DIVISION 02

SITE CONSTRUCTION

SECTION 02110 - SITE CLEARING

PART 1 - GENERAL

1.01 SUMMARY

A. Clear site within construction limits of plant life and grass.

B. Remove root system of trees and shrubs.

C. Remove surface debris.

1.02 REGULATORY COMPLIANCE

Conform to applicable local codes and ordinances for disposal of debris.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 REMOVAL OF EXISTING TREES AND OTHER VEGETATION

A. Reasonable care shall be taken during construction to avoid damage to vegetation. Ornamental shrubbery and tree branches shall be temporarily tied back, where appropriate, to minimize damage. Trees that receive damage to branches shall be trimmed of those branches to improve the appearance of the tree. Tree trunks receiving damage from equipment shall be treated with a tree dressing. The Contractor shall not cut or injure any trees or other vegetation outside right-of-way or easement line and outside areas to be cleared, as indicated on the drawings, without written permission from the Engineer. The Contractor shall be responsible for all damages done outside these lines.

B. The Engineer shall designate which trees are to be removed within permanent and temporary easement lines or right-of-way lines.

3.02 CLEARING

A. From areas to be cleared, the Contractor shall cut or otherwise remove all trees, brush, and other vegetable matter such as snags, bark, and refuse. The ground shall be cleared to the width of the permanent easement or right-of-way unless otherwise directed by the Engineer.

B. Except where clearing is done by uprooting with machinery, trees, stumps, and stubs to be cleared shall be cut as close to the ground surface as practicable, but no more than six (6) inches above the ground surface for small trees and 12 inches for larger trees.

C. Elm bark shall be either buried at least one (1) foot deep or burned in suitable incinerators off site with satisfactory antipollution controls and fire prevention controls, to prevent the spread of Dutch Elm disease and as required by applicable laws.

D. Tree removal can occur anytime, except between June 1 and July 31, in accordance with the Forest Dwelling Bat Conservation Memorandum of Agreement, included in Section 08900 – Permits.

3.03 GRUBBING

From areas to be grubbed, the Contractor shall remove completely all stumps, remove to a depth of 12 inches all roots larger than 3-inch diameter, and remove to a depth of six (6) inches all roots larger than 1/2-inch diameter. Such depths shall be measured from the existing ground surface or the proposed finished grade, whichever is lower.

3.04 STRIPPING OF TOPSOIL

Prior to starting general excavation, strip topsoil to a depth of six (6) inches or to depths required by the Engineer. Do not strip topsoil in a muddy condition and avoid mixture of subsoil. Stockpile the stripped topsoil onsite for use in finish grading and site restoration. Topsoil stockpiled shall be free from trash, brush, stones over two (2) inches in diameter and other extraneous material.

3.05 PROTECTION

A. Protect plant growth and features remaining as final landscaping.

B. Protect bench marks and existing work from damage or displacement.

C. Maintain designated site access for vehicle and pedestrian traffic.

3.06 DISPOSAL

A. All materials resulting from clearing and grubbing and not scheduled for reuse shall become the property of the Contractor and shall be suitably disposed of off-site, unless otherwise directed by the Engineer, in accordance with all applicable laws, ordinances, rules, and regulations.

B. Such disposal shall be performed as soon as possible after removal of the material and shall not be left until the final period of cleaning up.

- END OF SECTION -

SECTION 02200 - EARTHWORK

PART 1 - GENERAL

1.01 SUMMARY

A. The Contractor shall furnish all labor, materials, and equipment necessary for the construction of the areas requiring the Earthwork in accordance with the Drawings and Specifications. This includes hauling, placing, compacting, screening, crushing, processing, moisture additions, disking, scarification, and all other incidental items required in the work.

1.02 SUBMITTALS

A. There are no submittals required for this section.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. The equipment used for the earthwork will be of the Contractors option. The equipment used shall have sufficient capabilities to produce a product meeting the desired final performance of the product.

2.02 MATERIALS

A. The material used for the structural fill shall be as designated or approved by the Engineer. Structural fill is any material used to achieve subgrade elevation. Structural fill and embankment shall be in accordance with Section 02223 – Structural Fill and Embankment.

PART 3 - EXECUTION

3.01 SUBGRADE PREPARATION

A. All topsoil and organic material shall be stripped from the construction area and all structural fill areas. These materials should be wasted from the site or stockpiled for use as topsoil in landscaping areas.

B. For any rock bearing structures, including the south tank, the valve vaults, the headworks, remove all soil to the bedrock surface.

C. Remove all old fill to approved residual soil within the footprint of the electrical building and under any new site access roads. All residual soils shall be approved by the Owner's Geotechnical Engineer prior to any backfilling operations.

D. Areas ready to receive new fill should be proofrolled with a heavily loaded dump truck (GVW of at least 80,000 pounds) or similar equipment. Proofroll shall be overseen by the Owner's Geotechnical Engineer, and must be judged acceptable prior to backfilling operations.

E. Proofrolling shall be performed after a suitable period of dry weather to avoid degrading the subgrade.

F. Areas which pump, rut, or wave during proofrolling shall be undercut at the direction of the Owner's Geotechnical Engineer.

G. Areas to receive fill of overlying constructed materials shall be compacted to a minimum of 95 percent of the soil's maximum dry density. The surface layers of the subgrade shall be void of topsoil or deleterious material such as vegetation, roots, or other debris.

H. Compaction of the subgrade shall be tested by the Owner's Geotechnical Engineer using a nuclear density meter a minimum of nine tests per acre, if practical, otherwise a proof roll as described in D above.

I. The Contractor shall remove any areas of the subgrade deemed to be soft or contain organic materials. These areas shall be over-excavated to suitable material as approved by the Owner's Geotechnical Engineer or his representative. The excavated area shall be brought up to grade using compacted fill and retested.

J. Subgrade preparation will be required under the roadway within the zone of influence. The zone of influence is defined as a 1 to 1 slope from the proposed grade to the existing grade. The zone of influence must be proofrolled as previously stated. If pumping occurs, materials must be removed along the 1 to 1 zone of influence.

K. All previously placed (old) fill must be removed below any rock or soil bearing structure or slabs, including the roadways and their associated zone of influence.

L. Positive drainage shall be maintained during subgrade preparation.

3.02 TOLERANCES

A. Bottom of Excavation: Plus or minus one-tenth (0.1) foot.

- END OF SECTION -

SECTION 02211 - ROUGH GRADING / ROUGH CLEANUP

PART 1 - GENERAL

1.01 SUMMARY

A. Remove topsoil and stockpile for later reuse.

B. Excavate subsoil and stockpile for later reuse as directed in Section 02225, Excavating, Backfilling, and Compacting for Utilities

C. Grade and rough contour site.

D. Rough (preliminary) Clean-up
On a daily basis, maintain the work area free from accumulations of waste, debris, excess rock and excavated material, downed trees and brush resulting from line installation operations. Repair fences directly following backfilling of trench. Generally restore contours as directed by Engineer.

E. Final Clean-up
Fully restore contours, seed or sod, fertilize, and straw mulch as directed by Engineer. Restore property to original condition. Refer to Section 01740.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Cleaning: Section 01740

B. Excavation: Section 02222

C. Excavating, Backfilling, and Compacting for Utilities: Section 02225

1.03 PROTECTION

A. Protect trees and other features remaining as portion of final landscaping.

B. Protect bench marks, existing structures, fences, roads, sidewalks, and other features not designated for demolition.

C. Protect above or below grade utilities which are to remain.

D. Contractor shall be responsible for repairing any damage to those items not designated for demolition or removal in a manner satisfactory to the Owner at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Topsoil

Topsoil shall be fertile, natural soil, typical of the locality, free from large stones, roots, sticks, peat, weeds, and sod, and obtained from naturally well-drained areas. It shall not be excessively acid or alkaline nor contain other toxic material harmful to plant growth. Topsoil stockpiled under other sections or divisions may be used, but the Contractor shall furnish additional topsoil at his own expense, if required.

B. Subsoil

Subsoil shall be excavated material, graded free of lumps larger than 12 inches, rocks larger than 12 inches, and debris.

PART 3 - EXECUTION

3.01 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Identify known below grade utilities. Stake and flag locations.

C. Identify and flag above grade utilities.

D. Maintain and protect existing utilities remaining which pass through work area.

E. Upon discovery of unknown utility or concealed conditions, discontinue affected work; notify Engineer.

3.02 TOPSOIL EXCAVATION

A. Excavate topsoil from areas to be further excavated, and stockpile in area designated on site by the Engineer.

B. Do not excavate wet topsoil.

C. Stockpile topsoil to depth not exceeding eight (8) feet.

3.03 SUBSOIL EXCAVATION

A. Excavate subsoil from indicated areas and stockpile in area designated on site. Excess subsoil may be reused according to Section 02222 – Excavation and Section 02225, Excavating, Backfilling, and Compacting for Utilities.

B. Do not excavate wet subsoil.

C. Stockpile subsoil to depth not exceeding eight (8) feet.

D. When excavation through roots is necessary, perform work by hand and cut roots with a sharp axe.

3.04 TOLERANCES

Top Surface of Subgrade: Plus or minus three (3) inches.

- END OF SECTION -

SECTION 02221 - ROCK REMOVAL

PART 1 - GENERAL

1.01 SUMMARY

A. The Contractor shall excavate rock, if encountered, as required to perform the required work, dispose of the excavated material, and furnish acceptable material for backfill in place of the excavated rock, as indicated on the Drawings and in the Specifications.

B. In General, if encountered, all rock will be removed as necessary for the installation of the facilities of this project. Including, but not limited to, the headworks building, the wet wells, under vaults, generator building, junction chamber, recycle pump station, south tank, and north tank. Rock, if encountered during grading, must be removed 1 foot below final grade elevation.

C. In general, rock in pipe trenches shall be excavated so as to be not less than six (6) inches from the pipe after the pipe has been laid.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Excavation: Section 02222

B. Structural Fill and Embankment: Section 02223

C. Excavating, Backfilling, and Compacting for Utilities: Section 02225

1.03 REFERENCES

A. NFPA 495 - Code for the Manufacturer, Transportation, Storage and use of Explosive Materials.

B. Commonwealth of Kentucky Department of Mines and Minerals, Laws and Regulations Governing Explosives and Blasting.

1.04 SAFETY

A. Conform to Kentucky Department of Mines and Minerals code for explosive disintegration of rock.

B. Obtain permits from local authorities having jurisdiction before explosives are brought to site or drilling is started.

C. Conform to all federal, state, and local codes and regulations regarding safety.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Rock Definition

For mass excavation, competent rock is determined by the Owner's Geotechnical Engineer (or representative of) observing the teeth of a medium size excavator (such as a Cat 320 series) being dragged vertically across the top of the exposed rock. The equipment must meet the following specifications: 50,000 pounds (minimum weight), 150 HP (minimum horsepower), 2 foot minimum bucket width, using a rock bucket with rock teeth. The acceptance criteria is based upon removal of all loose soil, mud, and excess water in the bottom of the excavation.

B. Explosives

Type recommended by explosives firm and required by the authorities having jurisdiction.

C. Delay Devices

Type recommended by explosives firm and conforming to state regulations.

D. Blasting Mat Materials

Type recommended by explosives firm and conforming to state regulations.

PART 3 – EXECUTION

3.01 ROCK REMOVAL

A. Foundation bearing rock surfaces shall be benched to provide level bearing surfaces.

3.02 EXPLOSIVES

A. The Contractor shall keep explosives on the site only in such quantity as may be needed for the work under way and only during such time as they are being used. He shall notify the Engineer, in advance, of his intention to store and use explosives. Explosives shall be stored in a secure manner and separate from all tools. Caps or detonators shall be safely stored at a point over 100 feet distance from the explosives. When the need for explosives has ended, all such materials remaining on the work shall be promptly removed from the premises.

B. The Contractor shall observe all state, federal, and municipal laws, ordinances, and regulations relating to the transportation, storage, handling, and use of explosives. In the event that any of the above-mentioned laws, ordinances, or regulations require a licensed blaster to perform or supervise the work of blasting, said licensed blaster shall, at all times have his license on the work and shall permit examination thereof by the Engineer or other officials having jurisdiction.

3.03 BLASTING FRAGMENTATION

Blasting operations shall be sufficient to ensure good fragmentation of the rock material. No rock segment shall have any dimension greater than 12 inches in any direction. Oversized rock shall be subjected to further size reduction until the fragments are less than 12 inches.

3.04 BLASTING PRECAUTIONS

A. If rock removal by blasting methods is used, blasting must comply with Federal, State, and Local Regulations and National Codes on the purchase, transportation, storage, and use of explosive material. Codes include, but are not limited to the following:

1. Storage, security, and accountability: Bureau of Alcohol, Tobacco, and Firearms (ATF): 27 CFR Part 555.
2. Shipment: DOT, 49 CFR Parts 171-179, 390-397.
3. Safety and Health: OSHA 29 CFR Part 1926, Subpart U.
4. Transportation and Storage: NFPA 495, Chapters 3 through 6.
5. Kentucky Department of Mines and Minerals code for explosive disintegration of rock.

B. The Contractor must complete the following before explosives are brought to site:

1. Obtain all required permits from authorities having jurisdiction, with copies to Owner.

2. Obtain Blasting and Liability insurance in accordance with Kentucky Department of Highway requirements. A copy of the Declaration of Insurance shall be provided to the Owner.
3. Complete preblast survey with signed copy to Owner.
4. The Contractor shall submit a blasting plan by a professional blaster to the Engineer.

C. No explosives shall be used within 20 feet of:

1. Building and/or structures existing, constructed, or under construction.

2. Underground and/or overhead utilities whether existing or partially constructed.

3. See Section 3.07 for additional blasting restrictions.

4. No blasting shall occur on the east side of West Hickman Creek.

D. Permission for any deviation from the restriction set forth above shall be secured from the Engineer, in writing; however, permission for any such deviations shall not relieve the Contractor from any responsibility in the event of damage to buildings, structures, or utilities.

E. All operations involving explosives shall be conducted with all possible care to avoid injury to persons and property. Blasting shall be done only with such quantities and strengths of explosives and in such a manner as will break the rock approximately to the intended lines and grades and yet will leave the rock not to be excavated in an unshattered condition. Care shall be taken to avoid excessive cracking of the rock upon or against which any structure will be built, to prevent injury to existing pipes or other structures and property above or below ground. Rock shall be well covered with logs or mats, or both, where required. Sufficient warning shall be given to all persons in the vicinity of the work before a charge is exploded.

F. The Contractor shall be solely responsible for his blasting operations. The Contractor shall not hold the Owner and/or Engineer liable for any damages resulting from his blasting operations on this project. Furthermore, the Contractor shall, at his expense, repair any damage to any structure, resulting from his blasting operations.

G. The Contractor shall submit a blasting plan prepared by a licensed blaster to the Engineer, as well as Kentucky Utilities (Distribution and Transmission), Columbia Gas, and Kentucky American Water.

3.05 SEISMOGRAPHIC MONITORING

All blasting shall be monitored by seismographic methods by an independent third-party seismographic monitoring expert. The seismographic monitoring shall be conducted as follows:

A. Monitoring shall be continuous from the time the blasting program begins until the time it ends. Monitors shall be left in place from the beginning of the work week until the end of the work week.

B. The seismographs shall be capable of generating a printed record of all blasts.

C. Seismographic monitors shall be used at all times and located as follows:

1. On all Kentucky Utility poles in the area, including the transmission and distribution poles.
2. On existing MH 1A and Special Manhole 10.
3. On the following structures at West Hickman WWTP; the existing influent pump station, leaping weir structure, secondary clarifiers, nitrification reactors, and the chlorine contact building.
4. Any locations required by the Utilities.

D. Copies of the seismographic monitoring records and the appropriate blasting logs shall be submitted within two weeks of the completion of blasting.

E. Copies of all blasting monitoring and blasting logs shall be included with the as-built site plans.

3.06 PREBLAST SURVEY

A. A preblast survey is to be of such quality to determine whether blasting operations damaged structures. Preblast survey shall utilize video, still images and report forms to document each structure. Video with audible description of observations shall be used to observe general conditions of each structure and to note specific damage that exists to structure prior to blasting. Still images shall be utilized to supplement video as needed to document specific conditions of each structure. Report form shall document date of survey, and who was present during survey. Forms shall also be utilized to supplement video as to the conditions of structures. Existing damage such as cracked foundations, brick facade, and etc. shall have reference object such as a scale in image or video. Audio commentary of cracked foundations, brick facades, etc. shall denote width of cracks. The Contractor shall submit three copies of video, still images, and pdf copies of report forms on CD's.

B. A preblast survey is required for all structures and utilities within a 500 foot radius of the blasting area.

C. At least thirty (30) days before initiation of blasting, the Contractor shall notify, in writing, all residents or owners of dwellings or other structures located within 500 feet of the blasting area advising that they will have a preblast survey performed. Contractor to maintain records of notifications and responses to be submitted to the Engineer.

D. A preblast survey is required of the entire West Hickman Wastewater Treatment Plant facility and the home located to the west of the West Hickman Wastewater Treatment plant entrance, 3154 Ashgrove Road.

3.07 UTILITIES

A. The Contractor shall notify Kentucky Utilities distribution prior to any blasting occurring within 100 feet of the lines.

B. There will be no blasting within the Kentucky Utilities Transmission easement. The easement is defined on the site plans. Kentucky Utilities Transmission shall be notified prior to any blasting. No blasting shall occur north of the Kentucky Utilities easement.

C. The Contractor shall provide Columbia Gas with a Blasting Data Sheet for review and approval, if any blasting will occur within 300 feet of an active gas line.

D. No blasting within 30 feet of a Kentucky American Water Main. Kentucky American Water shall be notified of any blasting.

E. There is a Marathon Pipeline Co. 24-inch Cruse Oil line located in Veterans Park between manholes MH-3A and MH-3B. No blasting to occur within 600 feet of the crude oil line.

F. No blasting shall occur on the east side of West Hickman Creek.

3.08 ROCK REMOVAL FOR NORTH TANK AND ASSOCIATED STRUCTURES AND PIPING

A. Rock shall be removed during Phase 1 for the construction of the North Tank, as shown on the Contract Documents.

B. The Contractor shall be responsible for removing all rock within the North Tank foundation footprint, the twenty (20) foot roadway around the tank, the tank discharge pipe, the overflow

pipe, the cons and the discharge valve vault to the elevations as shown in the Contract Documents. The Contractor shall removal all material for the structures to the elevations shown on the plans to verify all necessary rock removal has been completed.

C. Contractor shall not solely rely on rock contours shown on the plans or the geotechnical report for the extent of rock removal, the Contractor must expose all elevations shown on the Contract Documents to ensure no additional rock removal is necessary.

D. The Contractor shall complete a full topographic survey of the cleared area and submitted to the Engineer for approval prior to backfilling and grading per the Contract Documents.

E. The Contractor may backfill the area with rock fragments created during the blasting operation. No rock fragments shall have any dimension greater than 12 inches in any direction. Oversized rock shall be subjected to further size reduction until the fragments are less than 12 inches.

- END OF SECTION -

SECTION 02222 - EXCAVATION

PART 1 - GENERAL

1.01 SUMMARY

A. The Contractor shall furnish all labor, materials, and equipment necessary for the unclassified excavation as shown on the Drawings.

1.02 RELATED SECTIONS

A. Earthwork: Section 02200

B. Structural Fill and Embankment: Section 02223

C. Excavating, Backfilling, and Compacting for Utilities: Section 02225

1.03 SAFETY

A. Conform to all federal, state, and local codes and regulations regarding safety.

B. Protect excavations by shoring, bracing, sheet piling, underpinning, or other methods required to prevent cave-in or loose soil from falling into excavation. Trench boxes shall meet OSHA standards.

C. Underpin adjacent structures which may be damaged by excavation work, including service utilities and pipe chases.

D. Notify Engineer of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.

E. Protect bottom of excavations and soil adjacent to and beneath foundations from frost.

F. Grade excavation top perimeter to prevent surface water run-off into excavation.

G. Contractor shall provide ample means and devices with which to intercept any water entering the excavation area.

1.04 ROCK EXCAVATION

A. Trenching may be accomplished by means of a backhoe, trenching machine or by hand depending on the construction area. At the Contractor's option, trenching by a trenching machine or by backhoe is acceptable except as noted below:

1. Where the pipeline parallels a state highway and is being installed within the limits of the shoulder, a trenching machine must be used whenever practicable.

2. Where the pipeline is being constructed close to other utilities, structures, building, or large trees, and it is reasonable to anticipate possible damage from the use of a trenching machine or backhoe, then trenching shall be made by hand methods.

B. Rock removal may be accomplished in accordance with Section 02221 – Rock Removal.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Subsoil

Excavated material, graded free of lumps larger than 12 inches, rocks larger than 12 inches, and debris.

PART 3 - EXECUTION

3.01 CLASSIFICATION

A. Without regard to the materials encountered, all trenching, and excavation is unclassified and the Owner will consider it Unclassified Excavation. Any reference to rock, earth, or any other material on the Drawings, whether in numbers, words, letters, or lines, is solely for the Owner's information and is not an indication of classified excavation or the quantity of either rock, earth, or any other material involved. The Bidder must draw their own conclusions as to the conditions to be encountered. The Owner does not give any guarantee as to the accuracy of the data and will not consider any claim for additional compensation when the materials encountered are not in accord with the classification shown.

3.02 PREPARATION

Identify required lines, levels, contours, and datum.

3.03 EXCAVATION

A. All unclassified excavation shall be done in accordance with Section 204 – Roadway and Drainage Excavation in the Kentucky Transportation Cabinet's *Standard Specifications for Road and Bridge Construction*, Latest Edition.

B. Reasonable care shall be taken during construction to avoid damage to vegetation. Ornamental shrubbery and tree branches shall be temporarily tied back, where appropriate, to minimize damage. Trees that receive damage to branches shall be trimmed of those branches to improve the appearance of the tree. Tree trunks receiving damage from equipment shall be treated with a tree dressing.

C. Before excavation and grading is commenced for buildings, structures, roads, parking areas, or other work described hereinafter or before material is removed from borrow pits, the topsoil shall be removed from the areas affected and stockpiled.

D. Excavate subsoil required for construction operations and other work.

E. Contractor is responsible to adequately brace open cuts and protect workmen and equipment from cave-in, in accordance with all federal, state, and local regulations.

F. Remove lumped subsoil, boulders, and rock up to 1/3 cu. yd., measured by volume.

G. Correct unauthorized excavation at no cost to Owner. This includes over blasting for rock removal.

H. Fill over-excavated areas under structure bearing surfaces in accordance with Section 02223 – Structural Fill and Embankment.

I. Stockpile excavated material in area designated on site.

J. Water shall not be allowed to pond in excavations or undercutting will be required at no additional cost to the Owner.

K. Excavate all previously placed old fill. No structure, foundation, or slab shall bear on previously placed fill.

L. When rock removal is required to achieve final grade where vegetation is required, the Contractor shall remove an additional foot of rock and replace with one (1) foot of topsoil.

3.04 EXCAVATION FOR STRUCTURES

A. For structures, excavate to elevations and dimensions indicated, plus ample space for construction operations and inspection of foundations.

1. Excavate for foundation bearing a minimum of 18 inches below existing grade. Structure foundations shall bear entirely in original subsoil, entirely on rock, or entirely on compacted earth, granular fill or lean concrete to rock. Where structures are not to be supported on rock and rock is encountered, under cut rock two (2) feet and backfill in accordance with Section 02223 – Structural Fill and Embankment.

2. When undercutting to rock and backfilling with DGA, the bottom of the undercut area must be equal to the dimensions of the structure plus an additional 1 foot of width on each side of the structure for every 1 foot of undercut below the design finished subgrade elevation.

3. The presence of rock and rock condition must be observed by the Owner's geotechnical engineer or a representative of the geotechnical engineer. The Contractor shall drill probe holes (1-1/2 to 2 inches in diameter) by means of a pneumatic percussion drill for every 100 square feet (using a 10 foot by 10 foot grid) of the undercut area. At a minimum, for each structure the Contractor shall drill 5 probe holes, 1 at each of the 4 corners of the structure and 1 at the center of the structure. Probe holes shall be to a minimum depth of 5 feet. Probe holes will not be required for the bridge.

4. Probe holes larger than 1-1/2 to 2 inches in diameter will be allowed, however, the Contractor shall fill the probe holes to the bottom of the foundation elevation with high strength, non-shrink grout.

5. The Owner's geotechnical engineer shall check the probe holes using a hooked-end steel feeler rod to assess the rock quality and continuity. A single report shall be completed by the Owner's geotechnical engineer for the results of the probe hole inspection for each bearing surface (i.e. one report for the south tank, 1 report for each bearing elevation of the headworks facility, etc.). The report shall be evaluated by the Design Geotechnical Engineer for further remediation and inspection requirements.

6. If voids are detected during a probe hole inspection completed by the Owner's geotechnical engineer or a representative of the Owner's geotechnical engineer, the Contractor shall drill additional probe holes. Additional probe holes must be drilled half way in between the probe hole with a void and the next probe hole without a void encountered, to delineate the void. Remediation of the void will be at the discretion of the Design geotechnical engineer.

7. Where required by the Design geotechnical engineer, remediation of the voids shall be completed by excavating overlying bedrock to expose the void. Once the excavation has been completed, the Contractor shall drill additional probe holes, in

accordance with the original grid. The Owner's geotechnical engineer shall inspect the probe holes, if no voids are encountered the Contractor shall backfill in accordance with Section 02223 – Structural Fill and Embankment.

8. All rock bearing structures shall bear on benched level rock surfaces.

9. For the south tank, if a series of voids are found which cause additional rock removal and the resulting hole is located well within the tank footprint, the "hole" shall be cleaned out using a trackhoe and backfilled to the required grade with lean concrete.

10. For the south tank, if additional rock removal is required (due to voids in the bedrock) along the edge of the tank footprint or if the top of the bedrock profile drops off near the edge of the footprint, then the Contractor shall remove loose rock and backfill with lean concrete at least 5 feet beyond the outer edge of the tank foundation. Rock benching shall not exceed a 1:1 vertical to horizontal ratio with a maximum vertical step of 1 foot.

11. The North Tank Discharge Valve Vault shall be checked using the probe holes to verify competent rock prior to backfilling.

12. For the Future North Tank, all material, soil or rock, shall be removed to the elevations shown on sheet C-2104. A post-excavation survey shall be completed to verify all rock has been removed to elevations required. The Contractor shall submit the post-excavation survey for the North Tank and all associated piping and structures to the Engineer for approval prior to backfilling.

13. Structure foundations shall be installed immediately after excavation is completed, or if this cannot be done, the last 4 to 6 inches of material should not be removed until preparations for installing the foundation are complete. In no case should foundations be installed in excavations which contain water. Any soft, saturated areas in the bottom of excavations shall be removed or stabilized using granular material.

14. Make no excavation to the full depth indicated when freezing temperatures may be expected unless foundations can be installed after the excavation has been completed. Protect the bottom of the excavation from frost if foundation installation is delayed.

15. All existing old fill encountered under and structure must be removed to stiff or residual soil.

3.05 DEWATERING

A. The Contractor, at his own expense, shall provide adequate facilities for prompt and continuous removal of water from all excavations. No additional payment will be made for dewatering associated with leakage from any existing facilities during the construction.

B. Dewatering shall be in accordance with Section 02240 – Dewatering.

3.06 UNAUTHORIZED EXCAVATION

If the bottom of any excavation is taken out beyond the limits indicated or prescribed, the resulting void shall be backfilled at the Contractor's expense with thoroughly compacted crushed stone in accordance with Section 02225, or with 4000 psi concrete, if the excavation was for a structure.

3.07 EXCAVATION / DISPOSAL OF UNSUITABLE MATERIAL

A. If material unsuitable for foundation (in the opinion of the Engineer) is found at or below the grade to which excavation would normally be carried in accordance with the Drawings and/or Specifications, the Contractor shall remove such material to the required width and depth and replace it in accordance with Section 02223 – Structural Fill and Embankment.

B. No excavated materials shall be removed from the site of the work or disposed of by the Contractor except as approved by the Owner.

3.08 EXCESS MATERIAL

Disposal of excess material shall be the responsibility of the Contractor. Excess material may be placed in the spoils area shown on the Drawings. Excess material placed in the spoils area shall be deposited in accordance with Specification Section 02223. For any excess material which exceeds the volume shown for the spoils area, the Contractor shall determine the best method and area for disposal and obtain all permits and required permission.

3.09 EXISTING UTILITIES AND OTHER OBSTRUCTIONS

Prior to the commencement of construction on the project, the Contractor shall contact the Owner and utility companies whose lines, above and below ground, may be affected during construction and verify the locations of the utilities as shown on the drawings. The Contractor shall ascertain from said parties if he will be allowed to displace or alter, by necessity, those lines encountered or replace those lines disturbed by accident during construction, or if the parties themselves are only permitted by policy to perform such work. If the Contractor is permitted to perform such work, he shall leave the lines in as good condition as were originally encountered and complete the work as quickly as possible. All such lines or underground structures damaged in the construction shall be replaced at the Contractor's expense, unless in the opinion of the Engineer, such damage was caused through no fault of the Contractor.

- END OF SECTION -

SECTION 02223 - STRUCTURAL FILL AND EMBANKMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Structural Fill

B. Embankment

C. Compaction Requirements

1.02 RELATED SECTIONS

A. Earthwork: Section 02200

B. Excavating, Backfilling, and Compacting for Utilities: Section 02225

C. Lawns and Grasses: Section 02920

1.03 QUALITY ASSURANCES

A. The Owner to perform soil testing and inspection service for quality control testing during earthwork operations.

1.04 REFERENCES

A. Commonwealth of Kentucky, Standard Specifications for Road and Bridge Construction, latest edition.

B. ANSI/ASTM D698 – Standard Test Method for Laboratory Compaction characteristics of Soil Using Standard Effort.

C. ANSI/ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Core Method.

D. ASTM D2922 – Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

E. ASTM D3017 – Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.05 TESTS

A. Contractor must provide laboratory tests and analysis of fill materials in accordance with applicable referenced standards and under provisions of Section 01400. The laboratory test shall be conducted by a third party independent Laboratory acceptable to the Owner. The cost of the Laboratory testing shall be paid by the Contractor. Tests shall include, but not be limited to, gradation analysis, classification, liquid limit, plastic limit, plasticity index, and moisture/density relationships.

B. The Owner will pay all cost associated with field compaction testing that will be performed in accordance with applicable referenced standards and under provisions of Section 01400.

C. When ASTM D2922 is used, the calibration curves shall be checked and adjusted if necessary by the procedure described in ASTM D2922, paragraph ADJUSTING CALIBRATION CURVE. ASTM D2922 results in wet unit weight of soil; and when using this method, ASTM D3017 shall be used to determine the moisture content of the soil. The calibration checks of both the density and moisture gages shall be made at the beginning of a job on each different type of material encountered and at intervals as directed by the testing laboratory.

D. Testing as required for verification of design bearing capacities.

E. If tests indicate work does not meet specified requirements, remove work, replace and retest at no cost to Owner.

1.06 SUBMITTALS

A. The Owner's testing agency shall submit reports directly to the Engineer in accordance with Section 01400, and copies to the Contractor. As a minimum, reports shall consist of the following:

1. Verification of each foundation subgrade.

2. Field density test reports.

B. The Contractor's testing agency shall submit reports directly to the Engineer in accordance with Section 01400, and copies to the Contractor. As a minimum, reports shall consist of the following:

1. Test reports on borrow material and structure excavation to be use for compacted fill.

2. One optimum moisture-maximum density curve for each type of soil encountered.

3. Report of actual unconfined compressive strength and/or results of bearing tests on each strata tested.

PART 2 - PRODUCTS

2.01 COMPACTED FILL MATERIALS

A. Soils (onsite or offsite) used for compacted structural fill, backfill, and embankment shall be inorganic clayey soils free of deleterious debris or rocks whose largest dimension is no larger than four (4) inches in any direction. The soil shall have a plasticity index of less than 30. Fill lifts shall be compacted to a minimum of 95 percent of the soil's maximum dry density (ASTM D 698) with a moisture content of compacted fill within three (3) percent of optimum moisture.

B. Structural granular backfill for the Bridge shall be crushed or uncrushed aggregate with everything passing the 4 inch sieve, and 10%-0% passing the No. 4 Sieve, and 5% - 0% passing the No. 200 sieve.

C. Crushed stone used for compacted structural fill shall be Kentucky Dense Graded Aggregate per Kentucky Transportation Cabinet Standard Specifications for Road and Bridge Construction, current edition, unless otherwise shown on the Drawings. All crushed stone backfill around structures will be DGA, unless otherwise noted. DGA backfill shall not be used within the 100-year floodplain.

D. Open graded stone used for compacted backfill shall be Kentucky No. 57 size aggregate per Kentucky Transportation Cabinet Standard Specifications for Road and Bridge Construction, current edition, unless otherwise shown on the Drawings.

E. On-site soils are suitable for use a structural fill material. The old fill material may be used as structural fill if all deleterious materials are removed and large boulders are crushed to meet maximum particle size criteria specified in this section. All onsite soils used for structural fill must be tested.

F. Frozen material shall not be placed in compacted fills.

G. All material, whether from the excavations or from borrow, shall be of such nature that after it has been placed and properly compacted, it will make a dense suitable fill. It shall not contain vegetation, masses of roots, individual roots more than 18 inches long or more than 1/2-inch diameter, stones over four (4) inches in diameter, or porous matter.

H. All rock bearing structures that are undercut to rock shall be backfilled from competent rock bearing to bottom of foundation with lean concrete. The undercut area shall be equal to the dimensions of the structure plus an additional 1 foot of width on each side of the structure for every 1 foot of undercut below the design finished subgrade elevation. The lean concrete is to extend vertically, from the outmost edge of the zone of influence to the bottom of foundation elevation from the rock bearing surface.

I. All old fill shall be removed to stiff or better residual soil under any soil bearing structure, including the roadway or embankment for the roadway.

J. For structures which are backfilled from competent rock bearing with DGA, the undercut area shall be equal to the dimensions of the structure plus an additional 1 foot width on each side of the structure for every 1 foot of undercut below the design finished subgrade elevation. The dense grade structural fill is to extend vertically, from the outmost edge of the zone of influence to the subgrade elevation from the rock bearing surface. Backfill from competent rock with DGA must be approved by the Project Engineer and the Design Geotechnical Engineer.

2.02 TOPSOIL

A. All topsoil and organic materials shall be stripped from the construction area and all structural fill areas.

B. Topsoil shall be as specified in Section 02920 – Lawns and Grasses.

PART 3 – EXECUTION

3.01 GENERAL

A. Granular and soil fill shall be placed in maximum 8-inch thick loose lifts and compacted 95 percent of maximum dry density (ASTM D 698) and within three (3) percent of optimum moisture content as determined by the standard Proctor moisture density test. Any fill to be compacted with small compaction equipment (such as a plate compactor, trench compactor, or similar means) should be placed in maximum four (4) inch loose lifts. Minimal vibration should be used in compaction equipment on silty soils existing on the site.

B. If field conditions warrant, dry DGA may be placed at the direction of the Owner's Geotechnical Engineer. If dry DGA is placed, a "roller pattern" shall be performed to determine a target density.

C. Any area of the subgrade deemed to be soft, unsuitable material, or not readily capable of in-situ compaction, shall be removed. These areas shall be over-excavated to suitable material as approved by the Owner's Geotechnical Engineer or his representative. The over-excavated area shall be brought up to the desired grade using concrete, crushed stone fill, or compacted soil fill as required by the Owner's Geotechnical Engineer or his representative, and the Contract Documents. The fill material for the over-excavated area shall meet all compaction or strength requirements as specified herein. The Contractor shall be responsible for this work in areas where the Contractor has previously placed fill.

D. Maintain optimum moisture content of backfill material to attain required compaction density as specified. Material deposited on the fill that is too wet shall be removed or spread and permitted to dry, assisted by disking or blading, if necessary, until the moisture content is reduced to the specified limits.

E. Backfill areas to contours and elevations. Use unfrozen materials. The Contractor shall keep the foundation and subgrade free from water or unacceptable materials after the fill operations have started.

F. Backfill systematically, as early as possible, to allow minimum time for natural settlement. Do not backfill over porous, wet, or spongy subgrade surfaces.

G. Verify areas to be backfilled are free of debris, snow, ice, or water, and ground surfaces are not frozen. Previously frozen material shall be removed or otherwise treated as required before new backfill is placed.

H. Employ a placement method so as not to disturb or damage foundation drainage and piping.

I. Walls below final grade shall be backfilled with a minimum 12-inch thick layer of free draining material up to two feet below final grade. The two feet above this free draining material should be backfilled with an impervious material that would retard surface water infiltration. The free draining material should extend down to a rock blanket beneath the bottom slab.

J. Where backfilling behind walls and other locations, as shown on the Drawings, provide filter fabric at the interface between crushed stone and soil backfilling.

K. Backfill shall not be placed against or on structures until they have attained sufficient strength to support all loads to which subjected without distortion, cracking, or damage. Deposit soil evenly around the structure.

L. For structures with concrete top slabs, there shall be no backfilling operations until the top slab is in place and cured for a minimum of 7 days and has reached 70% of its 28 day design strength , unless noted otherwise on the plans or approved by the Engineer.

M. Slope grade away from structures minimum two (2) inches in ten (10) feet, unless noted otherwise.

N. Make changes in grade gradual. Blend slopes into level areas.

O. Remove surplus excavation materials to designated areas.

P. Rough grading above compacted fill areas shall have been completed to approximately six (6) inches below finished grade and brought back up to grade with six (6) inches of topsoil.

Q. Tolerance for top surface of fill shall be plus or minus one (1) inch.

R. Plow, strip, or break up existing sloped surfaces steeper than 1 vertical to 4 horizontal so

that fill material will bond with existing surface.

S. Maintain site grading during construction so that positive drainage of soils is promoted at all times.

T. Maintain a subgrade free of standing or ponding water.

U. For soils, underneath soil bearing structures, that will remain exposed overnight or for an extended period of time, place a lean concrete mudmat over the bearing areas. The concrete shall be at least four (4) inches thick.

