STANDARD CONSTRUCTION SPECIFICATIONS

DUCKS UNLIMITED

GREAT PLAINS REGIONAL OFFICE

STANDARD CONSTRUCTION SPECIFICATIONS

2009 EDITION

GREAT PLAINS REGIONAL OFFICE

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201 MOBILIZATION

201.10 DESCRIPTION

The work shall include the supply of all labor, material and equipment to transport all needed labor, material and equipment to and from a project site to successfully complete that project as shown on the plans or described by the Engineer. When work consists of construction in a number of different locations at a given project site, mobilization shall include the transportation of the required labor, material and equipment between the various locations at the project site.

201.20 METHOD

The Contractor shall conduct all mobilization operations in a timely orderly, manner. Unless otherwise approved by the Engineer, mobilization operations shall commence no later than one week after the pre-construction meeting. Mobilization shall commence no later than one week after project completion and be finished within two weeks of project completion. During all operations, the Contractor is responsible for maintaining public and private property in original condition.

201.30 METHOD OF MEASUREMENT

Mobilization shall be measured on a unit basis. The unit shall be shown in the Unit Price Table of the Standard Bid Form for the pay item corresponding to this specification number. Mobilization shall be measured in the following manner:

1) Lump Sum (LS): Mobilization shall be measured on a lump sum basis during completion of the entire project.
2) Each (EA): Mobilization shall be measured per (each) mobilization required to complete identified phases of a project that need to be completed at different construction times.

201.40 METHOD OF PAYMENT

The completed work for Mobilization, measured as specified, shall be paid for at the contract unit price. Payment shall be made according to the following schedule:

1) 25% of contract unit price at project start up.
2) 50% of contract unit price at half project completion.
3) 100% of contract unit price at project completion.

The unit price bid for mobilization shall include supplying all materials, equipment, labor and any incidental items necessary for performing all mobilization operations described in this specification. Unless separate mobilizations are required to completed different phases of the work shown on the plans, a Contractor may be eligible for a separate mobilization payment when the Contractor is required to discontinue work by the Corporation for reasons other than seasonal termination of work. The payment shall be commensurate to the amount of equipment and materials that are required to be removed from the project site and that payment shall not exceed the original unit price specified for mobilization.

202 SITE PREPARATION

202.10 DESCRIPTION

This specification shall cover the supply of all labor, materials, and equipment required for clearing and grubbing, and site preparation. The work shall include:

a) Removal from site and disposal of all trees, roots, brush, stone, rubbish and all other surface litter in designated areas by burying or burning.

b) Coordination of necessary clearing and grubbing operations to allow timely completion of construction staking of a project.

c) Grubbing to remove grass and debris.

d) Stripping of six (6) inches of topsoil and re-spreading after construction is completed, unless otherwise specified on the plans.

e) Final clean up of the site prior to demobilization will require the spreading and shaping of all materials stockpiled or moved to facilitate construction including but not limited to vegetative material.

202.20 CONSTRUCTION METHODS

Clearing shall consist of the cutting, removing, disposal and cleaning up of all timber, brush and fallen timber, stumps, shrubs, and rubbish. Trees and shrubs designated for preservation shall be marked and protected from scoring, barking or other injury during construction operations.

Grubbing shall consist of the removal and disposal of all roots, stumps, imbedded logs or objectionable debris to a depth of not less than twelve (12) inches below the original ground surface. Where no trees or brush exist, grubbing shall consist of removal of grass and debris prior to placement of fill material.

Topsoil stripping and stockpiling shall be performed for the footprint of all embankments and at the surface area of all excavations and at the base of temporary stockpiles and waste area unless otherwise noted on the plans. Unless otherwise specified, upon completion of the construction, the stockpiled material shall be spread and finished to a reasonably smooth surface.

Trees, logs, stumps, brush and other debris shall be burned and buried or chipped, or disposed of in areas designated by the Engineer. All burning is subject to local or state ordinances. Areas such as borrows, pits, and excavations so designated shall be left in a neat and finished appearance free from debris. All materials disposed of shall be covered with clean fill and leveled in such a way as to promote drainage.

202.30 METHOD OF MEASUREMENT

Site preparation shall be measured on a unit basis. The unit shall be shown in the Unit Price Table of the Standard Bid Form for the pay item corresponding to this specification number. Site preparation shall be measured in the following manner:

1) Lump Sum (LS): Site preparation shall be measured on a lump sum basis of site preparation operations. No separate measurement will be made for topsoil removal and replacement, clearing and grubbing or coordination of clearing and grubbing operations for construction staking.

2) Cubic Yard-Plan (CY-P): Site preparation shall be measured on a plan quantity basis of site preparation operations. This quantity shall be the neat line site preparation quantity for the specified depth at the footprint of the embankment or the surface area of potholes and channels as

calculated from the construction plans. This measurement shall not include clearing and grubbing or topsoil stripping and stockpiling of borrow areas as these quantities are considered incidental to embankment construction unless otherwise noted on the plans. No separate measurement for clearing and grubbing or coordination of clearing and grubbing operations for construction staking will be made.

3) Cubic Yard-Staked Quantity (CY-S): Site Preparation shall be measured on a staked quantity basis of site preparation operations. This quantity shall be the area of work, as determined by superimposing the construction staking notes on the original ground elevations, multiplied by the specified depth. This measurement shall not include clearing and grubbing or topsoil stripping and stockpiling of borrow areas as these quantities are considered incidental to embankment construction unless otherwise noted on the plans. No separate measurement for clearing and grubbing or coordination of clearing and grubbing operations for construction staking will be made.

4) Linear Feet (LF): Site preparation shall be measured on a linear feet basis. The length shall be the actual staked centerline distance of site preparation completed according to plans and specifications.

5) Acre (AC): Site preparation shall be measured on an acre basis. The dimension shall be the actual staked outside dimensions of site preparation completed according to plans and specifications.

6) Hourly-Recorded (HR-R): Site preparation shall be measured on a per diem basis. The per diem basis shall be the actual hours as recorded from an approved rpm/hr recording system for each piece of equipment used to complete the excavation portion of this project. No separate recording shall be made for mobilization and idling of equipment, unless otherwise specified.

When Site Preparation is not listed on the Standard Bid Form or when a unit price bid has not been entered for Site Preparation, it shall be considered incidental to the excavation, embankment, structure, and piping operations and no measurement shall be made.

202.40 METHOD OF PAYMENT

The completed work for site preparation, measured as specified, shall be paid for at the contract unit price. The unit price bid for site preparation shall include supplying all materials, equipment, labor and any incidental items necessary for performing all site preparation operations described in this specification.

203 EXCAVATION

203.10 DESCRIPTION

This specification shall cover the supply of all labor, materials, and equipment required for the excavation, hauling and spreading of materials from within the limits of the cut area as shown on the plans, including but not limited to, excavation of designated areas; peninsula cutoffs; silt removal; pothole and dugout construction; and key trench construction. The work shall include control of water during excavation, the shaping of slopes to the lines and grades shown on the drawings and the disposal of materials within designated areas. Unless otherwise specified, all material to be excavated shall be considered unclassified regardless of their nature or the manner in which they are removed. In the case that drilling and blasting is required, due to size of density of rock encountered, extra work will be considered.

203.20 CONSTRUCTION METHODS

203.21 SITE PREPARATION

Prior to any excavation, sites shall be cleared and grubbed with topsoil removed in accordance with the specification for **SITE PREPARATION**. Material cleared and grubbed shall be disposed of per the Engineer's directions. Topsoil removed shall be stockpiled and later re-spread on those areas at a thickness of four (4) inches, unless otherwise specified.

203.22 EXCAVATION

Excavation shall mean the removal of all materials encountered within the limits of excavation as shown on the drawings or as staked by the Engineer. Excavation shall be performed in as nearly a continuous operation as possible, trimmed and leveled to conform to the required lines, grades and tolerances. Areas over-excavated shall be replaced with suitable materials compacted to a density at least equal to that of the in-situ material or to the satisfaction of the Engineer.

Suitable material excavated from the excavation areas shown on the plans shall be used in any embankments called for on the plans. This shall include areas stripped of topsoil or unsuitable material that need to be backfilled with suitable material or key trenches. Placement of these embankments or backfills shall be done in accordance with the specification for **EMBANKMENT CONSTRUCTION**.

Excavated material unsuitable for embankments shall be deposited in locations shown on the plans or as directed by the Engineer. Unsuitable excavated materials shall be deposited as uniformly and continuously as possible in successive layers. No specific compaction will be required but where the material is placed with equipment other than tractor scrapers, blading and leveling is required to minimize voids. The fill shall be leveled upon completion to conform to lines and grades and enable the area to be seeded.

Rock excavation operations shall be controlled by the Contractor to produce the size gradations specified for other parts of the work, if the rock is designated by the Engineer as suitable for use.

203.23 DISPOSAL OF WASTE MATERIALS

All surplus or unsuitable excavated materials designated as waste by the Engineer shall be disposed of at the locations shown on the plans or as directed by the Engineer.

203.24 CONTROL OF SURFACE AND SUBSURFACE WATER

The Contractor is responsible for control of surface water, subsurface water, and drainage during the construction period. All temporary fills, crossings, and culverts necessary to promote drainage during construction will be installed and removed at the Contractor's expense prior to acceptance of the work. Any claims arising from upstream or downstream damages as a result of the construction or failure of these temporary works will be the Contractor's responsibility.

It is the responsibility of the Contractor to control the surface and sub-surface water and drainage in any excavation area, dewatering placement area and borrow area. Should material quality lessen through inadequate drainage, the Contractor may be directed by the Engineer to construct drainage facilities or develop an alternate borrow area at the Contractor's expense.

203.30 METHOD OF MEASUREMENT

Excavation shall be measured on a unit basis. The unit shall be shown in the Unit Price Table of the Standard Bid Form for the pay item corresponding to this specification number. No measurement for over-excavation shall be made. Excavation shall be measured in the following manner:

1) Lump Sum (LS): Excavation shall be measured on a lump sum basis and no separate measurement shall be made for the volume of material excavated.
2) Cubic Yards-Plan Quantity (CY-P): Excavation shall be measured on a plan quantity basis. This quantity shall be the neat line excavation quantities calculated from the construction plans.
3) Cubic Yards-Staked Quantity (CY-S): Excavation shall be measured on a staked quantity basis. The quantity shall be calculated by superimposing construction staking notes on original ground and using average end area methods of volume calculation.
4) Cubic Yards (CY): Excavation shall be measured on a volume basis. The volume to be paid for shall be made by superimposing final cross- sections on applicable stripped or original ground profile sections and using average end area methods of volume calculation. No measurement for overexcavated materials shall be made.
5) Linear Feet (LF): Excavation shall be measured on a linear feet basis. The length shall be the actual staked centerline distance of excavation completed according to plans and specifications.
6) Hourly-Recorded (HR-R): Excavation shall be measured on a per diem basis. The per diem basis shall be the actual hours as recorded from an approved rpm/hr recording system for each piece of equipment used to complete the excavation operations. No separate recording shall be made for mobilization and idling of equipment, unless otherwise specified.

When a unit price bid has not been entered for Excavation, it shall be considered incidental to the embankment, structure, and piping operations and no measurement shall be made.

203.40 METHOD OF PAYMENT

The completed work for excavation, measured as specified, shall be paid for at the contract unit price. The unit price bid for excavation shall include supplying all materials, equipment, labor and any incidental items necessary for performing all excavation operations described in this specification. No payment shall be made for dewatering or the control and drainage of surface/sub-surface water. No payment for excavation of suitable material will be made when excavating in a designated borrow area to obtain material that is to be placed, measured and paid in accordance with the specification for **EMBANKMENT CONSTRUCTION**.

204 EMBANKMENT CONSTRUCTION

204.10 DESCRIPTION

The work shall include the supply of all labor, material and equipment required to complete the construction of key trenches, dams, dikes, berms, levees or roadway embankments as shown on the plans and as staked in the field. The work shall include:

a) Excavation of suitable materials from borrows or excavations.

b) Placement of materials from designated borrow areas or excavation into embankments such as dams, dikes, berms, levees or roadways.

c) Leveling and trimming of embankments and borrow areas.

204.20 CONSTRUCTION METHODS

204.21 SITE PREPARATION

Prior to any embankment or key trench construction, sites shall be cleared and grubbed with topsoil removed in accordance with the specification for **SITE PREPARATION**. Material cleared and grubbed shall be disposed of per the Engineer's directions. Topsoil removed shall be stockpiled and later re-spread on those areas at a thickness of four (4) inches, unless otherwise shown on the plans.

204.22 FILL MATERIAL

Unless otherwise specified, all material shall be placed in loose lifts of not more than eight (8) inches thickness and shall be compacted by suitable compaction equipment to a minimum of 95% of maximum density as determined by the Standard Proctor Method ASTM D698. Moisture content shall be in the range of -l% to +3% of optimum moisture content. Field tests conforming to standard ASTM testing methods will be scheduled at the discretion of the Engineer to ensure compliance with these specifications.

If material is placed into embankments during freezing conditions, any frost developed during embankment construction shall be removed prior to continuing fill operations. Embankments shall not be constructed during periods when the embankment material freezes while being placed and compacted.

Fill material shall be free from boulders, concrete, snow, stumps or other vegetation.

204.23 KEY TRENCH CONSTRUCTION

The Contractor shall not commence key trench construction until such work as specified in the specification for **SITE PREPARATION** has been completed to the satisfaction of the Engineer.

Where specified on the plans, the key trench excavation shall be made to the lines and grades shown on the drawings but may be altered during construction upon the direction of the Engineer to adjust for variation in soil conditions. Excavated material, if acceptable in quality to the Engineer, may be stockpiled for use in site preparation or embankment construction. Unacceptable materials shall be disposed of by placing into designated areas. The key trench completed to the original ground surface elevation shall be rough leveled prior to commencing embankment construction.

204.24 EMBANKMENT CONSTRUCTION

The Contractor shall not commence embankment construction until such work as specified in the specification for **SITE PREPARATION** and the key trench, where specified, has been completed to the satisfaction of the Engineer.

Embankment material excavated from ditches/borrows with tractor-scraper units shall be placed in successive layers across the entire width of the embankment. Each layer must be spread as deposited longitudinally along the embankment with each layer not exceeding eight (8) inches in thickness. With the Engineer's approval, the initial layer may be increased in thickness in wet areas to provide a working pad capable of supporting the hauling equipment. The embankment at all times must be maintained in a reasonably level condition and hauling equipment shall be directed over the full width of each layer to facilitate uniform compaction. Adequate equipment shall be used to obtain the minimum compaction specified in Section 204.22 of this specification.

Where embankment material is excavated with bucket equipment from ditches or borrow, it shall be deposited into the embankment within reach of the equipment. To prevent berm failure, stock piling on berms will not be permitted. Materials shall be placed and spread in layers with each layer after spreading not to exceed eight (8) inches in thickness.

All embankments will be construction staked to final grade elevations shown on the drawings. Embankments shall be brought to these elevations using embankment material graded to a tolerance of +/- 0.1 feet. Topsoil or riprap materials are to be placed on top of embankment construction. Topsoil depths shall be four (4) inches, unless otherwise specified, while riprap depths shall be as specified on the drawings. All embankment construction must be as continuous as possible and the fill maintained such that drainage is assured at all times.

Should fill settlement occur during the construction of the embankment and within seven days of substantial completion, and prior to acceptance of the work, additional material shall be placed and trimmed to achieve final grade by the Contractor at his own expense. After embankments have been constructed to grade, they shall be leveled and trimmed to conform to the lines, grades and cross-sections shown on the plans and/or as staked. Acceptance of finished embankment may be made progressively during the course of construction upon the request of the Contractor. A completed embankment once accepted by the Engineer shall not be used by the Contractor for haulage, access or other purposes without the consent of the Engineer.

Water used in conjunction with embankment construction activities shall be applied and paid as described in the specification for **WATER**.

Cold weather embankment construction - Embankment construction may not proceed if material freezes while being placed and compacted however when weather conditions are such that embankment construction may proceed, the contractor may be permitted to excavate any frozen foundation soils or previously installed fill and proceed with the embankment construction for so long as weather will permit, but only if and to the extent approved by the engineer and with the understanding that additional costs involved shall be borne by the contractor. The frozen soil shall be wasted and replaced with other suitable soil as may be necessary to construct the embankments as specified.

204.25 TRIMMING

The crest, side slopes and berms of the embankment shall be leveled and trimmed to conform to the lines and grades shown on the drawings. The crest shall be constructed to the elevation shown on the plans prior to acceptance of the work. Acceptance of the finished embankment may be made progressively

during the course of construction upon the request of the Contractor. Once accepted by the Engineer, the Contractor shall not use a completed embankment for haulage, access or other purposes.

204.26 HAUL ROADS AND BORROW AREAS

The construction, maintenance and removal of all haul roads from the borrow areas shall be the responsibility of the Contractor and be considered incidental to the work. Borrow areas shall be maintained during construction in a graded condition such that drainage is assured and that operations can resume quickly after precipitation periods. No borrow shall be obtain outside of designated borrow areas or designated depths or elevations without approval from the engineer, responsible agency and landowner. Following completion of the work, borrows are to be left in a graded condition acceptable to the Engineer and all haul roads, access roads and temporary crossings are to be removed.

204.27 CONTROL OF SURFACE AND SUBSURFACE WATER

The Contractor is responsible for control of surface water, subsurface water, and drainage during the construction period. All temporary fills, crossings, and culverts necessary to promote drainage during construction will be installed and removed at the Contractor's expense prior to acceptance of the work. Any claims arising from upstream or downstream damages as a result of the construction or failure of these temporary works will be the Contractor’s responsibility.

It is the responsibility of the Contractor to control the surface and sub-surface water and drainage in any excavation area, dewatering placement area and borrow area. Should material quality lessen through inadequate drainage, the Contractor may be directed by the Engineer to construct drainage facilities at the Contractor’s expense.

204.30 METHOD OF MEASUREMENT

Embankment construction shall be measured on a unit basis. The unit shall be shown in the Unit Price Table of the Standard Bid Form for the pay item corresponding to this specification number. No measurement for embankment constructed beyond the staked limits will be made. Embankment construction shall be measured in the following manner:

1) Lump Sum (LS): Embankment shall be measured on a lump sum basis of placed embankment. No separate volume measurement shall be made.

2) Cubic Yard-Plan Quantity (CY-P): Embankment shall be measured on a plan quantity basis. This quantity shall be the neat line quantity of placed embankment including site preparation calculated from the construction plans. This measurement shall also include site preparation quantities. Site preparation quantities to be added to embankment quantities shall be calculated as described in the specification for **SITE PREPARATION**. This measurement shall not include clearing and grubbing or topsoil stripping and stockpiling of borrow areas as these quantities are considered incidental to embankment construction.

3) Cubic Yard-Staked Quantity (CY-S): Embankment shall be measured on a staked quantity basis of placed embankment. This quantity shall be measured by superimposing the construction staking notes on the original ground elevations and using the average end method of volume calculation. This measurement shall also include site preparation quantities. Site preparation quantities to be added to embankment quantities shall be calculated as described in the specification for **SITE PREPARATION**. When indicated on the plans or unit table, an appropriate shrinkage factor will be applied to this calculation. This measurement shall not include clearing and grubbing or topsoil stripping and stockpiling of borrow areas as these

quantities are considered incidental to embankment construction unless otherwise indicated on the plans or unit price table.

