

General Requirements

1. SCOPE

Work shall consist of furnishing all equipment and materials and performing all operations in connection with construction of the project as shown on the drawings, described in the special provisions and as staked in the field.

2. RESPONSIBILITIES

Owner/Operator--is the official spokesperson for the project and enters into all contractual agreements, obtains all permits and easements necessary for construction, insures construction is in accordance with the plans, specifications and special provisions, and is financially responsible for the project.

Technician--is the responsible Natural Resources Conservation Service (NRCS) representative who has authority to review project construction and make necessary tests to insure that all work is in compliance with the construction plans. The technician makes recommendations to the owner/operator concerning changes and acceptance of the work.

Contractor--is the individual who has an agreement with the owner/operator to construct the project.

3. SAFETY

General--Equipment and methods used in construction shall be in accordance with United States Department of Labor, Occupational Safety and Health Administration (OSHA) regulations.

Trenching--When personnel must enter trenches or other excavations, safety requirements of OSHA Safety and Health Standards, Part 1926, Safety and Health Regulations for Construction, Subpart P, Excavations, shall be followed.

Utilities--There is great hazard to life and property from the disturbance of utilities by construction equipment. It is the owner/operator's responsibility to do the following prior to construction:

1. Notify all applicable aboveground and belowground utility companies of the location and kind of work to be done and proposed date that work will start.
2. Request that utility owners assist in locating and staking underground utilities on-site.
3. Request that a utility company employee be present during construction within the utility right-of-way.
4. Notify the contractor of location of all utilities.

Known utilities are shown on the drawings. The NRCS makes no representation of the existence or non-existence of any utilities.

4. PROJECT MODIFICATIONS

Any modifications resulting in changes in the project as specified in the drawings and specifications must be approved by NRCS prior to installation.

5. ENVIRONMENTAL CONSIDERATIONS

Construction operations shall be carried out in a manner to ensure that erosion and air and water pollution are minimized and within legal limits.

6. CULTURAL RESOURCES

If cultural material is discovered, construction work shall cease within 200 feet of the discovery area. NRCS field office personnel shall be notified, at which time they will contact the NRCS Cultural Resource Specialist for further instructions. Work may not resume in the discovery area until approval is given by field office personnel. Cultural material includes bones, fire hearths, flakes/points/scrapers, human remains or foundations.

7. REFERENCES

The following abbreviations will be used to designate the organizations who publish the referenced "Standard Specifications":

ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
AWS	American Welding Society
ACI	American Concrete Institute
FEDERAL	Federal Specifications
ANSI	American National Standard Institute (American Society of Mechanical Engineers)
AASHTO	American Association of State Highway and Transportation Officials

The following abbreviations are used to designate technical or regulating agencies:

NRCS	U.S. Department of Agriculture, Natural Resources Conservation Service (Specifications) (Construction Specifications)
OSHA	U.S. Department of Labor, Occupational Safety and Health Administration
EPA	U.S. Environmental Protection Agency

Clearing, Grubbing, Structure Removal

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

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.

Each structure unit to be removed, or the area where all structures are to be removed, will be marked by means of stakes, flags, painted markers or other suitable methods.

3. REMOVAL

All trees not marked for preservation and all snags, logs, brush, stumps 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 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. 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. Posts and rails shall be neatly piled.

5. DISPOSAL OF REFUSE MATERIALS

All materials removed from the cleared and grubbed or structure removal areas shall be burned or buried at locations shown on the drawings or as specified in the special provisions.

All burning operations shall be subject to all public laws, codes, and restrictions governing such operations. The contractor shall be responsible for obtaining all required permits for burning and for any damage to life and/or property caused by fires resulting from his operations.

All noncombustible materials removed from the area shall be buried at

approved locations or removed from the site. Materials buried at the work site shall have a minimum earth cover of two (2) feet and the backfilled surface shall be smoothed and graded.

6. MEASUREMENT AND PAYMENT

(Used only if applicable)

For items of work for which specific unit prices are established, each item will be measured to the nearest unit applicable. Acreage will be measured to the nearest 0.1 acre. Payment for each item will be made at the agreed-to unit price for that item. For items of work for which specific lump sum prices are established, payment will be made at the 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 shown on the drawings or described in the special provisions but not listed on the bid schedule will be considered incidental to and included in the pay items listed on the bid schedule.

Pollution Control

1. SCOPE

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

2. MATERIALS

All materials furnished shall meet the requirements in the special provisions.

3. EROSION AND SEDIMENT CONTROL MEASURES AND WORKS

The measures and works shall include but not be limited to the following, as shown on the drawings or as specified in the special provisions.

Staging of Earthwork Activities--The excavation and moving of soil materials shall be scheduled so as to minimize the amount of unprotected area susceptible to erosion.

Seeding--Seedings to protect disturbed areas shall be done as specified on the drawings or in the special provisions.

Mulching--Mulching shall be used to provide temporary protection to soil surfaces from erosion.

Diversions--Diversions shall be used to divert water away from work areas and/or to collect runoff from work areas for treatment and safe disposition.

Stream Crossings--Culverts or bridges shall be used where equipment must cross streams.

Sediment Basins--Sediment basins shall be used to settle and filter out sediment from eroding areas to protect properties and streams below the construction site.

Straw Bale Filters--Straw bale filters shall be used to trap sediment from areas of limited runoff. Bales are temporary and shall be removed when permanent measures are installed.

Waterways--Waterways shall be used for the safe disposal of runoff from fields, diversions and other structures or measures.

4. CHEMICAL POLLUTION

The Contractor shall provide watertight tanks or barrels or construct a sump sealed with plastic sheets to be used to dispose of chemical pollutants (such as drained lubricating or transmission oils, greases, soaps, asphalt, etc.) produced as a by-product of the project's work. At the completion of the construction work, sumps shall be voided without causing pollution.

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

5. AIR POLLUTION

Local and state regulations concerning the burning of brush or slash or disposal of other materials shall be adhered to.

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

All public access or haul roads used by the contractor during construction of the project shall be sprinkled or otherwise treated to suppress dust.

6. MAINTENANCE, REMOVAL, AND RESTORATION

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

7. MEASUREMENT AND PAYMENT

(Used only if applicable)

For items of work for which specific unit prices are established, each item will be measured to the nearest unit applicable. Payment for each item will be made at the agreed-to unit price for that item. For items of work for which specific lump sum prices are established, payment will be made at the 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 shown on the drawings or described in the special provisions but not listed on the bid schedule will be considered incidental to and included in the pay items listed on the bid schedule.

Removal and Control of Water

1. SCOPE

The work shall consist of the removal of surface water and groundwater as needed to perform the required construction in accordance with the drawings, specifications and special provisions. It shall include: (1) building and maintaining all necessary temporary impounding works, channels, irrigation water bypasses, 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, around, and away from the construction site while construction is in progress. Unless otherwise specified, a diversion must discharge into the same natural drainageway in which its headworks are located.

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 works. 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.

4. DEWATERING BORROW AREAS

Unless otherwise specified in the special provisions, the Contractor shall maintain the borrow areas in drainable condition. Otherwise, the contractor shall provide for timely and effective removal of surface and groundwaters that accumulate from any source. Borrow material shall be processed as necessary to achieve proper and uniform moisture content for placement.

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. The provisions of the National Pollution Discharge Elimination System (NPDES) regulations for construction sites, enacted by EPA shall be addressed.

6. REMOVAL OF TEMPORARY WORKS

After the temporary works have served their purposes, the Contractor shall remove or level and grade them to the extent required to present a slightly appearance. Care will be taken 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, abandonment of temporary wells shall conform to all Federal and State regulations. Abandoned wells must be completely filled with concrete or grout to within the last 3 feet of the surface. The last 3 feet shall be filled in with naturally occurring soils.

7. MEASUREMENT AND PAYMENT

(Used only if applicable)

For items of work for which specific unit prices are established, each item will be measured to the nearest unit applicable. Payment for each item will be made at the agreed-to unit price for that item. For items of work for which specific lump sum prices are established, payment will be made at the lump sum price.

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

Compensation for any item of work shown on the drawings or described in the special provisions but not listed on the bid schedule will be considered incidental to and included in the pay items listed on the bid schedule.