3.02 STRUCTURAL FILL

A. Compacted Fill Under Structures

1. All fill under indirect rock-bearing structures shall be lean concrete unless otherwise shown on the Drawings.

2. Where compacted soil or compacted dense grade aggregate is shown on the Drawings to be under structures, compact soil or DGA fill to a minimum of 95 percent of maximum dry density and within plus or minus three (3) percent of optimum moisture content. On-site and off-site soils shall have a plasticity index of less than 30 percent. Fill shall be placed in maximum eight (8) inch lifts. Maximum particle size shall be four (4) inches in any one direction.

3. Where soil fill is shown on the drawings, compact the top 12 inches of soil subgrades to a minimum of 95 percent of maximum dry density and within plus or minus three (3) percent of optimum moisture content.

4. Rock bearing structures shall bear directly on benched leveled solid bedrock or lean concrete backfill. Loose, weathered, and uneven rock shall be removed to reach a level, solid, bedrock. Provide concrete fill for the additional depth as required.

5. Structures shall not be supported on a combination of crushed stone or soil and bedrock. If rock is encountered above the soil subgrade level when excavating for soil bearing structures, excavate bedrock to a point two (2) feet below the foundation level and fill with compacted crushed stone or soil, as required.

6. If field conditions warrant, dry DGA may be placed. If the DGA will be placed dry, field density testing will yield distorted results. A “roller pattern” may be performed to determined target dry density.

7. For the generator building, if rock is encountered within two (2) feet of the bottom of the foundation, the rock shall be undercut at least two (2) feet below the bottom of the footing and backfilled with compacted soil.

8. Any backfill required due to over blasting shall be placed in accordance with the Specifications at no additional cost to the Owner.

B. Compacted Fill Under Piping

1. Compact to a minimum of 95 percent of maximum dry density and within plus or minus three (3) percent of optimum moisture content.

2. Compact fill to a minimum of 95 percent of maximum dry density and within plus or minus three (3) percent of optimum moisture content. Soils shall have a

plasticity index of less than 30 percent. Fill shall be placed in maximum eight (8) inch lifts. Maximum particle size shall be four (4) inches in any one direction.

3. For crushed stone or aggregate backfills in trenches or wall backfill and when using smaller compaction equipment the lift thickness should not exceed four (4) inches.

C. Compacted Backfill Around Structures

1. Compact to a minimum of 95 percent of maximum dry density and within plus or minus three (3) percent of optimum moisture content.

2. Soil backfill shall be used in accordance with 2.01(A) and shall be placed in maximum 8-inch loose lifts and compacted 95 percent of maximum dry density and within plus or minus three (3) percent of optimum moisture content as determined by the standard Proctor moisture density test. Any fill to be compacted with small compaction equipment (such as a plate compactor, trench compactor, or similar means) should be placed in maximum four (4) inch loose lifts. Minimal vibration should be used in compaction equipment on silty soils existing on the site.

3. Backfill for Headworks structure shall be DGA. Backfill for all other structures below grade shall be soil or DGA, in accordance with this specification.

D. Compacted Fill Under Roads, Drives, and Walks

1. Compact structural fill under roads, drives, and walks to a minimum of 95 percent of maximum dry density and within plus or minus three (3) percent of optimum moisture content.

2. Prior to stone base placement, the subgrade area shall be proofrolled (GVW with at least 80,000 pounds) to verify subgrade conditions. Undercutting or repair may be required, as directed by the geotechnical engineer.

3. Structural fill will be required under the roadway within the zone of influence. The zone of influence is defined as a 1 to 1 slope from the proposed grade to the existing grade. The zone of influence must be proofrolled as previously stated. If pumping occurs, materials must be removed along the 1 to 1 zone of influence.

E. Compacted Fill Under Slab-on-Grade Floor Slabs

1. If rock is encountered within twelve (12) inches of the finished subgrade elevation, the rock shall be undercut at least twelve (12) inches below the subgrade and backfilled with compacted soil. The floor slab shall not bear on a combination of rock and soil.

2. Place a <u>minimum</u> of four (4) inches of compacted dense graded crush stone beneath the slab.

3. The Contractor shall keep the crushed stone moist, but not wet, immediately prior to slab concrete placement to minimize slab curling.

F. Structural Fill Under the Headworks Structure, Tank Valve Vaults, Splitter Box/ Junction Chamber, Recycle Pump Station, and Flume Structure

1. The headworks structure, tank valve vaults, splitter box / junction chamber, recycle pump station and flume structure shall be rock bearing structures bearing on lean concrete (2,000 psi minimum) to competent bedrock. Rock surface shall

be leveled competent bedrock as previously defined.

2. Probe holes and rock excavation under structures shall be completed in accordance with Section 02222-3.04.

3. For the structures, if a series of voids are found which cause additional rock removal and the resulting hole is located well within the building footprint, the “hole” shall be cleaned out using a trackhoe and backfilled to the required grade with lean concrete.

4. For the structures, if additional rock removal is required (due to voids in the bedrock) along the edge of the building footprint or if the top of the bedrock profile drops off near the edge of the footprint, then the Contractor shall remove loose rock and backfill with lean concrete at least 5 feet beyond the outer edge of the tank foundation. Rock benching shall not exceed a 1:1 vertical to horizontal ratio with a maximum vertical step of 1 foot.

G. Structural Fill Under the South Tank

1. The south tank shall be a rock bearing structure, which bears on competent bedrock, as previously defined in these specifications.

2. Once competent rock is defined at or below the required elevation for the installation of the tank backfill, the Contractor shall place a minimum of 12 inches of lean concrete (2,000 psi minimum) sloped at a 3% slope to the center of the tank, to mirror the floor slab of the tank, and in accordance with the Drawings. Installed on top of the lean concrete shall be a 12 inch layer of #57 stone, compacted in accordance with the Specifications.

3. A collector system will also be installed underneath the tank as shown on the Drawings. A perimeter drain system will also be required in accordance with the Drawings.

4. For the south tank, if a series of voids are found which cause additional rock removal and the resulting hole is located well within the tank footprint, the “hole” shall be cleaned out using a trackhoe and backfilled to the required grade with lean concrete.

5. For the south tank, if additional rock removal is required (due to voids in the bedrock) along the edge of the tank footprint or if the top of the bedrock profile drops off near the edge of the footprint, then the Contractor shall remove loose rock and backfill with lean concrete at least 5 feet beyond the outer edge of the tank foundation. Rock benching shall not exceed a 1:1 vertical to horizontal ratio with a maximum vertical step of 1 foot.

H. Structural Fill Under the Bridge

1. The Bridge foundations shall bear directly on competent bedrock or lean concrete (2,000 psi minimum). Flowable fill, DGA, or #57 stone is NOT acceptable backfill under the bridge foundation.

2. Rock surface shall be leveled to competent bedrock as previously defined.

3. Probe holes will not be required for the bridge foundation.

I. Structural Fill Under the Generator Building

1. Foundation shall bear on stiff residual soil or new fill in accordance with Section 02223 – 3.02. Foundation shall not bear on old fill.

2. If rock is encountered within two (2) feet of the bottom of foundation, the Contractor shall undercut the rock at least two (2) feet below the bottom of footing and the excavation shall be backfilled with compacted soil up to the designed bottom of footing elevation.

3.03 EMBANKMENT

A. Embankment is considered to be fill areas of the site that do not support structures, piping, drives, or walks. This includes areas above piping elevations.

B. All compact embankment areas shall be compacted to a minimum of 95 percent of maximum dry density and within plus or minus three (3) percent of optimum moisture content.

C. Fill placed on side slopes must be placed in horizontal lifts starting at the toe of the slope while securely benching the new fill material into the existing slope. Continue to place the fill in horizontal lifts until final proposed grade is reached.

3.04 TOPSOIL

A. Topsoil shall be spread and lightly compacted in accordance with Section 02920 – Lawns and Grasses.

3.05 FIELD QUALITY CONTROL

A. Quality Control Testing During Construction

1. Contractor to allow Owner's testing service to inspect structure subgrades and each compacted soil fill layer under structures, report to the Engineer on findings, and approve subgrades and fill layers before further construction work is performed. Inspection to be performed by a qualified soils engineering technician working under the direct supervision of a professional geotechnical engineer.

2. Testing service to perform field density tests in accordance with ASTM D698, ASTM D1556 (Sand Cone Method) or ASTM D2992 (Nuclear Density Method), as applicable.

a. Building Slab and Foundations: Make at least one compaction/moisture percentage and field density test for every 100 square feet of subgrade and lift of compacted fill.

b. Foundation Wall Backfill: Make at least one field density test for every 100 square feet of lift of compacted fill, but not less than one test per lift.

c. Piping: Make at least one field density test for every 100 square feet of lift of compacted fill.

d. Road, Drives, Walks: Make at least one field density test for every 100 square feet of subgrade or lift of compacted fill.

e. Embankment: Make at least one field density test for every 2000 square feet of each lift of compacted fill.

3. Foundation Subgrade: For each strata of soil at each structure on which foundations will be placed, conduct at least one test to verify required design bearing capacities by means of portable dynamic cone penetration (DCP) testing.

B. If, in the opinion of the Engineer, based on testing service reports and inspection, subgrade or fills which have been placed are below specified density, provide additional compaction and testing at no additional cost to the Owner.

C. Where settling is measurable or observable at filled areas during the general project warranty period, remove surface (pavement, sod, etc.), add and compact backfill material, and replace surface.

END OF SECTION

SECTION 02225 - EXCAVATING, BACKFILLING, AND COMPACTING FOR UTILITIES

PART 1 - GENERAL

1.01 SUMMARY

A. Excavating of trenches.

B. Bedding of pipe.

C. Backfilling trenches.

D. Installing identification tape.

PART 2 - PRODUCTS

2.01 BEDDING AND BACKFILLING STONE

A. Crushed Stone material shall conform to the Kentucky Transportation Cabinet's Standard Specifications for Road and Bridge Construction, Current Edition, latest revision.

B. Dense Grade Aggregate material shall conform to the Kentucky Transportation Cabinet's Standard Specifications for Road and Bridge Construction, Current Edition, latest revision.

C. Bedding Stone: No. 9 Crushed Limestone

D. Backfill Stone: No. 9 Crushed Limestone

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. Trenching may be accomplished by means of a backhoe, trenching machine, hydro-excavation or by hand depending on the construction area.

B. Clearing - All trees, stumps, bushes, shrubbery, and abandoned concrete or masonry structures within the limits of the trench shall be removed by the Contractor and disposed of in accordance with federal, state and local regulations. All clearing work shall be considered as incidental to the cost of laying pipe.

C. Bracing and Sheeting - Bracing and sheeting shall be provided to adequately protect the workers during pipe line installation.

1. All requirements of the Occupational Safety and Health Act (OSHA) shall be met during trenching and backfill operations.

2. As backfill is placed, the sheeting shall be withdrawn in increments not exceeding one (1) foot and the void left by the withdrawn sheeting shall be filled and with #9 stone.

3. The Contractor is solely responsible for determining requirements for bracing or sheeting. The Owner or Engineer will not be responsible for determining these requirements.

3.02 TRENCHING

A. General:

1. The Contractor shall perform all excavation of every description and of whatever substances encountered, including clearing over the pipeline route. All excavations for the pipeline shall be open-cut except where noted for bore and jack.

B. Trench Width:

1. Trench widths shall be in accordance with LFUCG Standard Drawings.

2. **Contractor shall submit a shop drawing that includes a certification from the pipe manufacturer stating the recommended trench width for each pipe size and material being used.**

C. Trench Depth:

1. The trench shall be excavated to a minimum of six (6) inches below pipe grade as noted on LFUCG Standard Drawings.

3.03 BLASTING AND EXPLOSIVES

A. If rock removal by blasting methods is used, blasting must comply with Federal, State, and Local Regulations and National Codes on the purchase, transportation, storage, and use of explosive material. Codes include, but are not limited to the following:

1. Storage, security, and accountability: Bureau of Alcohol, Tobacco, and Firearms (BATF): 27 CFR Part 181.
2. Shipment: DOT, 49 CFR Parts 171-179, 390-397.
3. Safety and Health: OSHA 29 CFR Part 1926, Subpart U.
4. Transportation and Storage: NFPA 495, Chapters 3 through 6.
5. Kentucky Department of Mines and Minerals code for explosive disintegration of rock.

B. The Contractor must complete the following before explosives are brought to site:

1. Obtain all required permits from authorities having jurisdiction, with copies to Owner.
2. Obtain Blasting and Liability insurance in accordance with Kentucky Department of Highway requirements. A copy of the Declaration of Insurance shall be provided to the Owner.
3. Complete preblast survey with signed copy to Owner.

C. Preblast survey

1. A preblast survey is to be of such quality to determine whether blasting operations damaged structures. Preblast survey shall utilize video, still images and report forms to document each structure. Video with audible description of observations shall be used to observe general conditions of each structure and to note specific damage that exists to structure prior to blasting. Still images shall be utilized to supplement video as needed to document specific conditions of each structure. Report form shall document date of survey, and who was present during survey. Forms shall also be utilized to supplement video as to the conditions of structures. Existing damage such as cracked foundations, brick facade, and etc. shall have reference object such as a scale in image or video. Audio commentary of cracked foundations, brick facades, etc. shall denote width of cracks. The Contractor shall submit three copies of video, still images, and pdf copies of report forms on CD's.
2. A preblast survey is required for all structures and utilities within a 500 foot radius of the blasting area.
3. At least thirty (30) days before initiation of blasting, the Contractor shall notify, in writing, all residents or owners of dwellings or other structures located within 500 feet of the blasting area advising that they will have a preblast survey performed. Contractor to maintain records of notifications and responses to be submitted to the Engineer.
4. A preblast survey is required of the entire West Hickman Wastewater Treatment Plant

facility and the home located to the west of the West Hickman Wastewater Treatment plant entrance, 3154 Ashgrove Road.

D. Refer to Section 02221 for blasting requirements related to utilities.

E. Refer to Section 02221 – Part 3 for additional blasting requirements.

3.04 FORCE MAIN BEDDING

A. Refer to LFUCG Standard Drawings.

B. The trench shall be excavated to a depth to allow a minimum of 36 inches cover over the top of the pipe.

3.05 FORCE MAIN BACKFILLING

A. Refer to LFUCG Standard Drawings.

3.06 GRAVITY SEWER PIPE BEDDING

A. Refer to LFUCG Standard Drawings.

3.07 GRAVITY SEWER PIPE BACKFILLING

A. Refer to LFUCG Standard Drawings.

3.08 INSTALLING IDENTIFICATION TAPE

A. Detectable underground marking tape shall be installed over all force mains. Marking tape is not required for gravity sewers. Care shall be taken to insure that the buried marking tape is not broken when installed and shall be Lineguard brand encased aluminum foil, Type III. The identification tape is manufactured by Lineguard, Inc., P.O. Box 426, Wheaton, IL 60187

B. The identification tape shall bear the printed identification of the plastic utility line below it, such as “Caution – Buried Below”. Tape shall be reverse printed; surface printing will not be acceptable. The tape shall be visible in all types and colors of soil and provide maximum color contrast to the soil. The tape shall meet the APWA color code, and shall be two (2) inches in width. Colors are green for sewer and brown for force main.

END OF SECTION

SECTION 02240 - DEWATERING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor and equipment required to dewater all excavations.

B. Dewatering of all excavations shall be the responsibility of the Contractor, and no additional compensation will be allowed for same.

1.02 SUBMITTAL

A. Contractor shall submit a dewatering plan prior to beginning construction, including but not limited to a list of equipment, in accordance with the specification herein. Dewatering plan submitted shall cover all phases on construction. Contractor shall comply with provisions of Section 01300.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 GENERAL

A. Dewatering equipment shall be of adequate size and quantity to assure maintaining proper conditions for installing pipe, concrete, backfill or other material or structure in the excavation.

B. Dewatering shall include proper removal of any and all liquid, regardless of its source, from the excavation.

C. The site shall be kept free of surface water at all times. The Contractor shall install drainage ditches, dikes and shall perform all pumping and other work necessary to divert or remove rainfall and all other accumulations of surface water from the excavations. The diversion and removal of surface water shall be performed in a manner that will prevent flooding and/or damage to other locations within the construction area where it may be detrimental.

D. The Contractor shall provide, install and operate sufficient trenches, sumps, pumps, hose piping, well points, deep wells, etc., necessary to depress and maintain the ground water level below the base of the excavation during all stages of construction operations.

E. No groundwater from the excavated area shall be discharged into the sanitary sewer system.

F. Dewatering shall be in accordance with all state and local regulations/permits/plans.

G. Trench shall be dewatered as required and never shall the trench be allowed to accumulate groundwater to a depth that will cause pipe to float.

H. The Contractor's SWPPP shall include measures for controlling the discharge of sediment as a result of dewatering operations.

END OF SECTION

SECTION 02260 - EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This Section includes, but is not limited to, the following:

1. Shoring and bracing necessary to protect existing buildings, streets, walkways, utilities, and other improvements and excavation against loss of ground or caving embankments.

2. Maintenance of shoring and bracing.

3. Removal of shoring and bracing, as required.

B. Types of shoring and bracing systems include, but are not limited to, the following:

1. Steel H-section (soldier) piles.

2. Timber lagging.

3. Steel sheet piles.

4. Portable steel trench box.

C. Building excavation is specified in another Division 2 Section.

1.02 RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.03 QUALITY ASSURANCE

A. Engineer Qualifications: A professional engineer legally authorized to practice in jurisdiction where Project is located, and experienced in providing successful engineering services for excavation support systems similar in extent required for this Project.

B. Supervision: Engage and assign supervision of excavation support system to a qualified professional engineer foundation consultant.

C. Regulations: Comply with codes and ordinances of governing authorities having jurisdiction.

D. Layout drawings for excavation support system shall be prepared by, or under the supervision of, a qualified professional engineer. System design and calculations must be acceptable to local authorities having jurisdiction.

1.04 JOB CONDITIONS

A. Before starting work, verify governing dimensions and elevations. Verify condition of adjoining properties. Take photographs to record any existing settlement or cracking of structures, pavements, and other improvements. Prepare a list of such damages, verified by dated photographs, and signed by Contractor and others conducting investigation.

B. Survey adjacent structures and improvements, employing qualified professional engineer, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

C. During excavation, resurvey benchmarks weekly, maintaining accurate log of surveyed elevations for comparison with original elevations. Promptly notify Engineer if changes in elevations occur or if cracks, sags, or other damage is evident.

1.05 EXISTING UTILITIES

A. Protect existing active sewer, water, gas, electricity and other utility services and structures.

B. Notify municipal agencies and service utility companies having jurisdiction. Comply with requirements of governing authorities and agencies for protection, relocation, removal, and discontinuing of services.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Provide adequate shoring and bracing materials which will support loads imposed. Materials need not be new, but should be in serviceable condition.

B. Structural Steel: ASTM A 36.

C. Steel Sheet Piles: ASTM A 328.

D. Timber Lagging: Any species, rough-cut, mixed hardwood, nominal 3 inches thick, unless otherwise indicated.

E. Portable Steel Trench Box shall be OSHA approved.

PART 3 - EXECUTION

3.01 SHORING

A. Wherever shoring is required, locate the system to clear permanent construction and to permit forming and finishing of concrete surfaces. Provide shoring system adequately anchored and braced to resist earth and hydrostatic pressures.

B. Shoring systems retaining earth on which the support or stability of existing structures is dependent must be left in place at completion of work.

3.02 BRACING

A. Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move a brace, install new bracing prior to removal of original brace.

B. Do not place bracing where it will be cast into or included in permanent concrete work, except as otherwise acceptable to Engineer.

C. Install internal bracing, if required, to prevent spreading or distortion of braced frames.

D. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

E. Remove sheeting, shoring, and bracing in stages to avoid disturbance to underlying soils and damage to structures, pavements, facilities, and utilities.

F. Repair or replace, as acceptable to Engineer, adjacent work damaged or displaced through installation or removal of shoring and bracing work.

END OF SECTION

SECTION 02273 – EROSION CONTROL MATTING

PART 1 - GENERAL

1.01 SUMMARY

The Contractor shall furnish all labor, materials, and equipment necessary for the installation of erosion control matting in accordance with the Drawings and Specifications.

1.02 SYSTEM DESCRIPTION

Erosion control matting is intended to provide stability to vegetated earthen channels and regraded areas against the erosive forces of water.

1.03 SUBMITTALS

The Contractor shall furnish the following submittal to the Engineer in accordance with Section 01300:

A. Erosion control mat manufacturer's quality assurance/quality control certifications for each shipment of erosion control matting to verify that the materials supplied for the project are in accordance with the requirements of this specification.

B. Manufacturer's warranty covering materials and workmanship of the erosion control mat.

C. Manufacturer's installation instructions.

PART 2 - PRODUCTS

2.01 PERMANENT TURF REINFORCEMENT MAT

A. General

The turf reinforcement mat shall be a permanent application. The material shall consist of recycled fibers and be capable of withstanding water velocities up to eight (8) feet per second. The acceptable permanent turf reinforcement mat shall be Recyclex TRM, as manufactured by American Excelsior Company, or approved equal.

B. Product Documentation

The manufacturer shall provide the Engineer or other designated party with the QA/QC certifications for each shipment of turf reinforcement mat. The certification shall be signed by a responsible party employed by the manufacturer such as the QA/QC Manager, Production Manger, or Technical Services Manager. The QA/QC certifications shall include:

1. Turf reinforcement mat lot and roll numbers (with corresponding shipping information).

2. Manufacturer's test data for raw materials used in the turf reinforcement mat production.

3. Manufacturer's test data for finished turf reinforcement mat production.

C. Product Labeling

Prior to shipment, the turf reinforcement mat Manufacturer shall affix a label to each roll identifying the following characteristics:

1. Product identification information (manufacturer name and address, brand name, product code)
2. Lot number and roll number.
3. Roll length and width.
4. Total roll weight.

2.02 EROSION CONTROL BLANKET

A. General

The erosion control blanket shall be a temporary. The material shall consist of interlocking, curled fibers and be capable of withstanding shear stresses up to 1.75 pounds per square foot. The acceptable erosion control blanket shall be Curlex I ECB, as manufactured by American Excelsior Company, or approved equal.

B. Product Documentation

The manufacturer shall provide the Engineer or other designated party with the QA/QC certifications for each shipment of erosion control blanket. The certification shall be signed by a responsible party employed by the manufacturer such as the QA/QC Manager, Production Manager, or Technical Services Manager. The QA/QC certifications shall include:

1. Erosion control blanket lot and master pack number (with corresponding shipping information).
2. Manufacturer's test data for raw materials used in the erosion control blanket production.
3. Manufacturer's test data for finished erosion control blanket production.

C. Product Labeling

Prior to shipment, the erosion control blanket manufacturer shall affix a label to each pack identifying the following characteristics:

1. Product identification information (manufacturer name and address, brand name, product code)
2. Lot number and pack number.
3. Pack length and width.
4. Total pack weight.

2.01 ARTICULATED CONCRETE BLOCKS

A. General

Articulated Concrete Blocks (ACBs) shall be a permanent application. The material shall consist of cementitious materials and be capable of withstanding water velocities up to fifteen (15) feet per second. The acceptable articulated concrete blocks shall be 6” thick ArmorFlex, as manufactured by Contech Engineered Solutions, or approved equal.

B. Product Documentation

The manufacturer shall provide the Engineer or other designated party with the QA/QC certifications for each shipment of articulated concrete blocks. The certification shall be signed by a responsible party employed by the manufacturer such as the QA/QC Manager, Production Manager, or Technical Services Manager. The QA/QC certifications shall include:

1. Articulated concrete blocks lot and mat numbers (with corresponding shipping information).
2. Manufacturer's test data for raw materials used in the articulated concrete block production.
3. Manufacturer's test data for finished articulated concrete block production.

C. Product Labeling

Prior to shipment, the articulated concrete block manufacturer shall affix a label to each mat identifying the following characteristics:

1. Product identification information (manufacturer name and address, brand name, product code)
2. Lot number and mat number.
3. Mat length and width.
4. Total mat weight.

PART 3 - EXECUTION

3.01 PLACEMENT

A. Erosion control matting shall be installed per manufacturer’s specifications.

3.02 DAMAGE REPAIR

A. The patch material used for the repair of a hole or tear shall be the same type of material as the damaged erosion control mat.

B. The patch shall extend at least 12 inches beyond any portion of the damaged erosion control mat.

C. The repair patch shall be placed as per manufacturer's recommendations.

END OF SECTION

SECTION 02370 - RIPRAP

PART 1 - GENERAL

1.01 SUMMARY

The Contractor shall furnish all labor, equipment, and materials necessary for the installation of the riprap in accordance with the Drawings and Specifications.

1.02 SUBMITTALS

There are no submittals required for this section.

PART 2 - PRODUCTS

2.01 RIPRAP

The riprap material shall meet the following requirements:

Riprap material shall be clean, hard, durable limestone and meet the Specifications for Class IA, Class II, and/or Class III, channel lining as set forth in Section 805 and Section 703 of the Kentucky Transportation Cabinet *Standard Specifications for Road and Bridge Construction*, latest edition. The size of the riprap shall be shown on the Drawings or as directed by the Engineer.

PART 3 - EXECUTION

3.01 INSTALLATION

The riprap shall be installed at the locations shown in the Drawings. Prior to installation of the riprap, all excavation and shaping of the channel or slope shall have been completed. The riprap shall be installed to the specified lines, grades, cross sections, and depths shown in the Drawings. Care shall be taken by the Contractor when placing the riprap on geotextiles, as to not puncture the geotextile material during the installation process.

- END OF SECTION -

SECTION 02371 – STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

PART 1 - GENERAL

1.01 GENERAL

A. It is the Contractor's sole responsibility to meet all requirements of the Kentucky General Permit for Stormwater Discharges Associated with Construction Activities (KYR10) and the Jessamine County Grading Permit.

B. The Contract Documents include a draft SWPPP which shall be used for informational purposes only. The erosion control measures shown on sheets C-0101, C-0102, and C-0103 and listed in the specification herein are given as the minimum erosion control measures. It is the Contractor's sole responsibility to comply with KYR10, and to adapt the plan as necessary based on sequencing and construction means and methods.

C. The Contractor shall provide to the Engineer for review and approval a sequenced SWPPP. The sequenced SWPPP must align with the Contractor's construction activities. Erosion control measures in each area must be in place prior to any soil disturbance.

D. Any Erosion and Sediment Control measures required by Engineer or State and local agency inspections shall be provided by the Contractor at no additional cost to the Owner.

E. The Contractor shall submit an updated SWPPP and implementation schedule with each pay application for review by the Engineer.

F. The Contractor shall submit an updated SWPPP to the Engineer prior to beginning and after completing construction on any of the following areas:
    1. The headworks and generator buildings and all associated piping and grading
    2. The tanks and any associated piping and grading
    3. The spoils area
    4. The junction chamber and recycle pump station and any associated piping
    5. The installation of any stream crossings
    6. Upgrades to the access roadways
    7. The installation of the influent manholes and piping
    8. Installation of the bridge

CONSTRUCTION SITE STORMWATER POLLUTION PREVENTION PLAN

DRAFT

This Stormwater Pollution Prevention Plan (SWPPP) narrative and the attached plan sheets address requirements of the Kentucky General Permit for Stormwater Discharges Associated with Construction Activities (KYR10) and the Jessamine County Grading Permit.

Plan Preparer: Contactor or Contractor's Engineer

Date: XXXXX, 2016 **LFUCG Checklist and KY DOW NOI Attached:** Yes __ No:___

1. CONTACT INFORMATION AND SITE DESCRIPTION

Project Name and Location
West Hickman Wet Weather Storage Facility

Site Owner Name and Contact Information
Lexington-Fayette Urban County Government
Attn: Mark Fischer
125 Lisle Industrial Avenue, Suite 180
Lexington, Kentucky 40511

Construction Site SWPPP/BMP Plan Manager and Contact Information
Contractor

Project Start and End Dates
Start: July, 2016
End: TBD

Description – Existing Site Conditions, Purpose, and Types of Soil Disturbing Activities
The existing site is owned by LFUCG as part of the West Hickman Wastewater Treatment Plant site. The site is split by West Hickman Creek. The existing West Hickman Wastewater Treatment Plant sits on the east side of the creek. The west side of the creek is currently partly wooded and the remaining portion is used for agricultural purposes. West Hickman Creek is listed on the 2012 303(d) List of Waters for Nutrient / Eutrophication Organic Enrichment, and Sedimentation. No threatened or endangered plant species or historical sites were found on the property. The site is a potential habitat for the Indiana bat, the northern long eared bat and the gray bat. Lexington-Fayette Urban County Government has executed a Memorandum of Agreement with the U.S. Fish and Wildlife Service for tree removal. The site is located within the FEMA 100 year floodplain. The floodway is depicted on the Drawings. This project will consist of the construction of a new headworks facility, a 22 million gallon wet weather storage tank, a generator building, a recycle pump station, a flume structure, a flow splitter/junction chamber structure, the installation of numerous manholes, new sanitary sewer piping, non-potable and potable water piping. The construction will also consist off all associated electrical work and site access roadways. Soil disturbing activities will include: initial clearing and grubbing; installing a stabilized construction entrance, installing down gradient silt fence and other erosion and sediment controls; grading; excavation for the structures, and utilities; construction of the access road and parking areas; and preparation for final seeding and landscaping.

Runoff Coefficient
Current Runoff Coefficient = 0.4; Final Runoff Coefficient = 0.73

Site Area and Disturbed Acreage
Approximately 22.4 acres will be disturbed by construction activities.

Sequence of Major Activities

Construction Activity	Schedule Considerations
Work crew orientation	Pre-project briefing to review permits, plans, schedule, and staffing.
Construction access – install entrance to site, initial construction routes, initial areas designated for vehicle parking	This is the first land-disturbing activity. Minimal clearing/grading will be done to install stabilized #2 rock site exit with geotextile underliner, at least 50 ft long. Downgradient silt fences will be installed below areas to be cleared, grubbed, graded, or cut/filled. Do-not-disturb areas will be marked off.
Sediment traps and barriers – basins, traps, sediment fences, outlet protection	ID locations and install temporary sediment traps as needed to intercept flow. Build traps prior to upgradient work where possible, and seed/mulch/blanket slopes immediately. Relocate and reinstall silt fences as necessary prior to upgradient work. Maintain and remove sediment as necessary.
Runoff and run-on controls – diversion ditches or berms, perimeter dikes	Install controls as needed to divert clean flows around or through site. Key practices will be installed after the installation of principal sediment traps and before land grading. Additional runoff control measures may be installed during grading.
Land clearing and grading—site preparation (cutting, filling, and grading, sediment traps, barriers, diversions, drains, surface roughening)	Major clearing and grading will begin after installation of principal sediment and runoff control measures, and additional control measures will be installed as grading continues. Borrow and disposal areas will be cleared as needed. Trees and buffer areas around streams, sinkholes, and other protected areas will be marked for preservation.
Runoff conveyance system - storm drains, channels, inlet and outlet protection, slope drains	Inlet and outlet protection measures will be installed as needed. Drainage ditches will be stabilized immediately with sod or seed with erosion control blanket. Slope drains will be installed as indicated on site drawings. A minimum 50 ft vegetated buffer will be maintained around all streams and sinkholes.
Surface stabilization—temporary and permanent seeding, mulching, sodding, riprap	All disturbed areas will be graded and stabilized as soon as possible. Stabilization will begin within 14 days on areas of the site where construction has permanently or temporarily ceased. Temporary and permanent stabilization will comply with the LFUCG Stormwater Manual. Erosion control blankets and turf reinforcement mats will be used on slopes in accordance with the LFUCG Stormwater Manual.
Building construction—buildings, utilities, paving	During construction, erosion and sedimentation control measures will be installed as needed, such as construction entrances and downgradient silt fences and sediment traps. Areas at final grade not in the immediate construction area will be seeded/mulched as soon as possible.
Landscaping and final stabilization—topsoiling, trees and shrubs, permanent seeding, mulching, sodding.	This is the last construction phase. All remaining disturbed areas will be stabilized, including borrow and spoil areas. Temporary control structures will be removed and the area will be seeded and mulched.

2. SITE DESCRIPTION, MAPS, AND DRAWINGS

Drawings
See the Construction drawing sheets C-0101, C-0102, and C-0103.

Name of Receiving Waters
The entire site drains into West Hickman Creek which runs through the site.

Pollutants of Concern in Receiving Waters
West Hickman Creek is listed on the 2012 303(d) List of Waters for Nutrient / Eutrophication Biological Organic Enrichment and Sedimentation. No threatened or endangered plant species or historical sites were found on the property. The site is a potential habitat for the Indiana bat, the northern long eared bat and the gray bat. Lexington-Fayette Urban County has executed a Memorandum of Agreement with the U.S. Fish and Wildlife Service for tree removal.

Potential Sources of Pollutants
Sediment from land clearing and grading; fertilizer; concrete washout water; paint wash water; oil/fuel/grease from equipment; sanitary waste; trash/debris; sediment from dewatering operations.

3. EROSION PREVENTION AND SEDIMENT CONTROL MEASURES

Limits of Disturbance and Project Phasing
Land disturbance activities will be phased to minimize the amount of soil exposed and the length of exposure time. The overall objective will be to achieve final grades as quickly as possible, and to stabilize all areas with seed, mulch or blankets/mats within 14 days after final grade is achieved, or after grading work is suspended on that portion of the site. Disturbed areas within 50 feet of West Hickman shall be stabilized within 24 hours after completing work.

Stabilization Practices
Temporary Stabilization – Topsoil stockpiles and disturbed portions of the site where construction activity stops for 14 days or more will be stabilized with temporary seed or straw mulch no later than 14 days from the last construction activity in that area (portion) of the site. Seeding rates will be consistent with the Kentucky Erosion Prevention and Sediment Control Field Guide. Lime and fertilizer will be applied only when necessary. After seeding, each area shall be mulched with at least 3,000 pounds per acre of blown or hand-scattered straw. The straw will be netted down or crimped into place by a disk harrow with the blades set straight. Slopes will be covered with blankets or mats consistent with the LFUCG Stormwater Manual. Areas of the site which are to be paved will be temporarily stabilized by applying geotextile and stone sub-base until bituminous pavement can be applied. Dust will be controlled by water sprayed from a tanker truck as needed during dry weather.

Permanent Stabilization – Disturbed portions of the site where construction activities are completed will be stabilized with permanent seed no later than 14 days after completion of grading in that area. Seed and mulch will be applied consistent with the Kentucky Erosion Protection and Sediment Control Field Guide. Lime and fertilizer will be applied only if needed. After seeding, each area will be mulched with 4,000 pounds per acre of straw. The straw mulch will be netted down or crimped into place by a disk harrow with blades set straight. Slopes will be covered with erosion control blankets or turf reinforcement mats consistent with the LFUCG Stormwater Manual. Ditches will be triple-seeded and lined with erosion control blanket or turf reinforcement matting.

Structural Practices
Sediment Traps – will be sited and constructed as needed, according to the attached drawings and through field adaptations to changing grades and emergence of gullies that need to be controlled. Traps will consist of rock or rock bag berms across concentrated flow areas and be designed to intercept,

detain, and settle out these flows. Traps installed as field adaptations will be logged on the erosion control plan sheets.

Inlet Protection Measures – will be used to detain, pond, and settle (or filter) out sheet and concentrated flows moving toward curb, drop, or other inlets. Inlet protection structures will consist of rock bags, #2 rock berms, trenched in silt fence on framing, or commercial devices.

Outlet Protection Measures – will be used where culverts discharge to ditches or channels, and consist of turf reinforcement matting over triple seeding, erosion control blanket over triple seeding, or channel lining, depending on the scour flows and consistent with the Kentucky Division of Water's BMP Technical Specifications Manual.

Ditch Check Dams – will be installed as needed to control ditch downcutting, trap sediment, and stabilize ditches. Check dam installation will be consistent with the Kentucky Erosion Protection and Sediment Control Field Guide and BMP Technical Specifications Manual.

Site Runoff Management
Sediment will be prevented from leaving the site to the maximum extent practicable. Stormwater drainage will be provided mostly by grassed swales. Runoff will be diverted onto undisturbed vegetated areas and revegetated areas where possible for infiltration. Landscaped areas with no buildings or roads will be brought to grade and planted/seeded/mulched within 14 days.The floodway will be flagged off-limits to equipment and remain in its current natural state. When construction is complete the entire site will drain directly to West Hickman Creek.

4. OTHER CONTROL MEASURES

Dewatering Operations
The Contractor shall prevent sediment and silt laden water from leaving the site to the maximum extent possible. The sediment-laden water must be pumped to a dewatering structure before it is discharged offsite. These structures may include sediment trap, sediment tank, straw bales, silt fence pit, a commercial sediment bag, or a combination of the listed structures. The structure must be sized to allow pumped water to flow through the structure without overtopping.

Offsite Vehicle Tracking
A stabilized #2 and larger rock construction exit with geotextile underliner will be installed to help reduce vehicle tracking of sediments at all exits onto paved roads. The stabilized exit will be at least 100 ft in length. The paved street adjacent to the site entrance will be swept/cleaned daily if necessary to remove any excess mud, dirt, or rock tracked from the site. The rock exit will be grubbed lightly or otherwise maintained as needed to clear (shake down) dry mud. Dump trucks hauling material from the construction site will be covered with a tarpaulin.

Waste Disposal
Waste Materials – All waste materials that may leach pollutants (paint and paint containers, caulk tubes, oil/grease containers, liquids of any kind, soluble materials, etc.) will be collected and stored in a covered metal dumpster. The dumpster will meet all LFUCG and state solid waste management regulations. Construction debris and other wastes that do not leach pollutants will be recycled or deposited in a covered or open-topped dumpster. The dumpster will be emptied when full, and the contents will be hauled to an approved site. No construction waste materials will be buried onsite. All personnel will be instructed regarding the correct procedure for waste disposal. Notices stating these practices will be posted in the office trailer and the superintendent will be responsible for seeing that these procedures are followed.