4) Cubic Yards (CY): Embankment shall be measured on a volume basis of placed embankment. The volume to be paid for shall be made by cross sectioning designated borrow areas minus topsoil quantities and using the average end method of volume calculation. No measurement shall be made for overbuild areas.

5) Linear Feet (LF): Embankment shall be paid on a linear feet basis. This quantity shall be measured by the actual staked centerline distance of all embankment constructed according to plans and specifications.

6) Hourly-Recorded (HR-R): Embankment shall be measured on a per diem basis. The per diem basis shall be the actual hours as recorded from an approved rpm/hr recording system for each piece of equipment used to complete the embankment operations. No separate recording shall be made for mobilization and idling of equipment, unless otherwise specified.

No separate measurement shall be made for the fill around pipes, pipeline, and water control structures. This work shall be considered incidental to those bid items.

204.40 METHOD OF PAYMENT

The completed work for embankment construction, measured as specified, shall be paid for at the contract unit price. The unit price bid for embankment construction shall include supplying all materials, equipment, labor, and any incidental items necessary for performing all embankment construction operations described in this specification. No payment shall be made for dewatering or the control and drainage of surface/sub-surface water.

205 WATER

205.10 DESCRIPTION

The work shall include the supply of all labor, material, and equipment required to add water to embankments as directed by the Engineer. The work shall include:

a) Locating and procuring a suitable water source.

b) Delivery of water to the site, applying and mixing water with embankment material.

205.20 MATERIALS

Water used for construction shall be reasonably clean and shall not affect normal soil characteristics.

205.30 CONSTRUCTION METHODS

Water shall be applied to the embankment areas (or borrow areas) in a way that maintains the specified moisture content. Sufficient equipment shall be on the project site to secure and maintain the specified moisture content until the required density is secured. Water shall be applied uniformly over the working area.

205.40 METHOD OF MEASUREMENT

Water shall be measured on a unit basis. The unit shall be shown in the Unit Price Table of the Standard Bid Form for the pay item corresponding to this specification number. Water shall be measured in the following manner: **Note MGAL is defined as 1000 gallons**.

1) Lump Sum (LS): Water shall be measured on a lump sum basis for applied water. No separate measurement shall be made.

2) MGAL - Plan Quantity (MG-P): Water shall be measured on a plan quantity basis. The quantity shall be the one thousand gallon (KGAL) increments as calculated using soil investigation information and listed on the plans or shown on the Standard Bid Form. No measurement shall be made for the volume of water applied.

3) MGAL - (MG): Water shall be measured on a volume basis. The water measured shall be the actual amount of applied water in one thousand-gallon (KGAL) increments used in the construction of the project. The amount used shall be measured in the field as agreed to by the Contractor and the Engineer.

205.50 METHOD OF PAYMENT

The completed work for water, measured as specified, shall be paid for at the contract unit price. The unit price bid for water shall include supplying all materials, equipment, labor and any incidental items necessary for performing all water operations described in this specification.

206 CONSTRUCTED TOPOGRAPHY

206.10 DESCRIPTION

This specification shall cover the supply of all labor, materials, and equipment required for the construction of potholes, dugouts, basins, meandered channels, or other topographic reconstruction as shown on the plans. The work shall include the excavation, hauling and spreading of materials from within the limits of the cut area, control of water during excavation, the shaping of slopes to the lines and grades shown on the drawings and the disposal of materials within designated areas.

206.20 CONSTRUCTION METHODS

206.21 SITE PREPARATION

Prior to any excavation, sites shall be cleared and grubbed with topsoil removed in accordance with the

specification for **SITE PREPARATION**. Material cleared and grubbed shall be disposed of per the Engineer's directions. Unless otherwise specified, the debris shall be placed in the spoil areas and secured by incorporating it into the earth fill. Preparation of the site shall be done in a manner that destroys as little vegetation as feasible outside the area to be occupied by the topographic feature and the associated spoil areas. Topsoil removed shall be stockpiled and later re-spread on those areas at a thickness of four (4) inches, unless otherwise specified.

206.22 EXCAVATION

Excavation shall mean the removal of all materials encountered within the limits of excavation as shown on the drawings or as staked by the Engineer. Excavation shall be performed in as nearly a continuous operation as possible to conform to the required lines, grades and tolerances. Areas over-excavated shall be replaced with suitable materials compacted to a density at least equal to that of the in-situ material or to the satisfaction of the Engineer. The depth specified is nominal so the actual depth may vary 3 inches (0.25') above and below the specified depth. The side slopes of the excavated basins shall be free of abrupt changes and blend into the existing ground contours.

Connection ditches shall have 3:1 or flatter side slopes. For curved segments, a scour hole effect shall be obtained by over-excavating the outside of the ditch with the inside of the curve being shallower.

Material excavated from the designated locations shall be used to create multiple upland habitat conditions based on the height, shape, and location of habitat mounds. Where designated on plans, spoil shaped into a mound shall be placed 25 to 30 feet from edge of basin. The side slopes of the mound shall be 6:1 or flatter. Large spoil areas may be shaped into multiple mounds. The completed earth fill in the mounds and ridges shall be left rough graded such that the area can be reseeded using conventional seeding equipment. No compaction of the earth fill will be required. Where designated on plans, spoil shaped into a ridge shall be continuous, with a minimum height of 1 foot. The ridge shall be used on the down slope side of a basin to impound additional water over the basin area. Unless otherwise specified, all material to be excavated shall be considered unclassified regardless of their nature or the manner in which they are removed.

206.23 CONTROL OF SURFACE AND SUBSURFACE WATER

The Contractor is responsible for control of surface water, subsurface water, and drainage during the construction period. All temporary fills, crossings, and culverts necessary to promote drainage during construction will be installed and removed at the Contractor's expense prior to acceptance of the work. Any claims arising from upstream or downstream damages as a result of the construction or failure of these temporary works will be the Contractor's responsibility.

It is the responsibility of the Contractor to control the surface and sub-surface water and drainage in any excavation area, dewatering placement area and borrow area. Should material quality lessen through inadequate drainage, the Contractor may be directed by the Engineer to construct drainage facilities at the Contractor's expense.

206.30 METHOD OF MEASUREMENT

Constructed topography shall be measured on a unit basis. The unit shall be shown in the Unit Price Table of the Standard Bid Form for the pay item corresponding to this specification number. The Standard Bid Form shall list the appropriate unit of measurement for each applicable feature, i.e., potholes, dugouts, channels, etc. Constructed Topography shall be measured in the following manner:

1) Lump Sum (LS): Topographic features shall be measured on a lump sum basis and no separate measurement shall be made for the volume of material excavated.
2) Acre-Plan Quantity (AC-P): Surface areas shall be measured on a plan quantity basis. This quantity shall be the neat line areas as calculated from the construction plans.
3) Cubic Yards-Plan Quantity (CY-P): Topographic features shall be measured on a plan quantity basis. This quantity shall be the neat line excavation quantities calculated from the plans.
4) Cubic Yards-Staked Quantity (CY-S): Topographic features shall be measured on a staked quantity basis. The quantity shall be calculated by superimposing construction staking notes on original ground and using average end area methods of volume calculation.
5) Cubic Yards (CY): Embankment shall be measured on a volume basis of placed embankment. The volume to be paid for shall be made by cross sectioning designated borrow areas minus topsoil quantities and using the average end method of volume calculation. No measurement shall be made for overbuild areas.
6) Linear Feet (LF): Topographic features shall be measured on a linear feet basis. The length shall be the actual staked centerline distance of excavation completed according to plans and specifications. No measurement shall be made for over-excavation, or excavation quantities or operations conducted outside of given stakes.
7) Each (EA): Topographic features shall be measured on an individual feature basis. The estimated number of features will be shown on the Standard Bid Form. The volume of material excavated from individual sites will vary. A neat line plan quantity estimate of material to be excavated will be shown on the plans.
8) Hourly-Recorded (HR-R): Topographic features shall be measured on a per diem basis. The per diem basis shall be the actual hours as recorded from an approved rpm/hr recording system for each piece of equipment used to complete the constructed topography operations. No separate recording shall be made for mobilization and idling of equipment, unless otherwise specified.

Mobilization of equipment between the individual feature sites will not be measured. This work shall be considered incidental to the construction of the topographic feature.

206.40 METHOD OF PAYMENT

The completed work for constructed topography, measured as specified, shall be paid for at the contract unit price. The unit price bid for constructed topography shall include supplying all materials, equipment, labor, and any incidental items necessary for performing all operations described in this specification. No payment shall be made for dewatering or the control and drainage of surface/sub-surface water. No payment for excavation of suitable material will be made when excavating in a designated borrow area to obtain material that is to be placed, measured and paid in accordance with the specification for **EMBANKMENT CONSTRUCTION**.

301 WATER CONTROL STRUCTURES

301.l0 DESCRIPTION

The work of this section shall include the supply of all labor, materials, and equipment required to complete the installation of the water control structures as called for on the drawings and/or specified herein. These water control structures may include but are not limited to the following:

a) Stoplog control structures

b) Gate control structures

c) Fixed level control structures

d) Any other structures specified on the plans

This work shall consist of coupling the structure to the pipe; excavation; bed preparation; installation of structure and associated hardware with the use of a concrete base pad or form, reinforcement, and concrete placement, or framing and supports as shown on the plans. Work shall also include the supply, placing and compaction of backfill to the lines and grades shown on the drawings or as specified.

301.20 MATERIALS

301.21 SUPPLY OF MATERIALS

Unless otherwise specified, the Contractor shall supply all couplers, nuts, bolts, riser controls, stoplog channels, sealants, and all accessories necessary to complete the installation as shown on the plans or recommended by the material manufacturer.

The structure material, diameter and length shall be as specified on the plans. All culverts, inlet and outlet pipes, and appurtenances shall match the material and coating of the base riser unless otherwise specified on the plans. All materials supplied by the Contractor shall be subject to inspection by the Engineer.

The following specifications for each material type shall be adhered to.

1) Aluminum corrugated metal pipe risers. The minimum acceptable series for aluminum CMP shall be 3000 Series. The material shall meet the requirements of AASHTO M197.

   a) Pipe shall be close riveted or of a "lock seam" construction. Unless otherwise specified all pipes shall have a 2-2/3" x 1/2" corrugation. The gauge of the pipe shall be as follows unless otherwise specified on the plans:

Pipe Diameter	2-2/3” x ½” Corrugations Metal Thickness	3” x 1” Corrugations Metal Thickness
12"-21"	14	NA
24"-36"	12	14
42"-54"	10	12
60"-96"	8	10

   b) All welds shall be 3/16” fillets unless otherwise specified on the plans and should conform to Welded Joint Requirements of the latest edition of the AISC Manual. All bolted connections shall utilize stainless steel bolts, nuts, and washers, grade 18-8 or 304 or better.

c) The minimum acceptable series for all structural aluminum, channels, angles, plates, rounds, etc. shall be 5000 Series, unless otherwise specified.

d) The portion of the riser that will be embedded in the concrete base shall be coated with asphalt mastic prior to installation.

2) Steel corrugated metal pipe risers. Where stated as acceptable on the plans, steel corrugated metal risers shall be made of galvanized or aluminized Type II steel. Galvanized steel corrugated metal pipe shall meet the composition requirements of AASHTO M218. The aluminized Type II steel shall conform to the requirements of AASHTO M274.

a) Pipe shall be close riveted or of a "lock seam" construction. Unless otherwise specified all pipes shall have a 2 2/3" x 1/2" corrugation. The gauge of the pipe shall be as follows unless otherwise specified on the plans:

Pipe Diameter	2-2/3" x ½" Corrugations Metal Thickness	3" x 1" Corrugations Metal Thickness
12"-21"	16	NA
24"-36"	14	16
42"-54"	12	14
60"-96"	10	12

b) Risers made of galvanized or aluminized Type II steel shall be coated unless otherwise indicated on the plans. This coating shall be a 10 mil polymeric film laminate. The coatings shall be applied to both the inside and outside of the riser.

c) All welds shall be 3/16" fillets unless otherwise specified on the plans and should conform to Welded Joint Requirements of the latest edition of the AISC Manual. All cuts and welds required for riser fabrication shall be brushed or sprayed with a bituminous coating.

3) Pre-cast concrete risers. Where stated as acceptable on the plans, pre-cast concrete structures shall conform to the requirements of ASTM C478. The risers shall be of the length shown on the plans. All pipe shall be connected to the riser utilizing a flexible watertight connector as shown on the plans or as approved by the Engineer.

4) Fiberglass, High Density Polyethylene (HDPE) Pipe, and Polyvinyl Chloride (PVC) Pipe Risers. Where stated as acceptable on the plans, Fiberglass, HDPE, and PVC risers shall be approved by the Engineer and shall be of the length shown on the Plans.

a) The minimum acceptable series for all structural aluminum, channels, angles, plates, rounds, etc. shall be 5000 Series, unless otherwise specified.

b) All bolted connections shall utilize stainless steel bolts, nuts and washers, grade 18-8 or 304 or better.

c) The pipe stubs for the structure shall incorporate a gasketed bell and spigot design or engineer approved alternate with the ability to accept watertight HDPE or PVC pipe. The gasketed joint shall meet the requirements of ASTM F477 with a minimum watertight performance of 10.8 psi. 36" through 60" diameters shall have a reinforced bell and spigot.

d) The structure manufacturer shall weld and/or bond all stub joints on both the interior and exterior of the riser.

e) Fiberglass risers shall be of three-piece construction. The two-piece exterior shell shall consist of two molded fiberglass shells with reinforcing ribs and flanges. The fiberglass shall be a polyester resin. The center stop gate shall be of polyethylene construction.

f) HDPE risers shall have a smooth interior and annular exterior corrugations. The Engineer shall approve the pipe utilized for the structure. The material shall meet the requirements of ASTM D3350 with a minimum cell classification 335420C. 12" to 48" risers shall meet the requirements of AASHTO M294, Type S. 54" and 60" risers shall meet the requirements of AASHTO MP7.

~~g)~~ PVC structure shall be constructed of ½" thick or greater extruded pvc sheets, connected by anodized aluminum corners, sealed with waterproof caulking, and secured with stainless steel connections. The structure shall be similar to the inline water level control structure as manufactured by Agri-Drain Corp., or approved equal. Structure shall include a metal lid with attachment accessories.

5) Where called for the plans, annular connecting bands shall be the same material and have the same coating, corrugations, and gauge as specified for the pipe that is to be connected.

a) The connecting bands shall be either 24" in width or have a minimum of nine (9) corrugations. The minimum circumferential overlap shall be six (6) inches. If helical pipe is used, a minimum of four (4) re-rolled annular corrugations shall be formed to allow the use of the annular overlapping connecting bands.

b) To provide for a watertight joint, a closed cell expanded gasket or engineer approved equal shall be used in conjunction with connecting band. The gasket shall be at least 24" in width, 3/8" thick, with an unstretched diameter ten (10) percent less than normal pipe size and shall comply with ASTM D1056, Grade SCE-43. Mastic shall be placed on each side of the gasket.

c) The binders for the connecting bands will consist of a minimum of 6 rods and tank lugs, three (3) per side, in accordance with the plans. The minimum rod diameter shall be 7/16" with ½" threads. All rods and lugs shall be galvanized.

6) When called for on the plans, the Contractor shall supply to the site ready mix concrete, or site mix concrete in accordance with the specification for **CAST-IN-PLACE REINFORCED CONCRETE**. Forms, reinforcing steel or wire mesh, for the concrete pad for the control structure will be the responsibility of the Contractor. Installation of a concrete base for all prefabricated risers shall be considered incidental to the riser installation and no separate measurement or payment shall be made for this work.

301.22 HANDLING AND STORAGE OF MATERIALS

All materials shall be handled and stored in careful and workmanlike manner to the satisfaction of the Engineer. Any dents or depressions as a result of storage and handling during transportation or installation shall not be allowed. The Contractor shall be responsible for replacement and reinstallation of the damaged riser at his own expense.

301.30 CONSTRUCTION METHODS

301.31 CONTROL OF SURFACE/SUBSURFACE WATER

The Contractor is responsible for control of surface water, subsurface water, and drainage during the construction period. All temporary fills, crossings, and culverts necessary to promote drainage during construction will be installed and removed at the Contractor's expense prior to acceptance of the work.

Any claims arising from upstream or downstream damages as a result of the construction or failure of these temporary works will be the Contractor's responsibility.

It is the responsibility of the Contractor to control the surface and sub-surface water and drainage in any excavation area, dewatering placement area and borrow area. Should material quality lessen through inadequate drainage, the Contractor may be directed by the Engineer to construct drainage facilities at the Contractor's expense.

301.32 CMP, FIBERGLASS, HDPE, & PVC CONTROL STRUCTURE INSTALLATION

Prior to installation of the control structure, any protective coating that has been removed from the structure exposing the pipe shall be recoated. Welding, drilling, bolting or otherwise attaching devices, temporary or permanent, to the structure to assist in structure installation is prohibited.

The Contractor shall compact the in-situ material below the base elevation prior to assembly and erection of the structure. This bed shall be fully leveled and compacted throughout the full width and length of the trench and to the exact grade as specified, so that the structure shall be uniformly and evenly supported across its footprint.

The control structure, as delivered to the site, shall be cast-in-place into the concrete foundation or as shown on the plans. Cast-in-place concrete, reinforcing, mixing, delivery and placement shall be carried out in accordance with the specification for **CAST-IN-PLACE REINFORCED CONCRETE**.

The structure shall be supported with adequate falsework so as to maintain the lines and grades shown on the plans, and to maintain those lines and grades without movement, until the concrete has reached the strength as specified herein.

Care shall be taken in the placement of the concrete so as not to splash concrete on the control structure. All concrete splashed on the structure shall be cleaned off immediately, to the satisfaction of the Engineer.

Contractor shall install the bottom stoplog as shown on the plans. All other stoplogs, slide gates, tiedowns, lock, grating, railing, and assembly tools shall be removed from the control structure prior to installation of the control structure in the concrete base. All of these items shall be re-installed after completion of structure installation.

Falsework, chairs, or supportive devices used in supporting the control structure in the formwork, and to be permanently incorporated in the concrete shall be of the same material and shall be considered as reinforcement. All such falsework, chairs, and supportive devices shall be approved by the Engineer prior to installation. No supportive devices shall protrude from the finished surface of the concrete, unless approved by the Engineer.

Culvert assembly and installation shall be carried out in accordance with the specification for **CULVERT AND PIPE INSTALLATION**.

301.33 CONCRETE CONTROL STRUCTURE INSTALLATION

The Contractor shall compact the in-situ material below the base elevation prior to assembly and erection of the structure. This bed shall be fully leveled and compacted throughout the full width and length of the trench and to the exact grade as specified, so that the structure shall be uniformly and evenly supported across its footprint.

The control structure shall be set or cast-in-place to the lines and grades shown on the plans. Reinforcement, stoplog channels, gate bolts and other items to be cast-in-place shall be installed as called for on the plans. Falsework, chairs, or supportive devices to be permanently incorporated in the concrete shall be of the same material and shall be considered as reinforcement. All such falsework, chairs, and supportive devices shall be approved by the Engineer prior to installation. No supportive devices shall protrude from the finished surface of the concrete unless approved by the Engineer.

The structure shall be finished in accordance with the specification for **CAST-IN-PLACE REINFORCED CONCRETE** and once completed, slide gates, stoplogs, grating or railing as specified in the plans shall be installed.