Excavation

1. SCOPE

The work shall consist of the excavation required by the drawings, specifications and special provisions, as well as, disposal of the excavated materials.

2. CLASSIFICATION

Unless otherwise specified in the special provisions, all excavation will be common.

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-scraper with pusher tractors. Also excavated material that can be dumped into place or loaded onto hauling equipment by means of excavators having a rated capacity of one cubic yard. The excavators shall be 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 Technician, 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 or greater 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 or greater 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. STRIPPING

Stripping consists of excavating the top layer of soil which contains vegetation, roots and other undesirable organic matter. Stripping is required at all sites upon which embankments and fills are to be constructed, and at required excavations and borrow areas required for the proper installation of the work.

Stripping of Base for Embankments for Dams, Dikes, and Canals

Areas to be covered by embankments and fills shall be stripped of all vegetation, and the topsoil removed to sufficient depth to expose subsoil reasonably free of roots and other organic matter. All slopes within the limits of foundations and abutments, except pipe trenches, shall be excavated to slopes not steeper than one to one (1:1) unless otherwise indicated on the drawings. The foundation shall be cleared of all loose unconsolidated material to provide a firm base.

Stripping Borrow Areas and Required Excavations

Required excavations and areas from which borrow materials are to be obtained shall be stripped of all vegetation, and topsoil

shall be removed to sufficient depth to expose subsoil reasonably free of roots and other organic matter.

Use of Materials from Stripping Materials which are suitable for spreading over disturbed areas after construction has been completed shall be stockpiled and subsequently spread as directed by the Technician.

Materials suitable for use in construction of the required earthfill shall be used as directed by the Technician.

Unsuitable and/or excess materials shall be wasted as directed by the Technician.

The suitability of materials for specific purposes will be determined by the Technician.

5. BLASTING

The transportation, handling, storage, and use of dynamite and other explosives shall be directed and supervised by a properly licensed person. Material Safety Data Sheets (MSDS) for dynamite and other explosive materials shall be provided to the Technician prior to the blasting operation.

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 requirements in the special provisions.

6. USE OF EXCAVATED MATERIALS

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 Technician. The Contractor shall not waste or otherwise dispose of suitable excavated materials.

7. DISPOSAL OF WASTE MATERIALS

All surplus or unsuitable excavated materials will be designated as waste and shall be disposed of by the Contractor at sites of his or her own choosing away from the site of the work as approved by the owner/operator.

8. BRACING AND SHORING

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

All work shall be in accordance with safety requirements of Occupational Safety and Health Administration (OSHA) Safety and Health Standards, Part 1926, Safety and Health Regulations for Construction, Subpart P, Excavations.

9. 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, pipe, other structure or earthfill is placed within the limits of the excavation.

10. 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 borrow areas approved by the technician, as agreed-to by the owner/operator.

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

11. OVER EXCAVATION

Unless otherwise approved by the Technician, excavation in rock beyond the specified lines and grades shall be corrected by filling the resulting voids with portland cement concrete. Rock surfaces shall be thoroughly cleaned and dewatered prior to placement of the concrete. Concrete shall be made of materials and mix proportions approved by the Technician. 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.

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

12. MEASUREMENT AND PAYMENT

(Used only if applicable)

For items of work for which specific unit prices are established, each item will be measured to the nearest unit applicable. Payment for each item will be made at the agreed-to unit price for that item. For items of work for which specific lump sum prices are established, payment will be made at the lump sum price.

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

Compensation for any item of work shown on the drawings or described in the special provisions but not listed on the bid schedule will be considered incidental to and included in the pay items listed on the bid schedule.

Earthfill

1. SCOPE

The work shall consist of construction of earth embankments and other earthfill 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 Technician.

Fill materials shall contain no sod, brush, roots or other perishable materials. Unless otherwise specified, rock fragments incorporated in the fill shall be no larger than one-half of the lift thickness specified for each type of fill. Oversized material shall be removed prior to compaction.

The types of materials used in the various fills shall be as listed and described in the special provisions 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 two 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 no steeper than one horizontal to one vertical unless otherwise specified. Test pits or other cavities shall be filled with compacted earthfill conforming to the specifications for the earthfill to be placed 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.

Fill shall be placed in approximately horizontal layers. The thickness of each layer before compaction shall not exceed the maximum thickness specified, or eight inches if not specified. 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 the maximum thickness specified for layers of fill compacted by manually directed power tampers, or six inches if not specified.

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 two 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 two 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.
- 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 three feet horizontal to one foot vertical. The bonding surface of the embankment in-place shall be stripped of all material not meeting the requirements of this specification. The bonding surface 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 the contact of the in-place and new fills.

5. CONTROL OF MOISTURE CONTENT

Unless otherwise specified, the moisture content of the fill material shall be maintained within the range required to permit maximum compaction. The moisture content in plastic clays and silts should be such that when kneaded in the hand it will form a ball which does not readily separate when struck sharply with a pencil or which refuses to separate when pressed between the hands.

When working with sandy materials, the moisture content should be such that the material tends to form a ball under pressure, but seldom holds together.

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 (yields free water when kneaded in the hand) when deposited on the fill shall either be removed or be dried to the proper 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

Unless otherwise specified, earthfill shall be Class C

compaction, by one or a combination of the following methods:

1. Controlled movement of the hauling and spreading equipment over the area so that the entire surface area of each lift will be traversed by not less than one tread track of the loaded earth-moving equipment traveling in a direction parallel to the axis of the fill.

2. Each lift shall be compacted by not less than two complete passes of sheepsfoot tamping roller exerting a minimum pressure of 100 pounds per square inch.

Unless otherwise specified, 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.

The completed fill shall be constructed to the lines and grades shown on the plans or as staked by the Technician, plus the allowance indicated for settlement.

7. COMPACTION ADJACENT TO STRUCTURES

Heavy equipment including backhoe mounted power tampers, or vibrating compactors and manually directed vibrating rollers, shall not be operated within two feet of any structure. Towed or self-propelled vibrating rollers shall not be operated within five 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

TABLE 1

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

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 two feet, whichever is greater.

Compacting of fill adjacent to structures shall not be started until the concrete has attained the strength specified. The strength will be determined by compression testing of test cylinders cast by the Technician 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 into service.

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 time intervals shown in Table 1 have elapsed after placement of the concrete.

8. 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.

9. TESTING

During the course of the work, the Technician may 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 Technician will be used to verify that the fills conform to the requirements of the specifications. 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.

10. MEASUREMENT AND PAYMENT

(Used only if applicable)

For items of work for which specific unit prices are established, each item will be measured to the nearest unit applicable. Payment for each item will be made at the agreed-to unit price for that item. For items of work for which specific lump sum prices are established, payment will be made at the lump sum price.

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

Compensation for any item of work shown on the drawings or described in the special provisions but not listed on the bid schedule will be considered incidental to and included in the pay items listed on the bid schedule.

Reinforced Concrete

1. SCOPE

The work shall consist of furnishing, forming, placing, finishing and curing portland cement concrete and furnishing and placing steel reinforcement as required to build the structures as shown on the drawings.

2. MATERIALS

Steel Reinforcement Steel bars for concrete reinforcement requiring bends shall be deformed billet-steel bars conforming to ASTM A-615, Grade 40 or Grade 60.

Straight steel bars shall be deformed bars conforming to one of the following specifications:

Deformed Billet-Steel Bars for Concrete Reinforcement (Grade 40 or Grade 60)--ASTM A-615.

Rail-Steel Deformed Bars for Concrete Reinforcement (Grade 50 or Grade 60)--ASTM A-616.

Axle-Steel Deformed Bars for Concrete Reinforcement (Grade 40 or Grade 60)--ASTM A-617.

Fabricated steel bar mats shall conform to the requirements of ASTM A-184.

Welded steel wire fabric reinforcement shall conform to the requirements of ASTM A-185.

Cold-drawn steel wire reinforcement shall conform to the requirements of ASTM A-82.

Deformed steel wire for concrete reinforcement shall conform to the requirements of ASTM A-496.