Hazardous Waste – All waste materials will be disposed of in the manner specified by local or state regulation or by the manufacturer. Site personnel will be instructed in these practices and an individual onsite daily will be responsible for seeing that these practices are followed.

Sanitary Waste – Portable toilets will be used on site for sanitary wastes. All sanitary waste will be collected from the portable units as needed to prevent excessive odors and overflows. Portable units will be placed away from storm drain inlets, ditches, creeks, and other water bodies

Timing of Control Measures
As indicated in the Sequence of Major Activities, the stabilized construction exit, earthen diversion berm, silt fences / sediment barriers, and sediment basin will be constructed prior to clearing or grading of any other portions of the site. Sediment traps will be constructed as needed in areas where gullying occurs. Ditches will be built and triple seeded/mulched (or blanketed) after construction. Areas where construction activity temporarily ceases for more than 14 days will be stabilized with temporary seed and/or mulch within 14 days of the last disturbance. Once construction activity ceases permanently in an area, that area will be seeded and mulched within 14 days. Temporary controls in permanently stabilized areas, such as silt fences, sediment barriers, ditch checks, temporary sediment traps, etc., will be removed. Controls will remain in place until all vegetation is established and ditches are stable.

5. OTHER STATE AND LOCAL PLANS

Certification of Compliance with Federal, State, and Local Regulations
This Stormwater Pollution Prevention Plan (BMP Plan) has been prepared in accordance with KYR10 and LFUCG requirements for stormwater management and erosion and sediment control, as and Jessamine County Fiscal Court requirements.

6. MAINTENANCE PROCEDURES

Stormwater, Erosion, and Sediment Control Maintenance Practices
Maintenance of all BMPs at the site will be conducted by an individual who has been trained on construction site BMPs at workshops sponsored by the KY DOW and the Kentucky Erosion Prevention and Sediment Control (KEPSC) Program. Other workers on-site will be trained in BMP installation, maintenance, and good housekeeping. These are the inspection and maintenance practices that will be used to maintain erosion and sediment controls:

- Minimize the amount of will be cleared of vegetation at one time; areas at final grade will be seeded and mulched within 14 days.
- All Erosion and Sediment Control Measures will be maintained in good working order; if a repair is necessary, it will be initiated within 24 hours of being reported. This information will be logged on the SWPPP/BMP Plan
- Silt fences will be inspected for bypassing, overtopping, undercutting, depth of sediment, tears, and to ensure attachment to secure posts. Bypasses will be repaired immediately.
- Built-up sediment will be removed from behind the silt fence before it has reached one-third the height of the fence.
- Diversion dikes and berms will be inspected and any breaches promptly repaired. Areas that are eroding or scouring will be repaired and re-seeded / mulched as needed.
- Temporary and permanent seeding and mulching will be inspected for bare spots, washouts, and healthy growth. Bare or eroded areas will be repaired as needed.

7. INSPECTION PROCEDURES

Stormwater, Erosion, and Sediment Control Inspection Practices
Inspection of all BMPs at the site will be handled by an individual who has been trained on inspecting construction site BMPs at workshops sponsored by the KY DOW and the Kentucky Erosion Prevention and Sediment Control (KEPSC) Program.

- All erosion prevention and sediment control measures will be inspected at least once each week and following any rain of one-half inch or more.

- Inspections will be conducted by an individual who has been trained by the KY DOW and KEPSC.
- Inspection reports will be written, signed, dated, and kept on file for two years.

8. NON-STORMWATER DISCHARGES

It is expected that the following non-storm water discharges will occur from the site during the construction period:

- Water from water line flushings.
- Pavement wash waters (where no spills or leaks of toxic or hazardous materials have occurred).
- Uncontaminated groundwater and rain water (from dewatering during excavation).

All non-storm water discharges will be directed to a sediment trap, filter bag, or filter fence enclosure in a flat vegetated infiltration area prior to discharge, to remove sediment and other contaminants.

The materials or substances listed below are expected to be present onsite during construction:

- Concrete
- Detergents
- Paints (enamel and latex)
- Metal Studs
- Concrete
- Tar
- Fertilizers
- Petroleum Based Products
- Cleaning Solvents
- Wood
- Masonry Block
- Roofing Shingles

Spill Prevention and Material Management Practices
The following material management practices will be used to reduce the risk of spills or other accidental exposure of materials and substances to the weather and/or runoff.

Good Housekeeping
The following good housekeeping practices will be followed onsite during the construction project.
- An effort will be made to store only enough product required to do the job
- Products and materials will be stored away from the surface drainage system.
- All materials stored onsite will be stored in a neat, orderly manner in their appropriate containers and, if possible, under a roof or other enclosure
- Products will be kept in their original containers with the original manufacturer's label
- Substances will not be mixed with one another unless recommended by the manufacturer
- Whenever possible, all of the product will be used up before disposing of the container
- Manufacturers' recommendations for proper use and disposal will be followed
- The site superintendent will inspect daily to ensure proper used and disposal of materials onsite.
- Dust will be controlled by water sprayed from a tanker truck as needed during dry weather.

Hazardous Products
These practices will be used to reduce the risks associated with any and all hazardous materials.
- Products will be kept in original containers unless they are not resealable.
- Original labels and material safety data sheets (MSDS) will be reviewed and retained.
- If surplus product must be disposed of, manufacturers' or state/local recommended methods for proper disposal will be followed.

Petroleum Products
All onsite vehicles will be fueled and maintained off-site, monitored for leaks, and receive regular preventative maintenance to reduce the chance of leakage. Petroleum products stored onsite (oil, gas,

etc.) will be stored in tightly sealed containers, which are clearly labeled. Any asphalt substances used onsite will be applied according to the manufacturer's recommendations.

Fertilizers
If used, fertilizers used will be applied only in the minimum amounts recommended by the manufacturer. Once applied, fertilizer will be covered with mulch or blankets or worked into the soil to limit exposure to stormwater. Storage will be in a covered shed. The contents of any partially used bags of fertilizer will be transferred to a sealable plastic bin to avoid spills.

Paints
All containers will be tightly sealed and stored indoors or under roof when not being used. Excess paint or paint wash water will not be discharged to the drainage or storm sewer system but will be properly disposed of according to manufacturers' instructions or state and local regulations.

Concrete Truck Washout
Concrete truck mixers and chutes will not be washed on pavement, near storm drain inlets, or within 75 feet of any ditch, stream, wetland, lake, or sinkhole. Where possible, excess concrete and wash water will be discharged to areas prepared for pouring new concrete, flat areas to be paved that are away from ditches or drainage system features, or other locations that will not drain off site. Where this approach is not possible, a constructed wash basin lined with plastic sheeting will be installed away from ditches to receive the wash water.

Spill Control Practices
In addition to the good housekeeping and material management practices discussed in the previous sections of this plan, the following practices will be followed for spill prevention and cleanup:

- Manufacturers' recommended methods for spill cleanup will be clearly posted. All personnel will be made aware of procedures and the location of the information and cleanup supplies.
- Materials and equipment necessary for spill cleanup will be kept in the material storage area. Equipment and materials will include but not limited to brooms, dust pans, mops, rags, gloves, kitty litter, sand, sawdust, and plastic and metal trash containers.
- All spills will be cleaned up immediately after discovery.
- The spill area will be kept well ventilated and personnel will wear appropriate protective clothing to prevent injury from contract with a hazardous substance.
- Spills of toxic or hazardous material will be reported to the appropriate state/local agency.
- The spill prevention plan will be adjusted as needed to prevent spills from reoccurring and improve spill response and cleanup.
- The site superintendent will be the spill prevention and cleanup coordinator. He will designate at least three other people onsite to receive spill prevention/cleanup training and assist in cleanups. Their names will be posted in the material storage area and in the office trailer outside.

9. CONTRACTOR AND SUBCONTRACTOR CERTIFICATIONS

SWPPP Files, Updates, and Amendments
This SWPP Plan and related documents (e.g., NOI, inspection reports, etc.) will be kept on file at the construction site. The SWPPP will be updated by the Contractor to reflect any and all significant changes in site conditions, selection of BMPs, the presence of any unlisted potential pollutants on site, or changes in the contractor, subcontractors, or other key information. Updates and amendments will be made in writing within 7 days and will be appended to the original BMP Plan and available for review.

Stormwater Pollution Prevention Plan Certification
I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is,

to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signed: _____ Date: _____

I certify under penalty of law that I understand the terms and conditions of the general KPDES permit that authorizes the storm water discharges associated with the construction site activity identified as part of this certification.

Subcontractor Certification

The subcontractors below certify under penalty of law that they understand the terms and conditions of the general KPDES permit that authorizes the storm water discharges associated with the construction site activity identified as part of this certification.

_____ _____

Construction Site Inspection Report (SAMPLE – OR USE YOUR OWN)

Company:	**Site:**	**County:**
Site Operator:		**Inspection Date:**
Receiving Water:	**Total Site Area (acres):**	**# Disturbed Acres:**
Inspector Name:	**Inspector Qualifications:**	
Inspection Type: Weekly or ½ Inch Rain	**Days Since Last Rainfall** ____	**# Inches of Last Rainfall:** _____

Field Inspection Observations

BMP Category	Compliance Poor	Fair	Good	Field Indicators for Compliance
Project Operations				Notice of Intent (KPDES permit) and other local/state permits on file BMP Plan on site and available for review; project activities following BMP plan Weekly inspection and rain-event reports on BMPs available for review Diversions, silt checks/traps/basins, and silt fences/barriers installed prior to clearing Grading and clearing conducted in phases to minimize exposed soil areas No vegetation removal or operations in stream or sinkhole buffer area (25 ft min) Rock pad with underliner in place on all construction site exits leading to paved roads No sediment, mud, or rock on paved public roads in project area Dust control if needed when working in residential areas during dry conditions
Drainage Management				Upland runoff diverted around bare soil areas with vegetated/lined ditches/berms Drainage channels exiting the site are lined with grass/blanket/rock and stabilized Discharges from dewatering operations cleaned in silt fence enclosure or other filter No muddy runoff leaving site after rains up to 1½ inches
Erosion Protection				Exposed soil seeded/mulched after 2 weeks if no work is planned for the next 7 days Soils on steep slopes seeded/mulched/blanketed as needed to prevent rutting
Sediment Barriers				Silt fence, rock filter, or other sediment barrier below all bare soil areas on slopes Barrier installed across slope on the contour, trenched in, posts on downhill side Multiple sediment barriers at least 125 ft apart on unseeded slopes steeper than 4:1 J-hook interceptors along silt fence where heavy muddy flows run along fencing No visible undercutting or bypassing or blowout of sediment barrier Accumulated sediment is less than halfway to the top of sediment barrier
Slope Protection				Slopes tracked, disked, or conditioned after final grade is established Slopes seeded, mulched, or blanketed within 14 days, no unmanaged rills or gullying Heavy downslope flows controlled by lined downdrain channels or slope drain pipes No muddy runoff from slopes into streams, rivers, lakes, or wetlands
Inlet Protection				Inlet dam/device or filtration unit placed at all inlets receiving muddy flows No visible undercutting, bypassing, or blowout of inlet protection dam or device Accumulated sediment is less than halfway to the top of the inlet protection dam/device
Outlet Protection				High flow discharges have rock or other flow dissipaters of adequate sizing at outlet Culvert outlets show no visible signs of erosion/scour, bank failure, or collapse
Ditch and Channel Stabilization				No unmanaged channel bank erosion or bottom scouring visible within or below site Ditches with slopes more than 3% have check dams spaced as needed, if not grassed Ditch check dams tied in to banks, with center 4" lower than sides, and no bypassing Ditches with slopes of up to 5% are thickly seeded with grass (minimum requirement) Ditches 5% to 15% are lined with thick grass and erosion control blankets as needed Ditches 15% to 33% are lined with thick grass and matting or other approved product Ditches exceeding 33% are paved or lined with rock or other approved product

Sediment Traps and Basins	Storage volume is at least 134 cubic yards for each acre of bare soil area drained Trap or basin is seeded/mulched and stabilized; no collapsing sidewalls or banks Outlet structure is stable and consists of rock-lined notched overflow or outlet riser Rock overflow is 6" lower in center to control overflow discharge Outlet riser pipe has concrete & rock base, ½ inch holes every 3" to 6", and trash rack Area near pipe outlet or overflow is stable, with no scour or erosion Sediment removed before trap or basin is halfway full; disposal is away from ditches
Maintenance of EPSC Management Practices	Sediment behind silt fence and other filters does not reach halfway to top Sediment traps and basins are less than half full of sediment Gullies repaired, silt fences and other controls inspected and repaired/replaced Written documentation of controls installed, inspection results, and repairs performed All controls removed and areas graded, seeded, and stabilized before leaving site
Materials Storage, Handling, and Cleanup	Materials that may leach pollutants stored under cover and out of the weather Fuel tanks located in protected area with double containment system Fuel and/or other spills cleaned up promptly; no evidence of unmanaged spills No evidence of paint, concrete, or other material washouts near drain inlets No storage of hazardous or toxic materials near ditches or water bodies
Waste Disposal	Trash, litter, and other debris in proper containers or properly managed No litter or trash scattered around on the construction site Provisions made for restroom facilities and/or other sanitary waste management Sanitary waste facilities clean and serviced according to schedule No disposal of any wastes into curb or other inlets, ditches, streams, or water bodies

Inspection Notes and Key Observations

List of Stabilized Areas: Vegetation is Established; Ditches are Stabilized; No Exposed Soil
Other Notes or Observations:
Corrective Actions Taken and/or Proposed Revisions to BMP Plan:

I certify under penalty of law that I understand the terms and conditions of the general National Pollutant Discharge Elimination System (NPDES) permit that authorizes the storm water discharges associated with industrial activity from the construction site identified as part of this certification.

Signature of Inspector: _____ **Date:** _____

SECTION 02372 - EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, and equipment required for installing, maintaining, amending, and removing temporary soil erosion, sediment, and pollutant controls as required by the Jessamine County Fiscal Court (JCFC), and the KPDES General Permit for Stormwater Discharges Associated with Construction Activities (KYR10).

B. The Contractor shall take all site management measures necessary to minimize erosion and contain sediment, construction materials (including excavation and backfill), and pollutants (such as chemicals, fuels, lubricants, bitumen, raw sewage, and other harmful waste) and prevent them from being discharged into or alongside any body of water or into natural or man-made channels leading thereto.

C. The Contractor shall at all times minimize disturbance and the period of time that the disturbed area is exposed without stabilization practices. In “critical areas” (within 50 feet of a stream) erosion prevention measures such as erosion control mats/blankets, mulch, or straw blown in and stabilized with tackifiers or by treading, etc. shall be implemented on disturbed areas within 24 hours or “as soon as practical” after completion of disturbance/grading or following cessation of activities.

D. Temporary erosion controls include, but are not limited to grassing, mulching, seeding, providing erosion control and turf reinforcement mats on all disturbed surfaces including waste area surfaces and stockpile and borrow area surfaces; scheduling work to minimize erosion and providing interceptor ditches at those locations which will ensure that erosion during construction will be either eliminated or maintained within acceptable limits.

E. Temporary sedimentation controls include, but are not limited to, silt dams, traps, barriers, and appurtenances on sloped surfaces which will ensure that sedimentation pollution will be either eliminated or maintained within acceptable limits.

F. Contractor is responsible for providing and maintaining effective temporary erosion and sediment control measures prior to and during construction or until final controls become effective.

G. Prior to construction, the Contractor shall obtain a JCFC Grading Permit and shall obtain coverage under the KPDES General Permit for Stormwater Discharges Associated with Construction Activities (KYR10) (see Article 3.24 in this Section). The Contractor shall develop a Stormwater Pollution Prevention Plan (SWPPP) prior to excavation, fill or grade work. The Contractor shall be responsible for placement of pollutant, erosion and sedimentation controls. If during the course of construction, the state and/or LFUCG determine additional controls are required, the Contractor shall furnish, install and maintain additional mulch, blankets, sediment barriers, and/or other controls as necessary to control pollution, erosion, and sedimentation to the satisfaction of the regulatory agency.

H. The Contractor shall inspect and repair all erosion and sedimentation controls as follows:

1. At least once every seven (7) calendar days, and

2. Within 24 hours after any storm event of 0.5 inch or greater.

I. Final stabilization practices on those portions of the project where construction activities have permanently ceased shall be initiated within fourteen (14) days of the date of cessation of construction activities. Temporary stabilization practices on those portions of the project where

construction activities have temporarily ceased shall be initiated within fourteen (14) days of the date of cessation of construction activities.

J. **Erosion and Sediment Control prevention measures shall be installed prior to removal of vegetation and/or stripping of topsoil.** The Contractor is responsible for preparing and submitting the state Notice of Intent and attachments and obtaining state permit approval prior to the beginning of any construction activities.

1.02 PERMITS AND NOTIFICATION REQUIREMENTS

A. The Contractor shall prepare a Stormwater Pollution Prevention Plan (SWPPP) for inclusion with permit submittals. The SWPPP, including an Erosion and Sediment Control Plan, shall be prepared by a professional engineer licensed in the Commonwealth of Kentucky, meeting all of the requirements of KYR10 and the JCFC.

B. The Contractor shall submit a Notice of Intent specifically for Construction Activities (NOI-SWCA) before beginning any site disturbance, and shall implement erosion, sediment and pollution control measures as may be required by state, local and federal agencies. Contractor shall submit a signed Notice of Intent form and required attachments to the Division of Water at least seven (7) days prior to beginning of construction activity. **See Article 3.24 in this Section for detailed requirements.**

C. A Grading Permit shall be obtained from the JCFC. **See Article 3.25 in this Section for detailed requirements.**

D. The Contractor shall comply with all additional requirements of LFUCG. It is the Contractor's responsibility to provide evidence to the Owner that all permits have been obtained prior to initiation of construction.

1.03 RELATED WORK

A. Section 02371 – Storm Water Pollution Prevention Plan (SWPPP)

B. Section 02373 – Stream Crossings, Streambank Restoration, and Stream Buffer Restoration

C. Applicable LFUCG Storm Water Manual Standard Drawings are included at the end of this Section 02372.

PART 2 – PRODUCTS

2.01 MULCH

A. Mulch shall be used as a soil stabilization measure for any disturbed area inactive for 14 days or longer. Areas requiring stabilization during December through February shall receive only mulch held in place with bituminous material. Mulching shall be used whenever permanent or temporary seeding is used. The anchoring of mulch shall be in accordance with the Construction Drawings except all mulch placed in December through February shall be anchored with bituminous materials regardless of the slope. Permanent mulches shall be used in conjunction with planting trees, shrubs, and other ground covers that do not provide adequate soil stabilization.

B. Straw shall come from wheat, rye, or barley and may be spread by hand or machine. Straw shall be anchored. Straw shall be applied at two tons per acre or 90 pounds per 1,000 square feet. Straw shall be free from weeds and coarse matter.

C. Wood chips do not require tacking. Wood chips shall be applied at 270 cubic yards per acre or 6 cubic yard per 1,000 square feet and approximately 2 inches deep. Wood chips shall be

treated with 20 pounds of nitrogen per acre or shall be treated with 12 pounds slow-release nitrogen per ton to prevent nutrient deficiency in plants.

D. Bark chips or shredded bark shall be applied at 70 cubic yards per acre or 1.5 to 2 cubic yards per 1,000 square feet and about one-half inch thick. Bark does not require additional nitrogen fertilizer.

E. Manufacturer's recommendations shall be followed during application of manufactured wood fiber and recycled paper sold as mulch materials applied in a hydroseeder slurry with binders/tackifiers. Recycled paper (newsprint) or wood fiber shall be mixed at 50 pounds per 100 gallons of water and applied according to manufacturer's recommendations and model of hydroseeder in use.

F. Liquid mulch binders/tackifiers shall be applied according to manufacturer's recommendations. Chemical soil stabilizers or soil binders/tackifiers/emulsions shall not be used alone.

G. Netting and mats shall be used in critical areas such as waterways where concentrated flows are expected.

H. Before the gravel or crushed stone is applied, it shall be washed. Aggregate cover shall only be used in relatively small areas and shall be incorporated into an overall landscaping plan.

2.02 TEMPORARY SEED

A. Temporary seeding shall be used for soil stabilization when grades are not ready for permanent seeding, except during December through February. The seed shall be applied within 14 days after grading has stopped. Only rye grain or annual rye grass seed shall be used for temporary seeding.

2.03 PERMANENT SEED

A. Permanent seeding shall be applied within 14 days after final grade has been reached, except during December through February. Permanent seeding shall also be applied on any areas that will not be disturbed again for a year even if final grades have not been reached. The use of mulch and erosion matting and netting with permanent seeding shall be in accordance with applicable sections of this Specification. "Seed mats" may be used for permanent seeding in accordance with manufacturers' recommendations.

B. Permanent seeding shall be used on disturbed areas where permanent, long-lived vegetative cover is needed to stabilize the soil and on rough graded areas that will not be brought to final grade for one year or more.

C. The area to be seeded shall be protected from excess runoff as necessary with diversions, grassed waterways, terraces, or sediment ponds.

D. Contractor shall use the following Permanent Seed Mix, with the following exceptions:

   a. If a property owner landscaping agreement differs from this specification, the property owner landscaping agreement shall be followed on that property, or

   b. The area to be seeded is within 50 feet of a stream bank, in which case Contractor shall follow the seed mix provided in Section 02373, or

   c. The Construction Drawings identify a different seed mix.

   The Permanent Seed Mix shall consist of the following mix spread at a rate of 12.5 pounds/1,000 square feet:

Common Name	%	lbs per 1,000 sq. ft.
Bluegrass	24%	3
Perennial ryegrass (turf)	16%	2
+ bluegrass	20%	2.5
Tall fescue (turf type)	32%	4
+ bluegrass	8%	1
TOTAL	100%	12.5

E. Vegetative cover alone shall not be used to provide erosion control cover and prevent soil slippage on a soil that is not stable due to its structure, water movement, or excessive slope.

F. Permanent seeding may be done at any time except December through February.

G. Soil material shall be capable of supporting permanent vegetation and have at least 25 percent silt and clay to provide an adequate amount of moisture holding capacity. An excessive amount of sand will not consistently provide sufficient moisture for good growth regardless of other soil factors.

H. Fertilizer shall be applied at a rate of 800 pounds per acre of 10-10-10 analysis or equivalent, unless soil test results indicate a different rate is appropriate. Lime shall be applied at a rate of 100 pounds per 1,000 square feet or two tons per acre of agricultural ground limestone, unless soil test results indicate differently.

2.04 SOD

A. Sod shall be used for disturbed areas that require immediate vegetative cover, *e.g.*, the area surrounding a drop inlet in a grassed waterway, the design flow perimeter of a grassed waterway that will convey flow before vegetation can be established, and the inlet of a culvert. Sod may be installed throughout the year. “Seed mats” and seed with geotextiles may be used in place of sod when done in accordance with manufacturers’ recommendations.

B. Contractor shall use tall fescue sod, unless another species is specified in the Construction Drawings or unless the property owner landscaping agreement differs from this specification.

C. Sod shall not be used to provide erosion control and prevent soil slippage on a soil that is not stable due to its structure, water movement, or excessive slope.

D. Sod shall be installed within 36 hours of digging and removal from the field. Sod should not be used on slopes steeper than 2H:1V. If it is to be mowed, installation should be on slopes no greater than 3H:1V.

E. Soil material shall be capable of supporting permanent vegetation and shall consist of at least 25 percent silt and clay to provide an adequate amount of moisture holding capacity. An excessive amount of sand will not consistently provide sufficient moisture for the sod regardless of other soil factors.

F. Fertilizer shall be applied at a rate of 1,000 pounds per acre of 10-10-10 analysis or equivalent, unless soil test results indicate a different rate is appropriate. Lime shall be applied at a rate of 100 pounds per 1,000 square feet or two tons per acre of agricultural ground limestone, unless soil test results indicate differently.

G. The sod shall consist of strips of live, vigorously growing grasses. The sod shall be free of noxious and secondary noxious weeds and shall be obtained from good, solid, thick-growing stands. The sod shall be cut and transferred to the job in the largest continuous pieces that will hold together and are practical to handle.

H. The sod shall be cut with smooth clean edges and square ends to facilitate laying and fitting. The sod shall be cut to a uniform thickness of not less than three-fourth inch measured from the crown of the plants to the bottom of the sod strips for all grasses except bluegrass. Bluegrass sod shall be cut to a uniform thickness of not less than one and one-half inches.

I. The sod shall be mowed to a height of not less than two inches and no more than four inches prior to cutting.

J. The sod shall be kept moist and covered during hauling and preparation for placement on the sod bed.

2.05 ROAD/PARKING STABILIZATION

A. Gravel or paved material shall be used to stabilize permanent roads or parking areas or roads or parking areas used repeatedly by construction traffic. Stabilization shall be accomplished within 14 days of grading or initiation of use for construction traffic. Unstabilized roads are not acceptable except in instances where the road will be used less than one month.

B. Road/parking stabilization shall be used wherever roads or parking areas are constructed, whether permanent or temporary, for use by construction traffic.

C. Stabilization shall be accomplished with a minimum depth of six inches of crushed stone. Stabilized construction roadbeds shall be at least 14 feet wide for one-way traffic and at least 20 feet wide for two-way traffic.

D. Temporary roads shall follow the contour of the natural terrain to the extent possible. Slopes shall not exceed 10 percent.

E. Temporary parking areas shall be located on naturally flat areas to minimize grading. Grades shall be sufficient to provide drainage but shall not exceed 4 percent.

F. All cuts and fills shall be 2H:1V or flatter.

G. Drainage ditches shall be provided as needed.

H. Crushed stone shall be KYTC aggregate No. 2 (1.5 to 3 inches in diameter), or equivalent.

2.06 CONSTRUCTION ENTRANCE

A. A stabilized construction entrance shall be constructed wherever vehicles are leaving a construction site to enter a public road or at any unpaved entrance/exit location where there is a risk of transporting mud or sediment onto paved roads. A construction entrance shall be constructed at the beginning of the project before construction traffic begins to enter and exit the site.

B. A stabilized construction entrance shall be constructed of crushed stone a minimum of 6 inches thick laid over geotextile (filter fabric).

C. The width shall be at least 20 feet and as wide as the entire width of the access. At sites where traffic volume is high, the entrance shall be wide enough for two vehicles to pass safely. The length shall be at least 50 feet, and where practical, shall be extended to 100 feet. The entrance shall be flared where it meets the existing road to provide a turning radius.

D. Stormwater and wash water runoff from a stabilized construction entrance shall drain to a sediment trap or sediment pond. If conditions on the site are such that the majority of the mud is not removed by the vehicles traveling over the gravel, then the tires of the vehicles shall be washed before entering a public road.

E. Pipe placed under the entrance to handle runoff shall be protected with a mountable berm.

F. Dust control shall be provided in accordance with the applicable sections of this Specification.

G. Crushed stone shall be KYTC aggregate No. 2 (1.5 to 3 inches in diameter), or equivalent.

H. Geotextile filter fabric shall be KYTC Type III.

2.07 DUST CONTROL

A. Dust control measures shall be implemented on the site.

B. Construction activities shall be phased to minimize the total area unstabilized at any given time, thereby reducing erosion due to air and water movement.

C. Construction roads shall be watered as needed to minimize dust.

D. Existing trees, shrubs, and ground cover shall be retained as long as possible during the construction. Initial land clearing should be conducted only in those areas to be regraded or where construction is to occur. Areas to be cleared only for new vegetation or landscaping shall be stabilized with seed and mulch immediately following clearing.

E. Vegetative cover is the most effective means of dust and erosion control, when appropriate. See sections on Temporary Seed, Permanent Seed, Mulch, and Sod of this Specification.

F. When areas have been regraded and brought to final grade, they shall be stabilized using temporary or permanent seed and mulch or other measures.

G. Mulch with mulch binders may be used as an interim dust control measure in areas where vegetation may not be appropriate.

H. See sections on Temporary Seed, Permanent Seed, Sod, Mulch, Road/Parking Stabilization, and Construction Entrance of this Specification.

2.08 NETS AND MATS

A. Mulch netting, erosion control matting, or turf reinforcement matting (TRM) shall be used on sloping areas as indicated in the Construction Drawings. Mats or nets and permanent seeding may be used as an alternate to sod for culvert entrances and grassed waterways. TRMs shall be used at the water line to control wave action in wet ponds. TRMs shall be used in accordance with manufacturer's recommendations. Erosion control matting may be used to stabilize channels and swales and on recently planted slopes to protect seedlings until they become established.

B. Effective netting and matting shall require firm, continuous contact between the materials and the soil. If there is no contact, the material will not hold the soil and erosion will occur underneath the material.

C. Nets and mats shall be suitable for their intended purpose and shall be as indicated in the Construction Drawings.

2.09 TEMPORARY DIVERSION DITCH

A. Temporary diversion ditches shall be used to collect sediment-laden runoff from disturbed areas and direct it to a sediment pond where applicable. Temporary ditches are those expected to be in use for less than one year. Temporary diversion ditches do not require stabilization, unless otherwise indicated on the Construction Drawings.

B. Temporary diversion ditches shall have stable outlets. The combination of conditions of site, slopes, and soils should be so that the ditch can be maintained throughout its planned life.

C. Temporary diversion ditches shall not be constructed below high sediment-producing areas unless land treatment practices or structural measures, designed to prevent damaging accumulations of sediment in the channels, are installed with or before the diversion.

D. A typical diversion cross section consists of a channel and a supporting ridge. In the case of an excavated-type diversion, the natural ground serves as the diversion ridge. Diversion cross sections shall be adapted to the equipment that will be used for their construction and maintenance.

E. The channel may be parabolic or trapezoidal in shape. V-shaped ditches shall not be constructed.

F. Diversions shall be located so that water will empty onto an established area such as a stable watercourse, waterway, or structure.

G. Any high sediment-producing area above a diversion shall be controlled by good land use management or by structural measures to prevent excessive sediment accumulation in the diversion channel.

H. Temporary diversions above steep slopes or across graded rights-of-way shall have a berm with a minimum top width of 2 feet, side slopes of 2:1 or flatter and a minimum height of 18 inches measured from the channel bottom.

I. Diversions installed to intercept flow on graded rights-of-way shall be spaced 200 to 300 feet apart.

J. A level lip spreader shall be used at diversion outlets discharging onto areas already stabilized by vegetation.

2.10 LEVEL SPREADER

A. Level spreaders shall be constructed at the outlets of temporary diversion ditches. Level spreaders shall also be constructed at outlets of permanent constructed waterways where they terminate on undisturbed areas.

B. The length of the level spreader shall be constructed as shown on the Construction Drawings.

2.11 PERMANENT CONSTRUCTED WATERWAY

A. Permanent constructed waterways shall be used to divert stormwater runoff from upland undisturbed areas around or away from areas to be disturbed during construction. A waterway expected to be in place for at least one year shall be considered permanent. Permanent waterways shall be lined with sod or permanent seeding and nets, mats, or TRMs.

2.12 PIPE SLOPE DRAIN

A. Pipe slope drains shall be used whenever it is necessary to convey water down a steep slope, which is not stabilized or which is prone to erosion, unless paved ditch (flume) is installed.

B. Contractor shall use a 10-inch diameter pipe or larger to convey runoff from areas up to one-third acre; 12-inch or larger pipe for up to half-acre drainage areas; and 18-inch pipe for areas up to one acre, unless otherwise specified in the Construction Drawings. Multiple pipes shall be required for large areas, spaced as shown on the Construction Drawings.

C. The pipe shall be heavy duty flexible tubing designed for this purpose, *e.g.*, non-perforated, corrugated plastic pipe, or specially designed flexible tubing.

D. A standard flared end section or a standard T-section fitting secured with a watertight fitting shall be used for the inlet.

E. Extension collars shall be 12-inch long sections of corrugated pipe. All fittings shall be watertight.

2.13 IMPACT STILLING BASIN

A. Impact stilling basins shall be used at the outlet of culverts and storm sewers with calculated exit velocities greater than 15 feet per second when flowing full.

2.14 CHECK DAM

A. Check dams shall be limited to use in small, open channels that drain 10 acres or less.

B. Check dams shall not be used in streams.

C. Check dams can be constructed of stones, coir logs, or wood fiber logs.

D. Check dams shall be constructed prior to the establishment of vegetation.

E. The maximum height of a check dam shall be three feet above the ground on which the rock is placed.

F. The center of the portion of the check dam above the flat portion of the channel shall be at least 1 foot lower than the outer edges. The outer edges of the check dam shall extend up the side slopes of the channel to a point 3 feet in elevation above the center portion of the check dam or to the top of the side slopes.

G. The maximum spacing between rock check dams in a ditch should be such that the toe of the upstream dam is at the same elevation as the top of the next downstream dam.

H. The spacing of coir and wood fiber check dams is one log every 100 feet for velocities of 5 fps, 50 feet for velocities between 5 and 7.5 fps, and 25 feet for velocities greater than 10 fps, unless otherwise shown in the Construction Documents.

I. Stone check dams shall be constructed of KYTC Class II channel lining.

J. Coir log or wood fiber log check dams shall be constructed of a single log with a diameter of at least 20 inches.

2.15 SEDIMENT TRAP

A. Sediment traps shall be installed below all disturbed areas of less than 5 acres that do not drain to a sediment pond.

B. Erosion control practices such as seeding, mulching, sodding, diversion dikes, etc., shall be used in conjunction with sediment traps to reduce the amount of sediment flowing into the trap. The amount of sediment entering a trap can be reduced by the use of stabilized diversion dikes and ditches.

C. The trap shall not be located in a stream. It shall be located to trap sediment-laden runoff before it enters the stream.

D. Trap depth shall be at least 2 feet at the inlet and 4 feet at the outlet. Effective trap width shall be at least 10 feet and trap length shall be at least 30 feet.

E. The Construction Drawings shall indicate the final disposition of the sediment trap after the

upstream drainage area is stabilized. The Construction Drawings shall indicate methods for the removal of excess water lying over the sediment, stabilization of the pond site, and the disposal of any excess material.

2.16 SEDIMENT POND

A. A sediment pond shall be installed at the outlet of a disturbed area of 5 acres or more. The maximum drainage area for a single pond is 100 acres.

B. Design and construction shall comply with all federal, state, and local laws, ordinances, rules, and regulations regarding dams.

C. Erosion control practices such as seeding, mulching, sodding, diversion dikes, etc., shall be used in conjunction with sediment ponds to reduce the amount of sediment flowing into the pond.

D. The pond shall not be located in a stream. It shall be located to trap sediment-laden runoff before it enters the stream.

E. Contractor shall construct the sediment pond as shown on the Construction Drawings.

F. Permanent ponds designed for stormwater detention or water quality treatment may serve as temporary sediment ponds if site conditions make the use of these structures desirable. At the time of conversion from a sediment pond to a permanent stormwater management pond, excess sediment shall be cleaned from the pond. If the pond is converted to a water quality basin, the sand in the sand filter outlet shall be replaced with clean sand unless it is shown to be clean.

G. The Construction Drawings shall indicate the final disposition of the sediment pond after the upstream drainage area is stabilized. The Construction Drawings shall indicate methods for the removal of excess water lying over the sediment, stabilization of the pond site, and the disposal of any excess material.

H. Vegetation shall be established upon completion of construction of the embankment, emergency spillway and other areas disturbed by construction.

2.17 SILT FENCE

A. Silt fence shall be installed down-slope of areas to be disturbed prior to clearing and grading. Silt fence shall be situated such that the total area draining to the fence is not greater than one-fourth acre per 100 feet of fence. Silt fence shall be used for storm drain drop inlet protection and around soil stockpiles.

B. Under no circumstances shall silt fences be constructed in streams or in swales or ditch lines or any area of concentrated flow where discharge rates are likely to exceed 1 cubic foot per second (cfs).

C. Synthetic filter fabric shall be a pervious sheet of propylene, nylon, and polyester or ethylene yarn and shall be certified by the manufacturer or supplier as conforming to the following requirements:

PHYSICAL PROPERTY	REQUIREMENTS
Filtering Efficiency	80% (minimum)
Tensile Strength at 20%	50 lbs./linear inch (minimum)
Flow Rate	0.3 gal./ sq. ft/ min. (minimum)

D. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable construction life at a temperature range of 0°F to 120°F.

E. Posts for synthetic fabric silt fences shall be either 2-inch by 2-inch wood or 1.33 pounds per linear foot steel with a minimum length of 5 feet. Steel posts shall have projections for fastening wire to them.

F. Wire fence reinforcement for silt fences shall be a minimum of 36 inches in height, a minimum of 14 gauge and shall have a mesh spacing of no greater than 6 inches.

2.18 STORM DRAIN INLET PROTECTION

A. Storm drain inlet protection may be utilized on drop inlets and curb inlets.

B. Storm drain inlet protection shall only be used around drop inlets when the up-slope area draining to the inlet has no other or inadequate sediment control.

C. The drainage area shall be no greater than 1 acre.

D. The inlet protection device shall be constructed in a manner that will facilitate cleanout and disposal of trapped sediment and minimize interference with construction activities.

E. Inlet protection devices shall be constructed in such a manner that any resultant ponding of stormwater will not cause flooding or excessive inconvenience or damage to adjacent areas, roadways, properties, or structures.

F. Inlet protection devices are low flow filter devices, and as such shall be constructed in such a manner as to allow for higher flows to bypass into the storm drain system to prevent flooding of the roadway or downstream properties.

2.19 FILTER STRIP

A. Filter strips shall be used on each side of permanent constructed channels.

B. Filter strips shall only be used to remove sediment from overland flow. Filter strips are not effective in removing sediment from concentrated flows.

C. If vegetative filters are proposed as a sediment control device and they do not already exist, they shall be planted and established prior to initiating land disturbing activities.

D. The minimum filter strip width shall be 50 feet for streams, wetlands, and sinkholes. The minimum filter strip width shall be ten feet for constructed waterways.

E. Where a post development floodplain or wet weather conveyance is being protected, filter strips shall be provided on each side. When a wetland or sinkhole is being protected, filter strips shall be provided around the perimeter.