Any culvert or inlet/outlet pipe to be used in conjunction with a pre-cast or cast-in-place concrete control structure shall be installed according to the specification for **CULVERT AND PIPE INSTALLATION**. That portion of the culvert, which is to be embedded in the concrete, shall have a 1/2" thick butyl or mastic gasket between the culvert and concrete. The gasket shall meet the requirements of ASTM D1056 for "RE" closed all grades while the mastic shall meet AASHTO M190 Type "A" specification.

301.34 BACKFILL

If, in the opinion of the Engineer, the site-excavated material is unsuitable for backfill, the Contractor shall supply, from an assigned borrow area, suitable impervious backfill material. No granular backfill will be allowed unless approved by the Engineer. The payment for supplying this impervious fill shall be considered incidental to the water control structure installation.

If no compaction is specified on the plans or in the specifications the Contractor shall compact the backfill to in-situ conditions or embankment compaction requirements whichever is greater.

Initial backfill shall be deposited in horizontal, uniform layers not exceeding six (6) inches in thickness before compaction, and each layer shall be thoroughly compacted throughout to ensure thorough tamping of backfill around the structure and under the haunches of the pipe stubs. This is to be achieved by hand compaction for a distance of two (2) feet from the structure. Hand compaction of fill material shall be accomplished by the application of motor driven hand tampers or other approved equipment in such a manner that every point of the surface of each layer will be compacted. Each layer will be inspected and approved by the Engineer prior to proceeding with the next layer of fill.

After the above initial backfilling has been completed and approved, the remaining backfill, consisting of suitable site material, shall be placed in layers not exceeding eight (8) inches before compaction. Each layer shall be compacted by mechanical means to a density equivalent to that of the surrounding unexcavated material. Each layer will be inspected and approved by the Engineer prior to proceeding with the next layer of backfill.

No boulders, rock, ice, snow, organic material, or debris shall be permitted in the trench. This material will be classified as unsuitable material and treated as such.

Compaction equipment or methods that produce horizontal or vertical earth pressures which may cause excessive displacements or which may damage the installation shall not be used.

Backfill shall be executed to the lines and grades shown on the plans and as specified herein. No separate measurement shall be made for backfill. Compensation shall be included as payment for water control structures.

301.35 APPURTENANCE INSTALLATION

Any appurtenances to be used in conjunction with a water control structure shall be installed according to the specification for **STRUCTURE AND CULVERT APPURTENANCES**.

301.40 QUALITY CONTROL

301.41 WORKMANSHIP AND MATERIALS

All workmanship and materials furnished and supplied under this specification are subject to close and systematic inspection and testing by the Engineer including all operations from the selection and production of materials through to final acceptance of the specified work. The Contractor shall be wholly responsible for the control of all operations incidental thereto, notwithstanding any inspection or approval that may have been previously given. The Engineer reserves the right to reject any materials or works, which are not in accordance with the requirements of this specification.

301.42 ACCESS

The Engineer shall be afforded full access for the inspection and control testing of materials, both at the site of work and at any plant or borrow pit used for the supply of the materials, to determine whether the materials are being supplied in accordance with this specification.

301.50 METHOD OF MEASUREMENT

Water control structure installation shall be measured on a unit basis. The unit shall be shown in the Unit Price Table of the Standard Bid Form for the pay item corresponding to this specification number. Water control structure installation shall be measured in the following manner:

1) Lump Sum (LS): Water control structure installation shall be measured on a lump sum basis of installed structure(s). No separate measurement of control structure(s) shall be made.
2) Each (EA): Water control structure installation shall be measured on an individual basis. Measurement shall be made for each structure installed.

No separate measurement shall be made for the excavation, installation, and removal of cofferdams, dewatering, backfill, compaction, assembly and installation of pipe unless otherwise noted on the plans. This work shall be considered incidental to the water control structure installation measurement described herein.

301.60 METHOD OF PAYMENT

The completed work for water control structures, measured as specified, shall be paid for at the contract unit price. The unit price bid for water control structures shall include the supply of all equipment, materials, labor and any other incidental items necessary to install water control structures as described in this specification and shown on the plans. No payment shall be made for dewatering or the control and drainage of surface/sub-surface water.

302 STRUCTURE AND CULVERT APPURTENANCES

302.10 DESCRIPTION

The work shall include the supply of all labor, materials, equipment and any other incidental item necessary to complete the installation of appurtenances associated with water control structures and culverts as called for on the plans and/or specified herein. These appurtenances include but are not limited to:

a) Covers, lids and trash racks for water control structures
b) Stoplogs for water control structures
c) Water control gates for structures or culverts
d) T-sections for culverts
e) Fish screens for water control structures
f) Locking rods
g) Lifting hooks

This work shall include the installation of the various appurtenances to the associated water control structure or culvert. Work shall include all hardware necessary to install the appurtenance per manufacturer's recommendations or as specified on the plans or herein.

302.20 MATERIALS

302.21 SUPPLY OF MATERIALS

Unless otherwise specified, the Contractor shall supply all required appurtenances and those accessories recommended by the material manufacturer or required to complete installation of the appurtenance. All appurtenances shall be constructed as shown on the plans.

Corrugated metal pipe appurtenances and anti-seep diaphragms shall be of the same design, material and gauge as the water control structure or culvert it is attached to unless otherwise shown on the plans.

All bolted connections shall utilize stainless steel bolts, nuts and washers, grade 18-8 or 304 or better.

With the exception of the water control gates, all appurtenances shall be of the same material and color as the associated water control structure unless otherwise specified on the plans or described herein. Painting of non-submerged steel components shall consist of one shop coat of zinc base primer with two coats of alkyd enamel flat paint to both sides of the material. All submerged steel components shall be painted or galvanized. Prior to painting, all components shall be cleaned free of rust and scaling. Painting of submerged components shall consist of 2 part epoxy finish Sherwin Williams Zinc Clad IV, parts B69 A 8 630-1147 and B69 V 8 630-1154 or equivalent as approved by the engineer.

302.22 HANDLING AND STORAGE OF MATERIALS

All materials shall be handled and stored in a careful and workmanlike manner to the satisfaction of the Engineer.

Any dents or damage caused by mishandling during transportation or installation shall not be allowed. The Contractor shall be responsible for replacement and reinstallation of damaged appurtenances at his/her own expense.

302.30 INSTALLATION

All appurtenances shall be installed per manufacturer's recommendations or as specified on the plans or herein. Water control gates shall be installed to provide a watertight seal with the culvert. The Contractor shall install the gate with all-necessary framework and hardware to allow efficient operation of the gate. Planking/grating, railing, and bracing shall be provided as shown on the plans or specified herein.

Anti-seep diaphragms and associated fittings shall be attached to the culvert at the stations shown on the plans. Diaphragms should be located midway between two adjacent seams or at least four feet from a field joint. Backfill operations shall be carried out as not to damage diaphragms.

302.40 QUALITY CONTROL

302.41 WORKMANSHIP AND MATERIALS

All workmanship and materials furnished and supplied under this specification are subject to close and systematic inspection and testing by the Engineer including all operations from selection and production of materials through the final acceptance of the specified work. The Contractor shall be wholly responsible for the control of all operations incidental thereto, notwithstanding any inspection or approval that may have been previously given. The Engineer reserves the right to reject any materials or works, which are not in accordance with the requirements of this specification.

302.42 ACCESS

The Engineer shall be afforded full access for the inspection and control testing of materials, both at the site of work and at any plant used for the supply of the materials, to determine whether the materials are being supplied in accordance with this specification.

302.50 METHOD OF MEASUREMENT

Appurtenances shall be measured on a unit basis. The unit shall be shown in the Unit Price Table of the Standard Bid Form for the pay item corresponding to this specification number. Appurtenances shall be measured in the following manner:

1) Incidental (INC): Supply and installation of the appurtenances shall be considered incidental to the construction and installation of the associated water control structure and no measurement shall be made. This shall apply when appurtenances is not listed on the Standard Bid Form.
2) Lump Sum (LS): Appurtenances shall be measured on a lump sum basis of installed appurtenances. No separate measurement shall be made for individual appurtenances.
3) Each (EA): Appurtenances shall be measured on an individual basis. Measurement shall be made for each appurtenance installed.

302.60 METHOD OF PAYMENT

The completed work for structure and culvert appurtenances, measured as specified, shall be paid for at the contract unit price. The unit price bid for structure and culvert appurtenances shall include supplying all materials, equipment, labor and any incidental items necessary to install appurtenances as described in this specification or shown on the plans.

303 CULVERT INSTALLATION

303.10 DESCRIPTION

The work of this section shall include the supply of all labor, materials and equipment required to complete the installation of all culverts with associated earthwork called for on the drawings and/or specified herein.

This work shall consist of excavation; cofferdams and dewatering; preparing the bed for the pipe; assembly of the pipe sections, installation of pipe sections; and backfill and compacting to the lines and grades shown on the drawings, as specified.

303.20 MATERIALS

303.21 SUPPLY OF MATERIALS

Unless otherwise specified, the Contractor will supply all materials necessary to complete the installation as shown on the plans or recommended by the material manufacturer.

All culverts and inlet and outlet pipes shall be of the diameter and length as shown on the plans. The pipe shall match the material and coating of the base riser unless otherwise specified on the plans. All materials supplied by the Contractor shall be subject to inspection by the Engineer.

The following specifications for each material type shall be adhered to.

1) Steel corrugated metal pipe. Where stated as acceptable on the plans, all steel CMP shall be made of galvanized or aluminized Type II steel. Galvanized steel corrugated metal pipe shall meet the composition requirements of AASHTO M218. The aluminized Type II steel shall conform to the requirements of AASHTO M274. Pipe shall be close riveted or of a "lock seam" construction. Unless otherwise specified all pipes shall have a 2 2/3" x 1/2" corrugation. The gauge of the pipe shall be as follows unless otherwise specified on the plans:

Pipe Diameter	2-2/3” x ½” Corrugations Metal Thickness	3” x 1” Corrugations Metal Thickness
12"-21"	16	NA
24"-36"	14	16
42"-54"	12	14
60"-96"	10	12

   a) Pipe made of galvanized or aluminized Type II steel shall be coated. This coating shall be a 10 mil polymeric film laminate or unless otherwise specified on the plans. The coatings shall be applied to both the inside and outside of the pipe. All spray coatings shall conform to AASHTO M243.

   b) All welds shall be 3/16” fillets unless otherwise specified on the plans and shall conform to the Welded Joint Requirements of the latest edition of the AISC Manual.

2) Where called for the plans, annular connecting bands shall be the same material and have the same coating, corrugations, and gauge as specified for the pipe that is to be connected.

   a) The connecting bands shall be either 24” in width or have a minimum of nine (9) corrugations. The minimum circumferential overlap shall be six (6) inches. If helical

pipe is used, then a minimum of four (4) re-rolled annular corrugations shall be reformed into annular corrugations to allow the use of 21 inch wide watertight annular overlapping connecting bands of the same gauge as the pipe. All bands shall have the same coating as the pipe and shall be installed using a 5X grade bituminous sealer at least ¼" thick over the entire pipe area to be banded.

b) A closed cell expanded gasket shall be used in conjunction with connecting band when called for on the plans. The gasket shall be at least 24" in width, 3/8" thick, with an unstretched diameter ten (10) percent less than normal pipe size and shall comply with ASTM D1056, Grade SCE-43. Mastic shall be placed on each side of the gasket.

c) The binders for the connecting bands will consist of a minimum of 6 rods and tank lugs, three (3) per side, in accordance with the plans. The minimum rod diameter shall be 7/16" with ½" threads. All rods and lugs shall be galvanized.

3) Aluminum corrugated metal pipe. The minimum acceptable series for aluminum CMP shall be 3000 Series. The material shall meet the requirements of AASHTO M197.

a) Pipe shall be close riveted or of a "lock seam" construction. Unless otherwise specified all pipes shall have a 2-2/3" x 1/2" corrugation. The gauge of the pipe shall be as follows unless otherwise specified on the plans:

Pipe Diameter	2-2/3" x ½" Corrugations Metal Thickness	3" x 1" Corrugations Metal Thickness
12"-21"	14	NA
24"-36"	12	14
42"-54"	10	12
60"-96"	8	10

b) All welds shall be 3/16" fillets unless otherwise specified on the plans and shall conform to the Welded Joint Requirements of the latest edition of the AISC Manual. All bolted connections shall utilize stainless steel bolts, nuts, and washers, grade 18-8 or 304 or better.

4) High Density Polyethylene (HDPE) Pipe. Where stated as acceptable on the plans, watertight HDPE pipe shall have a smooth interior and annular exterior corrugations. The pipe shall be approved by the Engineer and shall be of the length shown on the Plans.

a) The material shall meet the requirements of ASTM D3350 with a minimum cell classification 335420C.

b) The pipe shall incorporate a gasketed bell and spigot design. The gasket shall meet the requirements of ASTM F477 with a minimum watertight performance of 10.8 psi.

c) 12" to 48" HDPE pipe shall meet the requirements of AASHTO M294, Type S.

d) 54" and 60" HDPE pipe shall meet the requirements of AASHTO MP7.

e) 36" through 60" diameters shall have a reinforced bell and spigot. The gasket corrugation shall be reinforced with a closed cell structural foam core.

5) Pre-cast concrete pipe shall conform to the requirements of ASTM C443 for gasketed pressure pipe unless otherwise indicated on the plans. Pre-cast concrete box culverts shall conform to the requirements of ASTM C1433.

6) PVC pipe shall conform to the requirements of ASTM Designation: D 2241 and be joined by bell and spigot type connections. The belled portion of the pipe for use with rubber gaskets shall conform to the requirements of ASTM Designation: D 3139. The pipe joint shall be tightly

sealed against infiltration and exfiltration by means of a locked-in-rubber sealing ring. The connection shall also permit the thermal expansion or contraction of the pipe.

Fittings shall be either injection molded PVC plastic pipe fittings, conforming to the requirements of ASTM Designation: D 2466 or D 3139, or machined pipestock fittings conforming to the requirements of ASTM Designation: D 2241.

7) When called for on the plans, the Contractor shall supply to the site ready mix concrete, or site mix concrete in accordance with the specification for **CAST-IN-PLACE REINFORCED CONCRETE**. Forms, reinforcing steel or wire mesh, for the concrete pad for the control structure will be the responsibility of the Contractor. The installation of this concrete shall be considered incidental to the culvert installation and no separate measurement or payment shall be made for this work.

303.22 HANDLING AND STORAGE OF MATERIALS

All materials shall be handled and stored in careful and workmanlike manner to the satisfaction of the Engineer. Any dents or depressions as a result of storage and handling during transportation or installation shall not be allowed. The Contractor shall be responsible for replacement and reinstallation of the damaged pipe at his own expense.

303.30 CONSTRUCTION METHODS

303.31 CONTROL OF SURFACE/SUBSURFACE WATER

The Contractor is responsible for control of surface water, subsurface water, and drainage during the construction period. All temporary fills, crossings, and culverts necessary to promote drainage during construction will be installed and removed at the Contractor's expense prior to acceptance of the work. Any claims arising from upstream or downstream damages as a result of the construction or failure of these temporary works will be the Contractor’s responsibility.

It is the responsibility of the Contractor to control the surface and sub-surface water and drainage in any excavation area, dewatering placement area and borrow area. Should material quality lessen through inadequate drainage, the Contractor may be directed by the Engineer to construct drainage facilities at the Contractor’s expense.

303.32 EXCAVATION

The Contractor will be required to excavate the base to the lines of excavation and to a depth of the invert elevations as shown on the plans. Base excavation shall extend a minimum of three (3) feet or one pipe diameter, whichever is greater, beyond the ends and sides of the pipe, or pipes, and the excavation shall be transitioned to meet the existing channel slopes. If necessary, the excavation shall be dewatered in order to prevent disturbing the natural soil conditions at the base of the excavation and to allow the placing and compacting of the backfill material in the dry.

Cofferdams will be required for all excavations in active watercourse channels and in areas of ground water seepage. Cofferdams must be built to withstand all the forces to which they may be subjected and shall be located such as to give sufficient clearance for the construction of cutoff trenches and/or sump pits for dewatering unless otherwise provided. Cofferdam placement, maintenance and removal shall be the responsibility of the Contractor and shall be considered as incidental to the placement of the culvert.

Dewatering shall be accomplished by constructing cut-off trenches and sump pits around the outside perimeter of the pipe beds. These shall be excavated to a depth of no less than two (2) feet below the elevation of the base of the excavation. Trenches and sump pits shall be shored and braced with cribs as necessary. The Contractor will be required to provide sufficient pumping capacity to lower and maintain the ground water approximately one (l) foot below the base of excavation.

The excavated base shall be inspected by the Engineer prior to commencement of backfilling. If the Engineer deems further excavation to be required below the bottom of the excavation line shown on the plans and specified herein, the Contractor shall excavate such additional materials as directed by the Engineer. The work involved in doing this additional excavation will be classified as extra work and will be paid for as such.

The Contractor shall not over excavate below specified lines and grades. If, in the opinion of the Engineer, the Contractor over excavates material in an area, he shall replace at his expense the over excavated material with suitable site material and compact that material to a density equal to the surrounding in-situ material, or to the satisfaction of the Engineer.

Excavated material not required as backfill shall be classified as "surplus material" and will be dealt with as shown on the plans. Unless otherwise specified, disposal of surplus material shall be considered incidental to the bid item culvert and pipe installation.

No separate payment shall be made for excavation. Compensation shall be included as payment for the bid item culvert and pipe installation.

303.33 INSTALLATION OF AND ASSEMBLY OF CULVERTS

The Contractor, after preparation of the bed, shall assemble the pipe sections, progressively in accordance with the manufacturer's instructions or as directed by the Engineer.

Concrete pipe shall be laid with the groove end of each section upgrade and the sections shall be tightly joined. Lifting holes shall be plugged with a precast plug and sealed with mastic or grout. Concrete culvert sections shall be tied together with approved fastners and wrapped with a non-woven geotextile fabric.

All pipe supplied to the site shall be inspected prior to assembly, for chipping or damage in handling and shall be repaired as directed by the Engineer. Welding, drilling, bolting or otherwise attaching devices (temporary or permanent) to the structure to assist in structure installation is prohibited.

All materials damaged, distorted by more than five (5) percent of nominal dimensions, lost, broken or deemed unsuitable due to the Contractor's method of installation, handling or from neglect shall be replaced by the Contractor at his expense.

303.34 BACKFILL

All materials to be used for bed preparation and backfill will be suitable site material as approved by the Engineer. In the event that no suitable site material is available from designated borrow areas for the pipe installation, the Contractor shall supply suitable material from an approved borrow area. The payment for placing this fill will be classified as extra work and will be paid for as such. Material used for backfill from designated borrow areas will be installed per the details specified in the specification for **EMBANKMENT CONSTRUCTION**. No separate payment will be made for excavation and backfill.

The Contractor shall compact the in-situ material below the invert elevations prior to assembly and erection of the pipe. This bed shall be fully leveled and compacted throughout the full width and length

of the trench and to the exact grade as specified, so that the barrel of the pipe shall be uniformly and evenly supported throughout its entire length.