Gages, spacing, and arrangement of wires in welded steel wire fabric shall be as defined in ACI Standard 315 of the American Concrete Institute for the specified style designations.

Portland Cement Portland cement shall conform to the requirements of ASTM Specification C-150 for the specified type. If a type is not specified, Type I, Type II low alkali, or Type III high early strength shall be used.

Air-Entraining Admixtures Air-entraining admixtures shall conform to the requirements of ASTM C-260.

Aggregates Concrete aggregates shall conform to the requirements of ASTM C-33. Where aggregates conforming to these specifications are not obtainable, aggregates that have been shown by tests or by actual service to produce concrete of the required strength, durability, watertightness, and wearing qualities may be used if authorized by the Engineer.

Concrete aggregates approved for use by the Montana Highway Department are acceptable.

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

Storage of Materials Steel reinforcement stored at the site of the work shall be stored above the ground surface on platforms, skids, or other supports and shall be protected from mechanical injury and corrosion.

Cement and aggregate shall be stored at the site in such a manner as to

prevent deterioration or intrusion of foreign matter. Damaged materials will be rejected and not permitted to be used in the work.

3. BENDING BAR REINFORCEMENT

Reinforcing bars may not be field milled or field bent. All bends shall be made in accordance with standard approved practice and by approved machine methods. All bends shall be made without heating. Bars with kinks, cracks, or improper bends will be rejected.

4. SPLICING BAR REINFORCEMENT

The length of splices of reinforcing bars shall be as shown on the drawings. When not shown on the drawings, the length of splices shall provide an overlap equal to at least 30 diameters of the smaller bar being spliced, but not less than 12 inches.

5. SPLICING WELDED WIRE REINFORCEMENT

Unless otherwise specified, welded wire fabric shall be spliced in the following manner:

Adjacent sections shall be spliced end to end (longitudinal lap) by overlapping a minimum of one full mesh plus two inches plus the length of the two end overhangs. The splice length is measured from the end of the longitudinal wires in one piece of fabric to the end of the longitudinal wires in the lapped piece of fabric.

Adjacent sections shall be spliced side to side (transverse lap) a minimum of one full mesh plus two inches.

The splice length shall be measured from the centerline of the first longitudinal wire in one piece of fabric to the centerline of the first longitudinal wire in the lapped piece of fabric.

6. SUPPORTING REINFORCEMENT

Reinforcement shall be accurately placed and secured in position in a manner that will prevent its displacement during the placement of concrete. Tack welding of bars will not be permitted.

Metal chairs, metal hangers, metal spacers and concrete chairs may be used to support the reinforcement. Metal hangers, spacers and ties shall be placed in such a manner that they will not be exposed in the finished concrete surface. The legs of metal chairs or side form spacers that may be exposed on any face of slabs, walls, beams or other concrete surfaces shall have a protective coating or finish by means of hot dip galvanizing, epoxy coating, plastic coating, or be stainless steel. Metal chairs and spacers not fully covered by a protective coating or finish shall have a minimum cover of 3/4 inch of concrete over the unprotected metal portion except for those with plastic coatings may have a minimum cover of 1/2 inch of concrete over the unprotected metal portion.

Precast concrete chairs shall be manufactured of the same class of concrete as that specified for the structure and shall have tie wires securely anchored in the chair or a V-shaped groove at least 3/4 inch in depth molded into the upper surface to receive the steel bar at the point of support. Precast concrete chairs shall be moist at the time concrete is placed.

TABLE 1

Class of Concrete	Maximum Net Water Content (gallons/bag)		Minimum Cement Content (bags/cu. yd.)	
	Without Air Entrainment	With Air Entrainment	Without Strength Test	With Strength Test
	3000	7	6	6
4000	6	5	6.5	6

Note: A bag of cement weighs 94 lbs

7. PLACING REINFORCEMENT

The following tolerances will be permitted in the placement of bars as shown on the drawings:

Variation in protective cover:

- 1/4 inch for 2-inch cover
- 1/2 inch for 3-inch cover

Variation of spacing:

- 1/12 of indicated spacing

Before reinforcement is placed, the surfaces of the bars and fabric and any metal supports shall be cleaned to remove any loose, flaky rust, mill scale, oil, grease or other coatings or foreign substances. After placement, the reinforcement shall be maintained in a clean condition until it is completely embedded in the concrete. On structures exceeding two cubic yards in concrete volume, the subgrade and placement of the reinforcing material shall be inspected by the Technician prior to placing the concrete.

8. DESIGN OF CONCRETE MIX

Concrete shall be classified as shown in Table 1.

Concrete shall be composed of portland cement, fine and coarse aggregates, water, and unless

otherwise specified, an air-entraining admixture mixed in such proportions so as to produce the specified minimum compressive strength at the end of 28 days.

The maximum gallons of water per bag of cement and the minimum number of bags of cement per cubic yard of concrete for the specified class of concrete shall be as tabulated in Table 1.

Concrete mixtures shall be designed to use a maximum size of coarse aggregate of 1-1/2 inches. The proportioning of cement, sand, and coarse aggregate shall produce a concrete mixture, neither too sandy nor too harsh, 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 consolidation.

Unless otherwise specified, the slump at the time of placement shall be 3 to 5 inches. Air content by volume shall be 5 to 8 percent of the volume of the concrete.

9. QUALITY OF CONCRETE

Control Prior to placement of any concrete, the Contractor shall furnish a statement to the Technician giving the proportions by dry weight of cement, aggregates, water and admixtures that he or she

intends to use. If requested by the Technician, the Contractor shall furnish evidence satisfactory to the Technician that the proportions selected will produce concrete of the quality specified. The materials and proportions so stated shall constitute the "job mix."

After a job mix has been approved, neither the source, character, grading of the aggregates nor the type or brand of cement or admixture shall be changed without prior notice to the Technician. If such changes are necessary, no concrete containing such new or altered materials shall be placed until the Technician has approved a revised job mix.

10. INSPECTION AND TESTING

The Technician shall have free entry to the plant and equipment furnishing concrete. Proper facilities shall be provided for the Technician to inspect materials, equipment, and processes and to obtain samples of the concrete. All tests and inspections will be conducted so as not to interfere unnecessarily with manufacture and delivery of the concrete.

If specified in the special provisions, standard tests of the compressive strength of the concrete will be made by the Contractor from concrete test cylinders cast by the Technician in conformance with ASTM C-31. The Contractor shall provide cylinder molds and shall have the cylinders tested by an approved laboratory (the Contractor bearing the costs of such testing).

One strength test shall consist of three standard cylinders made from a composite sample secured from a single load of concrete in accordance with ASTM C-172 and tested at 28 days. The test results at 28 days shall be the average of

the strength of three specimens determined in accordance with ASTM C-39, except that if one specimen shows manifest evidence of improper sampling, molding, or testing, it shall be discarded and the strengths of the remaining two specimens shall be averaged. Should more than one specimen representing a test show such defects, the entire test shall be discarded.

One strength test, consisting of three test cylinders, shall be made for (1) each day's run or (2) for each 25 cubic yards of concrete placed, or fraction thereof.

A record shall be made of the particular load of concrete tested, and the exact location in the work at which each load represented by a strength test is deposited.

In the event that concrete tested in accordance with the requirements stated above fails to meet the strength requirements of these specifications, the contractor shall provide an acceptable new or adjusted mix.

11. HANDLING AND MEASUREMENT OF MATERIALS

Materials shall be stockpiled and batched by methods that will prevent segregation or contamination of aggregates and insure accurate proportioning of the ingredients of the mix.

Cement shall be measured by weight or in bags of 94 pounds each. When cement is measured in bags, no fraction of a bag shall be used unless weighed.

Aggregates shall be measured by weight. Mix proportions shall be based on saturated, surface-dry weights. The batch weight of each aggregate shall be the required

saturated, surface-dry weight plus the weight of surface moisture it contains.

Water shall be measured, by volume or by weight, to an accuracy within one percent of the total quantity of water required for the batch.

Admixtures shall be measured within a limit of accuracy of three percent.

12. MIXERS AND MIXING

Concrete may be furnished by batch mixing at the site of the work or by ready-mix methods.

Mixers shall be capable of thoroughly mixing the concrete ingredients into a uniform mass and of discharging the mix without segregation.