F. Contractor shall construct the filter strips as shown on the Construction Drawings.

G. Existing grass or grass/legume mixtures used as filter strips shall be dense and well established, with no bare spots. When establishing new seeding, consideration shall be given to wildlife needs and soil conditions on the site. The following chart provides a list of alternative grass and grass/legume mixtures:

SEEDING MIXTURE AND SITE SUITABILITY CHART

Seeding Mixture	Rate lbs/acre	Soil Suitability
Alfalfa *Or* Red Clover *Plus* Timothy *Or* Orchardgrass *Or* Bromegrass	6 10 4 6 6	Well Drained
Ladino *Plus* Timothy *Or* Orchardgrass *Or* Bromegrass	.05 4 6 8	Wet or Well-Drained

Notes:

1. All seeding shall be in accordance with the seeding sections of this Specification.

2. Well drained sites include sites that are drained with tile as well as naturally well drained and droughty sites. Wet sites include sites that are excessively wet only a portion of the growing season.

2.20 STREAM CROSSING

A. Stream crossings shall be used in cases where construction traffic, permanent traffic, or utilities must cross existing post development floodplains. If the drainage area exceeds 1 square mile and a structure is necessary, the structure must be designed by a professional engineer licensed in Kentucky, and shall be considered a permanent structure.

B. Temporary stream crossings are applicable to flowing streams with drainage areas less than one square mile. Temporary stream crossings shall be planned to be in service for the shortest practical period of time and to be removed as soon as their function is completed.

C. All such structures, whether temporary or permanent, are subject to the rules and regulations of the U.S. Army Corps of Engineers for in-stream modifications (404 Permitting) and the Kentucky Division of Water (401 Certification). No stream crossing shall be installed without first obtaining all applicable local, state, and federal permits.

Where culverts are to be installed, compacted soil or rock shall be used to form the crossing. The depth of soil or rock cover over the culvert shall be equal to one-half the diameter of the culvert or 12 inches, whichever is greater. The sides of the fill shall be protected from erosion using the mulching and seeding erosion control measures specified in this Specification.

D. All stream crossings shall be constructed in such a manner as to avoid flooding or excessive inconvenience or damage to adjacent areas, roadways, properties, or structures.

E. When using a culvert crossing, the top of a compacted earth fill shall be covered with six inches of KYTC No. 57 stone.

F. KYTC No. 57 stone shall also be used for the stone pads forming the crossing approaches.

2.21 PUMP AROUND FLOW DIVERSION

A. A pump-around flow diversion shall be used to divert flow around construction activities occurring in a stream when those activities are reasonably expected to cause the erosion of sediment or deposition of sediment in the stream.

B. Check dams to form the diversion shall span the banks of the stream. Maintain 1-foot freeboard (minimum) on the upstream and downstream checks.

C. Check dams may be constructed of sandbags or may be a water-filled bladder such as an Aqua-Barrier.

D. The dewatering flow from the work area shall be treated in a sediment-trapping device prior to discharge to the stream.

E. Sandbags shall be woven polypropylene bags with approximate dimensions of 18-1/2 inches by 28 inches. Contractor shall tie the ends of filled bags closed using either draw strings or wire ties.

2.22 CONSTRUCTION DEWATERING

A. Sediment-laden water shall be pumped to a dewatering structure before it is discharged.

PART 3 – EXECUTION

3.01 GENERAL

A. Erosion and sediment control practices shall be consistent with the requirements of the state and local regulatory agencies and in any case shall be adequate to prevent erosion of disturbed and/or regraded areas.

B. Contractor is responsible for notifying the state regulatory agency concerning inclusion under the KPDES General Permit for Storm Water Discharges Associated with Construction Activities.

C. Gravity sewer lines, force mains and water lines that cross streams shall be constructed by methods that maintain normal stream flow and allow for a dry excavation. Water pumped from the excavation shall be contained and allowed to settle prior to reentering the stream. Excavation equipment and vehicles shall operate outside of the flowing portion of the stream. Spoil material from the line excavation shall not be allowed to enter the flowing portion of the stream. The provisions of this condition shall apply to all types of utility line stream crossings.

D. Removal of riparian vegetation in the utility line right-of-way shall be limited to that necessary for equipment access. Effective erosion and sedimentation control measures shall be employed at all times during the project to prevent degradation of waters of the Commonwealth. Site regrading and reseeding shall be accomplished with 14 days after disturbance.

3.02 MULCH

A. Seed shall be applied prior to mulching except where seed is to be applied as part of a hydroseeder slurry containing mulch.

B. Lime and fertilizer shall be incorporated and surface roughening accomplished as needed prior to mulching in accordance with applicable sections of this Specification.

C. Mulch materials shall be spread uniformly by hand or mechanically so the soil surface is covered. During or immediately following application, the mulch shall be anchored or otherwise secured to the ground according to one of the following methods:

1. Mechanical – Use a disk, crimper, or similar type tool set straight to punch or anchor the mulch material into the soil.

2. Mulch Tackifiers/Nettings/Emulsions – Use according to the manufacturer's recommendations. This is a superior method in areas of water concentration to hold mulch in place.

3. Wood Fiber – Wood fiber hydroseeder slurries may be used to tack straw mulch. This combination treatment is well suited to steep slopes and critical areas, and severe climate conditions.

D. Mulch shall be anchored using a mulch anchoring tool, a liquid binder/tackifier, or mulch nettings. Nets and mats shall be installed to obtain firm, continuous contact between the material and the soil. Without such contact, the material is useless and erosion occurs.

E. A mulch anchoring tool is a tractor-drawn implement that is typically used for anchoring straw and is designed to punch mulch approximately two inches into the soil surface. Machinery shall be operated on the contour and shall not be used on slopes steeper than 3H:1V.

F. When using liquid mulch binders and tackifiers, application shall be heaviest around edges of areas and at crests of ridges and banks to prevent wind blow. Remainder of area shall have binders/tackifiers spread uniformly in accordance with manufacturer's recommendations.

G. When using a mulch net, it shall be used in conjunction with an organic mulch and shall be installed immediately after the application and spreading of the mulch. Mulch net shall be installed over the mulch except when the mulch manufacturer recommends otherwise.

H. Excelsior blankets and mats with mulch are considered protective mulches and may be used alone on erodible soils and during all times of year. Erosion control mats shall be installed in accordance with manufacturer's recommendations.

I. Mulched areas shall be inspected at least weekly and after each rainfall of one-half inch or more. When mulch material is found to be loosened or removed, the mulch cover shall be replaced within 48 hours.

3.03 TEMPORARY SEED

A. The site shall be graded as needed to permit the use of conventional equipment for seedbed preparation, seeding, mulch application, and anchoring.

B. The needed erosion control practices, such as diversions, temporary waterways for diversion outlets, and sediment ponds, shall be installed prior to seeding.

C. Prior to seeding, lime and fertilizer shall be worked into the soil with a disk harrow, springtooth harrow, or similar tools to a depth of two inches. On sloping areas, the final operation shall be on the contour.

D. The seed shall be applied uniformly with a cyclone seeder, drill, cultipacker, seeder, or hydroseeder (slurry may include seed and fertilizer) preferably on a firm, moist seedbed. Seed shall be sown no deeper than one-fourth inch to one-half inch.

E. The seedbed shall be firmed following seeding operations with a cultipacker, roller, or light drag.

F. On sloping land, seeding operations shall be on the contour wherever possible.

G. Mulch shall be applied, in the amounts described in the mulch section of this Specification, to protect the soil and provide a better environment for plant growth.

H. New seed shall have adequate water for growth, through either natural means or irrigation, until plants are firmly established.

I. Seeded areas shall be inspected at least weekly after planting and after each rainfall of one-half inch or more. Areas requiring additional seed and mulch shall be repaired within 48 hours.

J. If vegetative cover is not established within 21 days, the area shall be reseeded.

3.04 PERMANENT SEED

A. During site preparation, topsoil shall be stockpiled for use in establishing permanent vegetation.

B. The site shall be graded as needed to permit the use of conventional equipment for seedbed preparation, seeding, mulch application, and anchoring.

C. The needed erosion control practices, such as diversions, temporary waterways for diversion outlets, and sediment ponds, shall be installed prior to seeding.

D. Prior to seeding, lime and fertilizer shall be worked into the soil with a disk harrow, springtooth harrow, or similar tools to a depth of four inches. On sloping areas, the final operation shall be on the contour.

E. Where compacted soils occur, they shall be broken up sufficiently to create a favorable rooting depth of six to eight inches.

F. The seed shall be applied uniformly with a cyclone seeder, drill, cultipacker, seeder, or hydroseeder (slurry may include seed and fertilizer) preferably on a firm, moist seedbed. Seed shall be sown no deeper than one-fourth inch to one-half inch.

G. The seedbed shall be firmed following seeding operations with a cultipacker, roller, or light drag.

H. On sloping land, seeding operations shall be on the contour wherever possible.

I. Mulch shall be applied, in the amounts described in the mulch section of this Specification, to protect the soil and provide a better environment for plant growth.

J. New seed shall have adequate water for growth, through either natural means or irrigation, until plants are firmly established.

K. Seeded areas shall be inspected at least weekly after planting and after each rainfall of 0.5 inches or more. Areas requiring additional seed and mulch shall be repaired within 48 hours.

L. If vegetative cover is not established (>70%) within 21 days, the area shall be reseeded. If 40 to 70 percent groundcover is established, seed and fertilize, using half of rates originally applied, and mulch. If less than 40 percent groundcover is established, follow original seedbed preparation methods, seeding and mulching specifications, and apply lime and fertilizer as needed according to soil tests.

3.05 SOD

A. The area to be sodded shall be protected from excess runoff, as necessary, with appropriate BMPs.

B. Prior to sodding, the soil surface shall be cleared of all trash, debris, and stones larger than one and one-half inches in diameter, and of all roots, brush, wire, and other objects that would interfere with the placing of the sod.

C. Compacted soils shall be broken up sufficiently to create a favorable rooting depth of six to eight inches.

D. Lime and fertilizer shall be worked into the soil with a disk harrow, springtooth harrow, or other suitable field equipment to a depth of four inches.

E. After the lime and fertilizer have been applied and just prior to the laying of the sod, the soil in the area to be sodded shall be loosened to a depth of one inch. The soil shall be thoroughly dampened immediately after the sod is laid if it is not already in a moist condition.

F. No sod shall be placed when the temperature is below 32°F. No frozen sod shall be placed nor shall any sod be placed on frozen soil.

G. When sod is placed during the periods of June 15 to September 1 or October 15 to March 1, it shall be covered immediately with a uniform layer of straw mulch approximately one-half inch thick or so the green sod is barely visible through the mulch.

H. Sod shall be carefully placed and pressed together so it will be continuous without any voids between the pieces. Joints between the ends of strips shall be staggered.

I. On gutter and channel sodding, the sod should be carefully placed on rows or strips at right angles to the centerline of the channel (*i.e.*, at right angles to the direction of flow). The edge of the sod at the outer edges of all gutters shall be sufficiently deep so that surface water will flow over onto the top of the sod.

J. On steep graded channels, each strip of sod shall be staked with at least two stakes not more than 18 inches apart.

K. On slopes 3H:1V or steeper, or where drainage into a sod gutter or channel is one-half acre or larger, the sod shall be rolled or tamped and then chicken wire, jute, or other netting shall be pegged over the sod for protection in the critical areas. The netting and sod shall be staked with at least two stakes not more than 18 inches apart. The netting shall be stapled on the side of each stake within two inches of the top of the stake. The stake should then be driven flush with the top of the sod.

L. When stakes are required, the stakes shall be wood and shall be approximately ½ inch by ¾ inch by 12 inches. They shall be driven flush with the top of the sod with the flat side against the slope and on an angle toward the slope.

M. Sod shall be tamped or rolled after placing and then watered. Watering shall consist of a thorough soaking of the sod and of the sod bed to a depth of at least 4 inches. The sod should be maintained in a moist condition by watering for a period of 30 days.

N. In the absence of adequate rainfall, watering shall be performed daily or as often as necessary during the first week to maintain moist soil to a depth of 4 inches. Watering shall be done during the heat of the day to prevent wilting. After the first week, sod shall be watered as necessary to maintain adequate moisture content.

O. The first mowing of sod shall not be attempted until the sod is firmly rooted. No more than one-third of the grass leaf shall be removed by the initial and subsequent cuttings. Grass height shall be maintained between 2 inches and 3 inches.

P. Where sod does not establish properly, the sod should be replaced immediately. Areas requiring resodding should be prepared in the same manner as the original installation.

3.06 ROAD/PARKING STABILIZATION

A. The roadbed or parking surface shall be cleared of all vegetation, roots, and other objectionable material.

B. All roadside ditches, cuts, fills, and disturbed areas adjacent to parking areas and roads shall be stabilized with appropriate temporary or permanent vegetation according to the applicable sections of this Specification.

C. Geotextile filter fabric may be applied beneath the stone for additional stability in accordance with fabric manufacturer's specifications.

D. Both temporary and permanent roads and parking areas may require periodic top dressing with new gravel. Seeded areas adjacent to the roads and parking areas shall be checked regularly to ensure that a vigorous stand of vegetation is maintained. Roadside ditches and other drainage structures shall be checked once each week to ensure that they do not have silt or other debris that reduces their effectiveness.

3.07 CONSTRUCTION ENTRANCE

A. Vegetation, roots, and all other obstructions shall be cleared in preparation for grading. Prior to placing geotextile (filter fabric), the entrance shall be graded and compacted to 80% of standard proctor density.

B. To reduce maintenance and loss of aggregate, the geotextile shall be placed over the existing ground before placing the stone for the entrance. Stone shall be placed to depth of 6 inches or greater for the entire width and length of the stabilized construction entrance.

C. If wash racks are used, they shall be installed according to manufacturer's specifications.

D. The stabilized construction entrance shall be inspected once each week and after there has been a high volume of traffic or a storm event greater than 0.2 inches.

E. The entrance shall be maintained in a condition that will prevent tracking or flow of sediments onto public rights-of-way. This may require periodic top dressing with additional stone, as conditions demand, and repair and/or cleanout of any structures used to trap sediment.

F. All materials spilled, dropped, washed, or tracked from vehicles onto roadways or into storm drains must be removed immediately.

3.08 DUST CONTROL

A. See Articles on Temporary Seed, Permanent Seed, Sod, Mulch, Road/Parking Stabilization, and Construction Entrance of this Specification Section.

B. When construction is active on the site, dust control shall be implemented as needed.

C. When using tillage as a dust control measure, Contractor shall begin plowing on windward side of area. Chisel-type plows spaced about 12 inches apart, spring-toothed harrow, and similar plows are examples of equipment that may produce the desired effect.

D. The site shall be observed daily for evidence of windblown dust and reasonable steps shall be taken to reduce dust whenever possible. When construction on a site is inactive for a period, the site shall be inspected at least weekly for evidence of dust emissions or previously windblown sediments. Dust control measures shall be implemented or upgraded if the site inspection shows evidence of wind erosion.

3.09 NETS AND MATS

A. Nets and mats shall be installed according to the manufacturer's recommendations. In the event that the manufacturer's recommendations conflict with any requirement of this Specification, the most conservative requirement, in terms of protection of public health and the environment, shall govern.

3.10 TEMPORARY DIVERSION DITCH

A. All dead furrows, ditches or other depressions to be crossed shall be filled before construction begins or as part of construction, and the earth fill used to fill the depressions shall be compacted using the treads of the construction equipment. All old terraces, fencerows, or other obstructions that will interfere with the successful operation of the diversion shall be removed.

B. The base for the diversion ridge shall be prepared so that a good bond is obtained between the original ground and the fill material. Vegetation shall be removed and the base shall be thoroughly disked prior to placement of fill.

C. The earth materials used to construct the earth fill portions of the diversions shall be obtained from the diversion channel or other approved source.

D. The earth fill materials used to construct diversions shall be compacted by running the construction equipment over the fill in such a manner that the entire surface of the fill will be traversed by not less than one tread track of the equipment.

E. When an excess of earth material results from cutting the channel cross section and grade, it shall be deposited adjacent to the supporting ridge unless otherwise directed.

F. The completed diversion shall conform to the cross section and grade shown on the Construction Drawings.

G. Temporary or permanent seeding and mulch shall be applied to the berm or ditch immediately following its construction. Contractor shall triple-seed areas below the flow line, and shall use erosion control blankets or turf reinforcement mats as needed.

H. Bare and vegetated diversion channels shall be inspected regularly to check for points of scour or bank failure; rubbish or channel obstruction; rodent holes, breaching, or settling of the ridge; and excessive wear from pedestrian or construction traffic.

I. Damaged channels or ridges shall be repaired at the time damage is detected. Sediment deposits shall be removed from diversion channels and adjoining vegetative filter strips regularly.

J. Diversions shall be reseeded and fertilized as needed to establish vegetative cover.

3.11 LEVEL SPREADER

A. The minimum acceptable width shall be 6 feet. The depth of the level spreader as measured from the lip shall be at least 6 inches and the depth shall be uniform across the entire length of the measure.

B. The grade of the channel for the last 15 feet entering the level spreader shall be less than or equal to 1%.

C. The level lip of the spreader shall be constructed on zero percent grade to insure uniform conversion of channel flow to sheet flow.

D. Level spreaders shall be constructed on undisturbed soil.

E. The entrance to the spreader shall be graded in a manner to insure that runoff enters directly onto the zero percent graded channel.

F. Storm runoff converted to sheet flow shall discharge onto undisturbed areas stabilized with vegetation.

G. All disturbed areas shall be stabilized immediately after construction is completed in accordance with the mulching and vegetation requirements of this Specification.

H. The level spreader shall be inspected after each storm event and at least once each week. Any observed damage shall be repaired immediately.

3.12 PERMANENT CONSTRUCTED WATERWAY

A. All ditches or other depressions to be crossed shall be filled before construction begins or as part of construction, and the earth fill used to fill the depressions shall be compacted using the treads of the construction equipment. All old terraces, fence rows, or other obstructions that will interfere with the successful operation of the channel shall be removed.

B. The earth materials used to construct the earth fill portions of the channel shall be obtained from the excavated portion of the channel or other approved source.

C. The earth fill materials used to construct the channel shall be compacted by running the construction equipment over the fill in such a manner that the entire surface of the fill will be traversed by at least one tread track of the equipment.

D. The completed channel shall conform to the cross section and grade shown on the Construction Drawings.

E. Channels shall be inspected regularly to check for points of scour or bank failure; rubbish or channel obstruction; rodent holes; breaching; and excessive wear from pedestrian or construction traffic.

F. Channels shall be repaired at the time damage is detected. Sediment deposits shall be removed from adjoining vegetative filter strips when they are visible.

G. Channels shall be reseeded and fertilized as needed to establish vegetative cover.

H. The subgrade of paved channels shall be constructed to the required elevations. All soft sections and unsuitable material shall be removed and replaced with suitable material. The subgrade shall be thoroughly compacted and shaped to a smooth, uniform surface. The subgrade shall be moist when pouring concrete.

I. Before permanent stabilization of the slope, the structure shall be inspected after each rainfall. Any damages to the paved channel or slope shall be repaired immediately.

3.13 PIPE SLOPE DRAIN

A. The pipe slope drain shall be placed on undisturbed or well-compacted soil.

B. Soil around and under the entrance section shall be hand-tamped in 4-inch to 8-inch lifts to the top of the dike to prevent piping failure around the inlet.

C. Filter fabric shall be placed under the inlet and extended 5 feet in front of the inlet and be keyed in 6 inches on all sides to prevent erosion.

D. Backfilling around and under the pipe with stable soil material hand compacted in lifts of 4 inches to 8 inches shall be done to ensure firm contact between the pipe and the soil at all points.

E. The pipe slope drain shall be securely staked to the slope using grommets provided for this purpose at intervals of 10 feet or less.

F. All slope drain sections shall be securely fastened together and have watertight fittings.

G. The pipe shall be extended beyond the toe of the slope and discharged at a non-erosive velocity into a stabilized area or to a sediment trap or pond.

H. The pipe slope drain shall have a minimum slope of 3 percent or steeper.

I. The height at the centerline of the earth dike shall range from a minimum of 1.0 foot over the pipe to twice the diameter of the pipe measured from the invert of the pipe. It shall also be at least 6 inches higher than the adjoining ridge on either side. At no point along the dike will the elevation of the top of the dike be less than 6 inches higher than the top of the pipe.

J. All areas disturbed by installation or removal of the pipe slope drain shall be immediately stabilized.

K. The pipe slope drain shall be inspected after every rainfall and at least weekly. Any necessary repairs shall be made immediately.

L. Contractor shall check to see that water is not bypassing the inlet and undercutting the inlet or pipe. If necessary, Contractor shall install headwall or sandbags.

M. Contractor shall check for erosion at the outlet point and shall check the pipe for breaks or clogs. Contractor shall install additional outlet protection if needed and immediately repair the breaks and clean any clogs.

N. Contractor shall not allow construction traffic to cross the pipe slope drain and shall not place any material on it.

O. If a sediment trap has been provided, it shall be cleaned out when the sediment level reaches 1/3 the design volume.

P. The pipe slope drain shall remain in place until the slope has been completely stabilized or up to 30 days after permanent slope stabilization.

3.14 IMPACT STILLING BASIN

A. Construction specifications for impact stilling basins are provided in the Construction Drawings.

3.15 CHECK DAM

A. Stone shall be placed by hand or mechanically as necessary to achieve complete coverage of the ditch and to ensure that the center of the dam is at least 1 foot lower than the outer edges. Stone shall also be placed to extend 3 feet in elevation above the center portion of the check dam or to the top of the channel side slopes.

B. Coir and wood fiber logs shall be laid on the channel bottom.

C. Check dams shall be removed when their useful life has been completed. In temporary ditches and swales, check dams shall be removed and the ditch filled in when it is no longer needed. In permanent channels, check dams shall be removed when a permanent lining can be installed. In the case of grass-lined ditches, check dams shall be removed when the grass has matured sufficiently to protect the ditch or swale. The area beneath the check dams shall be seeded and mulched or sodded (depending upon velocity) immediately after check dams are removed.

D. If stone check dams are used in grass-lined channels that will be mowed, care shall be taken to remove all stone from the channel when the dam is removed. This shall include any stone that has washed downstream.

E. Regular inspections shall be made to ensure that the check dam is in good working order and the center of the dam is lower than the edges. Erosion caused by high flows around the edges of the dam shall be corrected immediately, and the dam shall be extended beyond the repaired area.

F. Check dams shall be checked for sediment accumulation after each rainfall. Sediment shall be removed before or when it reaches one-third of the original height.

G. Check dams shall remain in place and operational until the drainage area and channel are completely stabilized, or up to 30 days after the permanent site stabilization is achieved.

3.16 SEDIMENT TRAP

A. The area to be excavated shall be cleared of all trees, stumps, roots, brush boulders, sod, and debris. All channel banks and sharp breaks shall be sloped to no steeper than 1:1. All topsoil containing excessive amounts of organic matter shall be removed.

B. Seeding, fertilizing, and mulching of the material taken from the excavation shall comply with the applicable soil stabilization sections of this Specification.

C. Construction specifications for sediment traps are provided in the Construction Drawings.

D. Any material excavated from the trap shall be placed in one of the following ways so that it will not be washed back into the trap by rainfall:

1. uniformly spread to a depth not exceeding 3 feet and graded to a continuous slope away from the trap

2. uniformly placed or shaped reasonably well with side slopes assuming the natural angle of repose for the excavated material behind a berm width not less than 12 feet.

E. Sediment shall be removed from the trap when the capacity is reduced to one third of the design volume. Contractor shall follow the methods for disposing of sediment removed from the trap as shown in the Construction Drawings.

3.17 SEDIMENT POND

A. The foundation area shall be cleared of all trees, stumps, roots, brush boulders, sod, and debris. All channel banks and sharp breaks shall be sloped to no steeper than 1:1. All topsoil containing excessive amounts of organic matter shall be removed. The surface of the foundation area shall be thoroughly scarified before placement of the embankment material.

B. A cutoff trench shall be backfilled with suitable material. The trench shall be kept free of standing water during backfill operations.

C. The pipe conduit barrel shall be placed on a firm foundation. Selected backfill material shall be placed around the conduit in layers, and each layer shall be compacted to at least the same density as the adjacent embankment. All compaction within 2 feet of the pipe spillway shall be accomplished with hand-operated tamping equipment.

D. All borrow areas outside the pond and in the drainage area shall be graded and left in such a manner that water will not be ponded.

E. The material placed in the fill shall be free of all sod, roots, frozen soil, stones more than 6 inches in diameter, and other objectionable material. The placing and spreading of the fill

material shall occur in approximately 6-inch horizontal layers or of such thickness that the required compaction can be obtained with the equipment used. Each layer shall be compacted in a way that will result in achieving 95 percent of the maximum standard dry density.

F. The distribution and gradation of materials throughout the fill shall be such that there will be no lenses, pockets, stakes, or layers of material differing substantially in texture or gradation from the surrounding material. Where it is necessary to use materials of varying texture and gradation, the more impervious material shall be placed in the upstream and center portions of the fill.

G. The moisture content of fill material shall be such that the required degree of compaction can be obtained with the equipment used.

H. Fill shall not be placed on frozen, slick, or saturated soil.

I. The topsoil material saved in the site preparation shall be placed as a top dressing on the surface of the emergency spillways, embankments, and borrow areas. It shall be evenly spread.

J. A protective cover of herbaceous vegetation shall be established on all exposed surfaces of the embankment, spillway, and borrow areas to the extent practical under prevailing soil and climatic conditions.

K. Seedbed preparation, seeding, fertilizing, and mulching shall comply with the applicable sections of this Specification.

L. Any material excavated from the pond shall be placed in one of the following ways so that its weight will not endanger the stability of the side slopes and where it will not be washed back into the pond by rainfall:

1. uniformly spread to a depth not exceeding 3 feet and graded to a continuous slope away from the pond.

2. uniformly placed or shaped reasonably well with side slopes assuming the natural angle of repose for the excavated material behind a berm width not less than 12 feet.

M. Sediment shall be removed from the pond when the capacity is reduced to one third of the design volume. Contractor shall follow the methods for disposing of sediment removed from the pond as shown in the Construction Drawings.

3.18 SILT FENCE

A. This Article provides construction specifications for silt fences using synthetic fabric. See the Construction Drawings for additional detail.

B. Posts shall be spaced a maximum of 10 feet apart at the barrier location and driven securely into the ground (minimum of 12 inches). When necessary because of rapid runoff, post spacing shall not exceed 6 feet.

C. A trench shall be excavated at least 6 inches wide and 6 inches deep along the line of posts and upslope from the barrier.

D. A wire mesh support fence shall be fastened securely to the upslope side of the posts using heavy-duty wire staples at least 1 inch long, tie wires or hog rings. The wire shall extend into the trench a minimum of 2 inches and shall not extend more than 36 inches above the original ground surface.

E. The filter fabric shall be stapled or wired to the fence, and 12 inches of the fabric shall be extended into the trench. The fabric shall not extend more than 30 inches above the original

ground surface. Filter fabric shall not be stapled to existing trees.

F. At joints, filter fabric shall be lapped with terminating posts with a minimum overlap of 3 feet.

G. The trench shall be backfilled and soil compacted over the filter fabric.

H. Silt fences shall be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized.

I. Silt fences and filter barriers shall be inspected immediately after each rainfall and at least daily during prolonged rainfall. Any required repairs shall be made immediately. Knocked down fences shall be repaired at the end of each day.

J. Should the fabric on a silt fence or filter barrier decompose or become ineffective prior to the end of the expected usable life and if the barrier is still necessary, the fabric shall be replaced promptly.

K. Sediment deposits shall be removed after each storm event or when deposits reach approximately one-third the height of the barrier.

L. Any sediment deposits remaining in place after the silt fence or filter barrier is no longer required shall be dressed to conform to the existing grade, prepared, and seeded.

M. Silt fences shall be replaced every 6 months.

3.19 STORM DRAIN INLET PROTECTION

A. For silt fence drop inlet protection, the following specifications apply:

1. For stakes, Contractor shall use 2 x 4-inch wood (preferred) or equivalent metal with a minimum length of 3 feet.

2. Stakes shall be evenly spaced around the perimeter of the inlet a maximum of 3 feet apart and securely driven into the ground, approximately 18 inches deep.
3. To provide needed stability to the installation, Contractor shall frame with 2 x 4-inch wood strips around the crest of the overflow area at a maximum of 1.5 feet above the drop inlet crest and shall brace diagonally.

4. Contractor shall place the bottom 12 inches of the fabric in a trench and backfill the trench with at least 4 inches of crushed stone or 12 inches of compacted soil.

5. Contractor shall fasten fabric securely to the stakes and frame. Joints shall be overlapped to the next stake.

B. For sod drop inlet protection, sod shall be placed to form a turf mat covering the soil for a distance of 4 feet from each side of the inlet structure. Soil preparation and sod placement shall be in accordance with the section entitled Sod.

C. For gravel curb inlet protection, the following specifications apply:

1. Wire mesh with ½-inch openings shall be placed over the curb inlet opening so that at least 12 inches of wire extends across the concrete gutter from the inlet opening.

2. KYTC No. 2 Coarse Aggregate shall be piled against the wire so as to anchor it against the gutter and inlet cover and to cover the inlet opening completely.

3. This type of device must never be used where overflow may endanger an exposed fill slope. Consideration shall also be given to the possible effects of ponding on traffic movement, nearby structures, working areas, and adjacent property.

D. For block and gravel curb inlet protection, the following specifications apply:

1. Two concrete blocks shall be placed on their sides abutting the curb at either side of the inlet opening to act as spacer blocks.

2. A 2-inch by 4-inch stud shall be cut and placed through the outer holes of each spacer block to help keep the front blocks in place.

3. Concrete blocks shall be placed on their sides across the front of the inlet and abutting the spacer blocks.

4. Wire mesh shall be placed over the outside of the concrete blocks to prevent stone from being washed through the holes in the blocks. Wire with ½-inch openings shall be used

5. KYTC No. 2 Coarse Aggregate shall be piled against the wire to the top of the barrier.

E. For stone-filled corrugated pipe curb inlet protection, the following specifications apply:

1. Two concrete “L” blocks shall be placed on their sides, with one leg fitting into the mouth of the curb opening.

2. A 6-inch corrugated pipe shall be filled with stone and covered with a filter sock.

3. The stone-filled pipe will be placed in front of the two concrete “L” blocks, and extend a minimum of the width of the curb inlet opening on either side. The total length of the stone filled pipe shall be three times the width of the curb inlet opening.

F. The structure shall be inspected after each rain, and repairs made as needed.

G. Sediment shall be removed and the device restored to its original dimensions when the sediment has accumulated to one-third the design depth of the filter. Removed sediment shall be deposited in a suitable area and in such a manner that it will not erode.

H. If a stone filter becomes clogged with sediment so that it no longer adequately performs its function, the stone must be pulled away from the blocks, cleaned, and replaced.

I. Structures shall be removed after the drainage area has been properly stabilized.

3.20 FILTER STRIP

A. When planting filter strips, Contractor shall prepare seedbed, incorporate fertilizer, and apply mulch consistent with the seeding sections of this Specification. Filter strips using areas of existing vegetation shall be over seeded, as necessary, with the specified mixtures to obtain an equivalent density of vegetation. The over seeding shall be accomplished prior to any land disturbing activities.

B. Filter strips shall be inspected regularly to ensure that a healthy vegetative growth is maintained. Any bare spots or spots where sediment deposition could lead to the destruction of vegetation shall be repaired.

C. Filter strips shall be fertilized once each year in the fall.

D. Irrigation shall be used as necessary to maintain the growth of the vegetation in the filter strip.

E. Sediment shall be removed when it becomes visible in the filter.

F. Construction traffic shall not be driven on or over filter strips.

3.21 STREAM CROSSING

A. Clearing and excavation of the streambed and banks shall be kept to a minimum.

B. The structure shall be removed as soon as it is no longer necessary for project construction.

C. Upon removal of the structure, the stream shall immediately be reshaped to its original cross section and properly stabilized.

D. The approaches to the structure shall consist of stone pads with a minimum thickness of 6 inches, a minimum width equal to the width of the structure, and a minimum approach length of 25 feet on each side.

E. The structure shall be inspected after every rainfall and at least once a week and all damages repaired immediately.

3.22 PUMP-AROUND FLOW DIVERSION

A. Operations shall be scheduled such that diversion installation, in-stream excavation, in-stream construction, stream restoration, and diversion removal are completed as quickly as possible. Contractor shall not construct in a stream when rainfall is expected during the time excavation will be occurring in the stream.

B. Check dams shall be installed across the stream during low flow conditions.

C. Stream flow shall be pumped around the check dams. Outlet protection shall be installed as required at the discharge point.

D. Contractor shall dewater the work area and pump into a sediment trapping device.

E. Contractor shall complete construction activities across the stream.

F. Contractor shall restore the streambed and banks.

G. Contractor shall remove sandbags and shut down pumping operation. (Salvage sandbags for future use if multiple stream crossings are required on the project.) Contractor shall remove all sandbags from the stream, including damaged and empty bags.

H. Pumps shall be manned around-the-clock when the pump-around diversion is in the stream.

I. This control provides short-term diversion of stream flow (typically 1 day to 3 days). Additional sandbags or pumps may be required to maintain 1-foot freeboard on the sandbag checks if flow conditions change.

J. Contractor shall add sandbags as required to seal leaks in checks.

3.23 CONSTRUCTION DEWATERING

A. Contractor shall follow the specifications for sediment traps and basins. The manufacturer's recommendations shall be followed for commercial products.

B. The dewatering structure shall be inspected frequently to ensure it is functioning properly and not overtopping. Accumulated sediment shall be spread out on site and stabilized or disposed of offsite.

3.24 KPDES GENERAL PERMIT FOR STORM WATER DISCHARGES FROM CONSTRUCTION ACTIVITIES

A. The Contractor is responsible for electronically filing the appropriate state Notice of Intent (NOI-SWCA) letter at least seven (7) days prior to start of construction activity. The Notice of Intent (NOI) is a Kentucky Pollution Discharge Elimination System (KPDES) permit application as provided by the Kentucky Revised Statutes, Chapter 224. This application is required to be submitted for construction projects that disturb one or more acres of land.

B. The NOI requires the inclusion of the descriptions of (but is not limited to) the following items:

1. Names and designated uses of any receiving waters

2. Anticipated number and locations of discharge points

3. Identification of planned construction in or along a water body

C. A topographic map showing project boundaries, areas to be disturbed, locations of anticipated discharge points and receiving waters is also required to be submitted with the NOI.

D. If the construction site is near a designated "High Quality/Impaired Waters" or a "Cold Water Aquatic Habitat Waters, Exceptional Waters, Outstanding National/State Resource Waters," additional items and/or individual permits will be required.

E. The NOI form requires an SIC code. The link to the SIC codes is http://www.osha.gov/pls/imis/sicsearch.html. The following are the typical construction SIC codes utilized:

1542 – Building Construction, nonresidential, except industrial and warehouses
1623 – Water Main Construction, Sewer Construction
1629 – Water and Wastewater Treatment Plant Construction
1711 – Water Pump Installation
1781 – Drilling Water Wells

F. The Contractor is responsible for implementing the approved Stormwater Pollution Prevention Plan (SWPPP) prior to commencement of site disturbance. The SWPPP shall include erosion prevention measures and sediment and pollutant control measures which are installed and maintained to minimize discharges of sediments and other pollutants from a 2-year, 24-hour storm event. The SWPPP must be kept at the site and available for review by LFUCG and state and local officials.

G. The Contractor is responsible for the description of procedures to maintain erosion and sediment control measures during the period of construction.

H. The Contractor is responsible for identifying each Contractor and Subcontractor who will install each SWPPP erosion and sediment control measure.

I. Each Contractor and Subcontractor shall sign a statement certifying the awareness of the requirements of the SWPPP related documents. Certification is attached at the end of this section.

J. The Contractor shall not start land disturbing activities until written permit coverage is obtained from the Kentucky Division of Water.

K. The inspection by qualified personnel, **provided by the Contractor**, of the site as follows:

1. at least once every seven (7) calendar days, and

2. within 24 hours after any storm event of 0.5 inch or greater

L. The Contractor is responsible for completing and maintaining the required Self-Inspection Forms. A sample is included in this specification Section.

M. Amendments to the approved SWPPP shall be made and implemented as necessary through the course of the construction project if inspections or investigations by the Contractor's inspector, site staff, or by local, state, or federal officials determine that the existing sediment control measures, erosion control measures, or other site management practices are ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the construction site. All plan amendments shall be noted on the copy of the SWPPP maintained at the project site.

N. Upon completion of the project and establishment of all permanent erosion and sediment control structures and devices, the Contractor shall submit the Notice of Termination (NOT) form to the Kentucky Division of Water, the LFUCG Division of Water Quality, and the JCFC.

O. All subcontractors shall be required to comply with the requirements of the state permit and the Stormwater Pollution Prevention Plan (SWPPP).