Initial backfill shall be deposited in horizontal, uniform layers not exceeding six (6) inches in thickness before compaction, and each layer shall be thoroughly compacted throughout to ensure thorough tamping of backfill under the haunches and around the pipe. This is to be achieved by hand compaction for a distance of two (2) feet from the pipe circumference. Hand compaction of fill material shall be accomplished by the application of motor driven hand tampers or other approved equipment in such a manner that every point of the surface of each layer will be compacted. Each layer will be inspected and approved by the Engineer prior to proceeding with the next layer of fill.

After the above initial backfilling has been completed and approved, the remaining backfill, consisting of suitable site material, shall be placed in layers not exceeding eight (8) inches before compaction. Each layer shall be compacted by mechanical means to a density equivalent to that of the surrounding unexcavated material. Each layer will be inspected and approved by the Engineer prior to proceeding with the next layer of backfill.

No boulders, rock, ice, snow, organic material or debris shall be permitted in the trench. This material will be classified as unsuitable material and treated as such.

Compaction equipment or methods that produce horizontal or vertical earth pressures which may cause excessive displacements or which may damage the installation shall not be used.

Backfill shall be executed to the lines and grades shown on the plans and as specified herein. No separate measurement shall be made for backfill. Compensation shall be included as payment for culvert and pipe installation.

303.35 ROAD SURFACE AT CULVERT CROSSING

Any road material removed as necessary for the installation of the culvert shall be replaced with material of the same quality to the width, depth, consistency and compaction of existing road on each side.

303.40 QUALITY CONTROL

303.41 WORKMANSHIP AND MATERIALS

All workmanship and materials furnished and supplied under this specification are subject to close and systematic inspection and testing by the Engineer including all operations, from the selection and production of materials, to final acceptance of the specified work. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or approval that may have been previously given. The Engineer reserves the right to reject any material or work that is not in accordance with the requirements of this specification.

303.42 ACCESS

The Engineer shall be afforded full access for the inspection and control testing of materials, both at the site of work and at any plant or borrow pit used for the supply of the materials, to determine whether the materials are being supplied in accordance with this specification.

303.50 METHOD OF MEASUREMENT

Culvert installation shall be measured on a unit basis. The unit shall be shown in the Unit Price Table of the Standard Bid Form for the pay item corresponding to this specification number. Culvert installation shall be measured in the following manner:

1) Incidental (INC): Supply and installation of the culverts shall be considered incidental to the construction and installation of the associated water control structure and no measurement shall be made. This shall apply when culvert installation is not listed on the Standard Bid Form.
2) Linear Feet (LF): Culvert installation shall be measured on a linear foot basis. The linear feet measured shall be the actual bottom length of an installed culvert size group. No measurement shall be made for couplers.
3) Each (EA): Culvert installation shall be measured on an individual basis. Measurement shall be made for each culvert installed.
4) Lump Sum (LS): Culvert installation shall be measured on a lump sum basis per size group of culvert placed. No measurement shall be made for linear feet of culvert installed.

No separate measurement shall be made for the excavation, installation and removal of cofferdams, dewatering, backfill, compaction, assembly and installation of pipe. This work shall be considered incidental to the culvert installation measurement described herein.

303.60 METHOD OF PAYMENT

The completed work for culvert and pipe installation, measured as specified, shall be paid for at the contract unit price. The unit price bid for culvert and pipe installation shall include supplying all materials, equipment, labor and any incidental items necessary for the installation of culverts as described in this specification. No payment shall be made for dewatering or the control and drainage of surface/sub-surface water.

304 CAST-IN-PLACE REINFORCED CONCRETE

304.10 DESCRIPTION

The work shall include the supply of all labor, materials, and equipment necessary to complete the construction of all cast-in-place concrete as shown on the plans and/or specified herein. The work shall include, but is not limited to the following:

a) Supply, erection and removal of all formwork

b) Supply and placement of reinforcement

c) Supply, placing and curing of concrete

d) Finishing of all concrete surfaces as specified

Unless otherwise specified herein or on the plans, the materials and work shall adhere to the requirements of the American Concrete Institute's "Specification for Structural Concrete", ACI 301-05.

304.20 MATERIALS

304.21 CEMENT

The cement shall be Portland Cement ANSI/ASTM C150, Type II A unless otherwise specified by or acceptable to the Engineer.

304.22 ADMIXTURES

All air-entraining agents shall conform to the specifications in ASTM C260. Use of calcium chloride shall not be allowed. Use of other admixtures shall only be allowed when approved by the Engineer. Approval will only be given when it is shown that the specified admixture will not affect the integrity of the concrete. Approved use of an admixture still requires concrete to meet specified slump, air and strength requirements.

304.23 WATER

Mixing water for concrete shall be fresh, clean, and potable.

304.24 AGGREGATES

Aggregates shall be free from dirt and organic material and shall meet the following gradation:

Aggregate Type	% Passing by Weight						
	1" Sieve	3/4" Sieve	1/2" Sieve	3/8" Sieve	#4 Sieve		
Coarse	100	90-100	20-55	0-15	0-5		
	3/8" Sieve	#4 Sieve	#8 Sieve	#16 Sieve	#30 Sieve	#50 Sieve	#100 Sieve
Fine	100	95-100	80-100	50-85	25-60	10-30	2-10

Aggregates will be inspected and approved by the Engineer prior to use.

304.25 REINFORCING STEEL

Reinforcing steel, except as otherwise specified, shall be deformed bars rolled from new billet stock, and shall conform to the requirements of ASTM A615, Grade 60. Sizes, details and locations of bars shall be as shown on the drawings and as may be specified herein.

All reinforcing steel shall be free of all dirt, scale, oil, grease, and other coating that may reduce bonding to concrete. The required reinforcing shall be of the size and grade specified on the plans.

304.26 STORAGE AND HANDLING OF MATERIALS

Cement shall be stored off the ground in a dry location at all times.

Aggregates shall be stored separately in a manner that will prevent segregating, mixing, and intrusions of foreign materials.

Reinforcement shall be stored on skids or racks off the ground.

304.30 CONSTRUCTION METHODS

All excavation and backfill associated with concrete structures shall be conducted in accordance with the specification for **EXCAVATION** and the specification for **WATER CONTROL STRUCTURES**.

304.31 WORKMANSHIP

Work shall be supervised by a competent foreman at all times and shall be performed by skilled and experienced workmen.

304.32 MIX REQUIREMENTS

All concrete shall be either site mix or ready-mix to achieve a 4,000 psi 28 day compressive strength, a 1 to 4 inch slump, and 4 to 6 percent air entrainment.

For the installation of corrugated metal pipe risers as described in the specification for **WATER CONTROL STRUCTURES**, the concrete used to pour the base shall have the following design mix:

PER CUBIC YARD DESIGN MIX

6 bags cement (Portland Cement ANSI/ASTM C150, Type IIA, 94 lb. ea.)

36 gallons water (adjust for moisture in aggregate)

2875 pounds of aggregates (38% fine aggregate)

Unless otherwise noted the Contractor shall submit a concrete mix design to the Engineer for all other concrete used in construction prior to the pouring of that concrete. Acceptance of this design by the Engineer does not relieve the Contractor's responsibility to meet above strength, slump or air requirements.

304.33 MIXING AND PLACING

The Contractor shall notify the Engineer two working days in advance of any concrete pour. This advance notice will allow the Engineer to schedule the concrete testing and inspection services. No concrete shall be poured without notification or approval of the Engineer.

Concrete shall be mixed only in quantities required for immediate use. Mixing procedures shall be approved by the Engineer prior to commencement. Water may be added on site by the Contractor as needed as long as slump and air requirements are met. Failure to adhere to these requirements may result in rejection of that batch. The minimum mixing time for all site batch mixes shall be 10 minutes and 75 revolutions for all mixes delivered by transit mixers. No concrete shall be placed in forms after mixing longer than 1-1/2 hours.

The concrete temperature shall be maintained between 50^{o}F to 90^{o}F during all phases of mixing and placement. When weather conditions will affect the concrete temperature it shall be kept within the stated range by methods approved by the Engineer.

Cold weather concreting procedures shall include but will not necessarily be limited to; preheating of forms and subgrade prior to pouring, heating of poured concrete for a minimum of 5 days and adequate protection of poured concrete during curing. Preheating of forms and subgrade as well as poured concrete shall be done in a manner to maintain temperatures between 50^{o}F and 90^{o}F. All procedures shall be outlined to the Engineer for approval prior to any concrete pour.

Hot weather concreting procedures shall include but will not necessarily be limited to; temperature control of concrete materials, wetting of subgrade, forms, and reinforcement prior to concrete placement and moist curing of poured concrete. All procedures shall be outlined to the Engineer for approval prior to any concrete pour.

Formwork, falsework, and reinforcing shall be inspected and approved by the Engineer prior to concrete placement. Earth surfaces shall be firm, moist, contain no frost or ice, and be free of debris. All formwork shall be oiled or moistened prior to concrete placement.

All reinforcement shall be accurately placed to the dimensions shown on the drawings and shall be secured in place by bar supports, spacers, chairs, wiring and nails. No welding of reinforcement shall be allowed. Bars shall be located so as to have the minimum concrete cover as shown on the drawings. Unless otherwise specified, the minimum cover when cast against earth shall be three inches at all times.

Where not otherwise shown or specified, bars in tension shall be lapped 36 diameters and bars in compression 24 diameters, but not less than twelve (12) inches in either case.

Bar supports and spacers shall be of steel or plastic and of suitable design and strength to hold the reinforcement accurately in place before and during the placing of concrete.

Footing reinforcement shall be supported on hychairs set on concrete blocks whose top surface is flush with the subgrade, or hung from supports above the forms with sufficient steel hangers. Steel in slabs on the ground shall be supported on hychairs to ensure its proper position in the slab. Hychairs shall be set on concrete bricks or concrete blocks whose top surface is flush with the subgrade surface.

Shop drawings and reinforcing bar shop lists shall be submitted for approval by the Engineer prior to any pour.

Concrete shall be placed by hand, buggy, trough or suitable placement method. Concrete shall not be allowed to freefall more than five feet. Concrete shall be handworked or mechanically vibrated to achieve a dense, homogenous, structure free of cold joints and honeycombing. If cold joints are necessary in pouring a structure the Contractor shall install waterstops at all such joints. All exposed edges shall be chamfered as shown on the plans. All exposed concrete not in forms shall be sealed or closed by giving these areas a float finish prior to the final broom finish.

Formwork shall not be removed until the concrete has hardened adequately to prevent surface damage and support applied loads. Forms shall remain on poured structures a minimum of 3 days unless otherwise directed by the Engineer. For cold weather concrete pours, forms shall remain on poured structures for a minimum of 5 days, unless otherwise directed by the Engineer. Under no circumstances shall backfilling occur prior to the minimum required days listed above.

304.34 FINISHING

All minor surface defects, small honeycomb areas, or broken edges shall be repaired using a drypack mortar consisting of 1 part cement and 2-1/2 parts of fine sand. Exposed steel forming ties shall be removed to a depth of one (l) inch below the planned concrete surface and the surface defect repaired with a dry pack mortar. All repairs shall be done in an efficient and timely manner after formwork is removed. Any necessary repairs shall be made prior to application of the concrete finish coat.

All exposed concrete surfaces shall have a grout cleaned or sack rubbed finish per ACI 301-05 or have two (2) coats of a cement-based waterproofing finish, approved by the Engineer, applied. This finish shall extend to a minimum of six (6) inches below the finished backfill lines.

Concrete shall be cured by means of waterproof paper, polyethylene or placement compound. Curing treatment shall be applied after concrete surfaces are finished.

304.35 TESTING

Unless otherwise specified, the Engineer or Engineer's representative will perform concrete testing during the course of the work to determine if specifications have been met. Testing shall include slump and air content measurements. Failure to meet specified requirements will mean rejection of that batch. In addition, four cylinders shall be made for compressive strength tests. Cylinders shall be taken randomly during a pour. Until notification by the Engineer, all cylinders shall be stored as close to the placed concrete as possible and covered from, or exposed to, the elements in the same manner as the placed concrete.

One cylinder shall be tested at 7 days and two at 28 days to determine the compressive strength. If either of the 28-day specimens fails to achieve 4000 psi, the fourth cylinder will be tested at 56 days and must achieve 4000 psi. If both cylinders achieve 4000 psi at 28 days, the fourth cylinder may be discarded. Failure of a cylinder to meet the specified strength for any pour shall require the removal of the concrete. In the event that the concrete does not meet the required strength, the Contractor may attempt to show that the placed concrete meets the specifications. This would require that the Contractor, at their own expense, hire a private, licensed concrete testing firm to perform an in-situ test. The firm and the method must be approved by the Engineer.

304.40 METHOD OF MEASUREMENT

Reinforced concrete shall be measured on a unit basis. The unit shall be shown in the Unit Price Table of the Standard Bid Form for the pay item corresponding to this specification number. Reinforced concrete shall be measured in the following manner:

1) Lump Sum (LS): Reinforced concrete shall be measured on a lump sum basis of placed concrete. No separate measurement of volume shall be made.
2) Cubic Yards-Plan Quantity (CY-P): Reinforced concrete shall be measured on a plan quantity basis. The quantity shall be the neat line volume of placed concrete calculated from the construction plans.

3) Cubic Yards (CY): Reinforced concrete shall be measured on a volume basis. The volume shall be the actual number of cubic yards of concrete placed. The volume shall be measured in the field using load tickets from the concrete supplier. No measurement for excess or wasted concrete shall be made.

No separate measurement will be made for reinforced concrete placed as a base for water control structures. The concrete shall be considered incidental to those bid items.

304.50 METHOD OF PAYMENT

The completed work for cast-in-place reinforced concrete, measured as specified, shall be paid for at the contract unit price. The unit price bid for cast-in-place reinforced concrete shall include supplying all materials, equipment, labor and any incidental items necessary for performing all concrete installation operations described in this specification.

305 RIPRAP, REVETMENT & AGGREGATE PLACEMENT

305.10 DESCRIPTION

This work shall consist of supply and placement of rock riprap, filterstone, concrete revetment or other aggregate as protective covering along the side slopes, bases of channels, slopes around culverts, and on embankments or such other places as may be indicated on the plans, as specified herein, or as directed by the Engineer.

305.20 MATERIALS

305.21 BEDDING MATERIAL

Where called for on the plans and unless otherwise specified, material used for bedding shall be well-graded sand and gravel with the following gradation:

Percent (%) Passing by Weight				
3" Sieve	1" Sieve	1/2" Sieve	#4 Sieve	#100 Sieve
100	75-85	45-65	15-35	0-15

The bedding material shall be from a source approved by the Engineer.

305.22 FILTER FABRIC

Unless otherwise specified, filter fabric shall be utilized, and considered incidental, in the installation of all riprap and revetment. The filter fabric shall be a nonwoven polyester or polypropylene geotextile. This geotextile shall have a minimum grab tensile strength of 150 pounds as determined by ASTM D4632. The geotextile shall have a maximum opening size equivalent to a #70 U.S. standard sieve.

The contractor shall supply all pins and other items necessary to fasten the filter fabric to the ground so it will not slide or form gaps when placing rock riprap.

All materials shall be handled and stored in a careful and workmen-like manner to the satisfaction of the engineer.

For concrete revetment, the geotextile shall be bonded to the base of the concrete block mats with an overlap of two to three feet incorporated on one end and one side adjacent to each other.

305.23 RIPRAP

The contractor shall supply rock, which will consist of fieldstone or rough, unhewn quarry rock. Stone containing shale, sandstone, or other material that will disintegrate readily shall not be used. Class designations shall be based on the following gradations:

Riprap Class	Percent of Total Weight Smaller Than Given Size						
	30"	24"	18"	12"	9"	6"	3"
Class I	100	100	100	100	100	35-80	0-20
Class II	100	100	100	50-75	10-50	0-10	
Class III	100	100	50-75	10-50	0-10		
Class IV	100	85-100	60-80	20-40		0-20	

If the rock riprap class designation is not specified on the construction plans, CLASS I rock riprap shall be acceptable. The rock shall be approved by the Engineer prior to installation.

305.24 CONCRETE BLOCK REVETMENT

Concrete block revetment systems shall be supplied in a manner that meets the requirements as specified on the plans. Unless otherwise specified, the concrete shall be in accordance with the specification for **CAST-IN-PLACE REINFORCED CONCRETE.** The cables shall be stainless steel aircraft cable of Type 302 or 304 stainless and of Type 1 x 19 construction. Stainless steel clamps of the type and number recommended by the revetment manufacturer shall be provided. Anchors shall be provided in accordance with the manufacturer's recommendations.

305.25 OTHER AGGREGATE

Any other aggregate as called for on the plans shall be supplied in a manner that meets the gradation as specified on the plans. The rock shall be approved by the Engineer prior to installation.

305.30 CONSTRUCTION METHODS

305.31 SUBGRADE PREPARATION

The areas on which the rock, revetment or other aggregate is to be placed shall be graded to the lines shown on the plans. The soil surface shall be smooth and free from any obstructions to provide adequate contact area between the soil and the bedding material or filter fabric.

305.32 BEDDING MATERIAL

When called for on the plans, a six (6) inch layer of bedding material shall be placed as shown prior to the placing of any riprap or revetment.

305.33 FILTER FABRIC

The filter fabric shall be placed under all riprap in such a way that there is adequate contact area between the soil and the fabric. Installation shall start on the downstream end of the slope. Pins shall be installed to prevent the filter fabric from sliding or forming gaps during installation of the filter material and placement of the rock riprap.

When filter fabric is to be placed on a slope, an anchor trench shall be constructed on the top of the slope and a toe trench shall be constructed on the lower end of the installation. The trenches shall be perpendicular to the slope and must be at least one foot wide and one foot deep. The filter fabric shall be placed in the anchor trench and the toe trench. The trenches shall be backfilled and compacted to adequately anchor the filter fabric.

Where a seam is needed to provide a continuous coverage of the filter fabric, the two pieces of filter material shall be overlapped a minimum of two feet. Pins shall be placed in the overlap area to prevent slipping during placement of the filter material and rock riprap.

Great care shall be taken to protect the filter fabric from damage either from the wheels or tracks or any sliding caused by the equipment.

The fabric shall not be exposed to the sun for more than seven days. If the fabric meets the requirements of ASTM D4255, less than 30% strength loss at 500 hours, the maximum exposure shall be 30 days.

305.34 RIPRAP

Riprap shall be placed by equipment capable of controlling the drop of the rock riprap. The maximum drop of the rock shall be three (3) feet. Pushing or rolling rocks over the geotextile will not be allowed. Placement will be in such a manner that the smaller stones will be uniformly distributed throughout the mass. Sufficient handwork shall be done to provide a neat and uniform surface, with the depth being specified herein and as shown on the plans. The surface may not vary from the theoretical surface by more than 4" at any point for riprap, unless otherwise specified.

305.35 CONCRETE BLOCK REVETMENT

The concrete revetment mats shall be laid from the downstream end of the project to the upstream end to ensure the geotextile joints are shingled to direct flow over the joint and prevent undermining. The gaps between each mat shall not be greater than two (2) inches or they shall be filled using a grout mixture as recommended by the manufacturer. The outside edges of the mat system shall be entrenched and buried at least one block into the ground. After installation of the mat system, the top surface shall be covered with topsoil and seeded, if specified on the plans.

305.36 OTHER AGGREGATE

Upon completion and approval of the subgrade preparation by the Engineer, the aggregate shall be placed and compacted on the prepared subgrade to the dimensions shown on the plans. The location and method of placement shall be shown on the plans. Equipment used for placement operations shall be approved by the Engineer.