Concrete shall be uniform and thoroughly mixed when delivered to the work site. Variations in slump of more than 1 inch within a batch will be considered evidence of inadequate mixing and shall be corrected by changing batching procedures, increasing mixing time, changing mixers, or other means.

For stationary mixers, the mixing time after all cement and aggregates are in the mixer drum shall be not less than 1-1/2 minutes. When concrete is mixed in a truck mixer, the number of revolutions of the drum or blades at mixing speed shall be not less than 70 nor more than 100.

Unless otherwise specified, volumetric batching and continuous mixing at the construction site will be permitted. The batching and mixing equipment shall conform to the requirements of ASTM Specification C-685 and shall be demonstrated prior to placement of concrete, by tests with the job mix,

to produce concrete meeting the specified proportioning and uniformity requirements. Concrete made by this method shall be produced, inspected, and certified in conformance with Sections 6, 7, 8, 13, and 14 of ASTM Specification C-685.

No mixing water in excess of the amount called for by the job mix shall be added to the concrete during mixing or hauling or after arrival at the delivery point.

When truck ready-mixed or truck-mixed concrete is used, the Contractor shall submit to the Technician, with each mixer load, a certified delivery ticket giving the quantities of cement, fine aggregate, coarse aggregate, water, and admixtures, if any, contained in the batch and the time the cement was introduced to the aggregates.

13. FORMS

Forms shall be of wood, plywood, steel, or other approved material and shall be mortar tight. The forms and associated falsework shall be substantial, unyielding and shall be constructed so that the finished concrete will conform to the specified dimensions and contours. Form surfaces shall be smooth and free from holes, dents, sags or other irregularities. Forms shall be coated with a nonstaining form release agent before being set into place.

Metal ties or anchorages within the forms shall be equipped with cones, she-bolts or other devices that permit their removal to a depth of at least one inch without injury to the concrete. Ties designed to break off below the surface of the concrete shall not be used without cones.

All edges that will be exposed to view when the structure is completed shall be chamfered, unless finished with molding tools.

14. PREPARATION OF FORMS AND SUBGRADE

Prior to placement of concrete the forms and subgrade shall be free of chips, sawdust, debris, water, ice, snow, extraneous oil, mortar, or other harmful substances or coatings. The temperature of all surfaces to be in contact with the new concrete shall be no colder than 40° F. Any oil on the reinforcing steel or other surfaces required to be bonded to the concrete shall be removed. Rock surfaces shall be cleaned by air-water cutting, wet sandblasting or wire brush scrubbing, as necessary, and shall be wetted immediately prior to placement of concrete. Earth surfaces shall be firm and damp. Placement of concrete on mud, dried earth or uncompacted fill or frozen subgrade will not be permitted.

Items to be embedded in the concrete shall be positioned accurately and anchored firmly.

Weepholes in walls or slabs shall be formed with nonferrous materials.

15. CONVEYING

Concrete shall be delivered to the site and discharged into the forms within 1-1/2 hours after the introduction of the cement to the aggregates. In hot weather or under conditions contributing to quick stiffening of the concrete, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes.

The Technician may allow a longer time, provided the setting time of the concrete is increased a

corresponding amount by the addition of an approved set-retarding admixture. In any case, concrete shall be conveyed from the mixer to the forms as rapidly as practicable by methods that will prevent segregation of the aggregates or loss of mortar.

16. PLACING

Concrete shall not be placed until the subgrade, forms and steel reinforcement have been inspected and approved by the Technician. The Contractor shall give reasonable notice to the Technician each time he or she intends to place concrete.

The concrete shall be deposited as closely as possible to its final position in the forms and shall be worked into the corners and angles of the forms and around all reinforcement and embedded items in a manner to prevent segregation of aggregates or excessive laitance. Formed concrete shall be placed in horizontal layers not more than 20 inches thick. Concrete shall not be dropped more than five feet vertically unless suitable equipment is used to prevent segregation. Hoppers and chutes, pipes or "elephant trunks" shall be used as necessary to prevent segregation and the splashing of mortar on the forms and reinforcing steel above the layer being placed.

Immediately after the concrete is placed in the forms, it shall be consolidated by spading, hand tamping or vibration as necessary to insure smooth surfaces and dense concrete. Each layer shall be consolidated to insure a monolithic bond with the preceding layer. If the surface of a layer of concrete in place sets to the degree that it will not flow and merge with the succeeding layer when spaded or vibrated, the Contractor shall discontinue placing concrete and

shall make a construction joint according to the procedure specified herein.

If placing is discontinued when an incomplete horizontal layer is in place, the unfinished end of the layer shall be formed by a vertical bulkhead.

17. CONSTRUCTION JOINTS

Construction joints shall be made at the locations shown on the drawings. If construction joints are needed which are not shown on the drawings, they shall be placed in locations approved by the Technician.

Where a feather edge would be produced at a construction joint, as in the top surface of a sloping wall, an insert form shall be used so that the resulting edge thickness on either side of the joint is not less than 6 inches.

In walls and columns, as each lift is completed, the top surfaces shall be immediately and carefully protected from any condition that might adversely affect the hardening of the concrete.

Steel tying and form construction adjacent to concrete in-place shall not be started until the concrete has cured at least 12 hours. Before new concrete is deposited on or against concrete that has hardened, the forms shall be retightened. New concrete shall not be placed until the hardened concrete has cured at least 12 hours.

Surfaces of construction joints shall be cleaned of all unsatisfactory concrete, laitance, coatings or debris by washing and scrubbing with a wire brush or wire broom or by other means approved by the Technician. The surfaces shall be kept moist for at least one hour

prior to placement of the new concrete.

18. EXPANSION AND CONTRACTION

Expansion and contraction joints shall be made only at locations shown on the drawings.

Exposed concrete edges at expansion and contraction joints shall be carefully tooled or chamfered, and the joints shall be free of mortar and concrete. Joint filler shall be left exposed for its full length with clean and true edges.

Preformed expansion joint filler shall be held firmly in the correct position as the concrete is placed.

When open joints are specified, they shall be constructed by the insertion and subsequent removal of a wooden strip, metal plate or other suitable template in such a manner that the corners of the concrete will not be chipped or broken. The edges of open joints shall be finished with an edging tool prior to removal of the joint strips.

19. WATERSTOPS

Waterstops shall be held firmly in the correct position as the concrete is placed. Joints in metal waterstops shall be soldered, brazed or welded. Joints in rubber or plastic waterstops shall be cemented, welded or vulcanized as recommended by the manufacturer.

20. REMOVAL OF FORMS

Forms shall be removed in such a way as to prevent damage to the concrete. Supports shall be removed in a manner that will permit the concrete to take the stresses due to its own weight uniformly and gradually.

Forms shall not be removed sooner than the following minimum times after the concrete is placed. These periods represent cumulative number of days and fractions of days, not necessarily consecutive, during which the temperature of the air adjacent to the concrete is above 50°F.

<u>Element</u>	<u>Time</u>
Beams, arches--supporting forms and shoring	14 days
Conduits, deck slabs --supporting (inside) forms and shoring	7 days
Conduits, (outside forms), sides of beams, small structures	24 hours
Columns, walls, spillway risers--with side or vertical load	7 days
Columns, walls, spillway risers --with no side or vertical load:	
Concrete supporting more than 30 feet of wall in place above it	7 days
Concrete supporting 20 to 30 feet of wall in place above it ¹	3 days
Concrete supporting not more than 20 feet of wall in place above it ¹	24 hours

¹Age of stripped concrete shall be at least seven days before any load is applied other than the weight of the column or wall itself and the forms and scaffolds for succeeding lifts.

22. FINISHING FORMED SURFACES

All concrete surfaces shall be true and even and shall be free from open

or rough spaces, depressions or projections.

Immediately after the removal of the forms:

- a. All fins and irregular projections shall be removed from exposed surfaces.
- b. The holes produced on all surfaces by the removal of form ties, cone-bolts, and she-bolts shall be cleaned, wetted and filled with a dry-pack mortar consisting of one part portland cement, three parts sand that will pass a No. 16 sieve, and just sufficient water to produce a consistency such that the filling is at the point of becoming rubbery when the material is solidly packed.