P. Where to submit:

1. Complete KPDES FORM NOI-SW at the following website:
   https://dep.gateway.ky.gov/eForms/default.aspx?FormID=7

2. Do not initiate work until receiving approval from the Kentucky Division of Water.

3. A complete copy of the NOI submittal shall also be provided to the following for approval/coverage verification:

   Division of Water Quality
   125 Lisle Industrial Avenue, Suite 180
   Lexington, KY 40511

   Jessamine County Fiscal Court
   Planning and Zoning
   121 S. Main Street
   Nicholasville, KY 40356

3.25 JCFC Grading Permit

A. The Contractor shall obtain a Grading Permit from the JCFC..

B. Where to obtain:

   Jessamine County Fiscal Court
   Planning and Zoning
   121 S. Main Street
   Nicholasville, KY 40356
   859-885-6145

Kentucky Best Management Practices Plan • Construction Site Inspection Report

Company:	**Site:**	**County:**
Site Operator:		**Date:**
Receiving Water:	**Total Site Area (acres):**	**# Disturbed Acres:**
Inspector Name:	**Inspector Qualifications:**	
Inspection Type: Weekly or ½ Inch Rain	**Days Since Last Rainfall** ____	**# Inches of Last Rainfall:** _____

Field Inspection Observations

BMP Category	Compliance Yes	No	N/A	Field Indicators for Compliance
Project Operations				Notice of Intent (KPDES permit) and other local/state permits on file BMP Plan on site and available for review Project timing/schedule and activities following BMP Plan Weekly inspection and rain-event reports on BMPs available for review Diversions, silt checks/traps/basins, and silt fences/barriers installed prior to clearing Grading and clearing conducted in phases to minimize exposed soil areas No vegetation removal or operations in stream or sinkhole buffer area (25-50 ft min) Rock pad in place on all construction site exits leading to paved roads No sediment, mud, or rock on paved public roads in project area Dust control if needed when working in residential areas during dry conditions
Drainage Management				Upland runoff diverted around bare soil areas with vegetated/lined ditches/berms Drainage channels exiting the site are lined with grass/blanket/rock and stabilized Discharges from dewatering operations cleaned in silt fence enclosure or other filter No muddy runoff leaving site after rains up to 1½ inches
Erosion Protection				Exposed soil seeded/mulched after 2 weeks if no work is planned for the next 7 days Soils on steep slopes seeded/mulched/blanketed as needed to prevent rutting
Sediment Barriers				Silt fence, rock filter, or other sediment barrier below all bare soil areas on slopes Barrier installed across slope on the contour, trenched in, posts on downhill side Multiple sediment barriers at least 125 ft apart on unseeded slopes steeper than 4:1 J-hook interceptors along silt fence where heavy muddy flows run along fencing No visible undercutting or bypassing or blowout of sediment barrier Accumulated sediment is less than halfway to the top of sediment barrier
Slope Protection				Slopes tracked, disked, or conditioned after final grade is established Slopes seeded, mulched, or blanketed within 21 days, no unmanaged rills or gullying Heavy downslope flows controlled by lined downdrain channels or slope drain pipes No muddy runoff from slopes into streams, rivers, lakes, or wetlands
Inlet Protection				Inlet dam/device or filtration unit placed at all inlets receiving muddy flows No visible undercutting, bypassing, or blowout of inlet protection dam or device Accumulated sediment is less than halfway to the top of the inlet protection dam/device
Outlet Protection				High flow discharges have rock or other flow dissipaters of adequate sizing at outlet Culvert outlets show no visible signs of erosion/scour, bank failure, or collapse
Ditch and Channel Stabilization				No unmanaged channel bank erosion or bottom scouring visible within or below site Ditches with slopes more than 3% have check dams spaced as needed, if not grassed Ditch check dams tied in to banks, with center 4" lower than sides, and no bypassing Ditches with slopes of up to 5% are thickly seeded with grass (minimum requirement) Ditches 5% to 15% are lined with thick grass and erosion control blankets as needed Ditches 15% to 33% are lined with thick grass and matting or other approved product Ditches exceeding 33% are paved or lined with rock or other approved product

Sediment Traps and Basins				Storage volume is at least 134 cubic yards for each acre of bare soil area drained Trap or basin is seeded/mulched and stabilized; no collapsing sidewalls or banks Outlet structure is stable and consists of rock-lined notched overflow or outlet riser Rock overflow is 6" lower in center to control overflow discharge Outlet riser pipe has concrete & rock base, ½ inch holes every 3" to 6", and trash rack Area near pipe outlet or overflow is stable, with no scour or erosion Sediment removed before trap or basin is halfway full; disposal is away from ditches
Maintenance of EPSC Management Practices				Sediment behind silt fence and other filters does not reach halfway to top Sediment traps and basins are less than half full of sediment Gullies repaired, silt fences and other controls inspected and repaired/replaced Written documentation of controls installed, inspection results, and repairs performed All controls removed and areas graded, seeded, and stabilized before leaving site
Materials Storage, Handling, and Cleanup				Materials that may leach pollutants stored under cover and out of the weather Fuel tanks located in protected area with double containment system Fuel and/or other spills cleaned up promptly; no evidence of unmanaged spills No evidence of paint, concrete, or other material washouts near drain inlets No storage of hazardous or toxic materials near ditches or water bodies
Waste Disposal				Trash, litter, and other debris in proper containers or properly managed No litter or trash scattered around on the construction site Provisions made for restroom facilities and/or other sanitary waste management Sanitary waste facilities clean and serviced according to schedule No disposal of any wastes into curb or other inlets, ditches, streams, or water bodies

Inspection Notes and Key Observations

List of Stabilized Areas: Vegetation is Established; Ditches are Stabilized; No Exposed Soil
Other Notes or Observations:
Corrective Actions Taken and/or Proposed Revisions to BMP Plan:

I certify under penalty of law that I understand the terms and conditions of the general Kentucky Pollutant Discharge Elimination System (KPDES) permit that authorizes the storm water discharges associated with industrial activity from the construction site identified as part of this certification.

Signature of Inspector: _____

CONTRACTOR AND SUBCONTRACTOR CERTIFICATIONS

SWPPP Files, Updates, and Amendments

This SWPP Plan and related documents (e.g., NOI, inspection reports, US ACE permits, etc.) will be kept on file at the construction site by _____ (name and title). The SWPPP will be updated by the Owner and/or Site Manager to reflect any and all significant changes in site conditions, selection of BMPs, the presence of any unlisted potential pollutants on site, or changes in the Site Manager, contractor, subcontractors, or other key information. Updates and amendments will be made in writing within 7 days and will be appended to the original BMP Plan and available for review.

Stormwater Pollution Prevention Plan Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signed: _____ Date: _____

Title: _____

I certify under penalty of law that I understand the terms and conditions of the general KPDES permit that authorizes the storm water discharges associated with the construction site activity identified as part of this certification.

Subcontractor Certification

The subcontractors below certify under penalty of law that they understand the terms and conditions of the general KPDES permit that authorizes the storm water discharges associated with the construction site activity identified as part of this certification.

Signed: _____ Date: _____

Title: _____

Signed: _____ Date: _____

Title: _____

Signed: _____ Date: _____

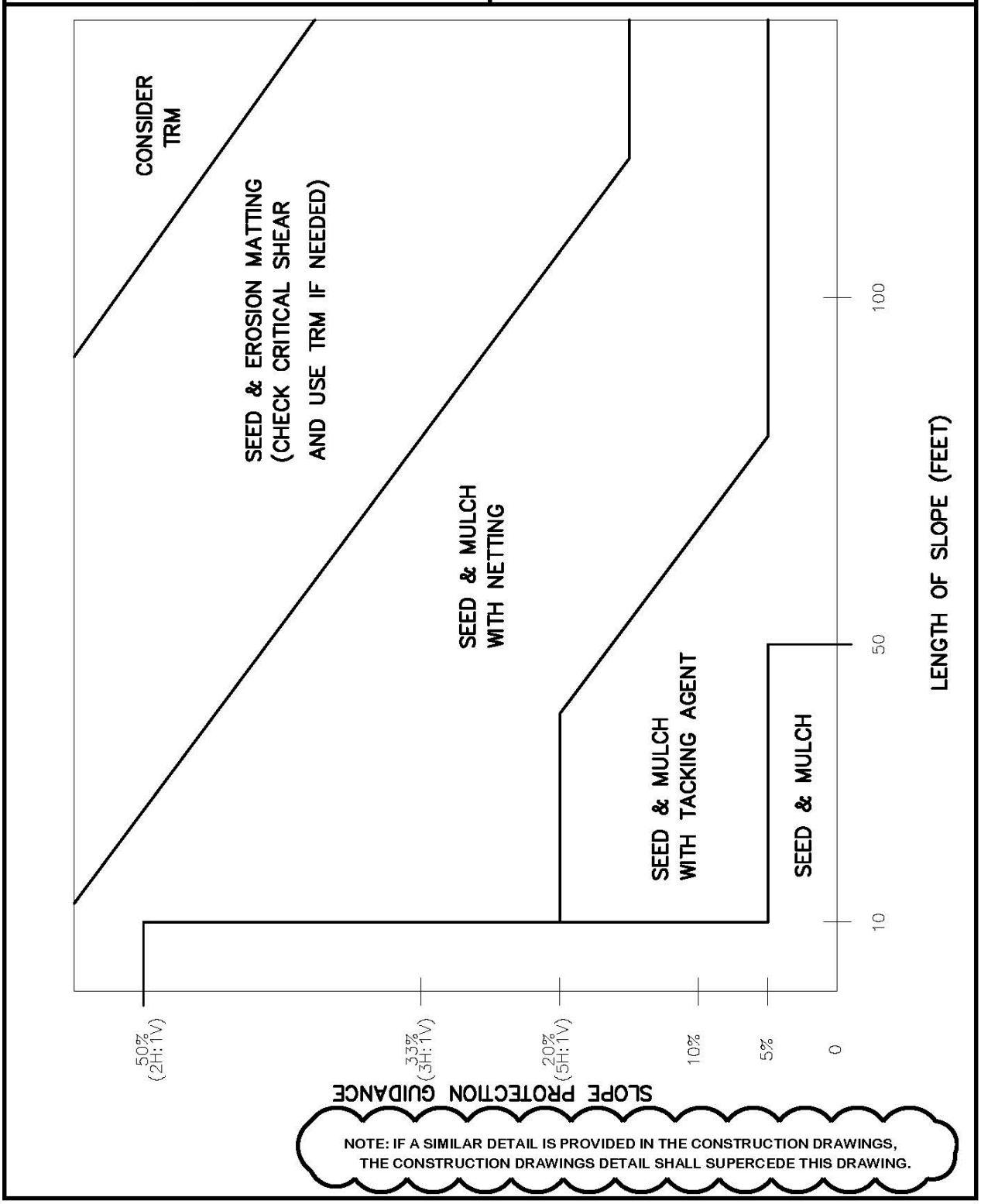
Title: _____

STORMWATER MANUAL

FIGURE 11–1

SLOPE PROTECTION GUIDANCE

(EFFECTIVE DATE 1/13/2011)



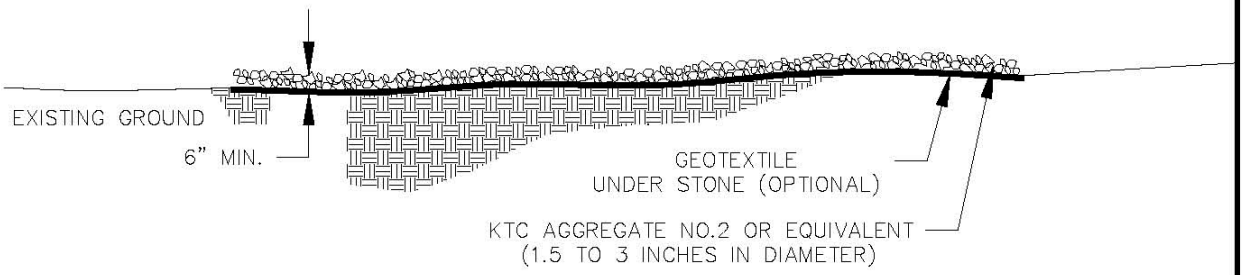
STORMWATER MANUAL

FIGURE 11–2

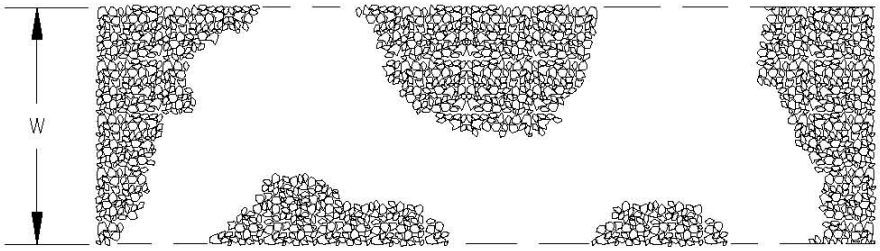
ROAD\PARKING STABILIZATION

(EFFECTIVE DATE 1/13/2011)

NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS DETAIL SHALL SUPERCEDE THIS DRAWING.



CROSS SECTION



PLAN VIEW

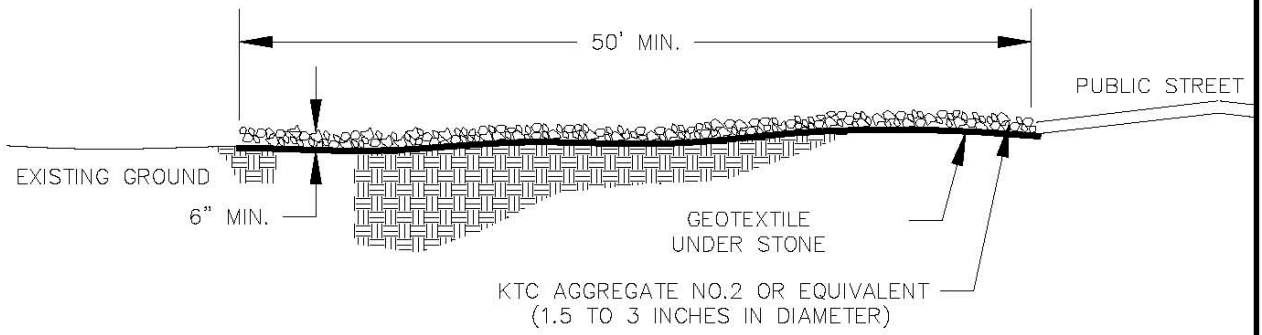
W = 14' MIN. FOR ONE WAY TRAFFIC
20' MIN. FOR TWO WAY TRAFFIC

STORMWATER MANUAL

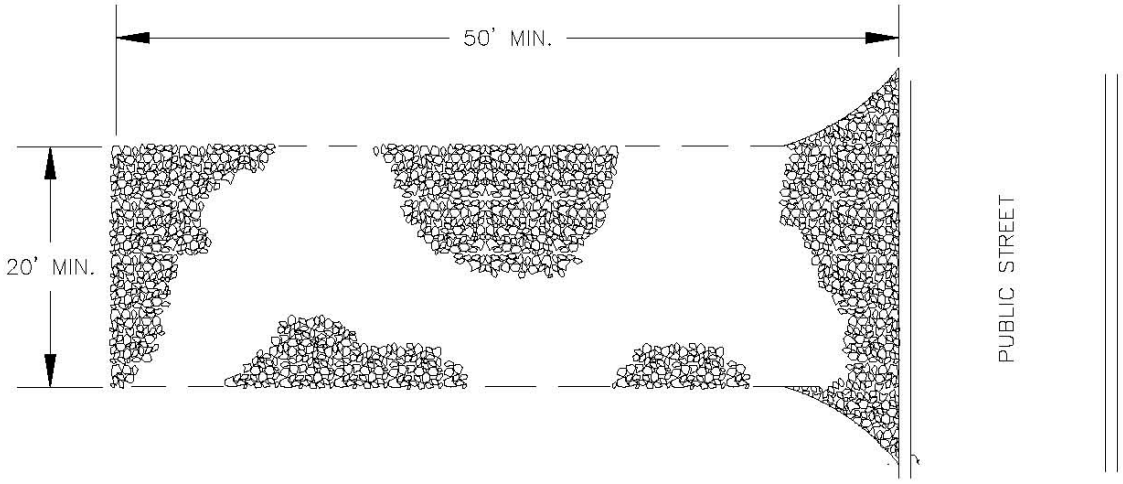
FIGURE 11–3

CONSTRUCTION ENTRANCE

(EFFECTIVE DATE 1/13/2011)



CROSS SECTION



PLAN VIEW

NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS DETAIL SHALL SUPERCEDE THIS DRAWING.

STORMWATER MANUAL

FIGURE 11–4

CONSTRUCTION ENTRANCE
NOTES AND SPECIFICATIONS

(EFFECTIVE DATE 1/13/2011)

SPECIFICATIONS FOR GEOTEXTILE FABRIC

GRAB TENSILE STRENGTH	220 LBS. (MIN.) (ASTM D1682)
ELONGATION FAILURE	60% (MIN.) (ASTM D1682)
MULLEN BURST STRENGTH	430 LBS. (MIN.) (ASTM D3768)
PUNCTURE STRENGTH	125 LBS. (MIN.) (ASTM D751) (MODIFIED)
EQUIVALENT OPENING	SIZE 40–80 (US STD SIEVE) (CW–02215)

NOTES

1. A STABILIZED ENTRANCE PAD OF CRUSHED STONE SHALL BE LOCATED WHERE TRAFFIC WILL ENTER OR LEAVE THE CONSTRUCTION SITE ONTO A PUBLIC STREET.
2. SOIL STABILIZATION FABRIC SHALL BE USED AS A BASE FOR THE CONSTRUCTION ENTRANCE.
3. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC STREETS OR EXISTING PAVEMENT. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS WARRANT AND REPAIR OR CLEAN OUT OF ANY MEASURES USED TO TRAP SEDIMENT.
4. ANY SEDIMENT SPILLED, DROPPED, WASHED, OR TRACKED ONTO PUBLIC STREETS OR INTO STORM DRAINS MUST BE REMOVED IMMEDIATELY.
5. WHEN APPROPRIATE, WHEELS MUST BE CLEANED TO REMOVE SEDIMENT PRIOR TO ENTERING A PUBLIC STREET. WHEN WASHING IS REQUIRED, IT SHALL BE DONE IN AN AREA STABILIZED WITH CRUSHED STONE WHICH DRAINS INTO AN APPROVED SEDIMENT BASIN.

NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS DETAIL SHALL SUPERCEDE THIS DRAWING.

STORMWATER MANUAL

FIGURE 11-5

STAPLE PATTERN FOR STRAW OR EXCELSIOR MATS

(EFFECTIVE DATE 1/13/2011)

SLOPES UP TO 1.5H:1V

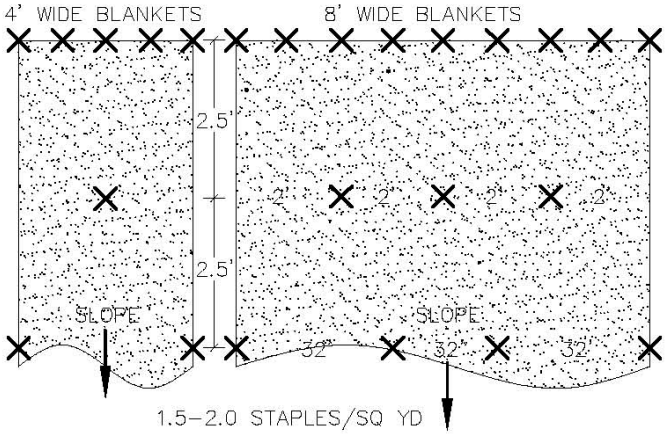
- INSTALL BLANKET VERTICALLY OR HORIZONTALLY
- USE 12" STAPLE SPACING ON STARTER ROW.

COHESIVE SOILS:

- NO OVERLAP REQUIRED ON SIDE SEAMS
- USE 6" STAPLE LENGTH

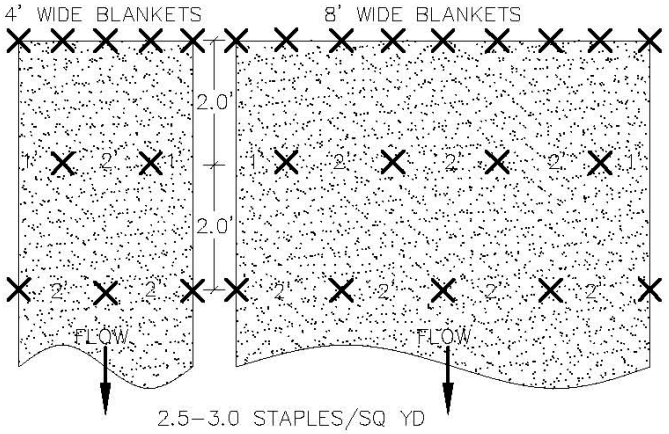
NON-COHESIVE SOILS:

- USE 6" SIDE SEAM OVERLAP
- USE 8" STAPLE LENGTH
- USE 6" ANCHOR TRENCH AT TOP OF SLOPE



CHANNELS IN COHESIVE SOILS

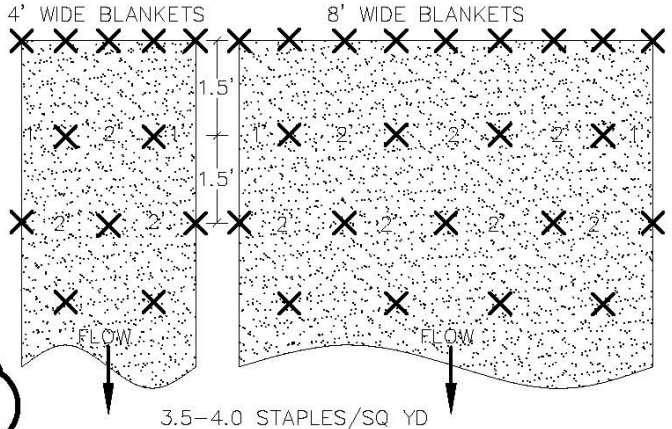
- USE 6" SIDE SEAM OVERLAP
- USE 6" STAPLE LENGTH
- USE 6" TRANSVERSE ANCHOR TRENCH AT 100-FT. INTERVALS
- USE 12" STAPLE SPACING ON STARTER ROW.
- UPSTREAM BLANKET SHOULD OVERLAP DOWNSTREAM BLANKET A DISTANCE OF 12" IN A "SHINGLE" FASHION AND BURY THE FINISHED TOE AT LEAST 6".



CHANNELS IN NON-COHESIVE SOILS

- USE 6" SIDE SEAM OVERLAP
- USE 8" STAPLE LENGTH
- USE 6" TRANSVERSE ANCHOR TRENCH AT 50-FT. INTERVALS
- USE 12" STAPLE SPACING ON STARTER ROW.
- UPSTREAM BLANKET SHOULD OVERLAP DOWNSTREAM BLANKET A DISTANCE OF 12" IN A "SHINGLE" FASHION AND BURY THE FINISHED TOE AT LEAST 6".

NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS DETAIL SHALL SUPERCEDE THIS DRAWING.

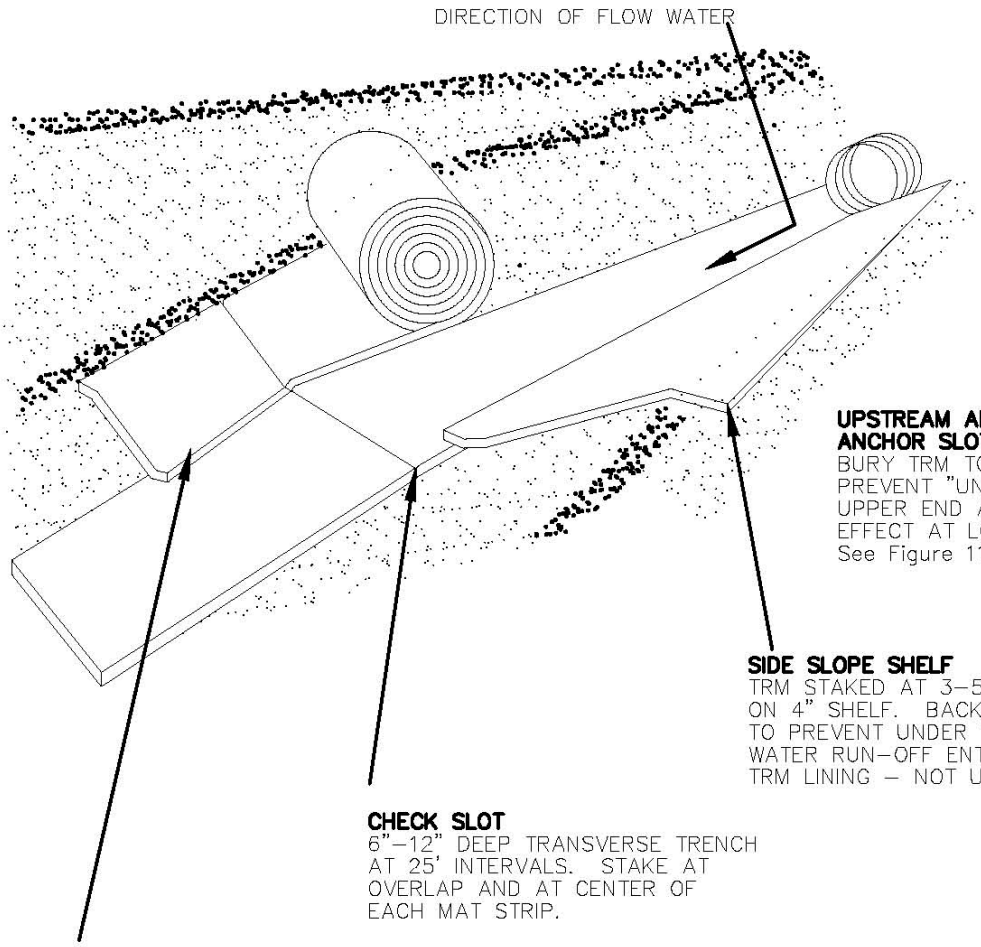


STORMWATER MANUAL

FIGURE 11–6

PLACEMENT OF TRM IN CHANNEL

(EFFECTIVE DATE 1/13/2011)



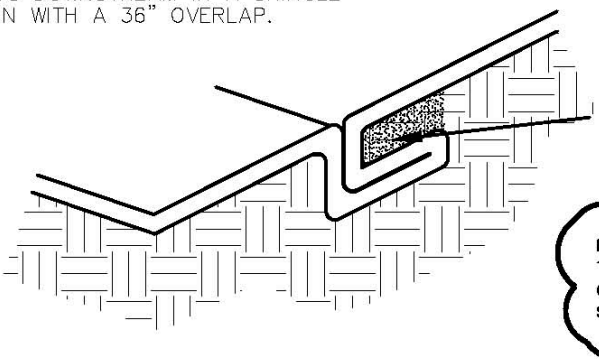
UPSTREAM AND DOWNSTREAM ANCHOR SLOTS
BURY TRM TO 12" DEPTH TO PREVENT "UNDER FLOW" AT UPPER END AND "WATERFALL" EFFECT AT LOWER END.
See Figure 11–7

SIDE SLOPE SHELF
TRM STAKED AT 3–5' INTERVALS ON 4" SHELF. BACK FILL AND TAMP TO PREVENT UNDER WASHING. WATER RUN–OFF ENTERS ONTO TRM LINING – NOT UNDER IT.

CHECK SLOT
6"–12" DEEP TRANSVERSE TRENCH AT 25' INTERVALS. STAKE AT OVERLAP AND AT CENTER OF EACH MAT STRIP.

OVERLAP IN A SHINGLE FASHION
3" OVERLAP STAKED AT 3–5' INTERVALS

WHEN ROLL TERMINATES, IT IS STAKED OVER THE ROLL WHICH EXTENDS DOWNSTREAM IN A SHINGLE FASHION WITH A 36" OVERLAP.



CHECK SLOT DETAIL
STAKE AND BACK FILL IN CHECK SLOT BEFORE CONTINUING TO PLACE UPSLOPE

NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS DETAIL SHALL SUPERCEDE THIS DRAWING.

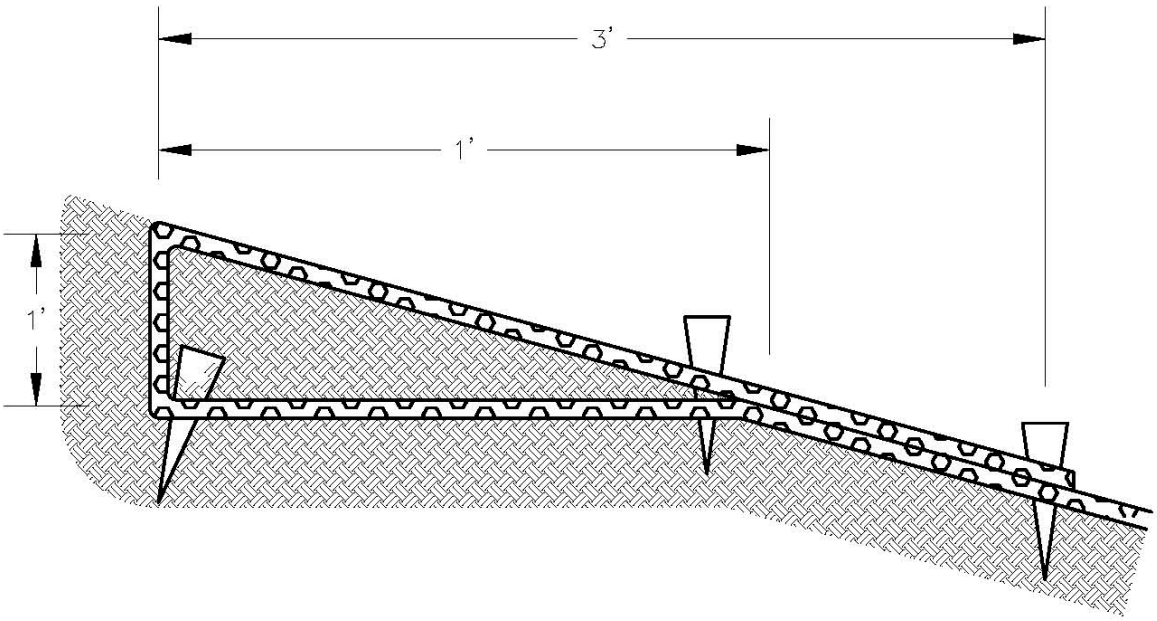
STORMWATER MANUAL

FIGURE 11–7

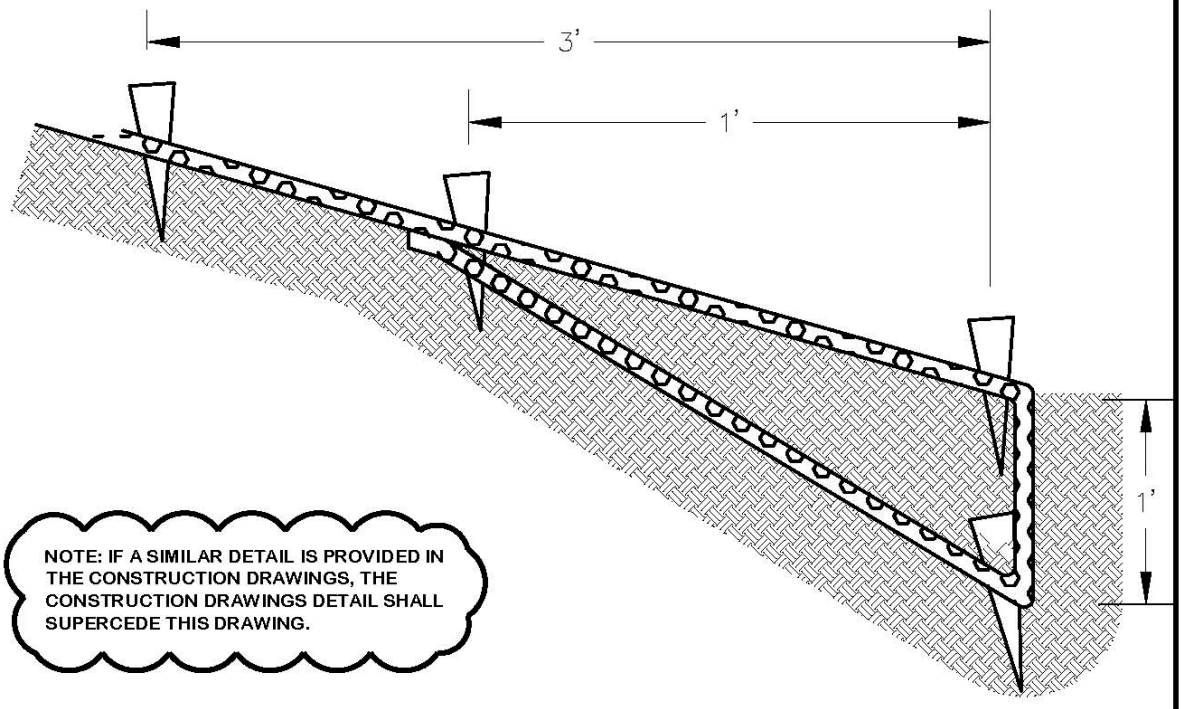
ANCHOR SLOT DETAILS FOR TRM

(EFFECTIVE DATE 1/13/2011)

UPSTREAM ANCHOR SLOT DETAIL



DOWNSTREAM ANCHOR SLOT DETAIL



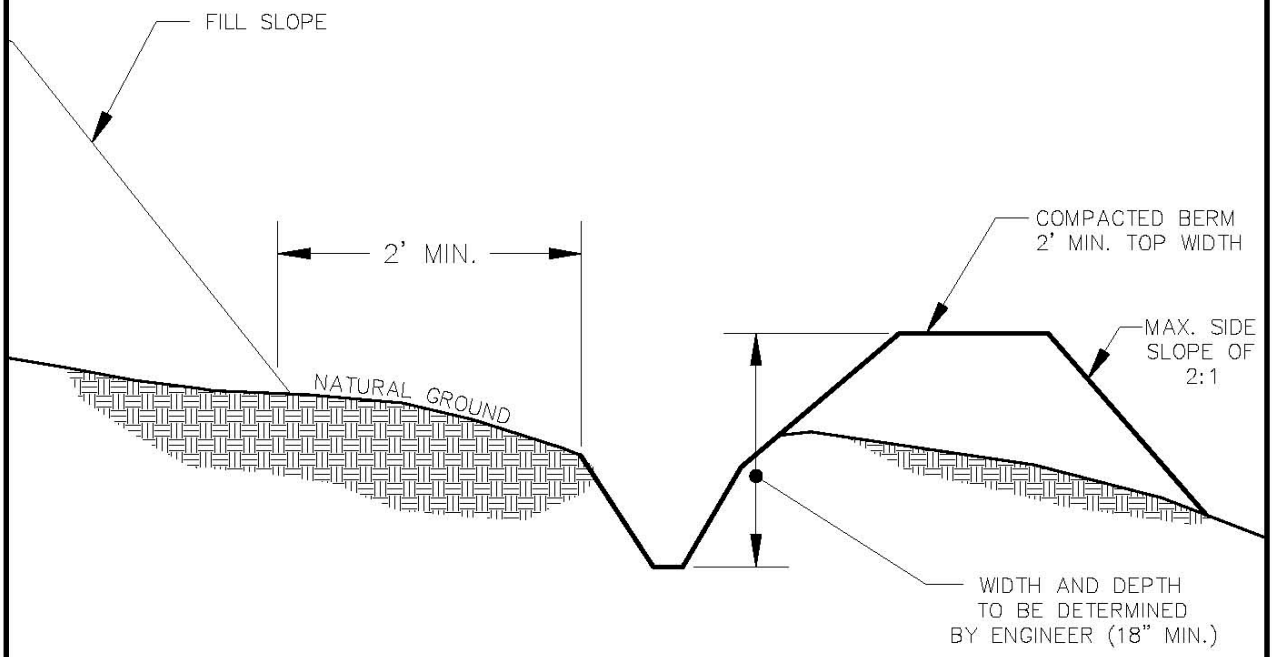
NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS DETAIL SHALL SUPERCEDE THIS DRAWING.

STORMWATER MANUAL

FIGURE 11-12

TEMPORARY DIVERSION DITCH

(EFFECTIVE DATE 1/13/2011)



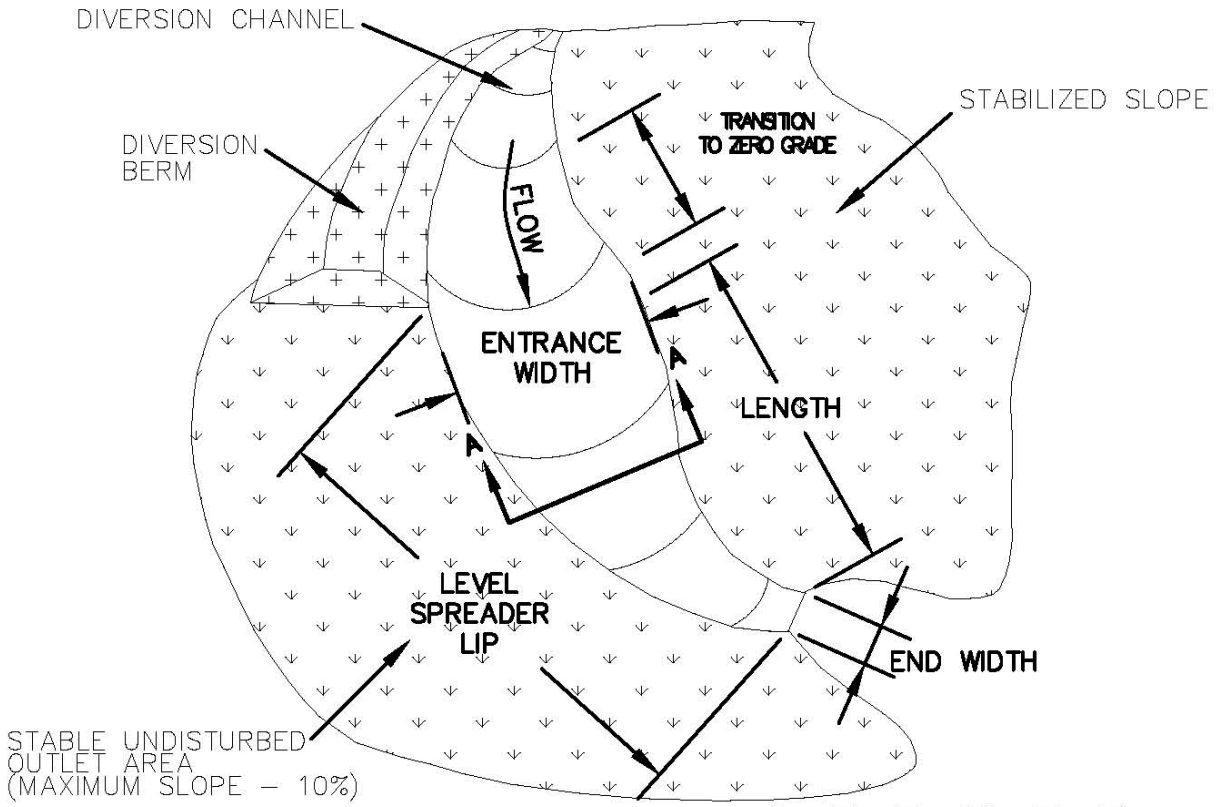
NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS DETAIL SHALL SUPERCEDE THIS DRAWING.