305.40 METHOD OF MEASUREMENT

Riprap, revetment and aggregate placement shall be measured on a unit basis. The unit shall be shown in the Unit Price Table of the Standard Bid Form for the pay item corresponding to this specification number. Riprap, revetment and aggregate placement shall be measured in the following manner:

1) Lump Sum (LS): Riprap revetment and aggregate placement shall be measured on a lump sum basis of placed riprap. No measurement for volume or weight shall be made.
2) Square Yard (SY): Riprap, revetment and aggregate placement shall be measured on a square yard basis. The quantity shall be the neat line measured quantity of the finished surface completed and accepted in-place, at the specified thickness. No separate measurement shall be made for excess riprap or aggregate.
3) Cubic Yard - Plan (CY-P): Riprap and aggregate placement shall be measured on a cubic yard-plan basis. The quantity shall be the neat line quantity of installed riprap material calculated from the construction plans. No separate measurement shall be made for excess riprap or aggregate.
4) Ton (TN): Riprap and aggregate placement shall be measured on a ton basis. The measurement shall be made by the collection of weight tickets from the supplier and shall be based on the short ton. Measurement shall be based on the actual amount of placed riprap or other aggregate. No measurement shall be made for excess rock.

No separate measurement shall be made for the filter fabric or bedding material used in the riprap placement. The supply and installation of these materials shall be considered incidental to the riprap placement.

305.50 METHOD OF PAYMENT

The completed work for riprap, revetment and aggregate placement, measured as specified, shall be paid for at the contract unit price. The unit price bid for riprap, revetment and aggregate placement shall include supplying all materials, equipment, labor, and any incidental items necessary for performing all riprap and aggregate installation operations described in this specification.

306 TOE DRAIN INSTALLATION

306.10 DESCRIPTION

The work shall include the supply of all labor, materials, and equipment necessary to complete the toe drain installation as shown on the plans and/or specified herein. The work may include, but is not limited to:

a) Trench excavation

b) Supplying and installing a drainage medium

c) Supplying and installing geotextile fabric, pipe and fittings

306.20 MATERIALS

306.21 DRAINAGE MEDIUM

The drainage medium shall be filter sand meeting the gradation requirements of ASTM C33 - Concrete Sand Gradation Requirements:

% Passing by Weight					
3/8" Sieve	#4 Sieve	#16 Sieve	#50 Sieve	#100 Sieve	#200 Sieve
100	95-100	45-80	10-30	2-10	Less than 5

306.22 PIPE & FITTINGS

The collector pipe shall be perforated polyvinyl chloride (PVC) pipe with a geotextile wrap as described below. The discharge pipe shall be non-perforated PVC pipe. The collector and discharge pipe shall meet the requirements of AASHTO M278.

306.23 GEOTEXTILE FABRIC

The filter fabric shall be a nonwoven polyester or polypropylene geotextile. This geotextile shall have a minimum grab tensile strength of 90 pounds as determined by ASTM D1682. The geotextile shall have an equivalent opening size between a #40 - #100 U.S. standard sieve.

The fabric shall not be exposed to the sun for more than seven days. If the fabric meets the requirements of ASTM D4255, less than 30% strength loss at 500 hours, the maximum exposure shall be 30 days.

306.30 METHOD OF CONSTRUCTION

306.31 TRENCH EXCAVATION

The trench shall be excavated to the dimensions and elevation shown on the plans by a method approved by the Engineer. Where excavations shall be carried out through soft or saturated soil conditions, bracing and shoring of the trench, excavating flatter side slopes, or other method of stabilizing the side slopes may be necessary. In no instance shall the trench remain open at the end of a working day.

306.32 DRAINAGE MEDIUM

The filter sand used as a drainage medium shall be placed in the loose lifts not greater than 12" and compacted to a minimum relative density of 70% as determined by ASTM D4253 and ASTM D4254. A drainage medium is only required for the collector pipe.

306.33 COVER MATERIAL

Material placed over the drainage medium shall be designated on the plans and compacted as required in the construction specification for that material.

306.34 COLLECTION AND DISCHARGE PIPE

The collection and discharge pipe shall be installed in the excavated trench on stable material. If material stability is questionable the Engineer will require coarse material placed as a foundation for the pipe. Backfill material shall be embankment material compacted to 95% of standard proctor.

306.40 METHOD OF MEASUREMENT

Toe drain installation shall be measured on a unit basis. The unit shall be shown in the Unit Price Table of the Standard Bid Form for the pay item corresponding to this specification number. Toe drain installation shall be measured in the following manner:

1) Lump Sum (LS): Toe drain installation shall be measured on a lump sum basis of installed toe drain. No separate measurement shall be made for trench excavation, drainage medium, or collection and discharge pipe.
2) TRENCH - Linear Feet (LF): Trench excavation shall be measured on a linear foot basis. The quantity shall be the actual linear feet of trench excavation parallel to the embankment. No measurement for volume of material excavated or excess trench excavation shall be made.
3) DRAINAGE MEDIUM
    a) Lump Sum (LS): Drainage medium shall be measured on a lump sum basis of installed medium. No separate measurement shall be made for volume of medium used or excess drainage medium.
    b) Cubic Yards - Plan Quantity (CY-P): Drainage medium shall be measured on a plan quantity basis. The quantity shall be the neat line cubic yard measurement of installed drainage medium. No measurement shall be made for drainage medium installed above and beyond the lines and grades shown on the construction plans.
4) PIPE - Linear Feet (LF): Pipe shall be measured on a linear foot basis. The quantity shall be the actual linear feet of installed pipe parallel and perpendicular to the embankment. No measurement for excess pipe material shall be made.

306.50 METHOD OF PAYMENT

The completed work for toe drain installation, measured as specified, shall be paid for at the contract unit price. The unit price bid for toe drain installation shall include supplying all materials, equipment, labor and any incidental items necessary for performing all toe drain installation operations described in this specification. No payment shall be made for dewatering or the control and drainage of surface/sub-surface water. No payment for excavation of suitable material will be made when excavating in a designated borrow area to obtain material that is to be placed, measured and paid in accordance with the specification for **EMBANKMENT CONSTRUCTION.**

307 SHEET PILING

307.10 DESCRIPTION

The work in this section shall consist of furnishing and installing the specified kinds and types of sheet piling at the location(s) shown on the plans. This shall include the furnishing of all labor, materials, tools, equipment, transportation, and any incidental items required to provide and install the sheet piling. This shall also include delivery of the sheet piling to the project site and removal of excess sheet piling from the project site.

307.20 MATERIALS

Sheet pile material shall be made of new, standard ASTM A36 grade steel, and be of the sections shown or specified on the plans. Alternate sheet piling may be used if approved by the Engineer and if it has a thickness and section modulus equal or greater than that specified on the plans. The sides of each piling shall be furnished with an interlock that is continuous for the full length of the pile. The interlock shall have an opening of sufficient width to allow free slippage of the adjoining sheet pile.

Sheet pile dimensions and weight variations shall be within the tolerances as shown on the plans. Unacceptable sheet pile shall not be driven.

A sufficient amount of sheet piling shall be provided to construct a structure of the dimensions shown on the plans. If an alternate sheet pile section is approved for use by the Engineer, then structure width dimensions may vary slightly. This variance (plus or minus) may not equal more than one section width of the original specified section. In addition, it is the Contractor's responsibility to ensure that the specified structural steel will fit the alternate sheet piling.

307.30 SHIPPING

Sheet pile material shall be obtained and supplied to the project site in a timely manner. Piling shall be handled in such a manner as to ensure no injury to the pile.

307.40 DRIVING

307.41 EQUIPMENT

The Contractor shall provide the necessary driving equipment that is capable of driving the specified sheet pile to the depth and alignment shown based on the soils information provided and knowledge of equipment capability.

Driving hammers may be drop, single acting, double acting, diesel, vibratory, or as approved by the Engineer. Drop hammers shall weigh between 1000-3000 lbs. with drops of 12 to 48 inches. Single acting, double acting and diesel hammers shall develop at least 7000 ft-lbs. with ram weights of at least 1400 lbs. Vibratory hammers shall be at least 40 hp and capable of driving at a minimum of 1000 vpm. Regardless of the type of hammer utilized, the energy developed by the hammer shall be of sufficient energy to adequately drive the sheet pile without damaging it.

Pile driver leads shall be of a type that will hold the pile and pile hammer in proper alignment during the driving operations and shall be long enough to preclude the necessity for the use of punches or chasers.

Leads for drop hammers shall be steel or steel shod. Generally, the recommendations of the pile hammer manufacturer shall be followed with respect to pile leads.

Piles shall be protected at all times from damage during driving. This shall include but is not limited to the use of suitable caps, rings, heads, blocks, and mandrels. A driving cap shall be used at all times and the heads of the steel piles shall be cut square to accept this cap. It will be the Contractor's responsibility to provide those items (driving heads, mandrels, etc.) necessary to drive special types of piles per pile manufacturer's recommendations.

307.42 DRIVING

The contractor will be required to provide the engineer a 24-hr. notification prior to the commencement of driving sheet pile. The piling shall be driven in such a manner as to ensure perfect interlocking throughout the entire length of each pile. The piles shall be held in proper alignment during driving by means of assembling frames or other suitable temporary guide structures. Temporary guide structures shall be removed when they have served their purpose. Pre-excavation or trenching shall not be allowed.

All piles shall be driven to the depth shown or specified on the plans unless directed by the Engineer in the field. If a pile hits refusal prior to reaching the required depth and can no longer be driven without damage to the pile or driving it out of alignment then driving of the pile shall cease. Refusal shall be determined by inability of driving equipment to drive a pile more than one inch with four blows of the driving hammer operating at normal capacity. If a pile is starting to deform or move out of alignment prior to determining if it has hit refusal then driving shall also cease.

If it appears that a pile has encountered a boulder or some other obstruction within the first five feet of driving then the pile shall be pulled and the area excavated. The obstruction shall be removed if possible with the excavation backfilled and compacted prior to re-driving of the pile. If the obstruction cannot be removed then the excavation shall be backfilled and re-compacted with the pile re-driven to the obstruction unless the Engineer directs otherwise. In all cases of refusal the undriven portion of sheet pile shall be cut at shown or specified elevations and saved on site for inspection and measurement by the Engineer prior to removal of this material from the site by the Contractor.

Under no circumstances shall the top of the pile vary from the design centerline alignment by more than one inch (horizontal or vertical).

307.43 PILE CUTOFF

The Contractor shall cut the piles off at the elevations shown or specified on the plans. The head of each pile, after cutoff, shall be sound, undamaged material. The length of cutoff shall be sufficient to permit the removal of all damaged material.

307.44 DEFECTIVE PILES

Any pile damaged, driven out of its proper location, driven below the specified cutoff elevation or inaccurately cut off shall be corrected by one of the following methods, whichever is approved by the Engineer in the field.

a) The defective pile shall be pulled and replaced or re-driven.

b) A new pile shall be driven adjacent to the defective pile.

c) The defective pile shall be spliced or built up or a sufficient portion of the footing shall be extended to properly embed the pile.

All piles pushed up due to the driving of adjacent piles or by any other cause shall be driven down again to their specified elevation. Any sheet pile ruptured in the interlock, or otherwise damaged during driving, shall be pulled and replaced.

307.45 CORRECTIVE SURFACE HEAVE

Any excess material resulting from displacement of earth by pile driving shall be removed. Materials disturbed by pile driving shall be reconditioned and compacted to a density equal to that of the adjacent undisturbed material.

307.50 METHOD OF MEASUREMENT

Sheet piling shall be measured on a unit basis. The unit shall be shown in the Unit Price Table of the Standard Bid Form for the pay item corresponding to this specification number. Sheet piling shall be measured in the following manner:

1) Lump Sum (LS): Sheet piling materials and/or installation shall be measured on a lump sum basis of furnished and installed sheet pile material. No separate measurement shall be made for square feet of sheet pile material installed.
2) Square Feet - Plan Quantity (SF-P): Sheet piling materials and/or installation shall be measured on a plan quantity basis. The quantity shall be the neat line square feet of sheet pile material furnished and installed to design depths as measured from the construction plans.

The measurement for sheet piling installation shall be reduced for that amount of sheet pile material not driven to design depths. No separate measurement shall be made for installation of sheet pile material driven past design depths.

307.60 METHOD OF PAYMENT

The completed work for sheet piling materials and installation, measured as specified, shall be paid for at the contract unit price. The unit price bid for sheet piling materials and installation shall include supplying all materials, equipment, labor and any incidental items necessary for performing all sheet pile operations described in this specification or shown the plans.

308 STEEL PILING

308.10 DESCRIPTION

The work shall consist of furnishing all labor, materials, tools, equipment and any incidental items necessary to drive steel piling as called for on the plans. Any non-driven piling shall be structural steel and paid for as such.

308.20 MATERIALS

All steel piles shall be made of ASTM A36 structural steel. Steel piles shall consist of shapes of the section provided on the plans or approved by the Engineer.

308.30 CONSTRUCTION METHODS

308.31 HANDLING

Piling shall be handled in such a manner as to ensure no injury to the pile.

308.32 EQUIPMENT FOR DRIVING

The pile hammer selected for a particular job shall conform to the minimum ram weight and energy requirements specified as follows:

	Gravity Hammers	Power Driven Hammers	
	Min. Weight	Min. Ram Weight	Energy
Pile Length	(lbs.)	(lbs.)	(ft-lbs.)
Less than 50 ft.	2,400	1,500	7,000

a) If a gravity hammer is used for driving, it is preferable to use a heavy hammer and operate with a short drop. The maximum height of a drop shall be ten feet.

b) The Contractor shall furnish the Engineer with the manufacturer's specifications and catalog for all steam or air hammers used, showing all data necessary for computing the bearing value of piles driven. Gravity or drop hammers shall be weighed in the presence of the Engineer, or a certificate of weight shall be furnished to the Engineer. Hammers so weighed shall have the exact weight stamped on them.

When necessary to protect the pile against damage during the driving, the top of the pile shall be equipped with a driving cap of adequate size and type. A shock block of approved type and size shall also be used on the upper side of the driving cap, when necessary. Generally, the recommendations of the pile hammer manufacturer shall be followed with respect to driving caps and shock blocks.

Pile driver leads shall be of a type that will hold the pile and pile hammer in proper alignment during the driving operations, and shall be long enough to preclude the necessity for the use of punches or chasers.

Leads for drop hammers shall be steel or steel shod. Generally, the recommendations of the pile hammer manufacturer shall be followed with respect to pile driver leads.

308.33 DRIVING

The Contractor shall notify the Engineer two working days in advance before beginning any pile driving operations and shall provide the necessary cooperation for determining the bearing capacity. This advance notice will allow the Engineer to schedule any testing and inspection services. No piles shall be driven without notification or approval of the Engineer.

In order to reach minimum depth, and if approved by the Engineer, water jetting and/or pre-boring shall be done. Pre-boring may be done with a power auger and/or steel mandrel (spud).

All piles shall be installed full length to plan alignments and grades.

308.34 PILE CUTOFF

After being driven the piles shall be cut off at the elevations shown on the plans. The head of each pile, after cutoff has been made, shall be sound, undamaged material. When a cap is used, the top of each pile shall be cut off so as to provide uniform bearing for the cap without the use of shims or fills.

308.35 DEFECTIVE PILES

Any pile damaged, driven out of its proper location, driven below the specified cutoff elevation or inaccurately cut off shall be corrected by one of the following methods, whichever is approved by the Engineer in the field.

a) The defective pile shall be pulled and replaced or re-driven.

b) A new pile shall be driven adjacent to the defective pile.

c) The defective pile shall be spliced or built up or a sufficient portion of the footing extended to properly embed the pile.

All piles pushed up by the driving of adjacent piles or by any other cause shall be driven down again to their specified elevation.

308.40 PILE PERFORMANCE

Substantial refusal shall be considered to be a penetration of 1/8” per blow. The piles shall be driven to substantial refusal or to the bottom tip elevation shown on the plans, whichever comes first. Where a bearing is specified on the plans, the pile shall be driven to that bearing or substantial refusal, whichever comes first.

FORMULAS FOR DETERMINING APPROXIMATE BEARING CAPACITIES

1) Gravity hammers

$$P = \frac{3WH}{S + 0.5} \times \frac{W + 0.1}{W + M}$$

2) Power-driven hammers (Timber piles)

$$P = \frac{3.5E}{S + 0.2} \times \frac{W + 0.1M}{W + M}$$

3) Power-driven hammers (Steel H-Piles)

$$P = \frac{3.5E}{S + 0.2} \times \frac{W + 0.2M}{W + M}$$

WHERE:

P= Safe bearing capacity in pounds.
W= Weight of the striking part of hammer in pounds.
H= Height of fall in feet.
E = W x H for single acting steam hammers; it also equals the foot-pounds of energy per blow for each full stroke of either single acting or double acting hammers as given by the manufacturer's rating for the speed at which the hammer operates.
S= Average penetration in inches per blow for the last five blows for the gravity hammers and for the last ten blows for the power driven hammers.
M= Total weight of pile plus weight of the driving cap.

These formulas will apply when:

a) The gravity hammer has free fall.
b) The height of the fall of gravity hammer will produce energy per blow of between 28,000 and 36,000
c) The head of the pile is free from broomed or crushed fiber.
d) The penetration of the pile is at a reasonably uniform rate.
e) There is not noticeable bounce after the blow. When there is noticeable bounce, twice its height shall be deducted from H to determine the value of the H formula.

308.50 METHOD OF MEASUREMENT

Steel piling shall be measured on a unit basis. The unit shall be shown in the Unit Price Table of the Standard Bid Form for the pay item corresponding to this specification number. Steel Piling shall be measured in the following manner:

1) Lump Sum (LS): Steel piling shall be measured on a lump sum basis of furnished and installed steel piles. No separate measurement shall be made for linear feet of steel piling furnished and installed.

2) Linear Feet-Plan Quantity (LF-P): Steel piling shall be paid on a plan quantity basis. The quantity shall be the neat line linear feet of steel piling furnished and installed as measured from the construction plans. No separate measurement shall be made for excess steel piles ordered to assist in driving operations.

No separate measurement shall be made for steel piles furnished and installed below design depths.

308.60 METHOD OF PAYMENT

The completed work for steel piling, measured as specified, shall be paid for at the contract unit price. The unit price bid for steel piling shall include supplying all materials, equipment, labor, and any incidental items necessary for performing all steel piling operations described in this specification or shown on the plans.

309 STRUCTURAL STEEL

309.10 DESCRIPTION

The work of this section will cover the fabrications, supply and placement of the structural steel portions of the project. The work shall consist of supplying all labor, materials and equipment required to furnish and install catwalk, catwalk frame, stoplog channels, bracing, grating and sheet piling cap, all non driven H-pile, and all other structural steel frames shown on the plans.

309.20 MATERIALS

Catwalk metal grating shall be of the dimensions and type as shown on the plans. The grating shall be galvanized and attached to the structural steel frame as per the manufacturer's recommendations. Where aluminum catwalk grating has been specified, the aluminum shall be isolated from the steel at all points of contact in a manner acceptable to the Engineer.

All structural channels, angles, and plates specified shall be ASTM A36 steel.

Unless otherwise specified, handrail shall be 2" x 2" x 3/16" structural tubing or 1 1/2” schedule 80 steel pipe welded and painted.

Fasteners, bolts and anchors shall be ASTM A36 steel.