22. FINISHING UNFORMED SURFACES

All exposed surfaces of the concrete shall be accurately screeded to grade and then wood or magnesium float finished, unless specified otherwise.

Excessive floating or troweling of surfaces while the concrete is soft will not be permitted.

The addition of dry cement or water to the surface of the screeded concrete to expedite finishing will not be allowed.

Joints and edges on unformed surfaces that will be exposed to view shall be chamfered or finished with molding tools.

23. 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 as specified below.

Moisture shall be maintained by sprinkling, flooding or fog spraying or by covering with continuously moistened canvas, cloth mats, straw, sand or other approved material. Wood forms left in place during the curing period shall be kept continuously wet. Formed surfaces shall be thoroughly wetted immediately after forms are removed and shall be kept wet until patching and repairs are completed. Water or covering shall be applied in such a way that the concrete surface is not eroded or otherwise damaged.

Concrete, except at construction joints, may be coated with an approved curing compound in lieu of continued application of moisture except as otherwise specified in the special provisions. The compound shall be sprayed on the moist concrete surfaces as soon as free water has disappeared, but shall not be applied to any surface until patching, repairs and finishing of that surface are completed. The compound shall be applied at a uniform rate of not less than one gallon per 150 square feet of surface and shall form a continuous adherent membrane over the entire surface. Curing compound shall be thoroughly mixed before applying and continuously agitated during application. Curing compound shall not be applied to surfaces requiring a bond to subsequently placed concrete, such as construction joints, shear plates, reinforcing steel and other embedded items. If the membrane is damaged during the curing period, the damaged area shall be resprayed at the rate of application specified above. Surfaces covered by the membrane shall not be trafficked unless protected from wear.

24. REMOVAL AND REPLACEMENT OR REPAIR

When concrete is honeycombed, damaged or otherwise defective, the Contractor shall remove and replace the structure or structural member containing the defective concrete or, where feasible, correct or repair the defective parts. The Technician will determine the required extent of removal, replacement or repair.

25. CONCRETING IN COLD WEATHER

Concrete shall not be mixed nor placed when the daily minimum atmospheric temperature is less than 40°F unless facilities are provided to prevent the concrete from freezing. The temperature of the concrete at the time of placing shall not be less than 50°F. nor more than 90°F. Concrete shall not be deposited on frozen ground nor in forms containing ice or frost. The use of accelerators or antifreeze compounds will not be allowed.

The air and forms in contact with the concrete shall be maintained at temperatures greater than 50°F but less than 90°F. for at least five days and at a temperature above freezing for the remainder of the specified curing period. Concrete permitted to be cured with curing compounds shall be provided the same protection against freezing and low temperatures as provided herein. No fire or excessive heat shall be permitted near or in direct contact with concrete at any time.

26. CONCRETING IN HOT WEATHER

The Contractor shall apply effective means to maintain the temperature of the concrete below 90°F during mixing, conveying and placing.

Formed surfaces shall be kept completely and continuously wet for the duration of curing period (prior to, during and after form removal) or until curing compound is applied.

Concrete surfaces, especially flat work placed with large areas of surface, shall be covered as soon as the concrete has sufficiently hardened and shall be kept continuously wet for at least 24 hours of the curing period. This protective method may be continued for the required curing period or until curing compound is applied.

Moist curing may be discontinued before the end of the curing period if white pigmented curing compound is applied immediately, in accordance with the procedures specified in Section 23.

27. MEASUREMENT AND PAYMENT

(Used only if applicable)

For items of work for which specific unit prices are established, reinforced 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. Measurement of concrete placed against the sides of an excavation without the use of intervening forms will be made only to the neat lines or pay limits shown on the drawings. No deduction in volume will be made for chamfers, rounded or beveled edges or for any void or embedded item that is less than 3 cubic feet in volume.

Payment for each item of concrete will be made at the agreed-to unit price or the agreed-to lump sum, whichever is applicable, for that item. Such payment will constitute full compensation for all labor, materials, including steel, equipment, transportation, tools, forms, falsework, bracing and all

other items necessary and incidental to the completion of the work.

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

Rock for rock riprap shall be obtained from the designated sources or, if the source is not specified, shall conform to the following specifications:

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.

Unless otherwise specified and 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 2 percent.
- c. Soundness: Weight loss in 5 cycles not more than 10 percent when sodium sulfate is used or 15 percent when magnesium sulfate is used.

The bulk specific gravity and absorption shall be determined by ASTM Method C 127. The test

for soundness shall be performed by ASTM Method C 88 for coarse aggregate modified as follows:

The test sample shall not be separated into fractions. It shall consist of 5000 + 300 grams of rock fragments, reasonably uniform in size and shape and weighing approximately 100 grams each, obtained by breaking the rock and selecting fragments of the required size.

After the sample has been dried, following completion of the final test cycle and washing to remove the sodium sulfate or magnesium sulfate, the loss of weight shall be determined by subtracting from the original weight of the sample the final weight of all fragments which have not broken into three or more pieces.

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 five 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.

Filter and bedding materials

When required, filter and bedding materials shall, unless otherwise specified, conform to Montana Construction Specification MT-117, Drainfill and Filters.

3. GRADING

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

The rock 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 or she intends to obtain the rock. The Contractor will also provide satisfactory documentation to the Technician that the material meets the requirements of the specifications. The Contractor shall provide the Technician 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 the special provisions.

Rock from designated sources shall be excavated, selected and processed as necessary to meet the quality and grading requirements in the special provisions. The rock shall conform to the specified grading limits when installed in the riprap.

4. 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 Technician.

5. EQUIPMENT-PLACED ROCK RIPRAP

The rock shall be placed by equipment on the surfaces and to the depths specified. 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 and spalls filling the voids between the larger rocks.

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.

6. 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.

7. FILTER LAYERS OR BEDDING

When filter layers or bedding beneath riprap is specified, 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.

When a geotextile filter is specified, the material used shall be nonwoven and meet the requirements as outlined in Table 1. Geotextile shall be joined by overlapping a minimum distance of 18 inches. Anchoring of the fabric is not required but care shall taken to minimize displacement.

Rock riprap shall not be dropped from a height greater than three feet on protected or unprotected geotextile. Sufficient handwork shall be done to produce a dense section with a neat and uniform surface.

8. MEASUREMENT AND PAYMENT

(Used only if applicable)

Items of work for which specific unit prices are established, will be

measured to the nearest unit applicable. Payment for each item will be made at the agreed-to unit price for that item. Items of work for which specific lump sum prices are established, payment will be made at the lump sum price.

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

Compensation for any item of work shown on the drawings or described in the special provisions but not listed on the bid schedule will be considered incidental to and included in the pay items listed on the bid schedule.

TABLE 1. REQUIREMENTS FOR NONWOVEN GEOTEXTILES

Property	Test Method	Class I ³	Class II ⁴
Tensile Strength (pounds) ¹	ASTM D 4632 Grab Test	180 min.	120 min.
Bursting Strength (psi) ¹	ASTM D 3786 Diaphragm Tester	320 min.	210 min.
Elongation at Failure (%) ¹	ASTM D 4632	≥50	≥50
Puncture (lbs.) ¹	ASTM D 4833	80 min.	60 min.
Ultraviolet Light (percent residual tensile strength)	ASTM D 4355 150 hours exposure	70 min.	70 min.
Apparent Opening Size - AOS	ASTM D 4751	As specified, max. # 40 ²	As specified, max. # 40 ²
Permittivity (1/seconds)	ASTM D 4491	0.70 min.	0.70 min.

1 Minimum average roll value (weakest principal direction)

2 U.S. standard sieve size

3 Unprotected

4 Protected (6 inches of sand or soil cover required)

Concrete Pipe

1. SCOPE

The work shall consist of furnishing and installing concrete pipe or concrete drain tile and the necessary fittings as shown on the drawings.