STORMWATER MANUAL

FIGURE 11–13

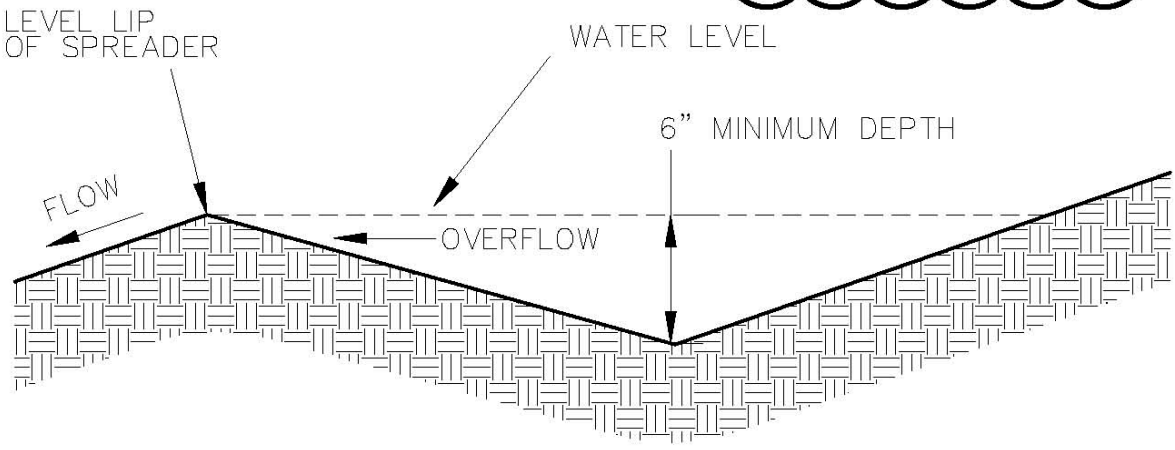
LEVEL SPREADER

(EFFECTIVE DATE 1/13/2011)



PERSPECTIVE

NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS DETAIL SHALL SUPERCEDE THIS DRAWING.



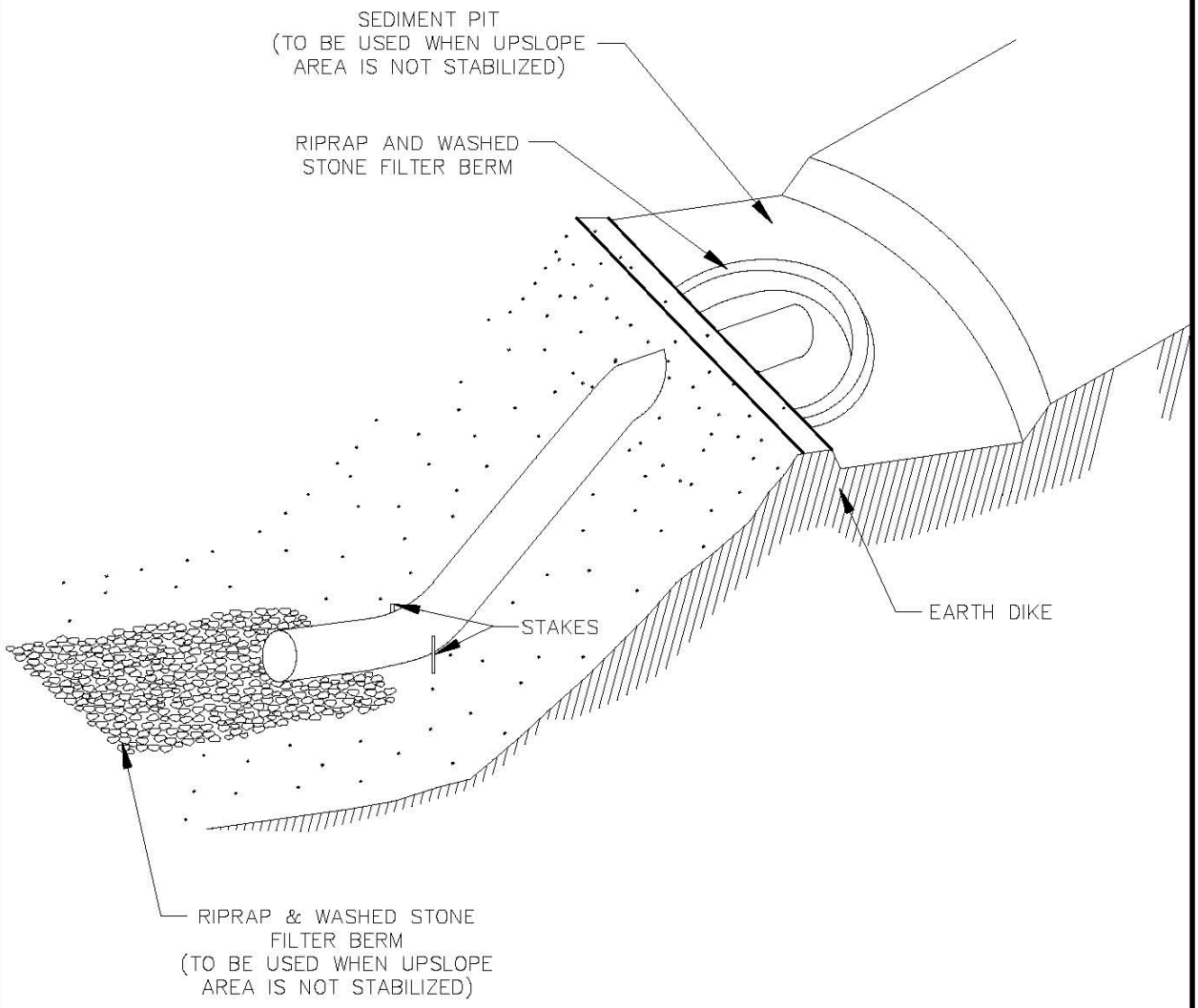
SECTION A–A

STORMWATER MANUAL

FIGURE 11–14

FLEXIBLE PIPE SLOPE DRAIN

(EFFECTIVE DATE 1/13/2011)



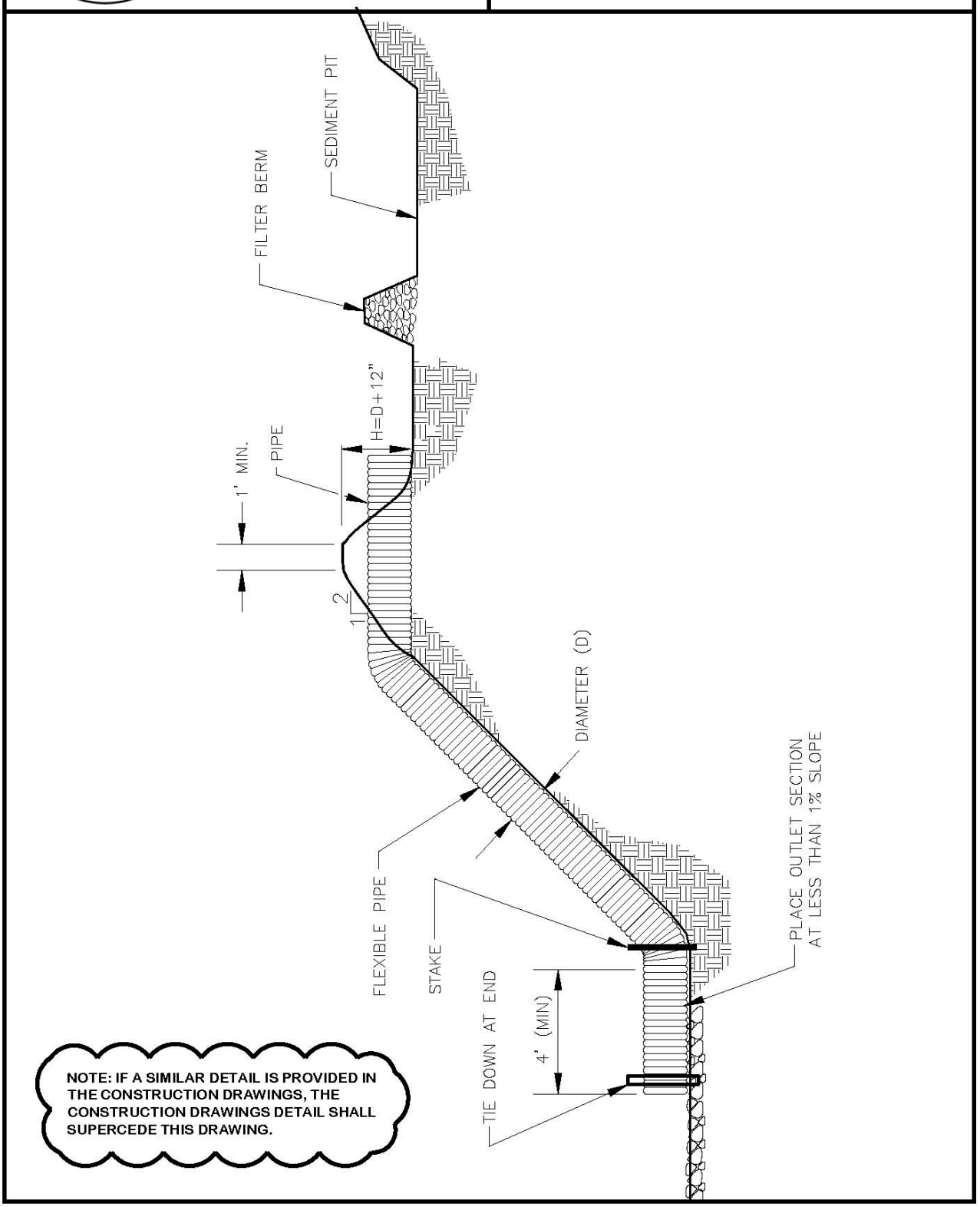
NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS DETAIL SHALL SUPERCEDE THIS DRAWING.

STORMWATER MANUAL

FIGURE 11–15

SLOPE DRAIN – PROFILE

(EFFECTIVE DATE 1/13/2011)



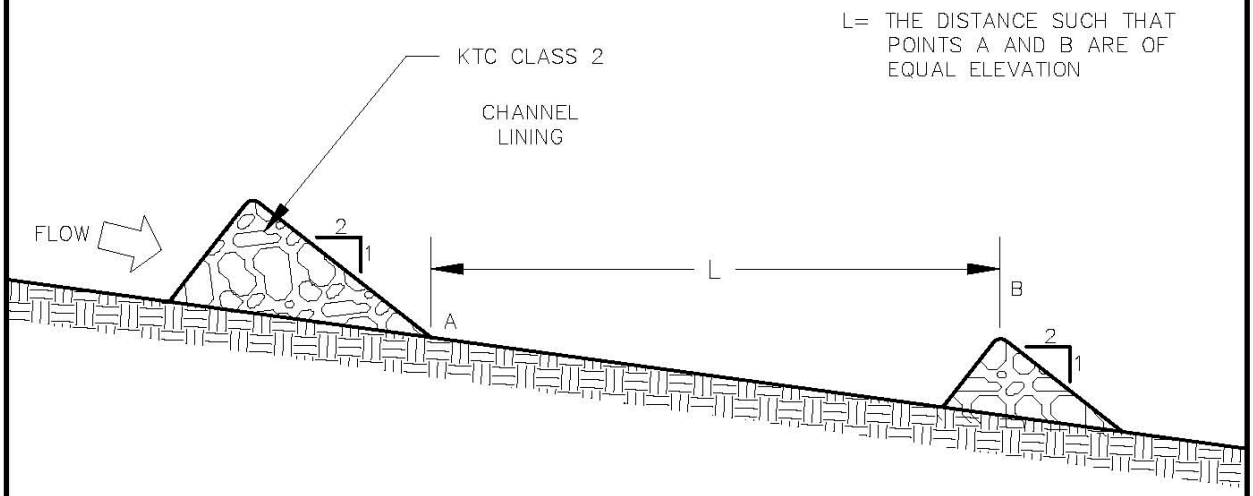
NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS DETAIL SHALL SUPERCEDE THIS DRAWING.

STORMWATER MANUAL

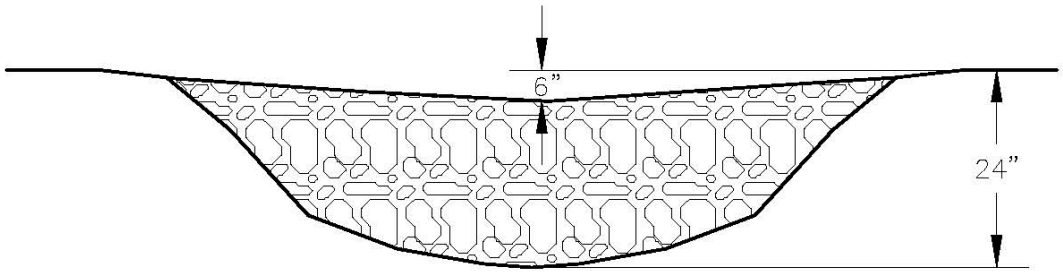
FIGURE 11-16

ROCK CHECK DAM

(EFFECTIVE DATE 1/13/2011)



LONGITUDINAL SECTION SHOWING SPACING BETWEEN CHECK DAMS



SECTION ACROSS CHANNEL

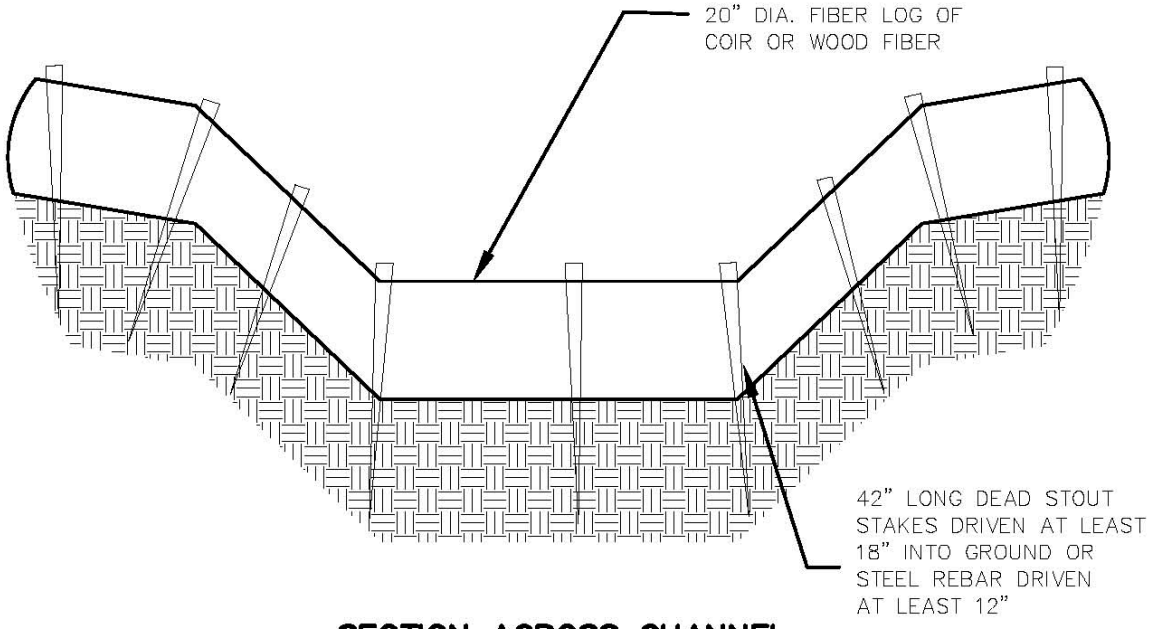
NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS DETAIL SHALL SUPERCEDE THIS DRAWING.

STORMWATER MANUAL

FIGURE 11–17

FIBER LOG CHECK DAM

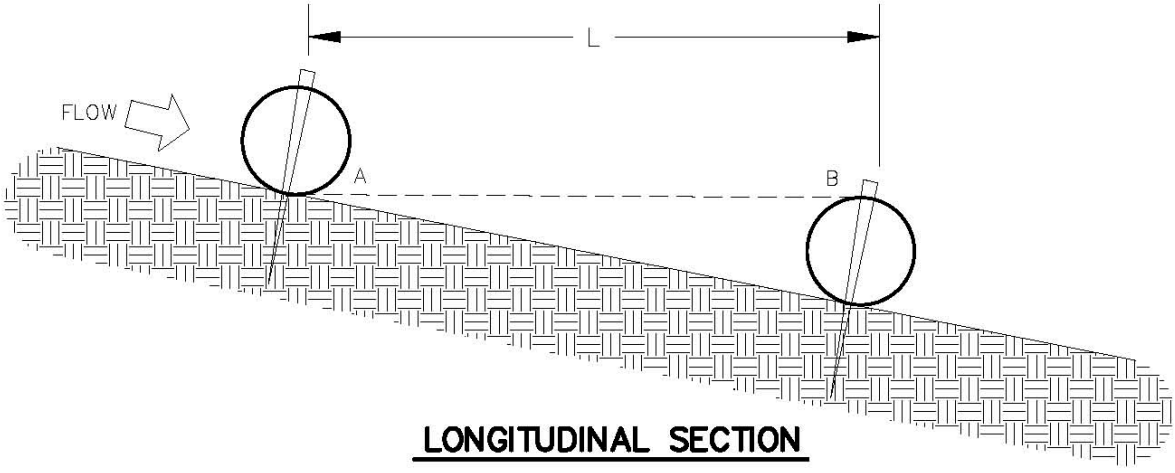
(EFFECTIVE DATE 1/01/09)



SECTION ACROSS CHANNEL

STAKES SHALL BE SPACED NO FURTHER THAN 24" AND SHALL BE DRIVEN AT EACH SIGNIFICANT SLOPE BREAK AND WITHIN 6" OF EACH END.

NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS DETAIL SHALL SUPERCEDE THIS DRAWING.



LONGITUDINAL SECTION

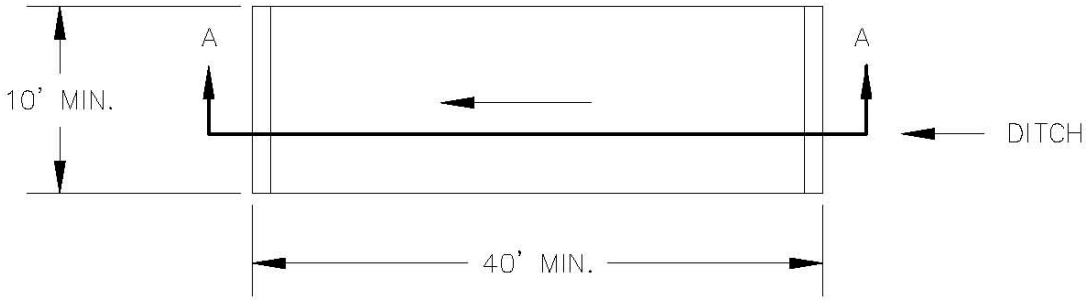
L = DISTANCE SUCH THAT POINTS A AND B ARE OF EQUAL ELEVATION

STORMWATER MANUAL

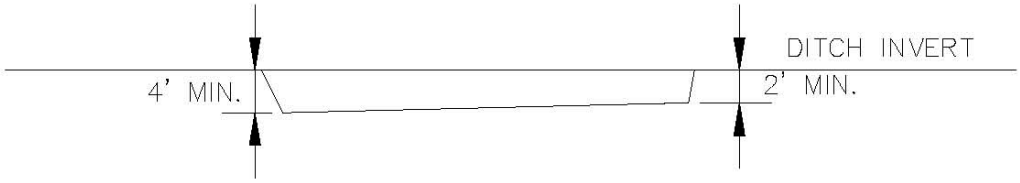
FIGURE 11-18

SEDIMENT TRAP

(EFFECTIVE DATE 1/13/2011)



PLAN VIEW



SECTION A-A

NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS DETAIL SHALL SUPERCEDE THIS DRAWING.

NOTES:

1) THE SIZE, SHAPE AND LOCATION OF TRAP MAY BE ADJUSTED FROM THAT SHOWN IN THE CONSTRUCTION PLANS, AS DIRECTED BY THE ENGINEER.
2) THE SEDIMENT TRAP MAY BE CONSTRUCTED AS DIRECTED BY THE ENGINEER AS LONG AS THE AREA AND DEPTH IS AT LEAST AS THAT INDICATED ON THE PLANS.
3) SEDIMENT TRAP SHALL BE CONSTRUCTED BY EXCAVATING THE BASIN IN NATURAL OR EXCAVATED CHANNELS. SEDIMENT DEPOSITS IN TRAP SHALL BE REMOVED EACH TIME THE TRAP IS APPROXIMATELY 50 PERCENT FILLED. WHEN THEIR USEFULNESS HAS ENDED, THE TRAPS SHALL BE REMOVED, SURPLUS MATERIAL DISPOSED OF AND THE ENTIRE DISTURBED AREA SHALL BE SEEDED AND PROTECTED, OR SODDED, AS DIRECTED. SEDIMENT TRAPS MAY REMAIN IN PLACE UPON COMPLETION OF THE PROJECT ONLY WHEN PERMITTED BY THE ENGINEER OR THE PLANS.

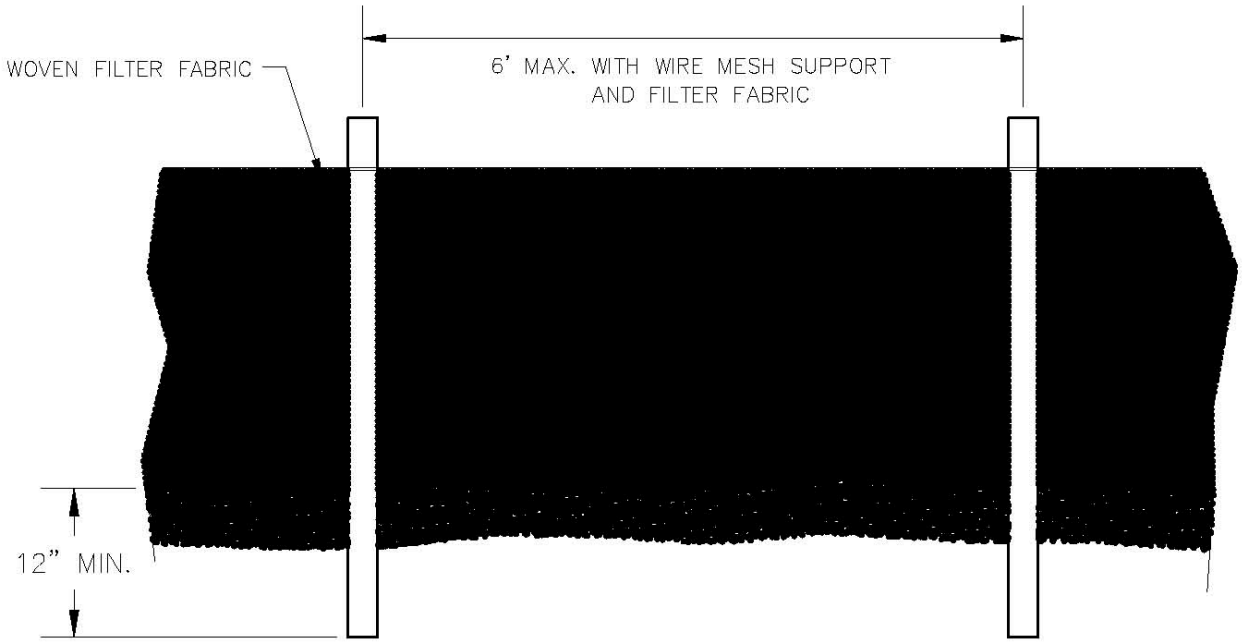
STORMWATER MANUAL

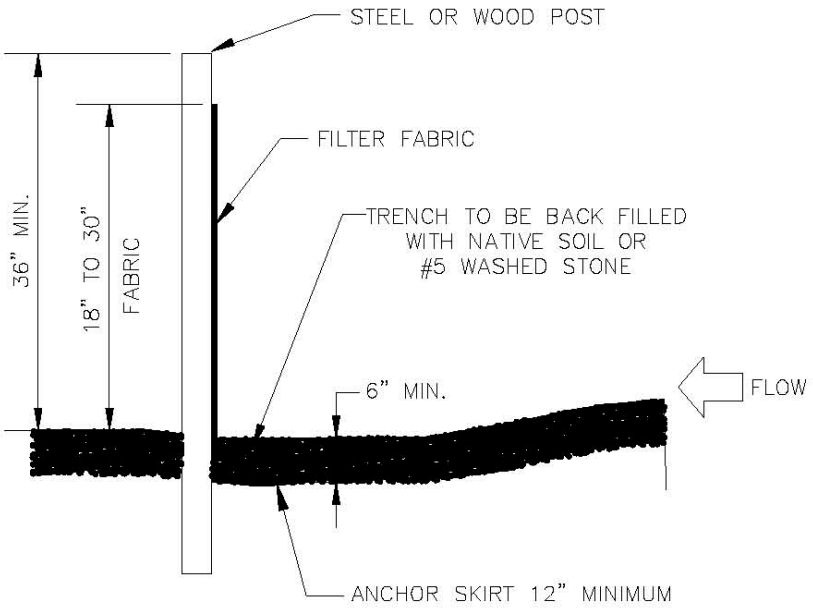
FIGURE 11–21

TEMPORARY SILT FENCE

(EFFECTIVE DATE 1/13/2011)

NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS DETAIL SHALL SUPERCEDE THIS DRAWING.





STORMWATER MANUAL

FIGURE 11–22

TEMPORARY SILT FENCE
GENERAL NOTES

(EFFECTIVE DATE 1/13/2011)

GENERAL NOTES

1. FILTER FABRIC SHALL BE PURCHASED IN A CONTINUOUS ROLL AND CUT TO THE LENGTH OF THE BARRIER. WHEN JOINTS CANNOT BE AVOIDED, FILTER FABRIC SHALL BE SPLICED TOGETHER ONLY AT A POST WITH 3 FOOT MIN. OVERLAP, AND SECURELY SEALED.
2. POSTS SHALL BE SPACED AT 6 FOOT INTERVALS IN AREAS OF RAPID RUNOFF.
3. POSTS SHALL BE AT LEAST 5 FEET IN LENGTH.
4. STEEL POSTS SHALL HAVE PROJECTIONS FOR FASTENING WIRE AND FABRIC.
5. WOOD POSTS SHALL BE 2 INCHES BY 2 INCHES OR EQUIVALENT. STEEL POSTS SHALL BE 1.33 LBS PER LINEAR FOOT.
6. A WIRE MESH SUPPORT FENCE SHALL BE FASTENED SECURELY TO THE UPSLOPE SIDE OF THE POSTS USING HEAVY DUTY WIRE STAPLES AT LEAST 1 INCH IN LENGTH, WIRE TIES OR HOG RINGS. THE WIRE SHALL EXTEND INTO THE TRENCH A MINIMUM OF 2 INCHES AND SHALL NOT EXTEND MORE THAN 36 INCHES ABOVE THE ORIGINAL GROUND SURFACE.
7. WASHED STONE SHALL BE USED TO BURY SKIRT WHEN SILT FENCE IS USED ADJACENT TO A CHANNEL, CREEK, OR POND.
8. TURN SILT FENCE UP SLOPE AT ENDS.

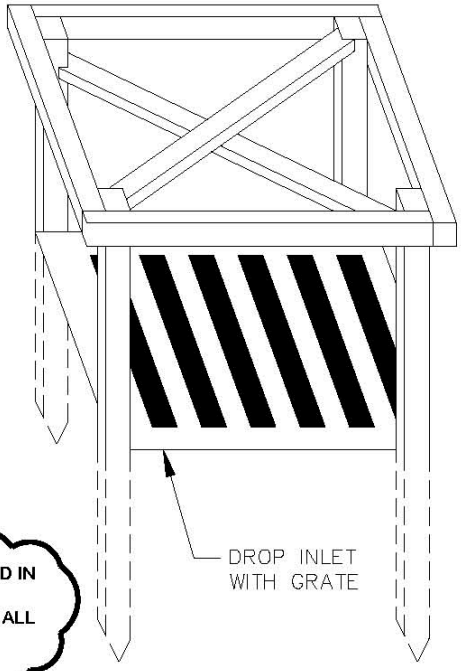
NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS DETAIL SHALL SUPERCEDE THIS DRAWING.

STORMWATER MANUAL

FIGURE 11–23

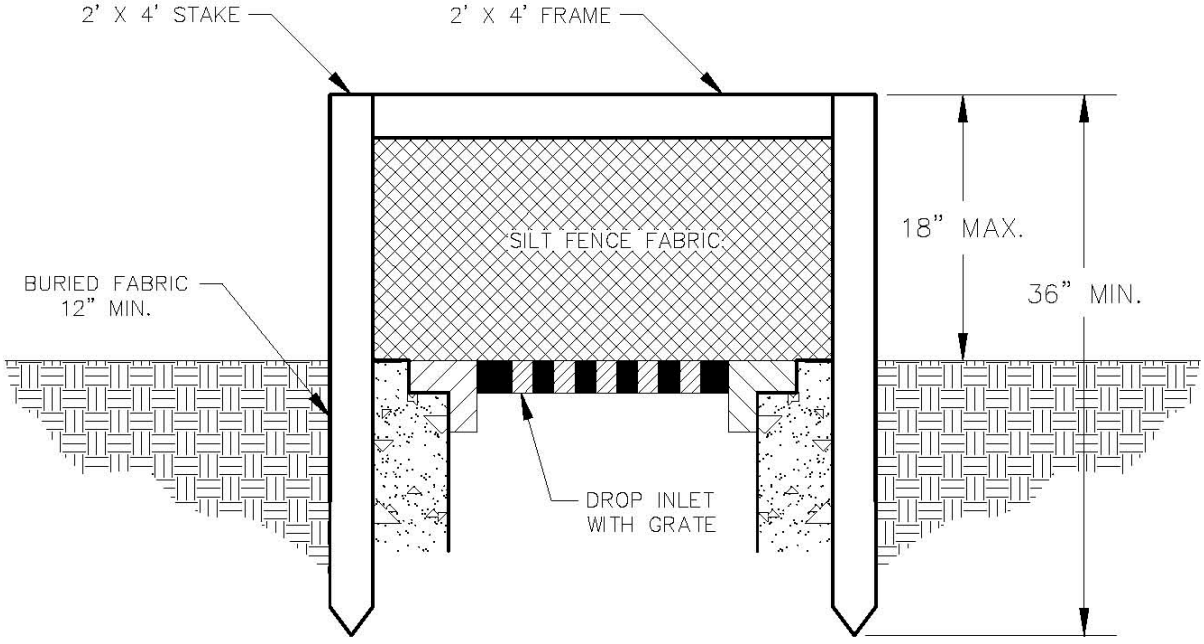
DROP INLET PROTECTION
USING SILT FENCE

(EFFECTIVE DATE 1/13/2011)



NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS DETAIL SHALL SUPERCEDE THIS DRAWING.

ISOMETRIC VIEW OF 2 X 4 WOOD FRAME



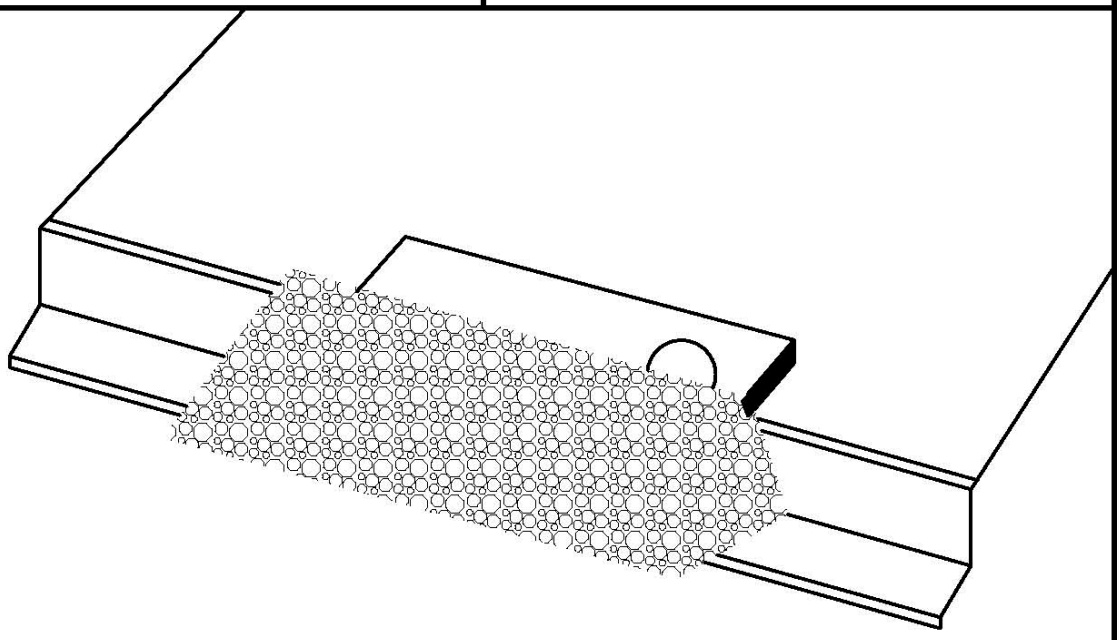
CROSS SECTION VIEW

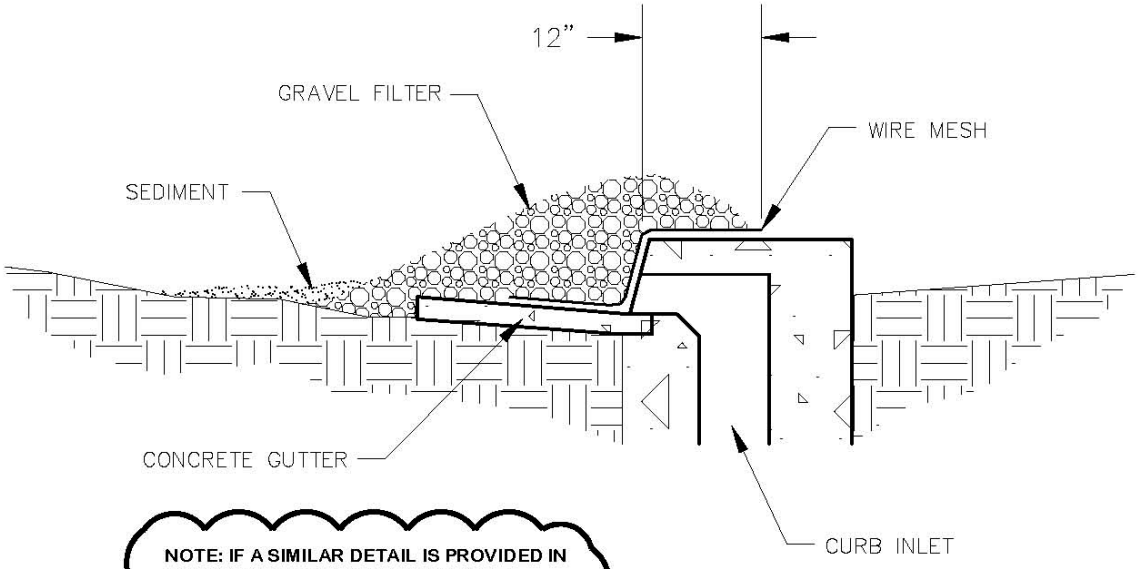
STORMWATER MANUAL

FIGURE 11–24

GRAVEL CURB INLET SEDIMENT FILTER

(EFFECTIVE DATE 1/13/2011)





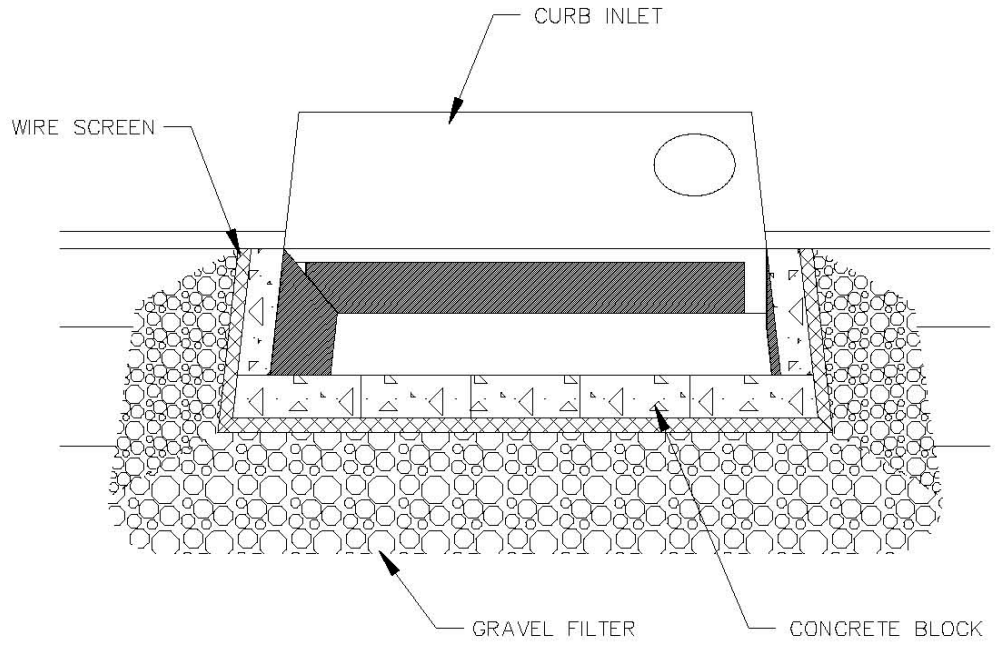
NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS DETAIL SHALL SUPERCEDE THIS DRAWING.