Arc-welding electrodes shall conform to the requirements of the American Welding Society Specifications for Iron and Steel Arc Welding Electrodes, latest edition.

309.30 FABRICATION

Fabrication shall be shown on the drawings. Weld all contact edges with a continuous 1/4” fillet weld. The technique, appearance and quality of all welds made shall conform to the American Welding Society code for Arc-Welding in Building Construction.

Shop drawings and a materials list shall be submitted for approval by the Engineer.

309.40 PAINTING

The catwalk, handrails, bracing, grating and miscellaneous steel shall be given one shop coat of zinc base primer and one coat of zinc base primer after erection is completed. Apply two coats of alkyd enamel flat black paint to all exposed structural steel surfaces. The non-driven H-piles, sheet piling cap and stoplog channels need not be painted.

309.50 METHOD OF MEASUREMENT

Structural steel shall be measured on a unit basis. The unit shall be shown in the Unit Price Table of the Standard Bid Form for the pay item corresponding to this specification number. Structural steel shall be measured in the following manner:

1) Incidental (INC): Supply and installation of the structural steel shall be considered incidental to the construction and installation of the associated water control structure and no measurement shall be made. This shall apply when structural steel is not listed on the Standard Bid Form.

2) Lump Sum (LS): Structural steel shall be measured on a lump sum basis of constructed structural steel. No separate measurement for pounds of steel required to construct the structural steel portion of a project shall be made.

3) Each (EA): Structural steel shall be measured on an individual structure basis. Measurement shall be made for each structure comprising the project and no separate measurement shall be made for pounds of steel used in construction.

No separate measurement shall be made for excess material used to construct design structures.

309.60 METHOD OF PAYMENT

The completed work for structural steel, measured as specified, shall be paid for at the contract unit price. The unit price bid for structural steel shall include supplying all materials, equipment, labor and any incidental items necessary for performing all structural steel operations described in this specification or shown on the plans.

311 REMOVAL OF EXISTING CULVERTS AND STRUCTURES

311.10 DESCRIPTION

The work of this section shall include the excavation, removal, cleaning, and stockpiling of culverts and structures designated to be removed.

311.20 CONSTRUCTION METHODS

311.2l EXCAVATION

Excavation shall be performed in a workmanlike manner, approved by the Engineer, to prevent damage to salvageable material.

311.22 DISMANTLING AND REMOVAL

The material shall be dismantled and removed in a careful and workmanlike manner. Equipment or facilities that may damage portions of the material shall not be used. Any salvageable material damaged by the Contractor, during the removal operation, by neglect or poor workmanship, shall be replaced or paid for by the Contractor. All salvageable material shall be cleaned, sorted and stored in an area designated by the Engineer. The Contractor shall prepare a list of all salvaged material.

311.23 DISPOSAL OF MATERIAL

All salvageable material shall be handled carefully to avoid damage. All material shall be piled neatly at a location, on site, as directed by the Engineer. All salvageable material as identified on the plans shall become the property of the owner and shall not be used by the Contractor for any of his construction operations. Non-salvageable materials shall become the property of the Contractor and removed from the site unless otherwise directed by the engineer.

311.30 METHOD OF MEASUREMENT

Removal of existing culverts and/or structures shall be measured on a unit basis. The unit shall be shown in the Unit Price Table of the Standard Bid Form for the pay item corresponding to this specification number. Removal of existing culverts and/or structures shall be measured in the following manner:

1) Lump Sum (LS): Removal of existing culverts and/or structures shall be measured on a lump sum basis of removed culverts and/or structures.
2) Each (EA): Removal of existing culverts and/or structures shall be measured on an individual basis. Measurement shall be made for each existing culvert or structure removed.
3) Linear Feet (LF): Removal of existing culverts and/or structures shall be measured on a linear foot basis. Measurements shall be made for each linear foot of existing culvert and/or structure removed.

311.40 METHOD OF PAYMENT

The completed work for removal of existing culverts and/or structures, measured as specified, shall be paid for at the contract unit price. The unit price bid for removal of existing culverts and/or structures shall include supplying all materials, equipment, labor and any incidental items necessary for performing

removal and salvage operations described in this specification or shown on the plans. No separate payment shall be made for disposal of removed culverts and/or structures.

312 TILE DRAIN LOCATION AND REMOVAL

312.10 DESCRIPTION

The work of this section shall include the location, identification and removal of all tile drains within the project site.

312.20 CONSTRUCTION METHODS

312.21 EXPLORATION

Tile exploration and location shall be performed in a manner approved by the Engineer. Unless otherwise specified on the plans, the minimum depth of exploration shall be five (5) feet. The Contractor shall be responsible for reporting to the Engineer the size, location, elevation, type and number of tiles found.

312.22 EXCAVATION

Excavation shall be performed in a workmanlike manner, approved by the Engineer. Excavation shall be performed as shown on the plans.

312.23 REMOVAL AND BLOCKAGE OF EXISTING TILES

All individual subsurface drain lines shall be broken and surface inlets shall be removed. The length removed shall be sufficient to prevent any drainage influence from the tile. This length will vary based on the site conditions. The minimum length removed shall range from fifty (50) feet in heavy clay soil to one hundred (100) feet in sandy or organic soils.

Tile removal from beneath any proposed berm, dike, or levee shall occur in the following manner:

1) When both an inside borrow ditch and an outside borrow ditch are utilized, the entire length of tile, from the inside toe of the inside borrow ditch to the outside toe of the outside borrow ditch, shall be removed.
2) When only an inside borrow ditch is utilized, the entire length of tile, from the inside toe of the inside borrow ditch to twenty (20) feet beyond the outside toe of the berm, shall be removed.
3) When only an outside borrow ditch is utilized, the entire length of tile, from twenty (20) feet inside the inside toe of the berm to the outside toe of the outside borrow ditch, shall be removed.
4) When borrow ditches are not utilized, the entire length of tile, from twenty (20) feet inside the inside toe of the berm to twenty (20) feet beyond the outside toe of the berm, shall be removed.

312.24 DISPOSAL OF MATERIAL

All salvageable material shall be handled carefully to avoid damage. All material shall be piled neatly at a location, on site, as directed by the Engineer. All salvageable material as identified on the plans shall become the property of the owner and shall not be used by the Contractor for any construction operations. Non-salvageable materials shall become the property of the Contractor and shall be removed from the site unless otherwise directed by the engineer.

312.30 METHOD OF MEASUREMENT

Location and/or removal of existing tile drains or structures shall be measured on a unit basis. The unit shall be shown in the Unit Price Table of the Standard Bid Form for the pay item corresponding to this specification number. Location and/or removal of tile drains shall be measured in the following manner:

1) Lump Sum (LS): Removal of existing drain tiles and/or structures shall be measured on a lump sum basis of removed drain tiles and/or structures.
2) Each (EA): Removal of existing tile drains shall be measured on a per unit basis. The measurement will be the number of drains found and removed from toe to toe of the proposed dike.
3) Linear Feet (LF): Removal of existing tile drains shall be measured on a linear foot basis. The measurement will be the actual linear feet of tile drains removed.
4) Linear Feet – Exploration (LF-EXP): When specified as "Exploration" only, exploration for existing tile drains shall be measured on a linear foot basis. The measurement will be total linear distance in feet of exploration conducted.

312.40 METHOD OF PAYMENT

The completed work for tile drain location and removal, measured as specified, shall be paid for at the contract unit price. Due to the unknown quantity of tile to be removed, the variance in quantity discussed in Section 101.401 of the Scope of Work in the General Conditions is waived. Adjustment in the unit price for an increase or decrease in the quantity of tile removed will not be granted. The contractor will be paid the unit price bid for each tile removed, regardless of the quantity. The unit price bid for the location and removal of tile drains shall include supplying all materials, equipment, labor and any incidental items necessary for performing all operations described in this specification or shown on the plans. No separate payment shall be made for disposal of removed tile drains.

313 PUMP INSTALLATION

313.10 DESCRIPTION

The work shall include the supply of all labor, materials and equipment necessary to complete the installation of the pump as specified on the plans. The work shall include supplying all pump features shown on the plans. These may include but are not limited to the pump, pump motor, strainer basket with vortex plate, vacuum valve, control panels, circuit breaker, motor starter, on/off switch, low water shut-off diodes, high water auto start up, CMP pipe, flap gates, canal gates, trashrack, dresser couplers, grate, support beam, discharge basins, catwalk structure, concrete, pump sump, excavation, embankment, and pressure shutoff switch. The work shall include a warranty from the vendor as described in this specification.

313.20 MATERIALS/SHOP DRAWINGS

All materials described in this specification shall be shown and listed on shop drawings. Shop drawings are required prior to construction. Shop drawings are to be submitted with the bid if an alternative pump or pump feature is proposed.

The control panel shall be designed for outdoor use and shall have heat tape as part of installation to avoid condensation on the inside of the control panel. Unless otherwise specified on the plans, a separate, external, main shutoff shall be provided for all pump installations. Unless otherwise specified on the plans, a low water shutoff control shall be provided for all pump installations.

313.30 ELECTRICITY

Power, as required for the application, shall be supplied to the pump unless otherwise specified. The power shall be supplied in accordance with the specification for **SUPPLY OF ELECTRICAL POWER**. The Contractor must connect the power supply to the control panel with all connections in accordance with local, state, and federal requirements.

313.40 INSTALLATION

Installation shall be made according to manufacturer's recommendations. The pump supplier and Contractor shall both have a representative present during initial pump start-up operations, and such personnel shall remain available until the pump is operating in a manner acceptable to the Owner and Engineer.

313.50 WARRANTY

The pump manufacturer shall supply a warranty to the Owner or Property Manager that shall provide that:

For a period of one (1) year from the date of installation, to absorb repair or replacement costs, including materials and labor, of any pump feature, described in this specification, that fail to function as intended under normal operation conditions subject to maintenance at intervals recommended by the manufacturer.

313.60 METHOD OF MEASUREMENT

Pump installation shall be measured on a unit basis. The unit shall be shown in the Unit Price Table of the Standard Bid Form for the pay item corresponding to this specification number. Pump installation shall be measured in the following manner:

1) Lump Sum (LS): Pump installation shall be measured on a lump sum basis. No Separate payment shall be made for the supply and installation of various components required for pump installation.

313.70 METHOD OF PAYMENT

The completed work for pump installation, measured as specified, shall be paid for at the contract unit price. The unit price bid for pump installation shall include supplying all materials, equipment, labor and any incidental items necessary to perform all installation operations as described in this specification and shown on the plans.

314 WATER WELL DRILLING

314.10 DESCRIPTION

The work shall include the supply of all labor, materials, and equipment necessary to complete the installation of water wells and associated equipment as shown on the plans and/or specified herein. Unless otherwise specified, the Contractor shall furnish all labor, equipment, and supplies required to complete the test pumping after the well installation.

314.20 PERMITS, LAWS, AND ORDINANCES

The Contractor shall, at his own expense, obtain all certificates and licenses required of him by law for the execution of this contract. The Contractor shall comply with all local, state, and federal laws and regulations relating to the performance of the work in this contract.

314.30 MATERIALS

314.31 TEMPORARY OUTER WELL CASING FOR GROUTING

The temporary casing is not required to be new or non-used, and shall be removed as grouting of the well progresses. The temporary casing remains the property of the Contractor.

314.32 WELL CAP

The well cap will be of the same material as the well casing and be suitable for reducing the well casing diameter to the diameter of the supply line.

314.33 SCREENING OR PERFORATING

Because of the uncertainty as to the type of water-bearing strata which may be encountered and utilized, the following alternatives may be considered at the option of the Engineer: open bottom casing; perforated casing; or screened to fit the size casing being used.

a) Open Bottom Casing. An aggregate pack shall be placed in the bottom of the well. The aggregate shall extend a minimum of five (5) feet below the bottom of the casing and a minimum of three (3) feet up into the casing from the bottom, for a total of at least eight (8) feet. The aggregate shall be uniformly graded and composed of hard, durable particles, free of dirt and organics. It shall pass a No. 4 screen and be retained on a No. 16 screen.

b) Perforated Casing. The Contractor shall be prepared and equipped to perforate the casing and/or install a section of perforated casing at any depth determined by the Engineer who will establish the size and extent of the perforations, and direct the Contractor to proceed. The Contractor shall remove any protrusions from the inside of the casing that may have been caused by perforating.

c) Screened Casing. The Contractor shall provide a one-quart sample of the water-bearing strata to the Engineer along with his preliminary recommendation as to screen materials, type, length, and opening size to be used. If a determination is made to use a screen, the Engineer will establish the screen materials, type, length, and opening size to be used and will direct the Contractor to proceed. The screen used shall be stainless steel, unless otherwise approved by the Engineer. If the Engineer elects to use gravel packing in conjunction with the screen, the gradation of the gravel and thickness of the gravel or sand layer shall be as specified. The gravel shall be placed to avoid segregation of finer and coarse particles.

314.40 INSTALLATION AND EXECUTION

314.41 DRILLING AND CASING

1) A well hole of suitable size to permit the installation of a protective casing shall be drilled and cased by the Contractor for the entire depth of the well or as approved by the Engineer. The depth of cased well eligible for payment shall be approved in writing by the Engineer.
2) The well shall be drilled and the casing installed with sufficient accuracy in the vertical alignment to permit the installation and operation of the submersible pump or hand pump at a later date, if necessary. The casing shall be thoroughly swabbed, using alkalis, if necessary, to remove oil, grease, or joint dope. Cleaning shall be considered incidental work.
3) The annular opening between the protective casing and the temporary casing shall be filled with cement grout. The grouting shall be done continuously and in such a manner that will force the grout from the bottom of the opening toward the surface. The well shall be grouted a minimum of twenty (20) feet. If a pitless adapter is shown on plans, the grouting shall extend twenty (20) feet below this unit. No grouting is necessary above the pitless adapter.
4) The temporary casing shall be withdrawn as grout is placed, so grout will fill the void between the protective casing and natural ground. No drilling operations or other work in the well(s) will be permitted until the grout has firmly set.
5) Cement grout shall be a mixture of one bag of Portland cement (94 lbs,) and five to six gallons of water. Up to five (5) percent commercial bentonite clay, by weight, may be added.
6) Alternate methods of grouting must meet all local laws and regulations and are subject to approval in advance by the Engineer.

314.42 POLLUTION PROTECTION

In order to avoid pollution by surface water and to assure ample drainage away from the well, the top of the casing shall be extended two feet above the surface of the ground. At the completion of the well, a well cap shall be installed on the top of the casing to prevent contaminating substances from entering the well. The Contractor shall take such reasonable measures as necessary to prevent contamination of the well when work is not in progress at the site.

314.43 WELL LOG AND SOIL SAMPLES

The Contractor shall keep a complete well log for the well, and shall keep samples of each water-bearing stratum. The well log shall contain entries for each stratum of water-bearing formation. The samples shall be kept in transparent plastic containers of approximately one pint capacity each and identified by labels showing the depth at which each was encountered. The Contractor shall furnish these plastic containers. The samples shall be given to the Engineer. One copy of the well driller's report including the well log shall be submitted to the Engineer within 15 days after completion of the well. All pertinent test pumping data shall be recorded on the well log.

314.44 DEVELOPMENT AND TESTING

It is possible that more than one water-bearing stratum will need to be tapped to secure the desired amount of water. The Contractor shall make such necessary tests at each water-bearing stratum encountered. The Contractor shall furnish all necessary pumps, compressors, plungers, bailing, or other needed equipment. The Contractor shall develop the well by such approval methods as shall be necessary to give the water-bearing formation the maximum practical quantity of such strata or sands as may, during the life of the well, be withdrawn when the well is pumped under maximum conditions or drawdown.

314.45 TEST PUMPING FOR YIELD AND DRAWDOWN

After the well has been completely constructed, cleaned out, and the depth of the well accurately measured, the Contractor shall notify the Engineer and make the necessary arrangements for conducting a final pumping test.

The Contractor shall furnish and install necessary pumping equipment capable of pumping to the required point of discharge. He shall also furnish, install, and maintain equipment of approved size and type for measuring the flow of water. Such equipment may be a weir box, orifice, water meter, or other approved mechanism. To measure the elevation of the water level in the well, a steel or electric tape shall be furnished, or an airline complete with gage, hand pump and check valve shall be provided. Unless otherwise permitted, the air line shall be securely fastened to the pumping unit and shall terminate approximately at the maximum desired pumping level stated herein, but shall in no case be nearer than two feet to the end of the suction pipe.

The pumping test shall be conducted at the maximum rate of flow, which will not damage the water-bearing aquifers, until the water level stabilizes. The Contractor shall record the static water level and the static pumping level for each flow measurement. During the pumping test, the drawdown in feet below static level and pumping rate shall be measured at least every five minutes until the drawdown stabilizes, and every ten minutes thereafter.

The well shall be pumped near the maximum rate, approximately 50 percent drawdown, until drawdown and yield are constant at that rate. Drawdown may be considered constant when three measurements, taken one hour apart, are the same. The drawdown and yield shall be recorded. The Engineer may request the drawdown at several pump discharge rates. After completion of the pumping test, water level recovery shall be recorded every five minutes until static water depth is reached.

The pumping unit shall be operated at such rates of discharge and for such periods of time as directed, excepting that the final test shall be run for a minimum period of one hour. Accidental interruptions may, if so agreed upon between the Contractor and the Engineer, be compensated for by correspondingly extending the time of the completion of the test run. After the completion of the final test, the Contractor shall remove, by bailing, sand pumping, or other methods, any sand, stones, or foreign material that may have become deposited in the well.

314.50 METHOD OF MEASUREMENT

Water well drilling shall be measured on a unit basis. The unit shall be shown in the Unit Price Table of the Standard Bid Form for the pay item corresponding to this specification number. Water well drilling shall be measured in the following manner:

1) Lump Sum (LS): Water well drilling shall be measured on a lump sum basis of an installed well. No separate measurement shall be made for linear foot of well or excess materials.
2) Linear Feet (LF): Water well drilling shall be measured on a linear foot basis of actual installed well. No measurement for excess well drilling or materials shall be made.

314.60 METHOD OF PAYMENT

The completed work for water well drilling, measured as specified, shall be paid for at the contract unit price. The unit price bid for water well drilling shall include supplying all materials, equipment, labor and any incidental items necessary to perform all well drilling operations as described in this specification and shown on the plans.

315 SUPPLY OF ELECTRICAL POWER

315.10 DESCRIPTION

The work of this section shall include the supply of all labor, materials, equipment and incidental items required to provide, install or relocate electric service lines as shown on the plans.

315.20 MATERIAL

The materials shall be of the industry standard required to meet the voltage and power requirements of the electrical facilities. They shall conform to all electric codes applicable at the project site. The Contractor shall notify the Engineer of what materials will be installed.

315.30 CONSTRUCTION

The electric cooperative or power company responsible for supplying power must approve the installation plan prior to construction. Installation of the electric service line shall conform to all electric codes applicable at the project site. For relocated lines, the existing line shall be cut and abandoned at a point determined by the Engineer in the field. The line shall be relocated as shown on the plans or staked by the Engineer. Installation of the new line shall conform to all electric codes applicable at the project site.

315.40 METHOD OF MEASUREMENT

The supply of electrical power shall be measured on a unit basis. The unit shall be shown in the Unit Price Table of the Standard Bid Form for the pay item corresponding to this specification number. Supplying electrical power shall be measured in the following manner:

1) Lump Sum (LS): Supplying electrical power shall be measured on a lump sum basis of installed/relocated power line. No separate measurement shall be made for linear footage of power line or excess materials.
2) Lineal Feet (L.F.): Supplying electrical power shall be measured on a lineal foot basis. The measurement will be the actual linear feet of electric power line installed.