2. MATERIALS

Concrete Pipe

Concrete pipe shall meet the requirements of the following specifications:

Nonreinforced:

ASTM C 14 Concrete Sewer, Storm Drain, and Culvert Pipe

ASTM C 118 Concrete Pipe for Irrigation or Drainage

ASTM C 412 Concrete Drain Tile

ASTM C 505 Nonreinforced Irrigation Pipe With Rubber Gasket Joints

Reinforced:

ASTM C 76 Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

ASTM C 361 Reinforced Concrete Low-Head Pressure Pipe

ASTM C 506 Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe

ASTM C 507 Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe

ASTM C 655 Reinforced Concrete D-Load Culvert, Storm Drain and Sewer Pipe

ASTM C 789 Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers

Perforated Pipe:

ASTM C 444 Perforated Concrete Pipe

Special Sections:

ASTM C 478 Precast Reinforced Concrete Manhole Sections

ASTM C 913 Precast Concrete Water and Wastewater Structures

Rubber Gasket Joints

When rubber gasket joints are specified, the joints and gaskets shall conform to the requirements of ASTM C 443.

Sealing Compound

Sealing compound for filling joints in concrete pipe shall meet the requirements of the following specifications:

ASTM D 1190 Concrete Joint Sealer, Hot-Poured Elastic Type

ASTM D 1850 Concrete Joint Sealer, Cold-Application Type

Federal Specification SS-S-210A; Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints

Federal Specification TT-S-227E; Sealing Compound: Elastomeric Type Multi-Component (for Caulking, Sealing, and Glazing in Buildings and Other Structures), Type II.

Joint Packing

Packing shall be commercial grade oakum.

Preformed Expansion Joint Filler

Preformed expansion joint filler shall meet the requirements of the following specifications:

ASTM D 1751 Preformed Expansion Joint Filler for Concrete Paving and Structural Construction

ASTM D 1752 Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

3. LAYING AND BEDDING

Pipe and tile shall be laid to the line and grade shown on the drawings. Pipe shall be laid with the bell or groove at the upstream end of each section.

Concrete Cradles or Bedding

Pipe to be cradled or bedded on concrete shall be set to the specified line and grade and temporarily supported on precast concrete blocks or wedges until the cradle or bedding concrete is placed. Concrete blocks or wedges used to temporarily support the pipe during placement of bedding or cradle shall be of a class of concrete equal to or better than that used in the bedding or cradle.

Earth, Sand, or Gravel Bedding

The pipe shall be firmly and uniformly bedded throughout its entire length to the depth and in the manner specified on the drawings. The pipe shall be loaded sufficiently during backfilling around the sides to prevent it from being lifted from the bedding.

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

Elliptical pipe and pipe with elliptical or quadrant reinforcement shall be laid so that the vertical axis, as indicated by markings on the pipe, is in a vertical position.

4. JOINTS

Pipe joints shall conform to the details shown on the drawings and to the requirements of the Special Provisions applicable to the type of joint specified. Except where unsealed joints are indicated, pipe joints shall be sound and watertight at the pressure specified.

5. JOINING BELL AND SPIGOT PIPERubber Gasket Joint, Pressure Pipe

Just before the joint is connected, the connecting surfaces of the spigot and the bell or coupling band, sleeve or collar shall be thoroughly cleaned and dried, and the rubber gasket and the inside surface of bell or coupling band, sleeve or collar shall be lubricated with a light film of soft vegetable soap compound (flax soap). The rubber gasket shall be stretched uniformly as it is placed in the spigot groove to insure a uniform volume of rubber around the circumference of the pipe.

The joint shall be connected by means of a pulling or jacking force so applied to the pipe that the spigot enters squarely into the bell.

When the spigot has been seated to within 1/2 inch of its final position, the position of the gasket

in the joint shall be checked around the entire circumference of the pipe by means of metal feeler gauge. In any case where the gasket is found to be displaced, the joint shall be disengaged and properly reconnected. After the position of the gasket has been checked, the spigot shall be completely pulled into the bell and the section of the pipe shall be adjusted to line and grade.

Rubber Gasket Joints, Sewer and Culvert Pipe or Irrigation Pipe

The pipe shall be joined in accordance with the gasket manufacturer's recommendations except as otherwise specified.

Mastic Sealed Joints:

At the time of assembly the inside surfaces of the bell and the outside surfaces of the spigot shall be clean, dry and primed as recommended by the manufacturer of the sealing compound. A closely twisted gasket of joint packing of the diameter required to support the spigot at the proper grade and to make the joint concentric shall be made in one piece of sufficient length to pass around the pipe and lap at the top. The gasket shall be laid in the bell throughout the lower third of the circumference. The end of the spigot shall be laid in the bell throughout the lower third of the circumference. The end of the spigot shall be laid on the gasket and the spigot shall be fully inserted into the bell so that the pipe sections are closely fitted and aligned. The gasket then shall be lapped at the top of the pipe and thoroughly packed into the annular space between the bell and the spigot.

(a) Hot-Pour Joint Sealer

The sealing compound shall be heated to within the temperature range recommended by the manufacturer and shall not be overheated or subjected to prolonged heating. After the joint is assembled, with the pipe in its final location, a suitable joint runner shall be placed around the joint with an opening left at the top. Molten sealing compound shall be poured into the joint as rapidly as possible without entrapping air until the annular space between bell and spigot is completely filled. After the compound has set, the runner may be removed. Alternate joints may be poured before the pipe is lowered into the trench. In this case, the joint shall be poured with the pipe in a vertical position without the use of the runner. The compound shall have thoroughly set before the pipe is placed in the trench, and the pipe be handled so as to cause no deformation of the joint during placement.

(b) Cold-Applied Sealing Compound

The annular space between bell and spigot shall be completely filled with the sealing compound. The compound shall be mixed on the job in accordance with the manufacturer's recommendations and in relatively small quantities so that setting will not be appreciable before application.

(c) Preformed Sealing Compound

Joint packing will not be required, except as recommended by the manufacturer of the sealing compound. Preformed strips or bands of the sealing compound shall be applied to the bell and spigot prior to assembly of the joint in accordance with the manufacturer's recommendations. Any compound extruded from the interior side of the joint during assembly shall be

trimmed even with the interior surface of the pipe.

Cement Mortar Sealed Joints:

Cement mortar for joints shall consist of one part by weight of portland cement and two parts by weight of fine sand with enough water added to produce a workable consistency. At the time of assembly the inside surface of the bell and the outside surface of the spigot shall be clean and moist.

(a) With Packing

A closely twisted gasket of joint packing of the diameter required to support the spigot at the proper grade and to make the joint concentric shall be made in one piece of sufficient length to pass around the pipe and lap at the top. The gasket shall be saturated with neat cement grout, laid in the bell throughout the lower third of the circumference and covered with mortar. The end of the spigot shall be fully inserted into the bell so that the pipe sections are closely fitted and aligned. A small amount of mortar shall be placed in the annular space throughout the upper two-thirds of the circumference. The gasket then shall be lapped at the top of the pipe and thoroughly packed into the annular space between the bell and the spigot. The remainder of the annular space then shall be filled completely with mortar and beveled off at an angle of approximately 45 degrees with the outside of the bell. If the mortar is not sufficiently stiff to prevent appreciable slump before setting, the outside of the joint thus made shall be wrapped with cheesecloth. After the mortar has set slightly, the joint shall be wiped inside the pipe. In pipe too small for a person to work inside, wiping may be done by dragging an approved swab

through the pipe as the work progresses.

(b) Without Packing

The lower portion of the bell shall be filled with stiff mortar of sufficient thickness to make the inner surface of the abutting sections flush. The spigot-end of the pipe to be joined shall be fully inserted into the bell so that the sections are closely fitted and aligned. The remaining annular space between the bell and spigot shall then be filled with mortar and the mortar neatly beveled off at an angle of approximately 45 degrees with the outside of the bell. After the mortar has set slightly, the joint shall be wiped inside the pipe. In pipe too small for a person to work inside, wiping may be done by dragging an approved swab through the pipe as the work progresses.

Unsealed Joints

When unsealed joints are specified, they shall conform to the details shown on the drawings.

