be uniformly and heavily coated (not washed) and shall be of such a nature that the coating will not chip or peel while being used with the maximum amperage specified by the manufacturer.

Aluminum welding electrodes shall conform to the requirements of American Welding Society specification AWS A 5.10, "Specification for Aluminum and Aluminum-Alloy Welding Rods and Bare Electrodes."

MATERIAL SPECIFICATION

582. GALVANIZING

1. SCOPE

This specification covers the quality of zinc coatings applied to iron and steel products.

2. QUALITY

Zinc coatings shall conform to the requirements of ASTM Specification A 123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products or as otherwise specified in the items of work and construction details of the Construction Specification.

ASTM A 123 covers both fabricated and unfabricated products e.g., assembled steel products, structural steel fabrications, large tubes already bent or welded before galvanizing, and wire work fabricated from uncoated steel wire. It also covers steel forgings and iron castings incorporated into pieces fabricated before galvanizing or which are too large to be centrifuged (or otherwise handled to removed excess galvanizing bath metal). Items to be centrifuged or otherwise handled to remove excess zinc shall meet the requirements of ASTM A 153, except: Bolts, screws and other fasteners 1/2 inch or less in diameter may be coated with electrodeposited zinc or cadmium coating conforming to the requirements of ASTM Specification A 165, Type TS, or ASTM Specification B 633, Service Condition SC-3 unless otherwise specified.

MATERIAL SPECIFICATION

591. FENCING MATERIALS

1. SCOPE

This specification covers the quality of materials used in the construction of farm field fences.

2. WIRE GAUGE

When the size of steel wire is designated by gauge number, the diameter shall be as defined for U.S. Steel Wire Gauge.

3. FENCING

Barbed wire, woven wire and wire netting fencing shall conform to the requirements of Federal Specification RR-F-221 for the specified types and styles of fencing. Barbed wire and woven wire shall have zinc coating of at least 0.50 ounce per square foot of wire surface unless otherwise specified.

4. STAYS, FASTENERS, AND TENSION WIRE

Stays and fasteners shall conform to the requirements of Federal Specification RR-F-221 unless otherwise specified.
Tension wires shall have a tensile strength not less than 58,000 pounds per square inch. Stays, fasteners and tension wire shall have Class 3 zinc coating as specified in ASTM Specification A 641.

5. WOOD FENCE POSTS AND BRACES

Wood posts shall be of Osage orange (Bois d'Arc). The posts shall be sound, new, free from decay, with all limbs trimmed substantially flush with the body. They shall be substantially straight throughout their length. Wood braces shall also be Osage orange.

6. STEEL FENCE POSTS AND BRACES

Steel fence posts and braces shall conform to the requirements of Federal Specification RR-F-221. Posts with punched tabs for fastening the wires shall not be used.

7. CONCRETE FENCE POSTS

Concrete fence posts shall be manufactured to the specified requirements of size, shape, and strength.

8. PANEL GATES

Panel gates shall be the specified types, sizes, and quality and shall include the necessary fittings. The fittings shall consist of not less than two hinges and two latches or galvanized chains for fastening. Latches shall be of such design that a padlock may be used for locking. All fittings shall be equivalent to the gate manufacturer's standard.

9. WIRE GATES

Wire gates shall be the type shown on the drawings, constructed in accordance with these specifications at the locations and to the dimensions shown on the drawings. The materials shall conform to the kinds, grades, and sizes specified for new fence, and shall include the necessary fittings and stays.

10. STAPLES

Staples used to fasten fence wire to wood posts shall be 9-gage galvanized wire with a minimum length of 1-1/2 inches for soft woods and a minimum length of one inch for close-grain hardwoods.

11. GALVANIZING

All iron and steel fencing materials, except as otherwise specified, shall be zinc coated by the hot dip process, except that clips, bolts, and other small hardware may be protected by electrodeposited zinc or cadmium coating.