315.50 METHOD OF PAYMENT

The completed work for supplying electrical power, measured as specified, shall be paid for at the contract unit price. The unit price bid for supplying electrical power shall include supplying all materials, equipment, labor and any incidental items necessary to perform the power line installation operations as described in this specification and shown on the plans.

316 DIKE AND ACCESS ROAD SURFACING

316.10 DESCRIPTION

The work shall include the supply of all labor, materials, and equipment necessary to complete the dike and/or access road surfacing as shown on the plans and/or specified herein. The work shall consist of preparing the subgrade, and furnishing and installing the surfacing on the dike or access road as shown on the plans and in accordance with this specification.

316.20 SUBGRADE PREPARATION

Before any site grading, road grading or placing fill material for dikes, roads, parking areas or other areas designated by the Engineer, the foundation areas shall be cleared and grubbed, and topsoil removed in accordance with the specification for **SITE PREPARATION**.

The subgrade shall be constructed to an elevation and cross section that, when compacted, will be in conformity with the lines, grades and cross sections shown on the plans or established by the Engineer. All soft areas and other portions of the subgrade that will not compact readily shall be removed as directed. Rocks that interfere with the trimming of the subgrade and all roots and other foreign matter brought to the surface shall be removed and disposed of satisfactorily. All holes or depressions made by the removal of materials as described above shall be filled with approved material. All fill material shall be placed in accordance with the specification for **EMBANKMENT CONSTRUCTION**.

The subgrade shall be scarified to a depth not less than six (6) inches, and re-compacted. At the time the base material or surface course is placed, the subgrade shall have "required stability". The required stability shall be such that no rutting or displacement of the dike, road bed, or parking area will occur under the operation of the equipment used for compaction.

The Contractor shall protect and repair any damage to the subgrade from his own and public traffic. The subgrade shall at all times be completed for a sufficient distance ahead of hauling and placing base or surface material to allow an adequate opportunity for inspection. No materials shall be placed on the subgrade until it has been checked, inspected, and approved by the Engineer.

316.30 MATERIAL

Surfacing material shall be coarse aggregate consisting of hard, durable particles or fragments of stone, gravel, or slag. Organic materials or those that break up when alternately frozen and thawed or wetted and dried shall not be used. Surfacing material shall conform to the following grading and physical requirements:

1) Grading requirements

Aggregate Type	Percent Passing by Weight						
	1" Sieve	3/4" Sieve	3/8" Sieve	#4 Sieve	#10 Sieve	#40 Sieve	#200 Sieve
Coarse	100	90-100	60-85	25-60	20-65	10-35	3-10

2) L.A. Abrasion Loss 50% max

3) Percent Shale or Soft Rock 12% max

316.40 TESTING

A sieve analysis by wash screening shall be conducted on a representative sample of material to be obtained at the discretion of the Engineer. A certified testing laboratory shall perform the sieve analysis and the test results shall be furnished to the Engineer for his approval. A sieve analysis is required for each stockpile of material prior to placement. A sieve analysis is required each time the source of the material changes. The Contractor shall pay for all laboratory costs.

316.50 PLACEMENT

Upon completion and approval of the subgrade preparation by the Engineer, the gravel shall be placed and compacted on the prepared subgrade to the dimensions shown on the plans. Equipment used for placement operations shall meet the requirements of the state or local highway department standard specifications or be approved by the Engineer. Material sources requiring the material to be blended to achieve the specified gradation may be blended at the material stockpile site or on areas designated by the field engineer. All blending of materials shall be done in a uniform manner to provide the specified gradation.

316.60 METHOD OF MEASUREMENT

Dike and access road surfacing shall be measured on a unit basis. The unit shall be shown in the Unit Price Table of the Standard Bid Form for the pay item corresponding to this specification number. Dike and access road surfacing shall be measured in the following manner:

1) Lump Sum (LS): Surfacing shall be measured on a lump sum basis of installed surfacing. No separate measurement of surfacing material or excess surfacing material shall be made.
2) Cubic Yards - Plan Quantity (CY-P): Surfacing shall be measured on a plan quantity basis. The quantity shall be the neat line quantity of installed surfacing material calculated from the construction plans. No separate measurement of surfacing material or excess surfacing material shall be made.
3) Ton (TN): Surfacing shall be measured on a ton basis. The measurement shall be made by the collection of weight tickets from the supplier and shall be based on the short ton. Measurement shall be based on the actual amount of placed surfacing. No measurement shall be made for excess rock.
4) Ton - Plan Quantity (TN-P): Surfacing shall be measured on a plan quantity basis based on a short ton weight. The quantity shall be calculated using the neat line dimensions of installed surfacing as shown on the construction plans. No separate measurement of surfacing material or excess surfacing material will be made.
5) Linear Feet (LF): Surfacing shall be measured on a linear feet basis. The quantity shall be measured taking the actual centerline distance of placed surfacing material.

316.70 METHOD OF PAYMENT

The completed work for dike and access road surfacing, measured as specified, shall be paid for at the contract unit price. The unit price bid for dike and access road surfacing shall include supplying all materials, equipment, labor and any incidental items necessary to perform all road surfacing operations as described in this specification and shown on the plans.

317 FENCING

317.10 DESCRIPTION

The work of this section shall include the supply of all labor, materials and equipment necessary for the installation of fencing as called for on the plans and/or specified herein. The fencing may include but is not limited to:

a) Woven wire fence

b) Chain link fence

c) Barbed wire fence

d) Electric predator fence

e) All posts, gates and necessary hardware associated with the above

317.20 MATERIALS

317.21 SUPPLY OF MATERIALS

Unless otherwise specified, the Contractor will supply all materials to complete the installation as shown on the plans.

1) Barbed Wire. Galvanized barbed wire fencing material shall meet the requirements of ASTM A 121 (minimum 12 ½ gauge). Aluminum coated barbed wire shall meet the requirements of ASTM A 585, Type I (Aluminum Coated) or Type II (Aluminum Alloy) barbs at the option of the manufacturer.

2) Fence Posts. Fence posts shall be steel manufactured in accordance with ASTM A 702 and can be painted. Fitting, hardware and other appurtenances shall be galvanized in accordance with ASTM A 120, by current standard practice, and be of standard commercial grade. Weathering steel posts shall meet the requirements of AASHTO M 222. Aluminum alloy posts shall meet the requirements of AASHTO M 181.

   On slopes greater than 2:1, there will be one wood line post (4" x 6 ½") for every steel posts. All wood posts shall be straight and all knots trimmed flush with the surface.

317.30 CONSTRUCTION METHODS

317.31 POSTS

The spacing of line posts shall be be every 16 ½' and each will be set to a depth of at least 22". Anchor plates on steel posts will be at least 3" – 4" below the ground surface. All wood posts will be tamped firmly, especially in the initial stages of setting a post. The posts shall be set in reasonably close conformity to the alignment and grade shown on the plans or as directed by the Engineer. An intersection post shall be set in line with intersecting fences shown on the plans. Both intersecting fences shall be connected to the intersection post. All posts shall be set plumb and to the required depth, anchored and braced in accordance with the plans. Posts that are bent or otherwise damaged shall be removed and replaced.

317.32 FENCE FABRIC OR WIRE

Fence will be four (4) wires unless otherwise shown on the plans or specified. Spacing of the bottom wire will be 16" from the ground, followed by 22" – 30" – 40". Wire should never be kinked or nicked. Wire must be taunt with due consideration for contraction and expansion. Not more than ¼ mile of wire is to be stretched at one time. Dead end corners and gates with wire ends wrapped around posts twice and twisted back on stretched wire.

317.33 GATES

Gates of the size and type specified shall be erected in an approved manner at the locations shown on the plans or as directed by the Engineer. Gate braces will be installed the same as line braces if it is less than 40 rods to the next brace, the gate brace will consist of 3 brace posts and 2 horizontal poles. Smooth wire will be used for all bales on the gate posts, as well as the loop for opening the gate. The fabric or wire used for the gates shall meet the same requirements as specified for the fence. The hinge post and latch post of all gates shall be set in concrete.

317.34 BRACING

Corner braces for short runs of less than 80 rods will consist of 3 brace posts and 2 horizontal poles which are to be at least 8' long. Corner braces for longer runs will consist of 5 brace posts and 4 horizontal poles.

317.40 QUALITY CONTROL

All workmanship and materials furnished and supplied under this specification are subject to close and systematic inspection and testing by the Engineer including all operations, from the selection and production of materials, through final acceptance of the specified work. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or approval that may have been previously given.

The tops of all posts shall be a uniform height above the ground. The finished fence shall be substantially true to line, taut and solid at all points. All surplus excavated material and other debris shall be disposed of properly. The Engineer reserves the right to reject any materials or works, which are not in accordance with the requirements of this specification.

317.50 METHOD OF MEASUREMENT

Fencing shall be measured on a unit basis. The unit shall be shown in the Unit Price Table of the Standard Bid Form for the pay item corresponding to this specification number. Fencing shall be measured in the following manner:

1) Lump Sum (LS): Fencing shall be measured on a lump sum basis of installed fence. No separate measurement shall be made for linear feet of fence or excess materials.
2) Linear Feet (LF): Fencing shall be measured on a linear foot basis. The quantity shall be the actual linear feet of installed fence. No measurement for excess fence or fencing materials shall be made. No measurement shall be made for gates.

Concrete, where required for post setting, shall be considered incidental to the fencing measurement described herein. No separate measurement shall be made.

317.60 METHOD OF PAYMENT

The completed work for fencing, measured as specified, shall be paid for at the contract unit price. The unit price bid for fencing shall include supplying all materials, equipment, labor and any incidental items necessary to perform all fencing installation operations as described in this specification and shown on the plans. No separate payment shall be made for pedestrian/vehicle gates or cattle guards.

318 BUILDINGS

318.10 DESCRIPTION

The work of this section shall include the supply of all labor, materials, and equipment required to complete the installation of the buildings or enclosures as called for on the drawings and/or specified herein. These buildings may include but are not limited to the following:

a) Pump houses

b) Equipment storage

c) Any other structures specified on the plans.

This work shall include, but is not limited to, supplying and installing the following components as shown on the plan; walls, roof, door, framing, supports, skylights, gutters, ventilation as required by pump/motor manufacturer and downspouts.

318.20 MATERIALS

All materials described in this specification shall be shown and listed on shop drawings. Shop drawings are required prior to construction. Shop drawings are to be submitted with the bid if an alternative building or building feature is proposed.

Unless otherwise specified on the plans, all buildings specified as pump house shall be able to accommodate the removal of the pump and/or motor, i.e., removal roof, hatch, etc.

318.30 SITE PREPARATION

The site shall be leveled and prepared as indicated on the plans.

318.40 INSTALLATION

Where called for on the plans, concrete slabs, floors, or pads shall be placed in accordance with the specification for **CAST-IN-PLACE REINFORCED CONCRETE**.

For prefabricated buildings, the installation shall be made according to manufacturer's recommendations. The manufacturer shall supply a warranty to the project Owner or Property Manager that shall provide that for a period of one (1) year from the date of installation, to absorb any repair or replacement costs, including materials and labor, of any building feature, described in this specification, that fails to function as intended under normal conditions subject to maintenance at intervals recommended by the manufacturer.

All other buildings shall be constructed as shown on the plans and in accordance with all state and local building codes.

318.50 QUALITY CONTROL

All workmanship and materials, furnished and supplied under this specification, are subject to close and systematic inspection and testing by the Engineer including all operations, from the selection and production of materials, through final acceptance of the specified work. The Contractor shall be wholly responsible for the control of all operations incidental thereto, notwithstanding any inspection or approval that may have been previously given.

The finished building shall be square and walls plumb, all mortar joints shall be properly finished, all doors and windows shall seal properly and locks shall function. All surplus excavated material and other debris shall be disposed of properly. The Engineer reserves the right to reject any materials or works, which are not in accordance with the requirements of this specification.

318.60 METHOD OF MEASUREMENT

Buildings shall be measured on a unit basis. The unit shall be shown in the Unit Price Table of the Standard Bid Form for the pay item corresponding to this specification number. Buildings shall be measured in the following manner:

1) Lump Sum (LS): Buildings shall be measured on a lump sum basis. No Separate payment shall be made for the supply and installation of various components required for the building installation.

318.70 METHOD OF PAYMENT

The completed work for buildings, measured as specified, shall be paid for at the contract unit price. The unit price bid for buildings shall include supplying all materials, equipment, labor and any incidental items necessary to perform all building installation operations as described in this specification and shown on the plans. No separate payment shall be made for concrete pads or floors.

319 TIMBER DECKING AND RAILING

319.10 DESCRIPTION

The work shall include the supply of all labor, material and equipment required for the installation of all decking and railings as shown on the plans. All wood construction shall be in compliance with minimum standards set by the most recent edition of BOCA National Building Code, Chapter 23 and the National Design Specification for Wood Construction (NDS) as published by the American Forest and Paper Association, formerly the National Forest Products Association.

319.20 SUPPLY OF MATERIALS

Structural framing members shall be southern pine, No. 1, S4s with minimum design values as published in the NDS. All lumber shall be preservative treated in accordance with AWPA C2 or C9, except handrails. All decking and rail cap shall be properly installed to prevent cupping.

All handrails shall be select western red cedar grade D or better, S4S, 15% maximum moisture content, grade stamped on ends. Installed handrail shall be smooth and free of splinters.

All hardware and fasteners shall be hot-dipped galvanized or stainless steel 304 or 316.

All concrete necessary for post footings shall be mixed and placed in accordance with the specification for **CAST-IN-PLACE REINFORCED CONCRETE**.

319.30 CONSTRUCTION METHODS

All decking and railings shall be constructed as shown on the plans and in accordance with all applicable building codes.

319.40 METHOD OF MEASUREMENT

Decking and railing installation shall be measured on a unit basis. The unit shall be shown in the Unit Price Table of the Standard Bid Form for the pay item corresponding to this specification number. Decking and railing installation shall be measured in the following manner:

1) Lump Sum (LS): Timber decking and railing installation shall be measured on a lump sum basis of installed lumber. No separate measurement of decking and railing shall be made.
2) Linear Feet (LF): Timber decking and railing shall be measured on a linear foot basis. The quantity shall be the actual linear feet of installed decking and railing. No measurement for excess deck or rail or decking or railing materials shall be made.

No separate measurement shall be made for the hot-dipped galvanized or stainless steel hardware and fasteners used in the decking and railing installation. No separate measurement shall be made for the concrete or other materials required for the footings. The supply and installation of these materials shall be considered incidental to the decking and railing installation.

319.50 METHOD OF PAYMENT

The completed work for timber decking and railing, measured as specified, shall be paid for at the contract unit price. The unit price bid for decking and railing shall include supplying all materials,

equipment, labor and any incidental items necessary to perform all decking and railing installation operations as described in this specification and shown on the plans.

320 WATER PIPELINE INSTALLATION

320.10 DESCRIPTION

This specification shall cover the supply of all labor, materials and equipment required for the installation of a water pipeline and associated appurtenances including any valves, fittings and thrust blocks shown on the plans.

320.20 MATERIALS

The specifications for the water pipeline pertaining to dimensions, psi rating, composition, or any specification pertinent to the pipe shall be shown on the plans or approved equal by Engineer prior to bidding.

320.21 POLYVINYL CHLORIDE PIPE (PVC)

PVC pipe shall conform to the requirements of ASTM Designation: D 2241 and be joined by bell and spigot type connections. The belled portion of the pipe for use with rubber gaskets shall conform to the requirements of ASTM Designation: D 3139. The pipe joint shall be tightly sealed against infiltration and exfiltration by means of a locked-in-rubber sealing ring. The connection shall also permit the thermal expansion or contraction of the pipe.

Fittings shall be either injection molded PVC plastic pipe fittings, conforming to the requirements of ASTM Designation: D 2466 or D 3139, or machined pipestock fittings conforming to the requirements of ASTM Designation: D 2241.

320.22 WELDED STEEL PIPE

Welded steel pipe shall be of the length, diameter, and metal thickness shown on the plans and shall conform to the following:

1) Pipe shall conform to the applicable requirements of AWWA Standard C200, Section 3, manufactured from steel sheets conforming to ASTM A570/A570M, Grade 33 or 36, plates conforming to ASTM A283/A283M Grade C or D, or ASTM A572 Grade 290 (42); or it shall be manufactured to meet the requirements of ASTM A53, Grade B or ASTM A139 Grade B or C.

2) Inside and outside surfaces shall be blast cleaned with sand, steel grit, steel shot or a combination of steel and steel shot to remove mill scale and rust. Exterior of pipe and fittings shall be coated with Standard 1-mil Asphaltic Coating per AWWA C151.

Flanges, mechanical couplings or field welded joints may be used, as conditions require to join the pipe.

320.23 DUCTILE IRON PIPE

Ductile iron pipe shall be of the length, diameter, and metal thickness shown on the plans and shall conform to the following:

All ductile iron pipe shall be designed and manufactured in accordance with AWWA C150 and AWWA C151.

Exterior of pipe and fittings shall be coated with Standard 1-mil Ashphaltic Coating per AWWA C151.

Flanges or mechanical couplings may be used to join the pipe as conditions allow.

320.24 HIGH DESITY POLYETHYLENE (HDPE) PIPE

Where stated as acceptable on the plans, HDPE pipe shall have a smooth interior lining and annular exterior corrugations.

1) 4" to 8" pipe shall meet AASHTO M252, Type S. The joint shall be watertight according to the laboratory requirements of ASTM D3212. Joints shall remain watertight when subjected to a 1.5 degree axial misalignment.
2) 12" – 48" pipe shall meet AASHTO M294, Type S. The joint shall be watertight according to the requirements of ASTM D3212.
3) 60" pipe shall meet AASHTO MP7, Type S.

Gaskets shall be made of polyisoprene meeting the requirements of ASTM F477 with the addition that the gaskets shall not have any visible cracking when tested according to ASTM D1149 after 72 hour exposure to 50 PPHM ozone at 104 degrees F. Gaskets shall be installed by the pipe manufacturer and covered with a removable wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.

Fittings shall conform to AASHTO M252, AASHTO M294 or AASHTO MP7. Fabricated fittings shall be welded at all accessible interior and exterior junctions.

Installation shall be in accordance with ASTM D2321 with the exception that minimum cover is trafficked areas shall be one foot (1 ft.).

320.25 GATE VALVES

Valves shall have non-rising stems, unless otherwise specified, with inside screw and shall open to the left or counterclockwise. Valves shall be equipped with double O-ring stem seals conforming with AWWA C500. All valves shall have the manufacturer's names, catalog number and working pressure molded or stamped thereon. Valves shall be painted as specified in AWWA C500, Section 27, and shall be furnished complete with all accessories. End of valve shall fit the pipe or fitting to which it will be attached (mechanical or flanged).

Materials equivalent to the specified materials may be used only upon approval by the engineer.

320.30 EXCAVATION

320.31 EXCAVATION

Pipeline construction shall be made by open cut unless otherwise specified or approved of by the engineer. All open trenches shall be adequately shored and/or braced to provide a safe working environment. It shall be the contractor's responsibility to comply with the requirements of OSHA as pertaining to men working in an open trench.