6. JOINING TONGUE AND GROOVE PIPE

Cement Mortar Sealed Joint

Mortar shall be as specified for bell and spigot joints. The tongue end of the section being placed shall be covered with mortar and firmly pressed into the groove of the laid section in such a manner that the tongue fits snugly and truly in the groove and that mortar is squeezed out both on the interior and exterior of the joint. Care shall be taken that no mortar falls from the groove end during the abutting operation. Immediately after the pipe sections have been abutted, exposed external surface mortar shall be pressed into the

joint and any excess mortar removed, after which the interior surface of the joint shall be carefully pointed and brushed smooth, and all surplus mortar removed.

Mastic Sealed Joints

Strips or bands of preformed sealing compound shall be applied to the tongue and groove prior to assembly of the joint in accordance with the manufacturer's recommendations. Any compound extruded from the interior side of the joint during assembly shall be trimmed even with the interior surface of the pipe.

Rubber Gasket Joints

The pipe shall be joined in accordance with the gasket manufacturer's recommendations except as otherwise specified.

Unsealed Joints

When unsealed joints are specified, they shall conform to the details shown on the drawings.

7. BANDING

When external mortar bands are specified, they shall conform to the details shown on the drawings.

8. CURING MORTAR JOINTS AND BANDS

The external surfaces of mortar joints shall be covered with moist earth, sand, canvas, burlap or other approved materials and shall be kept moist for 10 days or until the pipe is backfilled.

Water shall not be turned into the conduit within 24 hours after the joints are finished. Hydrostatic pressure shall not be applied to the conduit prior to 14 days after the joints are finished.

9. PRESSURE TESTING

If required by the Special Provisions the pipeline shall be pressure tested as follows:

Prior to the placement of concrete or earthfill around the conduit, the conduit shall be tested at the specified test pressure for a period of at least two hours. Any leaks shall be repaired and the conduit shall be retested. The procedure shall be repeated until the conduit is watertight.

The pipe joints shall show no leakage. Damp spots developing on the surface of the pipe will not be considered as leaks.

10. MEASUREMENT AND PAYMENT

(Used only if applicable)

For items of work for which specific unit prices are established, each item will be measured to the nearest unit applicable. Payment for each item will be made at the agreed-to unit price for that item. For items of work for which specific lump sum prices are established, payment will be made at the lump sum price.

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

Compensation for any item of work shown on the drawings or described in the special provisions but not listed on the bid schedule will be considered incidental to and included in the pay items listed on the bid schedule.

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

Steel shall be of 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.

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-570, Grade 40 or A-611, Grade D.

Carbon steel strip of structural quality shall conform to ASTM Specification A-570, Grade 40.

Commercial or Merchant Quality Steel

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

ASTM A-526 Zinc-Coated Carbon Steel Sheets:
 ASTM A-569 Carbon Steel Sheets
 ASTM A-569 Carbon Steel Strip
 ASTM A-575 Carbon Steel Bars Grade M 1015 to Grade M 1031

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.

ASTM B-209 Sheet and Plate
 ASTM B-210 Drawn Seamless Tubes
 ASTM B-211 Rolled or Cold-Finished Bars, Rods and Wire
 ASTM B-221 Extruded Bars, Rods, Shapes and Tube
 ASTM B-308 Standard Structural Shape
 ASTM B-429 Extruded Structural Pipe and Tube

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 A-165, Type TS, unless otherwise specified.

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.

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 A5.10, "Specification for Aluminum and Aluminum-Alloy Welding Rods and Bare Electrodes."

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 7, The Aluminum Association, November 1976.

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 loads, 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.

Unless otherwise specified in the Special Provisions, items designated

to be painted shall be painted with one of the following systems:

PAINT SYSTEM E

All surfaces that will not be submersed or subject to saturated soil conditions shall meet the following system requirements.

Surface Preparation. Surfaces to be painted shall be thoroughly cleaned prior to the application of paint. Surface preparation required by this specification is as designated by SSPC-SP7 (Steel Structures Painting Council). The procedure is summarized as follows:

Brush-Off Blast Cleaning.

Surfaces to be coated shall be prepared by removing all visible oil, dirt, dust, loose mill scale, loose rust and loose paint by sand or grit air blasting. Tightly adherent mill scale, rust and paint may remain on the surface. Mill scale, rust and paint are considered highly adherent if they cannot be removed by lifting with a dull putty knife. Oils, grease or other soluble contaminants shall first be removed by solvent cleaning.

Primer Coat. One coat of primer consisting of a single package moisture cured urethane primer shall be applied. Urethane primer shall have a minimum of 50 percent solids by volume. Primer shall be able to be applied at 2.0 to 3.0 mils DFT in one coat. Color shall be metallic aluminum.

Final Coat. A minimum of one coat of Acrylic Polyurethane (semi-gloss or gloss) shall be applied. The color shall be as specified on the drawings or Special Provisions. Acrylic Polyurethane shall be lead free.

Acrylic Polyurethane shall have a minimum of 58 percent solids by volume for semi-gloss or 74 percent solids for gloss.

Acrylic Polyurethane shall be able to be applied at 3.0 to 5.0 mils DFT in one coat.

PAINT SYSTEM F

All surfaces that will be immersed or subjected to saturated soil conditions shall meet the following system requirements.

Surface Preparation. Surfaces to be painted shall be thoroughly cleaned using the Near White Blast(SSPC-SP10) method as designated by the SSPC (Steel Structures Painting Council) and as summarized below.

All surfaces to be coated shall be prepared by removing all grease and oil using steam cleaning or solvent methods. After degreasing is completed, sand or grit blasting shall be performed to remove all dirt, rust, mill scale or other foreign material or residue. The cleaned, finished surface shall be at least 95 percent free of all visible foreign material or residue.

Paint. Paint type will be Coal Tar Epoxy. Coal tar epoxy shall have a minimum of 75 percent solids by volume and conform to the requirements of SSPC Paint Specification No. 16, Type I. Coal tar epoxy shall be able to be applied at 8.0 mils dry film thickness in one coat.

Paint Application. This system requires the application of two coats at a dry film thickness of 8.0 mils per coat. Total system shall provide a minimum dry film thickness of 16.0 mils.

6. MEASUREMENT AND PAYMENT

(Used only if applicable)

For items of work for which specific unit prices are established, each item will be measured to the nearest unit applicable. Payment for each item will be made at the agreed-to unit price for that item. For items of work for which specific lump sum prices are established, payment will be made at the lump sum price.

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

Compensation for any item of work shown on the drawings or described in the special provisions but not listed on the bid schedule will be considered incidental to and included in the pay items listed on the bid schedule.

Drainfill and Filters

1. SCOPE

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

2. MATERIALS

Quality. Drainfill materials shall be sand, gravel, 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.

Aggregates of crushed limestone shall be thoroughly washed and screened. Coarse 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.

If a source is not specified in the special provisions, drainfill materials shall conform to the following requirements. At least 30 days prior to delivery of the materials to the site the Contractor shall inform the Technician in writing of the source from which they intend to obtain them. The Contractor shall provide the Technician free access to the source for the purpose of obtaining samples for testing.

Aggregates shall be tested for soundness according to ASTM Method

C-88, and shall have a weighted average loss in five cycles of not more than 12 percent when sodium sulfate is used or 18 percent when magnesium sulfate is used.

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.

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.

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 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 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.

Placement of drainfill adjacent to structures shall not be started until the required time intervals shown in Table 1 have elapsed after placement of the concrete.

5. CONTROL OF MOISTURE

When the addition of water is required, it shall be applied in such a way as to avoid excessive wetting to adjacent earthfill. Except as specified in the Special Provisions, control of moisture content will not be required.

6. COMPACTION

Unless specific compaction requirements are specified by the Special Provisions, no compaction will be required beyond that resulting from the placing and spreading operations.

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. MEASUREMENT AND PAYMENT

(Used only if applicable)

For items of work for which specific unit prices are established, each item will be measured to the nearest unit applicable. Payment for each item will be made at the agreed-to unit price for that item. For items of work for which specific lump sum prices are established, payment will be made at the lump sum price.

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

Compensation for any item of work shown on the drawings or described in the Special Provisions but not listed on the bid schedule will be considered incidental to and included in the pay items listed on the bid schedule.

TABLE 1

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

CONSTRUCTION SPECIFICATION

MT-7 VEGETATING STRUCTURES

1. SCOPE

The work shall consist of site preparation and furnishing and applying the specified materials to establish permanent vegetation at the designated locations.