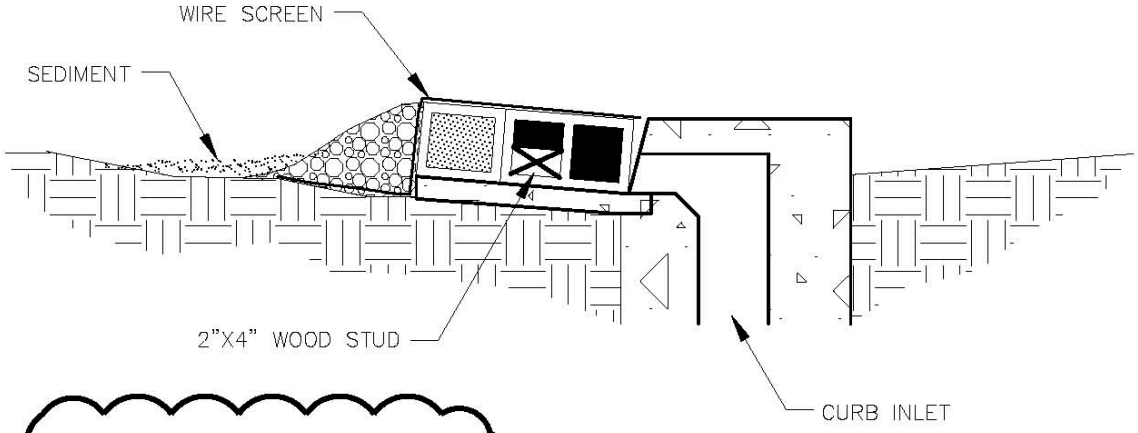
STORMWATER MANUAL

FIGURE 11-25

BLOCK AND GRAVEL CURB INLET SEDIMENT FILTER

(EFFECTIVE DATE 1/13/2011)



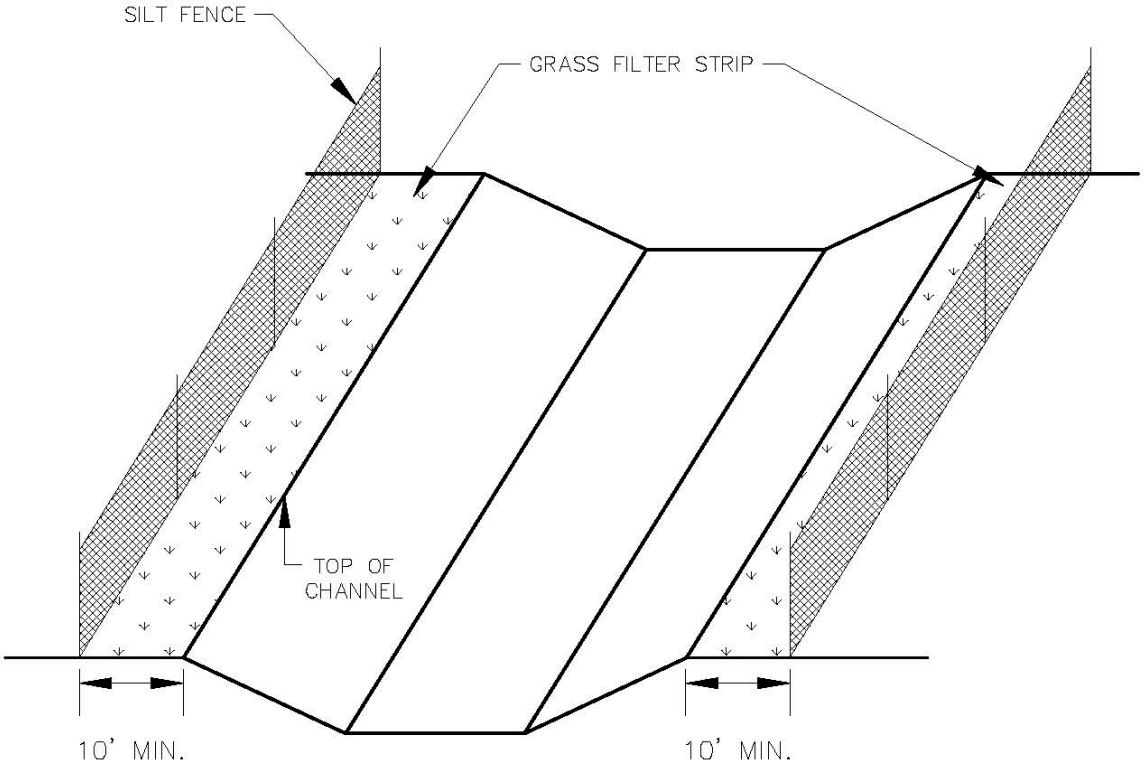


NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS DETAIL SHALL SUPERCEDE THIS DRAWING.

STORMWATER MANUAL

FIGURE 11–26
FILTER STRIP FOR
CONSTRUCTED CHANNEL

(EFFECTIVE DATE 1/13/2011)



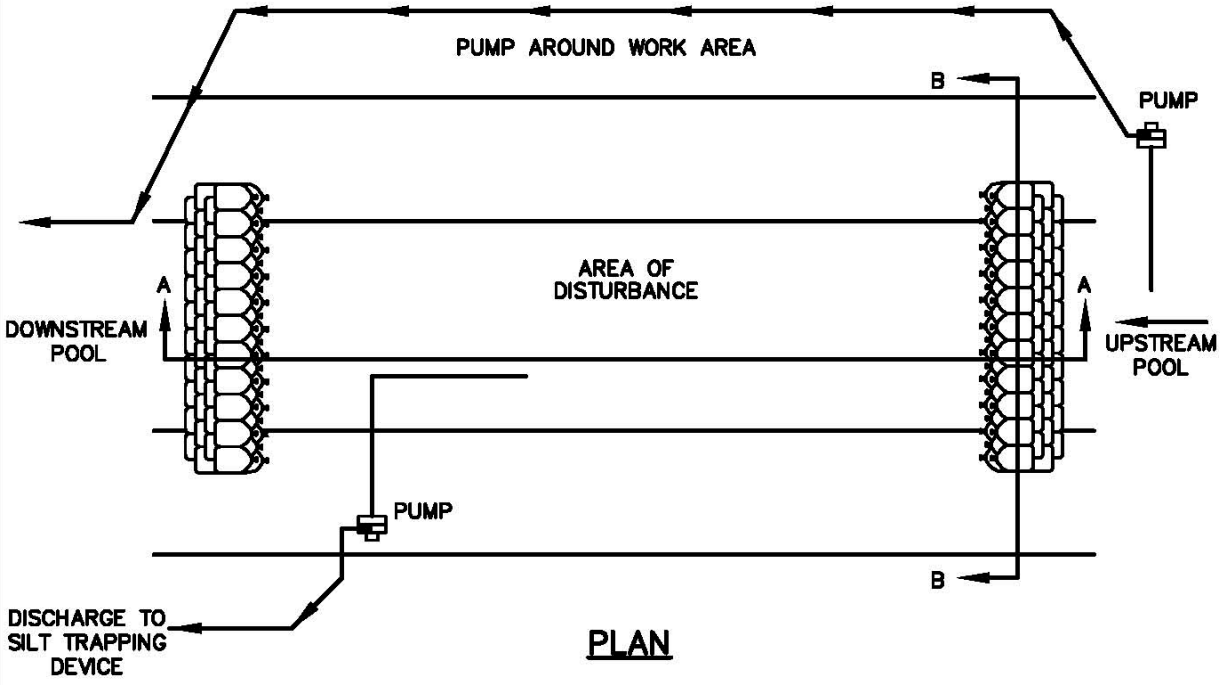
NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS DETAIL SHALL SUPERCEDE THIS DRAWING.

STORMWATER MANUAL

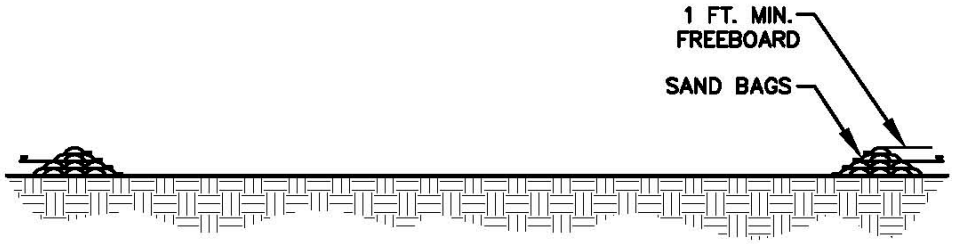
FIGURE 11–27

PUMP–AROUND FLOW DIVERSION

(EFFECTIVE DATE 1/13/2011)

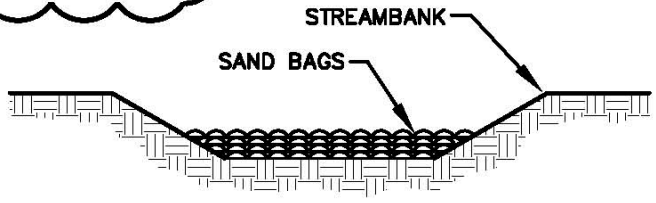


PLAN



SECTION A–A

NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS DETAIL SHALL SUPERCEDE THIS DRAWING.



SECTION B–B

END OF SECTION

SECTION 02373 – STREAM CROSSINGS, STREAMBANK RESTORATION, AND STREAM BUFFER RESTORATION

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, and equipment required for installing all structural and vegetative features associated with stream crossings, streambank restoration, and stream buffer restoration areas. Work in this section may include installation of Constructed Riffles, Temporary Stream Crossings, Streambank Restoration, and/or Stream Buffer Restoration.

B. The Contractor shall take all measures necessary to minimize the use of equipment within the banks of a stream.

1.02 PERMIT REQUIREMENTS

A. The Contractor is responsible to meet and follow all of the requirements and provisions in all project permits. A copy of applicable permits acquired by the Owner is included in Section 00890 – Permits.

PART 2 – PRODUCTS

2.01 STREAM BUFFER PERMANENT SEEDING

A. Stream buffer seeding shall be used for permanent seeding where land disturbance has occurred within 25 feet of the stream bank, with the following exceptions:

1. If a property owner landscaping agreement differs from this specification, the property owner landscaping agreement shall be followed on that property, or

2. The Construction Drawings identify a different location and/or seed mix.

B. The Stream Buffer Permanent Seed Mix shall consist of the following mix spread at a rate of 20 lbs/acre:

Common Name	Scientific Name	%	Lbs/ac
Redtop	*Agrostis alba*	10%	2
Elm-leaved Goldenrod	*Solidago ulmifolia*	5%	1
Big Bluestem	*Andropodon gerardii*	20%	4
Virginia Wild Rye	*Elymus virginicus*	20%	4
Prairie Switchgrass	*Panicum virgatum*	15%	3
Cutleaf Coneflower	*Rudbeckia laciniata*	5%	1
Ox Eye Sunflower	*Heliopsis helianthoides*	5%	1
River Oats	*Chasmanthium latifolium*	15%	3
Black-eyed Susan	*Rudbeckia hirta*	5%	1
TOTAL		**100%**	**20**

2.02 WOVEN COIR FABRIC

A. The Contractor shall submit a shop drawing for the proposed material for review and approval by the Owner's Engineer prior to placement.

B. Woven Coir Fabric shall be woven from machine twisted coir twines made of bristle coir. Woven Coir Fabric shall be Rolanka BioD-Mat 90 or approved equal meeting the following minimum requirements:

PROPERTY	TEST METHOD	TYPICAL
Mass/Unit Area (oz/yd^2)	ASTM D 3776	29
Tensile Strength (Machine Direction) (lbs./ft)	ASTM D 4595	1776
Tensile Strength (Transverse Directions) (lbs./ft)	ASTM D 4595	936
Elongation (Machine Direction) (%)	ASTM D 4595	52
Elongation (Transverse Direction) (%)	ASTM D 4595	24
Thickness (in.)	ASTM D 1777	0.35
Recommended Shear Stress (lbs./ft.^{2})	N/A	5
Recommended Flow (ft/s)	N/A	16

C. Wooden stakes to fasten coir fabric to the soil shall be hardwood stakes that are solid and free of rot, with the following approximate dimensions: 1" x 2" x 18" (tapered to a point). The Contractor may fabricate or purchase stakes.

D. Sod staples for anchoring void spaces of the coir fabric shall be bio-degradable wooden stakes.

2.03 CONTAINER PLANTS

A. Tree and shrub plant species and quantities shall be in accordance with those listed or shown on the Construction Drawings. All trees and shrubs shall be in containers grown with air-root pruned technique, spin-out containers or equivalent.

B. Woody plants shall exhibit a fully developed fibrous root system that allows the root ball to remain intact after removal from the container. Roots shall not be pot-bound or spiraling in the container.

C. Double shredded hardwood mulch shall consist of the bark from hardwood trees which has been milled and screened to a maximum 4 inch particle size. Mulch shall provide a uniform texture free from sawdust, weed seeds, foreign materials and any artificially introduced chemical compounds detrimental to plant life. Mulch shall be well aged (a minimum age of 6 months).

D. Nursery stock material shall be identified with attached, durable, waterproof labels and weatherproof ink. Labels shall state the scientific name of the specified plants. Common names are not acceptable. The scientific names must match those in the project plans. Plants that are unlabeled or improperly labeled shall not be accepted. Plant material shall be protected during delivery to prevent desiccation and damage to branches, trunk, root system, or earth ball.

E. Plant material shall be checked for unauthorized substitution and to establish nursery grown status. Plant material showing desiccation, abrasion, sun-scald injury, disfigurement, or unauthorized substitution shall be rejected. Container-grown plant material shall show new fibrous roots and the root mass shall contain its shape when removed from the container.

Plant material with broken containers shall be rejected. All rejected plant material shall be removed from the project site by the Contractor by the close of each working day.

F. Fertilizer for container plants shall be MYCOtabs 20-10-5 slow release mycorrhizal fertilizer tablets or equivalent.

2.04 LIVE STAKES

A. Live stake plant species shall be silky dogwood unless otherwise denoted in the Construction Drawings. Cuttings shall be alive, but dormant, with side branches removed and bark intact.

B. Cuttings shall be ½ to 2-inch diameter stock and 3 feet in length.

C. The basal ends of the cuttings shall be cut on an angle to facilitate insertion into the soil.

D. The materials may be collected or purchased.

E. No species shall be substituted without prior written approval from the Owner.

F. Cuttings shall be bagged and/or bundled by species and shall be identified with durable and waterproof labeling and/or weatherproof ink. Labels shall state the scientific name of the plant species grouping. Common names are not acceptable. The scientific names must match those in the specification. Plants that are unlabeled or improperly labeled shall not be accepted.

G. Plant material that is damaged or desiccated, or does not meet the material specifications shall not be accepted. All rejected plant material shall be removed from the project site by the Contractor by the close of the working day.

2.05 BRANCH PACKING

A. Material may consist of branches of silky dogwood species. Branches should be a minimum of 5 feet long and should be installed the same day that they are prepared, if harvested locally. Materials can be either harvested from existing living trees or purchased from a vendor. If immediate planting cannot be performed, the basal end of the plant shall be kept in water and the plant shall be refrigerated.

2.06 STONE

A. All stone shall consist of clean limestone of the specified size; hard, durable, and angular in shape, and resistant to weathering. Stone shall not contain deleterious amounts of shale, as determined by the Engineer. Porous or friable stone shall not be accepted.

B. Stone shall be of the size and quantity as shown on the Construction Drawings.

2.07 TOPSOIL

A. Topsoil shall consist of the upper portion of the soil profile and shall be loose, friable soil that is free of stones larger than one inch (1”), sub-soil, refuse and other debris including stumps, roots, brush, weeds, and non-organic materials. The acceptable soil texture classification for topsoil, in accordance with the U.S. Department of Agriculture is: clay (40% maximum), silt (70% maximum), and sand (60% maximum). Manure and/or partially composted materials are not acceptable. Topsoil (both salvaged and furnished) shall meet the following minimum standards through analytical testing, unless otherwise directed by LFUCG or the Owner’s Engineer:

Organic Matter	> 3%
pH (range)	5.8 – 7.0
Soluble Salts	< 500 parts per million

The Owner's Engineer shall visually approve representative samples of topsoil. All operations involved in the placing, spreading, and rolling of the topsoil shall be subject to the approval of the Owner. Selected topsoil shall be obtained from approved stockpiles of materials from excavation, from stripping, from borrow areas, or from other approved sources.

PART 3 – EXECUTION

3.01 GENERAL

A. All work within and along a stream shall be consistent with all project permits and the requirements of the state and local regulatory agencies.

B. The Contractor shall take care to prevent the deposition of sediment into the stream.

C. Stream diversion operations shall be scheduled such that work is completed as quickly as possible. Contractor shall not construct in a stream when rainfall is expected during the time excavation will be occurring in the stream.

D. Gravity sewer lines, force mains and water lines that cross streams shall be constructed by methods that maintain normal stream flow and allow for a dry excavation. Water pumped from the excavation shall be contained and allowed to settle prior to reentering the stream. Excavation equipment and vehicles shall operate outside of the flowing portion of the stream. Spoil material from the line excavation shall not be allowed to enter the flowing portion of the stream. The provisions of this condition shall apply to all types of utility line stream crossings.

E. Removal of riparian vegetation in the stream buffer and on the stream banks shall be limited to that necessary for equipment access. Effective erosion and sedimentation control measures shall be employed at all times during the project to prevent degradation of waters of the Commonwealth. Within 25 feet of a stream, site regrading and reseeding shall be accomplished within 7 days after disturbance.

3.02 STREAM BUFFER PERMANENT SEEDING

A. Stream Buffer Permanent Seeding shall be conducted in accordance with the specifications of Section 02372, Article 3.04 - Permanent Seed using the seed mix listed in this Section 02373, Article 2.01 - Stream Buffer Permanent Seeding.

3.03 WOVEN COIR FABRIC

A. When placing woven coir fabric, the surface of the soil should be smooth and free of rocks, roots and other obstructions.

B. Seed the prepared soil areas in accordance with Section 02372, Article 3.04 – Permanent Seed prior to the installation of the coir fabric.

C. Fabric shall be trenched, placed and staked in according to the Construction Drawings.

D. Biodegradable wooden stakes shall be inserted sporadically within void spaces and areas with puckers in the fabric.

3.04 CONTAINER PLANTS

A. Planting operations shall be performed only during periods when successful results are likely. To minimize stress or transplant shock, no plants shall be installed when ambient temperatures are forecasted to rise above 90°F at any point during a forty-eight (48) hour period following installation. In addition, no plants shall be installed when ambient temperatures are forecasted to drop below freezing. In general, trees and shrubs do best when planted in early spring or fall.

B. If trees and shrubs are not planted through erosion control blanket, then mulch in the form of hardwood mulch or mulch mats shall be used.

C. The Contractor shall mulch and fertilize.

D. All trees and shrubs should be fertilized with MYCOtabs 20-10-5 slow release mycorrhizal fertilizer tablets or equivalent. Each containerized plant should receive one 21 gram tablet. All fertilizer tablets are to be installed 4 inches below and 4 inches to the side of the plant roots.

E. All plants shall be watered thoroughly once unloaded and immediately after planting. Water until saturated once per week for the first four to six weeks and once every other week through the fall season. Water shall not contain elements toxic to plant life.

F. Prior to shipping to the site, the Contractor shall request approval of trees, shrubs, and fertilizer ordered. A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery of trees and shrubs.

G. If plants are not planted on the day of delivery, the plants shall be stored onsite in a shaded location and will be kept moist and cool.

H. Each root ball from containerized woody stock shall be carefully removed from the container without damaging the root system or plant.

I. When digging a planting hole for containerized woody stock, the diameter of the planting hole shall be at least 30% greater than the diameter of the root ball.

J. Trees and shrubs shall be placed in the center of the hole with top of root ball 1 inch above finished grades.

K. Following planting, each hole shall be backfilled with soil removed from the hole when the hole was formed.

L. Where the removed soil is unacceptable, a soil amendment shall be required.

M. Each planted tree and shrub shall have a minimum depth of 6 inches of organic material.

N. Organic soil amendment may consist of composted wood chips, composted leaf mulch, or other suitable and available natural organic material.

O. If amending the planting areas with topsoil, acceptable topsoil shall meet the material requirements of this Section 02373, Article 3.08 - Topsoil.

P. Containerized trees and shrubs planted through erosion control blanket shall be planted through clean incisions in the blanket. Incisions shall be parallel to the direction of flow in the stream.

Q. Portions of the erosion control blanket shall not be removed.

R. The blanket incision shall be securely closed with wire staples or stakes.

S. Seeded areas shall be inspected at least weekly after planting and after each rainfall of one-half inch or more. Areas requiring additional seed and mulch shall be repaired within 48 hours.

T. If vegetative cover is not established within 21 days, the area shall be reseeded.

3.05 LIVE STAKES

A. Live stakes shall be installed at any time during their dormant period when the ground is not frozen. Live stakes shall not be installed after dormancy is broken or after sprouting. Stakes that begin sprouting before planting will be rejected.

B. Prior to shipping to the site, the Contractor shall request approval from the Owner's Engineer of live stakes ordered. A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery of live stakes.

C. Plants shall be stored in a continuously cool, covered, and moist state.

D. Live stakes shall be soaked for 24 hours prior to installation in clear water, with the basal end of the plant in the water and shall be removed from the water no more than 1 hour before planting.

E. Live stakes shall not be soaked for a length greater than ten (10) days.

F. The angled end of the live stakes shall be inserted into the soil manually or with the use of a dead blow hammer with the uncut end protruding for approximately 3/5 of the cutting length.

G. In rock toe, live stakes shall be inserted to one-half their length into soil below stone fill with a minimum of two buds exposed above the stone fill. An iron bar or a stinger attached to a backhoe bucket can be used to make a pilot hole in firm or rocky soil.

H. If a pilot hole is used, the diameter of the pilot hole shall be less than the diameter of the smallest live stake to ensure firm contact with the soil.

I. Each live stake shall be positioned perpendicular to the slope at a 45º angle facing downstream followed by foot compaction around each cutting.

J. Live stakes shall be installed in a random configuration.

K. Live stakes that become split or "mushroomed" during installation shall be replaced at the Contactor's expense.

3.06 BRANCH PACKING

A. Prior to shipping to the site, the Contractor shall request approval from the Owner's Engineer of live stakes ordered. A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery of live stakes.

B. Plants shall be stored in a continuously cool, covered, and moist state.

C. Branches shall be soaked for 24 hours prior to installation in clear water, with the basal end of the plant in the water and shall be removed from the water no more than 1 hour before planting.

D. Branches shall not be soaked for a length greater than ten (10) days.

E. The live branches should be placed in a crisscross configuration with the growing tips generally oriented toward the slope face.

F. The density of the branches shall be 10-15 branches per linear foot.

G. After the live branches are configured, cover with a thin layer of soil approximately 1" thick.

3.07 STONE

A. All stone shall consist of clean limestone of the specified size; hard, durable, and angular in shape, and resistant to weathering. Stone shall not contain deleterious amounts of shale, as determined by the Engineer. Porous or friable stone shall not be accepted.

B. Stone shall be of the size and quantity as shown on the Construction Drawings and shall be placed in the manner shown in Construction Drawings.

3.08 TOPSOIL

A. All proposed planted areas, not including stream banks, are to be covered with a minimum of 6 inches of topsoil prior to seeding or planting. Do not place topsoil within a stream channel or on a stream bank where full bank flow could erode and remove the material.

B. Topsoil shall be evenly placed and spread over the graded area to a depth of 6 inches.

C. Minimize compaction during all operations by utilizing equipment having low unit pressure ground contact and by limiting repeat passes over the same areas.

3.09 PUMP AROUND FLOW DIVERSION FOR STREAM CROSSINGS

A. For stream crossings, the Contractor shall install, maintain, and operate all cofferdams, pumps, and protective works needed to divert stream flow and other surface water through and around the project work zone.

B. The Contractor is responsible to determine the number and sizes of pumps necessary for dewatering needs.

C. The Contractor shall inform the Owner's Engineer of a plan for diverting the stream flow. The de-watering plan must be approved by the Owner prior to the start of work and it shall include information on the type, sizes of pumps, dam construction techniques, discharge outfall protection, and other relevant information.

D. Operations shall be scheduled such that diversion installation, in-stream excavation, in-stream construction, stream restoration, and diversion removal are completed as quickly as possible.

E. The Contractor shall not construct in a stream when rainfall is expected during the time excavation will be occurring in the stream.

F. To capture or divert water flows, cofferdams can be used across the stream channel and secondary drainageways above (up-slope from) the work side as follows:

1. Cofferdams shall be constructed of materials that will have a minimal impact on the stream system. Cofferdams constructed of soil or material from the site shall not be used unless specifically directed by the Owner's Engineer.

2. Acceptable materials shall include stone, water structures, plastic barriers, or sand bags filled with clean and washed sand.

3. Contractor shall add sand bags filled with clean and washed sand as required to seal

leaks in rock cofferdams.

4. The Contractor is responsible to install all cofferdams/diversion structures in a safe and correct manner. Cofferdams must be installed so as to withstand the pressures exerted by the stream flow or ponded water against the cofferdam.

5. Commercial projects used as cofferdams (i.e. water structures, plastic barriers) shall be installed in accordance with the manufacturer's specifications.

6. The Contractor is permitted to make only minor disturbances to the streambed or banks as may be required to properly install the cofferdam.

G. Stream flow shall be pumped around the cofferdams and discharged back into the same drainageway that the water was taken from.

H. The Contractor shall be responsible to provide all pumps, hoses, pipelines, fuel tanks, and other items required to pump the stream flow around the work site, and for providing supervision of the pumping operation during all hours the pumps are running.

1. The Contractor shall be responsible for calculating the required pump capacity to handle the average stream flow in the area of the work.

2. The Contractor shall provide pumps that are in good operating order and free of leaks. Pumps that are leaking fuel, lubricants, or other material, shall be immediately repaired or replaced as necessary. All pump equipment shall be properly equipped with mufflers and other noise suppression equipment to minimize noise impacts on the surrounding residences.

3. Discharge hoses shall be reasonably free of leaks at either the fittings or the discharge hose casing. No leaks from discharge lines shall be allowed to cause erosion.

4. The Contractor shall provide adequate suction hose length to allow the pumps to be placed back from the immediate edge of the stream. Electric sump type pumps are exempt from this requirement.

5. Only clean water will be allowed to enter the storm system or stream. The pumping operation shall not allow for sediment from the stream bottom to be pulled into the pump.

I. Contractor shall dewater the work area and pump the work zone dewatering water into a sediment trapping device.

J. Outlet protection shall be installed as required at the discharge point to prevent erosion of soils and the streambed or bank.

K. Contractor shall complete construction activities across the stream.

L. Contractor shall restore the streambed and banks.

M. Contractor shall remove all materials placed for the cofferdam and outfall protection and shut down pumping operation. (Salvage sandbags for future use if multiple stream crossings are required on the project.) Contractor shall remove all sandbags from the stream, including damaged and empty bags.

3.10 TEMPORARY STREAM CROSSING

A. Clearing and excavation of the streambed and banks shall be kept to a minimum.

B. The structure shall be removed as soon as it is no longer necessary for project construction.

C. Upon removal of the structure, the stream shall immediately be reshaped to its original cross section and properly stabilized.

D. The approaches to the structure shall consist of stone pads with a minimum thickness of 6 inches, a minimum width equal to the width of the structure, and a minimum approach length of 25 feet on each side.

E. The structure shall be inspected after every rainfall and at least once a week and all damages repaired immediately.

3.11 PLANTING FIELD PREPARATION

A. The planting area shall be staked in a grid pattern as shown on the Drawings, with the stakes set at 25 feet on center, as indicated.

B. The individual species shall be planted as recommended by the supplying nursery, or a method selected by the Contractor to achieve the specified survival rate.

3.12 TREE PLACEMENT

A. The species shall be placed sequentially in the planting holes in a fashion that does not have the same species directly opposite.

B. The Contractor may, at his option, add an appropriate grade of fertilizer and/or herbicide to stimulate growth.

C. The burlap shall be removed from the root balls, and the trees shall be placed in the center of the planting hole in a vertical position. The planting hole shall be backfilled. Do not cover the root crown with soil. Tamp the soil regularly during backfilling to collapse any large air pockets in the soil.

D. The tree and backfill soil shall be thoroughly watered. Any resultant soil settlement shall be refilled with soil, and firmly tamped into place.

E. During the one-year period following planting, the Contractor shall perform periodic maintenance consisting of, but not limited to, removing volunteer trees, replacing dead trees, and watering.

F. Planting success is defined as achieving a 90% survival rate within the planted area. The Contractor shall warrant planting success for one year. If the survival rate is less than 90%, the Contractor shall be responsible for replanting all non-surviving specimens at no additional cost to the Owner. The Contactor shall perform periodic maintenance of the replanted trees to achieve the 90% survival rate of the entire planted area.

G. The Contractor shall ensure that the crew selected for tree planting is experienced, knowledgeable, and skilled in the techniques for planting, nurturing, and maintaining the selected tree species.

H. Trees shall be planted during the time recommended by the nursery supplying the trees for the species being planted.

END OF SECTION

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Permitting, Inspection, and Enforcement Procedures for
Erosion and Sediment Control on Capital Projects
Division of Water Quality Remedial Measures Plan (RMP)

West Hickman Wet Weather Storage Project (WH-20)

DWQ Project Manager: Mark Fischer
DWQ Administrative Specialist Principal: Courtney Thacher
Construction Contract Administrators (CA): Tetra Tech
Resident Project Representatives (RPR): Integrated Engineering (subconsultant to Tetra Tech)
ACCELA Data Entry: Mark Fischer
Permittee: Contractor

Permitting Procedures

1. Contractor shall develop a Stormwater Pollution Prevention Plan (SWPPP)/ESC Plan. A draft SWPPP/ESC Plan is included in the specifications. The Contractor has sole responsibility for the content of the SWPPP and the implementation of the SWPPP during construction.
2. Contractor shall obtain a Grading Permit from the Jessamine County Fiscal Court, Department of Planning and Zoning, before beginning construction.
3. Contractor shall submit a Notice of Intent (NOI) to the KY Division of Water (KDOW) and obtain KYR10 Permit coverage before beginning construction. The NOI shall be submitted electronically at: https://dep.gateway.ky.gov/eForms/default.aspx?FormID=48
4. Contractor shall not start work until they have obtained the Jessamine County Grading Permit and KYR10 Permit coverage. In addition, Contractor will be required to post an ESC Performance Bond before starting construction.
5. The Contractor shall provide Tetra Tech with copies of the Jessamine County Grading Permit and the KYR10 permit.

Contractor Responsibilities

Contractor shall:

1. Attend a pre-construction conference with LFUCG.
2. **Post the Jessamine County Grading Permit and KYR10 Permit on the project sign at the site.**
3. **Follow the SWPPP/ESC Plan; revise and redline it as conditions change on the site.**
4. **Install and maintain BMPs to prevent sediment from washing into streets, storm sewers, and streams.**
5. **Conduct an ESC inspection at least once every 7 calendar days, and within 24 hours after each storm event of 0.5 inches or greater. The Contractor shall also conduct an ESC inspection within 24 hours after a snow event of 4 inches or greater.**
6. **Complete an inspection form after each inspection.**
7. **Stabilize the site within 14 days after reaching temporary or final grade.**
8. **For work within 50 feet of West Hickman Creek, or within 25 feet of a tributary to West Hickman Creek, stabilize the area within 24 hours after completing work.**
9. Maintain a 50-foot vegetative buffer strip along West Hickman Creek, and a 25-foot buffer strip along tributaries to West Hickman Creek.
10. File a Notice of Termination with the KY Division of Water when final stabilization has been achieved. Final stabilization is defined as follows from KYR10:

    "All soil disturbing activities at the site have been completed and either of the two following criteria are met:

    a. a uniform(e.g., evenly distributed, without large bare areas) perennial vegetative cover with a density of 70 percent of the native background vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures, or
    b. equivalent stabilization measures (such as the use of riprap, gabions, or geotextiles) have been employed."

11. Respond promptly to Verbal Warnings from the RPR regarding correcting ESC problems.

Inspection Procedures of the RPR

RPR Monthly Field Inspection (two times a month if crossing a stream or in a floodplain)

1. **Ensure the Jessamine County Grading Permit and KYR10 Permit are posted at the site**
2. **Ensure ESC Plan and SWPPP are available for review**
3. **Ensure Contractors' weekly inspection forms are available for review**
4. Walk the perimeter of the entire site
5. Note downgradient controls
    - Inspect silt fences, culvert/ditch outlets
    - Significant sediment discharges?
6. Walk around internal disturbed areas
    - Idle for more than 14 days . . . stabilized?
7. Inspect all inlets and ditches
    - Inlets protected, ditches stabilized?
8. Check out material/fuel storage areas
    - Spills? Leaks? Leaching pollutants?
9. Inspect concrete washout(s)
10. Inspect the construction entrance/exit
11. Inspect the vegetated buffer strip adjacent to streams (no disturbance allowed)
12. Complete the LFUCG monthly inspection checklist. Submit an electronic copy of the completed checklist to the DWQ Project Manager.
13. Inspect the site the next working day after a storm event of 0.5 inches or greater (or a snow event of 4 inches or larger) and complete the inspection checklist. Submit a copy to the DWQ Project Manager.

Important things for the RPR to look for:

- Posted permits, plans, and inspection reports
- Graded areas stabilized with seed, mulch, blankets, mats, etc.
- Stabilized ditches
- Maintenance on silt fences and curb/drop inlets
- No mud on the street
- Trash and litter managed
- No disturbance within 50 feet of West Hickman Creek, and within 25 feet of tributaries to West Hickman Creek.

Enforcement Procedures

1. The Contractor will be paid for erosion and sediment control based upon a schedule of values established within the Measurement and Payment section of the specifications (e.g. 25% paid once initial ESCs have been installed and LDP obtained, 50% paid in equal monthly payments for maintenance over the construction period, 25% paid for removal of ESCs and final stabilization). The intent of this provision is to pay the Contractor for monthly ESC maintenance only if the BMPs are functioning properly.
2. When the RPR identifies ESC deficiencies, the RPR shall issue a verbal warning to the Contractor to address the deficiencies. If the deficiencies are not addressed after two verbal warnings, the RPR shall notify the RMP Contract Administrator of the deficiencies. In some cases, the RMP Contract Administrator should be notified immediately. **Refer to the attached Compliance Assistance Guidance for RPRs.**
3. The RMP Contract Administrator shall prepare a written summary of the deficiencies referred by the RPR, and shall notify the DWQ Project Manager that additional enforcement measures are needed to achieve compliance.
4. The DWQ Project Manager shall use all available means in the contract to obtain compliance, including:
    a. stopping work
    b. withholding payment
    c. notifying the Contractor that LFUCG intends to initiate the process for declaring that the Contractor is in default of the contract and specifying a deadline for addressing the ESC deficiencies
    d. initiating the process for calling the ESC Performance Bond
5. **The Contractor is also subject to enforcement by the Jessamine County Fiscal Court.**

Compliance Assistance Guidance for the RPR

Observed Condition	Verbal Warning to Correct within 3-5 days	Verbal Warning to Correct within 24 hours (See Note 1)	Notify RMP Contract Administrator Immediately
Construction Entrance to Public Road	Rock pad poorly installed/maintained	Rock pad not installed	
	Small amount of sediment on road	Rock pad completely covered with soil	
		Significant amount of sediment on road	
Unstabilized Areas	Flat inactive disturbed areas not stabilized in 14 days	Ditches not stabilized immediately after construction	
		Disturbed, inactive slopes not stabilized within 14 days	Disturbed, inactive slopes above waterways, wetlands, floodplains, critical areas not stabilized within 24 hours
Inlet Protection	Sediment needs to be removed around inlet protection	Curb inlet protection not in place or improperly installed	Discharge of concrete wash water, chemicals, other pollutants into inlets, streams, wetlands, etc.
Silt Fencing	Does not match ESC Plan but critical areas and roads are protected	Silt fence not installed per plan	
	Does not comply with Stormwater Manual but is functional	Blowouts have occurred with discharge of sediment to critical areas	
	Needs maintenance/repair, but is not near an inlet or surface water	Not trenched in, is not functional	
		Needs repaired in critical areas	
Soil Stockpiles	No perimeter controls, downstream BMPS in place	No perimeter controls, downstream BMPs not in place	
Permit Violations		Permit expired	Site not permitted
		Permit not posted or available on site	
		Contact name/phone not posted	
		No self-inspection reports; reports not on site	
		Self-inspection reports not current	
		ESC Plan / SWPPP not on site	
		Minor unapproved construction activities in buffer zone around sinkholes, streams, wetlands, etc.	Major unapproved construction activities in buffer zone around sinkholes, streams, wetlands, etc.
		Construction has started, BMPs not installed	

1. Refer issue to RMP Contract Administrator after 2nd Verbal Warning
2. Critical areas are streams, wetlands, sinkholes, and inlets

SECTION 02505 - WATER PIPING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required for furnishing and installing all potable water piping and appurtenances as specified and shown on Drawings. This section also applies to the non-potable water piping.

PART 2 - PRODUCTS

2.01 DUCTILE IRON PIPE AND FITTINGS – POTABLE WATER

A. Ductile iron pipe shall be furnished cement lined unless otherwise noted on the drawings or in other sections of these specifications. Ductile iron pipe shall be furnished with rubber gasket push-on joints except as may otherwise be noted on the drawings or in difficult working areas and approval of the Engineer.

B. Pressure class shall be 350 psi for pipe sizes 20 inches or smaller and pressure class 250 psi for pipe sizes larger than 20 inches for mechanical and push-on joint pipe.

C. Thickness design of ductile iron shall conform in all aspects to the requirements of ANSI/AWWA C150/A 21.50 latest revision.

D. Manufacture and testing of ductile iron pipe shall conform in all aspects to the requirements of ANSI/AWWA C151/A 21.51 latest revisions.

E. Cement mortar lining with bituminous seal coat shall conform to the requirements of ANSI/AWWA C104/A 21.4, latest revision for cement-mortar lining for ductile iron pipe, gray iron pipe, and fittings for water. Bituminous outside coating shall be in accordance with ANSI/AWWA C151/A 21.51 for pipe and ANSI/AWWA C110/A 21.10 for fittings.