All excavated material not suitable for backfill shall be removed and disposed of in an acceptable manner.

Trenches in which the pipe is to be laid shall be opened in accordance with the plans so pipe can be laid to the alignment and grade required. Pipeline shall be laid true to line and grade as shown on the plans.

The Contractor shall not over excavate by digging below specified lines and grades. If, in the opinion of the Engineer, the Contractor over excavates, he shall replace at his expense the material with suitable site material and compact that material to a density equal to the surrounding insitu-material.

320.32 CONSTRUCTION IN FILL AREAS

Where pipelines are to be installed in fill areas, suitable fill shall be placed and compacted to 95% of the maximum density at optimum moisture as determined by the Standard Proctor test.

320.33 ROCK EXCAVATION

Where rock is encountered in trench excavation, whether solid or in the form of loose rock, shale, or large boulders, it shall be removed by approved methods to the extent that no projection of rock shall be nearer than six (6) inches to any part of the pipeline and fittings when laid.

Cost of loose rock excavation shall be considered incidental to pipeline installation. Cost of solid rock excavation shall be considered extra work and paid for at a rate negotiated in the field.

320.40 INSTALLATION AND ASSEMBLY OF PIPE

The contractor, after preparation of the bed, shall assemble the pipe sections, progressively in accordance with the manufacturer's instructions.

All pipe supplied to the site shall be inspected prior to assembly, for chipping or damage in handling and shall be repaired as directed by the Engineer.

All materials damaged, lost broken or deemed unsuitable due to the Contractor's method of installation, handling or from neglect shall be replaced by the Contractor at his expense.

320.41 THRUST BLOCK CONSTRUCTION

Thrust blocks shall be constructed at the station and elevation shown on the plans. Concrete placement shall conform to specification for Cast-In-Place Concrete.

320.50 BACKFILL

Backfill over all pipe to a depth of twenty-four (24) inches shall be carefully placed in layers approximately six (6) inches thick, each layer being thoroughly tamped and compacted by hand or pneumatic tamper in place. Special care shall be taken in using a mechanical tamper directly over the pipe. Above 24", backfill shall be deposited in 12" layers and compacted to a density of at least 90% of the maximum density at optimum moisture content as determined by the AASHTO Standard Proctor test.

No boulders, rock, ice, snow, organic material or debris shall be permitted in the trench. This material will be classified as unsuitable material and treated as such.

Compaction equipment or methods that produce horizontal or vertical earth pressures which may cause excessive displacements or which may damage the installation, shall not be used.

Backfill shall be executed to the lines and grades shown on the plans and as specified herein.

320.60 QUALITY CONTROL

320.61 WORKMANSHIP AND MATERIALS

All workmanship and materials furnished and supplied under this specification are subject to close and systematic inspection and testing by the Engineer including all operations, from the selection and production of materials, to final acceptance of the specified work.

The contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or approval that may have previously been given. The Engineer reserves the right to reject any materials or works which is not in accordance with the requirements of this specification.

320.62 GENERAL REQUIREMENTS

All excavation, dewatering, backfill, compaction, thrust block construction, assembly, and installation of water pipeline shall be considered as incidental to construction of the water pipeline and no separate payment will be made for this work unless otherwise specified herein.

320.63 TESTING

Pipeline shall be hydro-static pressure tested, when indicated on the plans, at 100 psi for a minimum duration of 2 hours. All blocking must be in place and pipe properly backfilled. Contractor may at his discretion test pipeline in segments.

Allowable leakage shall be within the limits shown on the following chart:

ALLOWABLE LEAKAGE FOR PVC PIPE WITH ELASTOMERIC JOINTS IN U.S. GALLONS PER HOUR

Pipe Size, Inches	Average Test Pressure in Line - P.S.I. 50	100	150	200	250
	Allowable Leakage Per 1,000 Ft.				
4"	0.19	0.27	0.33	0.38	0.43
6"	0.29	0.41	0.5	0.57	0.64
8"	0.38	0.54	0.66	0.76	0.85
10"	0.48	0.68	0.83	0.96	1.07
12"	0.57	0.81	0.99	1.15	1.28

VOLUME OF WATER REQUIRED IN GALLONS PER 100 FEET OF PIPE

Pipe Size	U.S. Gal/100 Ft.
4"	70
6"	153
8"	259
10"	405
12"	573

Allowable leakage shall be within the limits shown on the following chart:

320.70 METHOD OF MEASUREMENT

Water pipeline installation shall be measured on a unit basis. The unit shall be shown in the Unit Price Table of the Standard Bid Form for "WATER PIPELINE INSTALLATION" bid item. Water pipeline installation shall be measured in the following manner:

1) Lump Sum (L.S.): Water pipeline installation shall be measured on a lump sum basis of installed pipeline.

2) Linear Feet (L.F.): Water pipeline installation shall be measured on a linear foot basis. This quantity shall be the actual linear feet of installed pipeline.

320.80 METHOD OF PAYMENT

Water pipeline installation shall be paid for at the unit price bid for "WATER PIPELINE INSTALLATION" and measured as specified herein. The unit price bid for water pipeline installation shall be payment in full for the supply of all materials, equipment, labor and any other incidental items necessary for performing pipeline operations described in this specification.

401 SOIL EROSION AND POLLUTION CONTROL

401.10 DESCRIPTION

The work shall include the supply of all labor, materials and equipment necessary for the construction and maintenance of erosion controls and to minimize the production of sediment and other pollutants to water and air during construction operations. It is the Contractor's responsibility to adhere to all Local, State and Federal regulations regarding the control of soil erosion, sedimentation, and pollution. The work and measures may include, but are not limited to the following as shown on the drawings or as specified herein.

a) Staging of Earthwork Activities - The excavation and moving of soil materials shall be scheduled so that the smallest possible areas will be unprotected from erosion for the shortest time feasible.

b) 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.

c) Stream Crossings - Stream crossings shall be used where fording of streams by equipment is necessary.

d) Silt Fence - Silt fence shall be used to trap sediment from areas of limited runoff. Silt fence is temporary and shall be removed when permanent measures are installed.

e) 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.

f) Filters – Rock and straw bale filters shall be used to trap sediment from areas of limited runoff. Straw bales are temporary and shall be removed when permanent measures are installed.

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

401.20 MATERIALS

401.21 SUPPLY OF MATERIALS

Unless otherwise specified, the Contractor will supply all materials necessary to complete the installation as shown on the plans or recommended by the material manufacturer.

Silt fences are intended to intercept and detain small amounts of sediment from disturbed areas in order to keep the sediment from leaving the site. The Contractor shall supply and install the silt fence as specified unless otherwise identified on the plans. Silt fence shall be installed on the contour and constructed so that flow cannot bypass the ends. It shall be buried at the base and cleaned of soil when appropriate.

Silt Fence TABLE 1. Specifications for

Description	Heavy Duty	Standard
Geotextile		
Type	Woven	Woven
Width	48 inches	36 inches
Grab Tensile Strength ASTM D4632	100 lb minimum	100 lb minimum
Apparent Opening Size ASTM D4751	20-70 Sieve	20-70 Sieve
UV Stability USTM D4355 500 hr.	70% minimum	70% minimum
Top-fastening Component	Overlap around Woven-wire backing	Sewn-in cord
Net Backing		
Material	Woven Wire or Plastic Mesh	
Minimum Weight	14-1/2 gauge	
Minimum Mesh Opening	2 inches	
Maximum Mesh Opening	6 inches	
Minimum Width	30 inches	
Tensile Strength ASTM D4595	100 lb/ft	
UV Stability ASTM D4355 500 hr.	70% minimum	
	Heavy Duty	Standard
Posts		
Material	Metal	Wood
Minimum Size	1.25 lb/ft	1½ in x 1½ in
Minimum Length	5 feet	4 feet
Minimum Embedment	2 feet	1.5 feet
Maximum Spacing	8 feet	8 feet
Type of Post Fasteners	U-shaped clips No. 16 gauge wire	Gun staples 1.5 inch long
Min. Fasteners Per Post	3	5

401.30 CONSTRUCTION METHODS

401.31 GENERAL REQUIREMENTS

Construction operations shall be conducted in such a manner to reduce erosion and sedimentation to a practical minimum. Temporary or permanent controls shall be constructed to the extent possible prior to clearing and grubbing operations. Clearing and grubbing shall not be done until the area is needed in the construction operation.

The construction site shall be maintained in a clean and sanitary condition during construction operation. Trash barrels shall be provided at the site and periodically emptied.

Installation of all controls shall be accomplished as specified on the plans or with the approval of the Engineer in accordance with the manufacturer's published recommended practice.

401.32 INCIDENTAL EROSION AND POLLUTION CONTROL ITEMS

These items shall consist of installing measures, supplying all materials and equipment, and performing all work to control erosion and minimize the production of sediment and other pollutants to the water and air during construction operations. Such measures shall include, but are not limited to, silt fences and other measures listed in this specification or deemed necessary by the Engineer.

All state and local laws governing soil erosion and pollution control shall be followed. The Engineer shall have sole authority in determining when pollution control measures are necessary, when pollution control measures are functioning properly, and when silt fences for this item of work are required.

With the exception of silt fence, the Contractor shall determine which soil erosion and pollution control measures to install, provided that the measures are in accordance with applicable laws. The Contractor shall maintain all soil erosion and pollution control measures.

Earth stockpiles shall be in the area located on the drawings and protected with silt fences to control runoff and erosion in such a manner as to minimize the production of sediment and other pollutants to the water during construction operations.

401.40 CHEMICAL POLLUTION

The Contractor shall provide tanks or barrels to be used to dispose of waste oils or other chemical pollutants produced as a by-product of the work under the contract, such as drained lubricating or transmission oils, greases, soaps, asphalt, etc. At the completion of the work, all storage tanks or barrels shall be removed and disposed of at the Contractor's expense in accordance with all Local, State and Federal regulations.

Sanitary facilities 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.

401.50 AIR POLLUTION

All Local, State and Federal 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 that may result from any contract work. Firebreaks or guards shall be constructed at locations as shown on the drawings.

All public access or haul roads used during construction of the project shall be watered or treated with dust palliative when necessary to control the dust raised by the hauling equipment.

401.60 MAINTENANCE, REMOVAL AND RESTORATION

All measures and works shall be adequately maintained in a functional condition as long as needed during the construction operation. Sediment shall be removed periodically or as directed by the Engineer. Upon sediment removal, all trapped sediment from the controls must be disposed of in the spoil area as shown on the plans. All temporary measures shall be removed and the site restored as nearly to original conditions as practicable as directed by the Engineer. All temporary measures and materials become the property of the Contractor upon removal.

401.70 METHOD OF MEASUREMENT

Soil erosion and pollution control shall be measured on a unit basis. The unit shall be shown in the Unit Price Table of the Standard Bid Form for the pay item corresponding to this specification number. Soil erosion and pollution control shall be measured in the following manner:

1) Lump Sum (LS): Soil erosion and pollution control shall be measured on a lump sum basis of installed devices. No separate payment shall be made for excess material.
2) Linear Feet (LF): Soil erosion and pollution control shall be measured on a linear feet basis. The length shall be the actual length of soil erosion control measures installed according to plans and specifications.
3) Square Yard (SY): Soil erosion and pollution control shall be measured on a square yard basis. The quantity shall be the neat line measured quantity of the finished surface completed and accepted in-place.
4) Each (EA): Soil erosion and pollution control measures shall be measured on an individual basis. The type and number of controls paid for shall be specified on the plans and itemized on the Standard Bid Form.

401.80 METHOD OF PAYMENT

The completed work for soil erosion and pollution control, measured as specified, shall be paid for at the contract unit price. The unit price bid for soil erosion and pollution control shall include supplying all materials, equipment, labor and any incidental items necessary for performing all operations described in this specification and shown on the plans.

402 SEEDING AND MULCHING

402.10 DESCRIPTION

The work of this section shall include the supply of all labor, materials, equipment and incidental items required to complete the seeding and mulching operations as shown on the plans or specified herein. This specification shall cover the preparation of areas to be seeded, furnishing and placing required seed, fertilizer, and other materials necessary for the complete seeding of the areas of this project requiring the establishment of turf.

402.20 MATERIALS

402.21 SEED MIXTURE

Seed mixtures shall be composed of certified seed of the purity, germination, and proportions, by weight, as specified on the plans or in a special provision. Seed shall be furnished separately or in mixture in standard, sealed containers with (1) seed name; (2) lot number; (3) net weight; (4) percentages of purity and of germination and (5) percentage of maximum weed seed content clearly marked for each kind of seed. The Contractor shall furnish the Owner duplicate signed copies of a statement by the vendor, certifying that each lot of seed has been tested by a qualified laboratory for seed testing within six months of date of delivery.

402.22 MULCHING MATERIAL

Straw or excelsior mulches shall be of an approved material. Devices used to hold the net in place shall be of the material and design specified on the plans or approved by the Engineer.

402.30 SEEDING SEASON

The Contractor shall obtain the permission of the Owner to proceed with a dormant seeding during the late fall. If fall dormant seeding is not approved, the Contractor shall complete all seeding the following spring prior to June 15.

402.40 SOIL PREPARATION

Areas to be seeded that have been damaged by erosion shall be restored prior to seeding. All areas to be seeded shall be finished to the grades shown on the plans, plus 4" for topsoil thickness, and then cultivated to provide a reasonably firm, but friable seedbed, free of lumps and clods detrimental to seeding operations. A minimum of 1 inch of surface soil shall be in a loose condition.

402.50 APPLICATION

Mechanical seeders, seed drills, landscape seeders, cultipacker seeders, fertilizer spreaders, or other approved mechanical seeding equipment shall be used to apply the seed and fertilizer in the amounts and mixtures shown on the plans. When a hydro-seed method is used, the capability of the equipment shall be adequate as approved by the Engineer to effectively cover the area to be seeded. Areas that are inaccessible may be sown by the broadcast method. All areas shall be visually inspected for uniformity of application. Hand-operated seeding devices may be used when seed and fertilizer are applied in dry form.

Application shall start at the top of the slope and work downward. All application rates shall be approved by the Engineer prior to application.

402.60 QUALITY CONTROL

402.61 WORKMANSHIP AND MATERIALS

All workmanship and materials furnished and supplied under this specification are subject to close and systematic inspection and testing by the Engineer including all operations, from the selection and production of materials, to final acceptance of the specified work.

The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or approval that may have been previously given. The Engineer reserves the right to reject any work or materials that are not in accordance with the requirements of this specification.

402.62 CARE DURING CONSTRUCTION

The Contractor shall be responsible for protecting and caring for seeded areas until acceptance of the work. The Contractor shall repair any damage to seeded areas caused by construction operations without additional compensation.

402.70 METHOD OF MEASUREMENT

Seeding shall be measured on a unit basis. The unit shall be shown in the Unit Price Table of the Standard Bid Form for the pay item corresponding to this specification number. Seeding shall be measured in the following manner:

1) Lump Sum (LS): Seeding shall be measured on a lump sum basis. No measurement of area seeded will be made.
2) Acre-Plan Quantity (AC-P): Seeding shall be measured on a plan quantity basis. This quantity shall be the neat line areas to be seeded as calculated from the construction plans.
3) Acre (AC): Seeding shall be measured on an area basis. The quantity shall be determined by actual field measurements of the number of acres seeded. No measurement will be made for excess seeding of project areas.

No measurement shall be made for the supply and installation of mulch where required. This shall be considered incidental to seeding operations.

402.80 METHOD OF PAYMENT

The completed work for seeding, measured as specified, shall be paid for at the contract unit price. The unit price bid for seeding shall include supplying all materials, equipment, labor and any incidental items necessary for performing all seeding operations described in this specification. No separate payment shall be made for mulching. Mulching will be considered incidental to seeding operations.

403 HERBICIDE APPLICATION

403.10 DESCRIPTION

The work of this section shall include the supply of all labor, materials, equipment and incidental items required to complete the herbicide application as shown on the plans.

403.20 MATERIALS

Herbicides shall refer to any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any undesirable plants, fungi, or microorganisms and any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant. The material used for each particular application shall be listed on the plans or provided by the Engineer.

403.30 APPLICATION

The work shall be performed by an appropriately licensed and recognized applicator. It is the Contractor's responsibility to adhere to any and all Federal, State and Local laws, regulations, and standards that pertain to the purchase, storage, handling, application, and disposal of regulated and non-regulated herbicides.

Appropriate measures shall be taken to address and minimize the risks to humans and non-target plants and animals. Any non-target damage caused by drift or poor application practices shall be the responsibility of the contractor.

403.40 METHOD OF MEASUREMENT

Herbicide application shall be measured on a unit basis. The unit shall be shown in the Unit Price Table of the Standard Bid Form for the pay item corresponding to this specification number. Herbicide application shall be measured in the following manner:

1) Lump Sum (LS): Herbicide application shall be measured on a lump sum basis. No measurement of the applied area will be made.
2) Acre-Plan Quantity (AC-P): Herbicide application shall be measured on a plan quantity basis. This quantity shall be the neat line areas to be treated as calculated from the construction plans.
3) Acre (AC): Herbicide application shall be measured on an area basis. The quantity shall be determined by actual field measurements of the number of acres treated. No measurement will be made for excess treatment of project areas.

403.50 METHOD OF PAYMENT

The completed work for herbicide application, measured as specified, shall be paid for at the contract unit price. The unit price bid for herbicide application shall include supplying all materials, equipment, labor, and any incidental items necessary for performing all operations described in this specification.

404 TRAFFIC MAINTENANCE AND CONTROL

404.10 DESCRIPTION

The work shall include the supply of all labor, materials and equipment necessary to protect and maintain traffic and to protect the work while the contract is in force. The work and measures may include, but are not limited to, the following as shown on the drawings or as specified herein; furnishing, erecting, and maintaining signs, barricades, warning lights, and other traffic control devices.

404.20 MATERIALS

All materials shall conform to those found in the current State Manual of Uniform Traffic Control Devices for the state in which the project is located.

404.30 CONSTRUCTION REQUIREMENTS

All barrels, signs, cones, warning lights, and barricades shall be erected in accordance with the Manual on Uniform Traffic Control Devices unless otherwise specified on the plans. No construction work shall be started until the proper signs and traffic control devices are installed. All applications shall follow the requirements of the Manual on Uniform Traffic Control Devices. The Contractor shall provide a watch person who shall patrol the entire job and detour route if any at least once before 8 a.m. each day and once again before dark each day, including days the Contractor is not working until or otherwise directed by the Engineer. The watch person under the Contractor's supervision will be responsible for making sure all signs, barricades, cones, warning lights and markers are in good condition and working order and that the travel way is in good condition. Additional signs and barricades may be required as directed by the Engineer.

404.40 METHOD OF MEASUREMENT

Traffic control shall be measured on a unit basis. The unit shall be shown in the Unit Price Table of the Standard Bid Form for the pay item corresponding to this specification number. Traffic Control shall be measured in the following manner:

1) Lump Sum (LS): Traffic maintenance and control shall be measured on a lump sum basis. No measurement of traffic maintenance and control will be made.
2) Incidental (INC): Traffic maintenance and control shall be considered incidental to work being performed. No separate measurement will be made for traffic maintenance and control.

404.50 METHOD OF PAYMENT

The completed work for traffic control, measured as specified, shall be paid for at the contract unit price. The unit price bid for traffic control shall include supplying all materials, equipment, labor, and any incidental items necessary for performing all operations described in this specification.