All areas where vegetation has been disturbed during construction (e.g., waste, borrow, and equipment parking areas) and all other earth construction (e.g., cut slopes, earth embankments) shall be seeded following completion of construction. (Site conditions may exist where it is impossible to establish vegetative cover, e.g., rock cuts, bentonite or raw shale. If the establishment of vegetation is impractical, the responsible technician must indicate the reasons on the construction plans.)

2. MATERIALS

Specific materials for permanent vegetation at each site shall be as shown on the drawings or as specified in an attachment to this specification. Unless otherwise specified, all specified materials shall meet the following requirements.

2.1 Seed

All seed shall be labeled in accordance with state laws and the U.S. Department of Agriculture rules and regulations under the Federal Seed Act in effect on the date of invitations for bids. Bag tag figures will be evidence of purity and germination. No seed will be accepted with a date of test more than nine 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. The percent of noxious and other weed seed allowable shall be 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 Technician.

2.2 Inoculant

The inoculant for treating legume seeds shall be a pure culture of nitrogen-fixing bacteria prepared specifically for the species and shall not be used later than the date indicated on the container or as otherwise specified. A mixing medium as recommended by the manufacturer shall be used to bond the inoculant to the seed. Inoculation of legumes shall be done within 48 hours before seeding.

2.3 Fertilizers

Fertilizers shall be free flowing, suitable for application with hydraulic or pneumatic-type equipment or fertilizer spreaders, delivered to the site in bags or other convenient containers fully labeled, conforming to applicable state fertilizer laws and bearing the name, trade names, or trademarks, composition, and warranty of the producer. Caked or lumpy fertilizer will not be accepted.

All fertilizers shall be in a form readily available to plants.

2.4 Mulch

Straw or hay mulch shall be of the type specified (e.g., native grass hay, tame grass hay, other hay, or small grain straw). Weed seed content shall be at a level acceptable to the Technician with no noxious weed seeds present. Mulching machines shall be such that mulch can be applied in a uniform manner. Mulch shall not be musty, moldy, caked, decayed, or of otherwise low quality.

Wood cellulose fiber mulch shall consist of a specially prepared fiber processed to contain no growth- or germination-inhibiting factors. The fiber mulch shall be manufactured and processed in such manner that the wood cellulose fibers will remain in uniform suspension in water under agitation and will blend with grass seed, fertilizer, and other additives to form a homogeneous slurry. The processed mulch material shall have characteristics to form a blotter-like ground cover on application, having moisture absorption and percolation properties and the ability to cover and hold grass seed in contact with soil. The wood cellulose fiber mulch material shall be furnished in packages of uniform weight (plus or minus 5 percent) and bearing the name of the manufacturer and air-dry weight content. Upon request of the Technician, suppliers shall furnish certification that laboratory and field testing of their product has been accomplished and that it meets the foregoing requirements and intent.

2.5 Stabilizing Materials

Asphalt emulsion shall be gasoline (naphtha), cutback asphalt MC-2 or MC-3, or Emulsified Asphalt SS-1, SS-2, or MS-2, meeting the requirements of the Asphalt Institute.

Jute matting shall be of uniform open plain weave of undyed and unbleached single jute yarn. The yarn shall be of loosely twisted construction and shall not vary in thickness by more than one-half its normal diameter. Jute matting shall have a minimum width of 48 inches and shall contain 78 warp ends and 41 weft ends per yard. In any one shipment, the weight of matting shall average 1.22 pounds per linear yard or 48-inch-wide matting and with proportional weight for wider matting with a tolerance of plus or minus 5 percent.

2.6 Topsoil

Topsoil or soils materials capable of supporting plant growth shall be borrowed from designated areas and only to the depth shown on the drawings or designated by the Technician. The area from which this material is removed will be seeded to permanent vegetation as shown on the drawings or as designated by the Technician.

3. NOTICE OF PROCEDURE

The Contractor shall give the Technician at least 2 days' notice of the time and place of starting his operations and shall continue to advise as to his schedule of operations.

4. TOPSOILING

Where specified, topsoil or soils materials shall be applied uniformly on the designated areas to the depth required.

5. SEEDBED PREPARATION

The entire area to be seeded shall be reasonably smooth and free of debris which would interfere with seeding operations. All rills, depressions, and ridges shall be smoothed prior to seedbed preparation. The seedbed will be loosened to the specified depth (1 to 2 inches if not specified) with a disc, spiketooth harrow, or similar tillage equipment, unless the Technician determines it is already sufficiently loosened.

Seedbed preparation shall be suspended when soil moisture conditions are not suitable for the preparation of a satisfactory seedbed as determined by the Technician.

6. SEED APPLICATION

The time and method(s) of seed application shall be as shown on the drawings or as specified in an attachment to this specification. The seed shall be applied uniformly on the prepared areas at the specified rates.

When more than one kind of seed is to be used, the several different kinds may be mixed together in the required proportions and used as a seed mixture.

Method A. Seedings on all slopes 3:1 and flatter shall be done with a grass or grain drill in rows 4 to 14 inches apart. The seed shall be placed at a depth of approximately 3/4 to 1 inch on coarse-textured materials and one-half on other side.

Method B. Seedings on slopes steeper than 3:1 shall be by hand or machine broadcasting. Broadcast seed shall be covered about one-fourth to one-half inch deep by light spiketooth harrowing or similar method unless applied in the mulch.

Method C. The hydro-seeding method of application is applicable to few locations and sites in Montana. When specified, all materials shall be applied by hydraulic type equipment that provides a continuous mixing and agitating action to the mixture of water, fertilizer, seed, and mulch. The mixture shall be applied through a pressure spray distribution system providing a continuous, non-fluctuating discharge and delivery of the mixture in prescribed quantities uniformly on the specified areas. Seedbed preparation, if required, shall be as specified in an attachment to this specification.

Method D. In pneumatic seed application, all materials shall be applied by blower-type equipment using air pressure and an adjustable disseminating device whereby dry fertilizer and dry seed shall be applied in prescribed quantities uniformly on specified areas. Seedbed preparation, if required, shall be as specified in an attachment to this specification.

Method E. Seed application by hand-operated mechanical spreaders or seeders shall be performed such that dry seed will be applied uniformly in the prescribed quantities on specified areas.

7. FERTILIZING

Fertilizers not applied with other material shall be applied separately and uniformly in the prescribed amounts to the entire area to be seeded as shown on the drawings or as specified in an attachment to this specification.

8. MULCHING

The kind of method to be used shall be specified. Mulches shall be applied uniformly to the designated areas at the specified rates. If not applied with the seed, mulch shall be applied no later than 2 work days after seeding has been performed. The type, rate, and method of anchoring mulch shall be as shown on the drawings or specified in an attachment to these specifications.

When specified, a weighted disc harrow shall be used to stabilize or anchor the mulch. The disc harrow with the discs set straight shall be run over the mulched areas on the contour. A notched colter-type disc is superior. The mulch shall be adequately anchored to a depth of about 2 inches with a minimum space of 12 inches between the colters.

Small areas may be anchored by hand with a square point spade. Mulch shall be pushed into the soil two inches deep at approximately 12-inch intervals.

When specified, asphalt emulsion shall be used to stabilize or anchor the mulch. Asphalt emulsion shall be applied uniformly over the mulch at the rate of 200 gallons per acre or may be applied by injecting the designated asphaltic materials into the mulch as the mulch leaves the mulch spreader at the rate of 100 gallons per ton of mulch.

When specified, jute matting shall be used for stabilizing the mulch. Jute matting shall be installed in accordance with the manufacturer's instructions.

9. MEASUREMENT AND PAYMENT

METHOD 1 For items of work for which specific lump sum prices are established in the contract, the quantity of work will not be measured for payment. Payment for this item will be made at the contract lump sum price and will constitute full compensation for the completion of the work.

METHOD 2 For items of work for which specific lump sum prices are established in the contract, payment will be made as the work proceeds. Progress payments will be determined as specified in the Special Provisions. Payment of the lump sum contract price will constitute full compensation for completion of the work.