F. Fittings and gaskets for mechanical and push-on joint ductile and cast iron pipe shall conform to the latest revisions of ANSI/AWWA C110/A 21.10 for mechanical and push-on joint fittings, ANSI/AWWA C111/A 21.11 for gaskets, and ANSI/AWWA C153/A 21.53 for mechanical and push-on joint compact fittings. Mechanical and push-on joint fittings shall have pressure class rating of 350 psi for sizes 20 inches and smaller and 250 psi for sizes larger than 20 inches.

G. All ductile and cast iron fittings shall be ductile iron grade 80-60-03 in accordance with ASTM A339-55.

H. Flanged ductile iron pipe shall conform to the latest revisions of ANSI/AWWA C115/A 21.15. Bolt pattern of flange shall be in accordance with ANSI/AWWA C115/A 21.15 (which is equivalent to ASME/ANSI B16.1, Class 125 flange bolt pattern). Pipe shall have pressure class 250 rating. Gaskets shall be synthetic rubber ring gaskets with a thickness of 1/8 inch. Nuts and bolts shall be in accordance with ASME/ANSI B18.2.1, ASME/ANSI B18.2.2, ASME/ANSI B1.1, and ASTM A307.

I. Flanged fittings shall conform to the latest revisions of ANSI/AWWA C110/A 21.10 or ANSI/AWWA C153/A 21.53 (compact fittings). Gaskets shall be in accordance with ANSI/AWWA C111/A 21.11. Fittings shall have pressure class rating of 250 psi. Bolt pattern of flange shall be in accordance with ANSI/AWWA C115/A 21.15 (which is equivalent to ASME/ANSI B16.1, class 125 flange bolt pattern).

J. Restrained joint pipe and fittings using restraining gaskets shall be a boltless system equal to "Field-Lok" restraining gaskets as manufactured by U.S. Pipe & Foundry Company or approved equal.

K. Restrained joint pipe and fittings using a locking ring system shall be American Flex-Ring, U.S. Pipe TRFLEX, or Clow Clow Tyton/Fastite shop or field systems.

L. Restrained joint pipe and fittings using a grip ring system shall be equal to Romac Grip Rings or Mega Lugs.

M. Mechanical joint ductile iron anchor pipe shall be included with fire hydrant setting as noted on Drawings. Anchor pipe shall be Clow Corporation F1211 mechanical joint, Tyler swivel by solid adapter 5-198 mechanical joint, or approved equal.

N. Ball and socket restrained joint pipe and fittings shall be a boltless system equal to USIFLEX manufactured by U.S. Pipe & Foundry Company or FLEX-LOK manufactured by American Pipe Company. Pipe shall have a working pressure rating of 250 psi and have a maximum joint deflection of 15°. Nominal laying lengths shall be in range of 18 feet 6 inches to 20 feet 6 inches.

O. Manufacturers: Pipe shall be as manufactured by U.S. Pipe & Foundry Company, Clow, American Cast Iron Pipe Company, or equal.

P. Marking: Pipe or fitting shall have the ANSI/AWWA standard, pressure (or thickness) class, diameter, DI or ductile noted, manufacturer, and country and year where cast on the outside of the body.

2.02 PVC (POLYVINYL CHLORIDE) PIPE

A. Scope

This article covers the design and manufacture of PVC 1120 manufactured of CLASS 12454-B or CLASS 12454-C (cell classification) resin material with a hydrostatic-design-basis (HDB) rating of 4,000 psi at 73.4º F (23º C).

B. Specific Requirements

PVC pressure pipe shall be furnished, constructed of materials and to the specifications of this section. The types of PVC pipe permitted for use on the project will be as noted on the drawings or bid form. The selected pipe will be designated either as PVC (ASTM) or PVC (AWWA) followed by an appropriate pressure rating or dimension ratio (DR or SDR).

1. PVC (ASTM) Pipe

a. PVC (ASTM) pipe shall be designed, manufactured, and tested to conform with the latest revision of ASTM D-2241, ASTM D-1784, and ASTM D-2672.

b. Rubber gasketed joints shall conform to ASTM D-3139. The gaskets for the PVC pipe joint shall conform to ASTM F-477 and D-1869. Gaskets shall be twin gasket joints or integral bell joints with rubber O-ring seals.

c. PVC (ASTM) pipe shall be furnished as SDR 17 for Class 250 psi.

1. PVC (AWWA) Pipe

a. PVC (AWWA) pipe shall be designed, manufactured, and tested to conform with the latest revision of AWWA C900 for pipes sizes 12 inches and smaller and AWWA C905 for pipes sizes 14 inches and larger.

b. Pipe shall have cast iron pipe equivalent ODs.

c. Rubber gasketed joints shall conform to ASTM D-3139. The gaskets for the PVC pipe joint shall conform to ASTM F-477 and D-1869.

d. PVC (AWWA) pipe shall be furnished as DR 18 for Class 235 psi,

C. Rubber gasket joints shall provide adequate expansion to allow for a 50 □ change in temperature on one length of pipe. Lubrication for rubber connected couplings shall be water soluble, non-toxic, be non-objectionable in taste and odor and have no deteriorating effect on the PVC or rubber gaskets and shall be as supplied by the pipe manufacturer.

D. Standard laying lengths shall be 20 feet ± for all sizes. At least 85 percent of the total footage of pipe of any class and size shall be furnished in standard lengths, the remaining 15 percent in random lengths. Random lengths shall not be less than 10 feet long. Each standard and random length of pipe shall be tested to four times the class pressure of the pipe for a minimum of five (5) seconds. The integral bell shall be tested with the pipe.

E. PVC Pipe shall be NSF approved for potable water service.

F. All pipe and couplings shall bear identification markings that will remain legible during normal handling, storage, and installation, which have been applied in a manner what will not reduce the strength of the pipe or the coupling or otherwise damage them. Pipe and coupling markings shall include the nominal size and OD base, material code designation, dimension ratio number, ASTM or AWWA Pressure Class, ASTM or AWWA designation number for this standard, manufacturer's name or trademark seal (mark) of the testing agency that verified the suitability of the pipe material for potable-water service. Each marking shall be applied at intervals of not more than five (5) feet for the pipe and shall be marked on each coupling.

G. Fittings shall be ductile iron in accordance with Article 2.01 of this section.

2.03 RESTRAINT DEVICES FOR POLYVINYL CHLORIDE PLASTIC (PVC) PIPE

A. Each restraint system shall be manufactured of ductile iron conforming to ASTM A536. A backup ring shall be utilized behind the PVC Bell. A restraint ring incorporating a plurality of individually actuating gripping surfaces shall be used to grip the pipe then bolted to the backup ring. The restraint shall be the Series 2000PV (mechanical joint restraint to fittings) or 2800 (pipe harness) as manufactured by EBAA Iron, Inc. or approved equal.

B. Restraint devices for mechanical joint fittings and appurtenances shall conform to either AWWA C111, or AWWA C153. The working pressure for the restraint shall equal that of the pipe on which it is used.

C. Mechanical joint restraints, 4” through 24”, shall meet or exceed the requirements of ASTM F1674.

D. Mechanical joint restraint shall be Series 2800 produced by EBAA Iron, Inc. or approved equal.

E. Mechanical joint retainer glands and pipe bell harnesses shall receive a fluoropolymer corrosion protective coating (EBAA Iron Mega-Bond or equal).

2.04 CONNECTION OF NEW UTILITIES TO EXISTING SYSTEM

A. The Contractor shall connect the new utilities to the existing system where shown on the Drawings or directed by the Engineer, and shall furnish all necessary equipment and materials required to complete the connection.

B. Couplings and Adaptors

1. Flexible couplings shall be of the sleeve type with a middle ring, two wedge shaped resilient gaskets at each end, two follower rings, and a set of steel trackhead bolts. The middle ring shall be flared at each end to receive the wedge portion of the gaskets. The follower rings shall confine the outer ends of the gaskets, and tightening of the bolts shall cause the follower rings to compress the gaskets against the pipe surface, forming a leak-proof seal. Flexible couplings shall be steel with minimum wall thickness of the middle ring or sleeve installed on pipe being 5/16-inch for pipe smaller than 10 inches, 3/8-inch for pipe 10 inches or larger. The minimum length of the middle ring shall be 5-inches for pipe sizes up to 10 inches and 7 inches for pipe 10 inches to 30 inches. The pipe stop shall be removed. Gaskets shall be suitable for 250 psi pressure rating or at rated working pressure of the connecting pipe. Couplings shall be harnessed and be designed for 250 psi.

2. Flanged adapters shall have one end suitable for bolting to a pipe flange and the other end of flexible coupling similar to that described hereinbefore. All pressure piping with couplings or adapters shall be harnessed with full threaded rods spanning across the couplings or adapters. The adapters shall be furnished with bolts of an approved corrosion resistant steel alloy, extending to the adjacent pipe flanges. Flanges on flanged adapter (unless otherwise indicated or required) shall be faced and drilled ANSI B16.1 Class 125.

3. Flexible couplings and flanged adapters shall be as manufactured by Dresser, Rockwell, or equal, per the following, unless otherwise specified and/or noted on the Drawings:

4. Steel couplings for joining same size, plain-end, steel, cast iron, and PVC plastic pipe -

Dresser	Rockwell
Style 138	411

5. Transition couplings for joining pipe of different outside diameters-

Dresser	Rockwell
Style 162 (4"-12")	413 steel (2"-24")
Style 62 (2"-24")	415 steel (6"-48")
	433 cast (2"-16")
	435 cast (2"-12")

6. Flanged adapters for joining plain-end pipe to flanged pipe, fittings, valves and equipment.

Dresser	Rockwell
Style 127 cast (3"-12")	912 cast (3"-12")
Style 128 steel (3"-48" C.I. Pipe)	913 steel (3" and larger)
Style 128 steel (2"-96" steel pipe)	

PART 3 - EXECUTION

3.01 EXCAVATION FOR PIPELINE TRENCHES

A. See Section 02225 for trenching specification.

B. **Minimum cover of 36” shall be provided for all water mains.**

3.02 PIPE BEDDING

A. Bedding shall be in accordance with LFUCG Standard Drawings.

3.03 LAYING PIPE

A. The laying of pipe in finished trenches shall be commenced so the spigot ends point in the direction of flow.

A. All pipes shall be laid with ends abutting and true to line and grade as given by the Engineer. Supporting of pipes shall be as set out hereinbefore under “Pipe Bedding” and in no case shall the supporting of pipes on blocks be permitted.

C. Before each piece of pipe is lowered into the trench, it shall be thoroughly inspected to insure it’s clean. Each piece of pipe shall be lowered separately unless special permission is given otherwise by the Engineer. No piece of pipe or fitting which is known to be defective shall be laid or placed in the lines. If any defective pipe or fitting shall be discovered after the pipe is laid, they shall be removed and replaced with a satisfactory pipe or fitting without additional charge. In case a length of pipe is cut to fit in a line, it shall be so cut as to leave a smooth end at right angles to the longitudinal axis of the pipe.

D. Pipe shall not be laid on solid rock. Pipe bedding shall be installed prior to laying pipe. Irregularities in subgrade in an earth trench shall be corrected by use of #9 crushed limestone.

E. When ordered by the Engineer, unsuitable materials in subgrades shall be removed below ordinary trench depth in order to prepare a proper bed for the pipe.

F. When laying of pipe is stopped for any reason, the exposed end of such pipe shall be closed with a plywood or fabricated plug fitted into the pipe bell, so as to exclude earth or other material, and precautions taken to prevent flotation of pipe by runoff into trench.

G. No backfilling (except for securing pipe in place) over pipe will be allowed until the Engineer has had an opportunity to make an inspection of the joints, alignment and grade, in the section laid.

3.04 BACKFILLING PIPELINE TRENCHES

A. Backfilling shall be in accordance with LFUCG Standard Drawings.

3.05 COPPER TRACING WIRE

At the Owner’s discretion, No. 12 solid copper wire shall be laid in top 12 inches of ditch over all plastic pipe. The copper tracing wire shall be connected valve to valve unless the distance between valves is greater than 1000 feet. If distance is greater than 1000 feet, the tracing wire shall be wrapped around a line marker at least three (3) times and tied one (1) foot above grade.

3.06 SETTLEMENT OF TRENCHES

A. Whenever lines are in, or cross, driveways and streets, the Contractor shall be responsible for any trench settlement which occurs within these rights-of-way within one year from the time of final acceptance of the work. If paving shall require replacement because of trench settlement within this time, it shall be replaced by the Contractor at no extra cost to the Owner. Repair of settlement damage shall meet the approval of the Owner and/or the State Department of Transportation.

3.07 CONCRETE THRUST BLOCKS OR ENCASEMENT

A. Concrete thrust blocks or encasement shall be placed at all bends or where shown on the Drawings and in accordance with LFUCG Standard Drawings.

3.08 TESTING

A. All pressure piping (lines not laid to grade) shall be given a hydrostatic test of at least 1.5 times the normal operating pressure of the pipe (at its lowest elevation), but not to exceed the rated working pressure of the pipe or valves. Note: Engineer shall verify test pressure. Loss of pressure during the test shall not exceed 0 psi in a 4 hour period and 5 psi in a 24 hour period. Any test results that do not meet either of these requirements shall constitute a failure of the pressure test.

B. Contractor shall furnish a recording gauge and water meter for measuring water used during leakage test and recording pressure charts during duration of test. Recording pressure charts shall be turned over to the Engineer at conclusion of test. The pressure recording device shall be suitable for outside service, with a range from 0-200 psig, 24-hour spring wound clock, designed for 9" charts, and shall be approved by the Engineer.

C. Pipelines shall be tested before backfilling at joints except where otherwise required by necessity or convenience.

D. Duration of test shall be not less than four (4) hours where joints are exposed and not less than 24 hours where joints are covered.

E. Where leaks are visible at exposed joints and/or evident on the surface where joints are covered, the joints shall be laid and leakage must be minimized, regardless of total leakage as shown by test.

F. All pipe, fittings and other materials found to be defective under test shall be removed and replaced at no additional expense to the Owner.

G. Lines which fail to meet tests shall be repaired and retested as necessary until test requirements are complied with.

H. Where nonmetallic joint compounds are used, pipelines should be held under normal operating pressure for at least three days before testing.

I. The Owner will provide initial water for testing and disinfecting the pressure piping. Should the first test fail to pass, all additional water required for subsequent tests shall be furnished at the Contractor's expense.

J. The cost of testing pressure piping is to be included in the Contractor's lump sum Contract Price.

3.09 CLEAN UP

A. Upon completion of installation of the piping and appurtenances, the Contractor shall remove all debris and surplus construction materials resulting from the work. The Contractor shall grade the ground along each side of pipe trenches in a uniform and neat manner leaving the construction area in a shape as near as possible to the original ground line.

3.10 DISINFECTION OF POTABLE WATER LINES

A. Comply with Section 02675 of the specifications for the disinfection of potable water piping. Disinfection not required for non-potable water lines.

END OF SECTION

SECTION 02515 - VALVES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required to furnish and install all valves shown on the Drawings and/or specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 11295 – Interior Process Valves

1.03 SUBMITTAL

A. Descriptive literature, catalog cuts, and dimensional prints clearly indicating all dimensions and materials of construction, shall be submitted on all items specified herein to the Engineer for review before ordering. Comply with provisions of Section 01300.

B. At the time of submission, the Contractor shall, in writing, call Engineer's attention to any deviations that the submittals may have from the requirements of the Engineer's Contract Drawings and Specifications.

PART 2 - PRODUCTS

2.01 GATE VALVES

A. Gate valves shall conform with AWWA C-509 standard, and shall be of the resilient seat type, iron body, fully bronze mounted, non-rising stem and have a design working pressure of 250 psi. All assembly bolts shall be stainless steel. Valves shall be of standard manufacturer and of the highest quality both as to materials and workmanship.

B. All gate valves shall be furnished with mechanical joint connections, unless otherwise shown on the Drawings or specified hereinafter.

C. An epoxy coating conforming to AWWA C-550 shall be applied to the interior and exterior ferrous surfaces of the valve except for finished or seating surfaces.

D. All gate valves shall have the name or monogram of the manufacturer, the year the valve casting was made, the size of the valve, and the working water pressure cast on the body of the valve.

E. Gate valves 12" and smaller shall be installed in a vertical position. Gate valves greater than 12"shall have the bonnet mounted in the horizontal position and have a bevel gear actuator. Gate valves shall be provided with a 2-inch square operating nut and shall be opened by turning to the left (counter-clockwise). All valve operating nuts shall be set within a cast iron valve box. There shall be a maximum 36" depth of valve operating nut. Contractor must use extension stems, if necessary, to raise operator nut within 36" of final grade.

2.02 GATE VALVES - BURIED

A. Gate valves shall conform to the Specifications of Section 02515, Paragraph 2.01, except be designed for buried service, have mechanical joint ends, have all exterior surfaces shop painted with two coats of Fed. Spec. TT-V-51F Asphalt Varnish, with 2-inch square nut operator in a vertical position for use in a valve box.

2.03 VALVE BOXES - BURIED VALVES

A. Valve boxes shall be of 5-1/4 inch standard cast iron, two-piece, screw type valve box with drop cover marked "WATER", "SEWER", "DRAIN", as applicable. Valve boxes for gate valves larger than 8 inches shall be three-piece. Valve boxes shall be accurately centered over valve operating nut, and backfill thoroughly tamped about them. Valve boxes shall not rest on the valves but shall be supported on crushed stone fill. They shall be set vertically and properly cut and/or adjusted so that the tops of boxes will be at grade in any paving, walk or road surface, and in grass plots, fields, woods or other open terrain. Valve boxes and covers shall be as manufactured by Tyler Corporation, Opelika Foundry, Bingham & Taylor, or equal.

B. Contractor shall furnish two (2) 6-foot T-handle operating wrenches for underground valves. Nut operator extensions for all valves buried deeper than 3 feet shall be provided with stem extensions sufficient to raise operator nut to within 3 feet of finished grade.

C. Valve boxes shall have extension stems, where necessary when operating nut is raised to be within 3 feet of the existing grade.

D. Wherever valve boxes fall outside of the pavement, the top of the box shall be set in a cast-in-place concrete slab 18” x 18” x 4” thick with the top of the slab and box flush with the top of the ground. This provision shall apply to all new and all existing valve boxes which fall within the limits of the contract, unless otherwise stated on the plans or ordered by the Engineer.

PART 3 - EXECUTION

3.01 VALVE INSTALLATION

A. All valves shall be installed in accordance with details on the Contract Drawings and with the manufacturer's recommendations.

B. All valves shall be anchored in accordance with the details on the Contract Drawings.

END OF SECTION

SECTION 02517 - HYDRANTS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required for furnishing and installing all hydrants and appurtenances specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Excavating, Backfilling, and Compacting: Section 02225

B. Valves - Utilities Services: Section 02515

C. Plumbing Specialties: Section 15430

1.03 SUBMITTALS

A. Submit shop drawings and product data in accordance with Section 01340 of this specification covering both yard hydrants and hydrant boxes.

B. Descriptive literature, catalog cuts, parts lists, and dimensional prints clearly indicating all dimensions and materials of construction, shall be submitted on all items specified herein to the Engineer for review before ordering.

C. At the time of submission, the Contractor shall, in writing, call the Engineer's attention to any deviations that the submittals may have from the requirements of the Engineer's Contract Drawings and Specifications.

PART 2 - PRODUCTS

2.01 YARD HYDRANTS

A. Yard hydrants shall be installed where described on the Drawings or directed by the Engineer in accordance with the details shown. Hydrants shown on the Drawings which are located in the grass shall be yard hydrants. Hydrants shall be of the frostproof, compression type with all working parts removable without digging up the hydrants. Hydrants shall be equipped with removable handwheel or lever, hose connections (1-1/2" size) and bottom connection for 2-inch water line. Hydrants shall be Model M-200 Murdock Manufacturing and Supply Company, American-Darling, Zurn, or equal.

B. All hydrants shall be backfilled to the ground surface with crushed stone.

C. Exposed portions of hydrants shall be factory painted with an enamel finish. Color charts shall be furnished with Shop Drawings for color selection by the Engineer. Below ground portions shall have two (2) coats of Fed. Spec. TT-V-51F Asphalt Varnish.

2.02 YARD HYDRANTS – FLUSH STYLE

A. Flush hydrants shall be installed where described on the Drawings or directed by the Engineer in accordance with the details shown. Hydrants shown on the Drawings which are located in the pavement shall be flush style hydrants. Flush hydrants shall be comply with AWWA C502, latest revision.

B. Hydrant shall have a main valve opening of at least 2-1/8” diameter and be dry barrel design. Inlet connection shall be 4” MJ with the outlet being 2-1/2” NST. The hydrant shall be compression type, the main valve shall close with pressure and open against pressure.

C. Hydrants shall be rated at 150 psi working pressure and shall be tested at 300 psi hydrostatically.

D. Hydrant shall be constructed of ASTM A-126 Cast Iron and the main valve facing of the hydrant shall be rubber.

E. Bonnet shall be weatherproof and free draining, to maintain the operation under freezing conditions.

F. Hydrant assembly shall include a cast iron box from installation flush with grade.

G. Hydrants shall open by turning left.

H. Hydrant shall have a minimum cover of 3’-0”.

I. Hydrants shall be Kupferle Eclipse No 85, or approved equal.

J. Exposed portions of hydrants shall be factory painted with an enamel finish. Color charts shall be furnished with Shop Drawings for color selection by Engineer. Below ground portions have two (2) coats of Fed, Spec TT-V-15F Asphalt Varnish.

2.03 SANITARY YARD HYDRANTS

A. Sanitary yard hydrants shall be installed where described on the Drawings or directed by the Engineer in accordance with the details shown.

B. Sanitary yard hydrants shall be in accordance with Specification Section 15430.

C. Sanitary yard hydrants shall be connected to the main as listed in this specification.

PART 3 - EXECUTION

3.01 SETTING OF YARD HYDRANTS

A. Location:

1. Hydrants shall be located as shown on the Contract Drawings or as directed by the Owner or Engineer so as to provide complete accessibility and minimize the possibility of damage from vehicles or injury to pedestrians.

B. Position:

1. All hydrants shall be set plumb with not less than two (2) cubic feet of crushed stone. Hydrants shall be set to the established grade, with nozzles at least thirty-six inches (36") above the ground, as shown on the Details in the Drawings, or as directed by the Owner or Engineer. Hydrants shall be backfilled with crushed stone, which shall be encased by a section of an 18" diameter concrete pipe. (See Standard Details)

C. Connection to Main:

1. Each hydrant shall be connected to the main with a restrained joint ductile iron branch controlled by an independent two (2) inch gate valve, unless otherwise specified.

D. Hydrant Drainage in Pervious Soil:

1. Whenever a hydrant is set in soil that is pervious, drainage shall be provided at the base of the hydrant by placing uncrushed course aggregate (AAHSTO M-43) No. 57 from the bottom of the trench to at least six inches (6") above the drain opening in the hydrant and to a distance of one foot (1') around the elbow. No drainage system shall be connected to a sewer.

E. Hydrant Drainage in Impervious Soil:

1. Whenever a hydrant is set in clay or impervious soil, a drainage pit two feet (2') in diameter and three feet (3') deep shall be excavated below each hydrant and filled compactly with uncrushed course aggregate (AASHTO M-43) No. 57 under and around the elbow of the hydrant and to a level of six inches (6") above the drain opening. No drainage pit shall be connected to a sewer (see Standard Details).

3.02 ANCHORAGE

A. The bowl of each hydrant shall be tied to the pipe with suitable anchor couplings, as shown on the Standard Details in the Drawings or as directed by the Owner or Engineer.

3.03 FIRE HYDRANT WRENCHES

A. One (1) hydrant wrench shall be furnished for each ten (10) hydrants or less. When the number of hydrants furnished and installed exceeds twenty-five (25), one (1) hydrant repair kit shall be supplied at no additional cost to the Owner.

END OF SECTION

SECTION 02531 – SEWAGE FORCE MAINS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required for furnishing and installing all force main pipe and appurtenances as specified and shown on Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Rock Removal: Section 02221

B. Excavating, Backfilling, and Compacting: Section 02225

C. Excavation Support and Protection: Section 02260

1.03 SUBMITTALS

A. Submit shop drawings and product data in accordance with Section 01300 of these specifications.

B. Descriptive literature, catalog cuts, parts lists, and dimensional prints clearly indicating all dimensions and materials of construction, shall be submitted on all items specified herein to the Engineer for review before ordering.

C. A notarized certification shall be furnished for all pipe and fittings which verifies compliance with all applicable specifications and AIS requirements for DI

PART 2 - PRODUCTS

2.01 POLYVINYL CHLORIDE (PVC) PLASTIC PRESSURE PIPE

A. AWWA C905 (Outside Diameter compatible with Cast Iron O.D.)

1. 14-inch through 36-inch PVC plastic pipe shall conform to ANSI/AWWA C905. Pipe shall be pressure Class 165, DR 25 for 14-inch through 16-inch; pressure Class 200, DR 21 for 18-inch through 36-inch. PVC pipe shall have a maximum laying length of 20 feet, with bell end and elastomeric gasket, and with plain end for cast-iron or ductile-iron fittings. Elastomeric gasket shall conform with the requirements of ASTM F-477. The seal of the National Sanitation Foundation Testing Laboratory must appear on each pipe.

2. Joints for polyvinyl chloride (PVC) mains shall be integral bell and spigot type joints with rubber o-ring gasket. The cleaning and assembling of the pipe joints shall be in accordance with manufacturer's recommendations.

3. Pipe color shall be green.

4. Fittings shall be DI in the same pressure class as pipe with Protecto 401 lining as specified in this Section.

B. AWWA C900 (Outside Diameter compatible with Cast Iron O.D.)

1. 8-inch through 12-inch PVC plastic pipe shall conform to ANSI/AWWA C900. Pipe shall be pressure Class 165, DR 25. PVC pipe shall have a maximum laying length of 20 feet, with bell end and elastomeric gasket, and with plain end for cast-iron or ductile-iron fittings. Elastomeric gasket shall conform with the requirements of ASTM F-477. The seal

of the National Sanitation Foundation Testing Laboratory must appear on each pipe.

2. Joints for polyvinyl chloride (PVC) mains shall be integral bell and spigot type joints with rubber o-ring gasket. The cleaning and assembling of the pipe joints shall be in accordance with manufacturer's recommendations.

3. Pipe color shall be green.

4. Fittings shall be DI in the same pressure class as pipe with Protecto 401 lining as specified in this Section.

2.02 RESTRAINT DEVICES FOR POLYVINYL CHLORIDE PLASTIC (PVC) PIPE

A. Each restraint system shall be manufactured of ductile iron conforming to ASTM A536. A backup ring shall be utilized behind the PVC Bell. A restraint ring incorporating a plurality of individually actuating gripping surfaces shall be used to grip the pipe then bolted to the backup ring. The restraint shall be the Series 2000PV (mechanical joint restraint to fittings) or 2800 (pipe harness) as manufactured by EBAA Iron, Inc. or approved equal.

B. Restraint devices for mechanical joint fittings and appurtenances shall conform to either AWWA C111, or AWWA C153. The working pressure for the restraint shall equal that of the pipe on which it is used.

C. Mechanical joint restraints, 4" through 24", shall meet or exceed the requirements of ASTM F1674.

D. Mechanical joint restraint shall be Series 2800 produced by EBAA Iron, Inc. or approved equal.

E. Mechanical joint retainer glands and pipe bell harnesses shall receive a fluoropolymer corrosion protective coating (EBAA Iron Mega-Bond or equal).

2.03 DUCTILE IRON (DI) PIPE AND FITTINGS

A. **Ductile iron pipe and fittings shall be furnished with Protecto 401 lining as specified herein.** Ductile iron pipe shall be furnished with rubber gasket push-on joints except as may otherwise be noted on the drawings or in difficult working areas and with approval of the Engineer. All pipe inside of casing pipe shall have restraining gaskets as specified in this Section.

B. Pressure class shall be minimum 150 psi for mechanical and push-on joint pipe.

C. Thickness design of ductile iron shall conform in all aspects to the requirements of ANSI/AWWA C150/A 21.50 latest revision.

D. Manufacture and testing of ductile iron pipe shall conform in all aspects to the requirements of ANSI/AWWA C151/A 21.51 latest revision.

E. Pipe Coatings

1. Interior Lining

a. Condition of Ductile Iron Prior to Surface Preparation

All ductile pipe and fittings shall be delivered to the application facility without asphalt, cement lining, or any other lining on the interior surface. Because removal of old linings may not be possible, the intent of this specification is that the entire interior of the ductile iron pipe and fittings shall not have been lined with any substance prior to the application of the specified lining material and no coating shall have been applied

to the first six (6) inches of the exterior of the spigot ends.

b. Lining Material

The standard of quality is Protecto 401 Ceramic Epoxy. The material shall be an amine cured novalac epoxy containing at least 20% by volume of ceramic quartz pigment. Any request for substitution must be accompanied by a successful history of lining pipe and fittings for sewer service, a test report verifying the following properties, and a certification of the test results.

(1) A permeability rating of 0.00 when tested according to Method A of ASTM E-96-66, Procedure A with a test duration of 30 days.

(2) The following test must be conducted on coupons from factory lined ductile iron pipe:

(a) ASTM B-117 Salt Spray (scribed panel) – Results to equal 0.0 undercutting after two years.

(b) ASTM G-95 Cathodic Disbondment 1.5 volts @ 77^{o}F. Results to equal no more than 0.5 mm undercutting after 30 days.

(c) Immersion Testing rated using ASTM D-714-87.

i. 20% Sulfuric Acid – no effect after two years
ii. 25% Sodium Hydroxide – No effect after two years
iii. 160^{o}F Distilled Water – No effect after two years
iv. 120^{o} Tap Water (scribed panel) – 0.0 undercutting after two years with no effect.

(3) An abrasion resistance of no more than 4 mils (.10 mm) loss after one million cycles European Standard EN 598: 1994 section 7.8 Abrasion resistance.

c. Application

(1) Applicator

The lining shall be applied by a competent firm with a successful history of applying linings to the interior of ductile iron pipe and fittings.

(2) Surface Preparation

Prior to abrasive blasting, the entire area to receive the protective compound shall be inspected for oil, grease, etc. Any areas where oil, grease, or any substance which can be removed by solvent is present, shall be solvent cleaned using the guidelines outlined in DIPRA-1 Solvent Cleaning. After the surface has been made free of grease, oil, or other substances, all areas to receive the protective compounds shall be abrasively blasted using compressed air nozzles with sand or grit abrasive media. The entire surface to be lined shall be struck with the blast media so that all rust, loose oxides, etc., are removed from the surface. Only slight stains and tightly adhering annealing oxide may be left on the surface. Any area where rust reappears before lining must be reblasted.

(3) Lining

After the surface preparation and within eight (8) hours of surface preparation, the interior of the pipe shall receive 40 mils nominal dry film thickness of Protecto 401. No lining shall take place when the substrate or ambient temperature is below 40 degrees Fahrenheit. The surface also must be dry and dust free. If

flange pipe or fittings are included in the project, the lining shall not be used on the face of the flange.

(4) Coating of Bell Sockets and Spigot Ends

Due to the tolerances involved, the gasket area and spigot end up to six (6) inches back from the end of the spigot end must be coated with 6 mils nominal, 10 mils maximum Protecto Joint Compound. The joint compound shall be applied by brush to ensure coverage. Care should be taken that the joint compound is smooth without excess buildup in the gasket seat or on the spigot ends. Coating of the gasket seat and spigot ends shall be done after the application of the lining.

(5) Number of Coats

The number of coats of lining material applied shall be as recommended by the lining manufacturer. However, in no case shall this material be applied above the dry thickness per coat recommended by the lining manufacturer in printed literature. The maximum or minimum time between coats shall be that time recommended by the lining material manufacturer. **No material shall be used for lining which is not indefinitely recoatable with itself without roughening of the surface.**

(6) Touch-Up and Repair

Protecto Joint Compound shall be used for touch-up or repair in accordance with manufacturer's recommendations.

d. Inspection and Certification

(1) Inspection

(a) All ductile iron pipe and fitting linings shall be checked for thickness using a magnetic film thickness gauge. The thickness testing shall be done using the method outlined in SSPC-PA-2 Film Thickness Rating.

(b) The interior lining of all pipe barrels and fittings shall be tested for pinholes with a non-destructive 2,500-volt test. Any defects found shall be repaired prior to shipment.

(c) Each pipe joint and fitting shall be marked with the date of application of the lining system along with its numerical sequence of application on that date and records maintained by the applicator of his work.

(2) Certification

The pipe or fitting manufacturer must supply a certificate attesting to the fact that the applicator met the requirements of this specification, and that the material used was as specified.

e. Handling

Protecto 401 lined pipe and fittings must be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, etc., shall be placed inside the pipe and fittings for lifting, positioning, or laying.

2. Exterior Coating

Bituminous outside coating shall be in accordance with ANSI/AWWA C151/A 21.51 for

pipe and ANSI/AWWA C110/A 21.10 for fittings.

F. Fittings and gaskets for mechanical and push-on joint ductile and cast iron pipe shall conform to the latest revisions of ANSI/AWWA C110/A 21.10 for mechanical and push-on joint fittings, ANSI/AWWA C111/A 21.11 for gaskets and ANSI/AWWA C153/A 21.53 for mechanical and push-on joint compact fittings. Mechanical and push-on joint fittings shall have pressure class rating of 150 psi minimum.

G. All ductile and cast iron fittings shall be ductile iron grade 80-60-03 in accordance with ASTM A339-55.

H. Restrained joint pipe and fittings shall use Mega-Lug pipe restraints or be a boltless system equal to “Field-Lok” restraining gaskets or “TRFLEX Joint” as manufactured by U.S. Pipe and Foundry Company. The buried 60-inch force main shall be restrained joints and fittings.

I. Pipe shall be as manufactured by U.S. Pipe and Foundry Company, Clow, American Pipe Company, or equal.

J. Pipe or fitting shall have the ANSI/AWWA standard, pressure (or thickness) class, diameter, DI or ductile noted, manufacturer, and country and year where cast on the outside of the body.

K. Polyethylene Encasement

1. Polyethylene encasement shall be installed as indicated on the drawings or herein.

2. Polyethylene encasement material, size, sheet width, and markings shall meet all requirements set forth in AWWA C105/A21.5-10 Standards

3. Polyethylene encasement shall be installed in accordance to AWWA C105/A21.5-10 to prevent contact between the pipe and the surrounding backfill material. During installation, all lumps of soil shall be removed from the pipe surface and no soil of embedment material shall be trapped between the pipe and the encasement. The encasement shall be fitted to the pipe creating a snug encasement with minimum space between the polyethylene and the pipe. For installations below the water table, tube form polyethylene should be used, both ends shall be sealed with tape or plastic tie straps at joints.

4. Two methods of installation are set forth in AWWA C-105/A21.5-10 for polyethylene tubes and one for polyethylene sheets. The encasement shall be installed by a personnel trained or experienced in proper installation and application of the polyethylene encasement.

a. Method A for Polyethylene Tubes:

Cut the polyethylene tube to a length approximately 2 feet longer than the pipe section. Slip the tube around the pipe, centering the pipe within the tube, leaving approximately 12 inches overlap at each end of the section, bunch it accordion fashion until it clears the pipe end. Lower the pipe into the trench and make up the pipe joint with the preceding pipe section. To facilitate the installation of the tube, a shallow bell hole must be made at the joints. After the joint is assembled, make and overlap of the polyethylene tube, pull the bunched polyethylene from the preceding pipe, slip it over the end of the new pipe and secure it. Slip the end of the polyethylene from the new pipe section over the end of the first wrap until it overlaps the joint at the preceding end and secure the overlap in place. Take up the slack width at the top of the pipe to make it a snug fit along the barrel of the pipe, securing at quarter points.

Cuts, tears, punctures, or other damage to the polyethylene shall be repaired

with adhesive tape or with a short length of polyethylene sheet or tube cut opened, wrapped around the pipe to cover the damaged area and secured in place.

b. Method B for Polyethylene Tubes:

Cut polyethylene tube to a length of approximately 12 inches shorter than the pipe section and slip the tube around the pipe centering the pipe in the tubing, leaving 6 inches care at each end of the pipe. Take the slack out of the top of the pipe to make a snug fit, not tight, along the barrel, securing at quarter points. Before making up a joint, slip a 3 foot length of polyethylene tube over the end of the preceding pipe section, bunching it accordion-fashion lengthwise. Alternatively, place a 3 foot length of polyethylene sheet in the trench under the joint to be made. After the joint is complete, pull the 3 foot length of tubing over or around the pipe, overlapping the polyethylene by at least 12 inches on each adjacent section of pipe. Make each end snug and secure.

Cuts, tears, punctures, or other damage to the polyethylene shall be repaired with adhesive tape or with a short length of polyethylene sheet or tube cut opened, wrapped around the pipe to cover the damaged area and secured in place.

c. Method C for Polyethylene sheets

Cut polyethylene sheet to a length approximately 2 feet longer than the section of pipe. Center the cut on the section providing 12 inches of overlap at each end of the pipe section. Bunch the sheet until it clears the pipe ends. Wrap the polyethylene around the pipe so that it circumferentially overlap the top quadrant of the pipe. Secure the cut edge of polyethylene sheet at intervals of approximately 3 feet. Lower the wrapped pipe into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole is necessary and shall be made at the joints to facilitate installation of polyethylene. After completing the joint, make an overlap and secure the ends.

Cuts, tears, punctures, or other damage to the polyethylene shall be repaired with adhesive tape or with a short length of polyethylene sheet or tube cut opened, wrapped around the pipe to cover the damaged area and secured in place.

2.04 FIBERGLASS REINFORCED POLYMER MORTAR PIPE (FRPM)

A. References

1. ASTM D3517 – Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pressure Pipe.

2. ASTM D4161 – Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastorneric Seals.

3. ASTM D2412 – Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.

4. ASTM D3681 – Standard Test Method for Chemical Resistance of “Fiberglass” Pipe in a Deflected Condition.

5. ASTM D638 – Test Method for Tensile Properties of Plastics.

B. Materials

1. Pipe Class: Pipe shall be stiffness class 46 (SN) for depths 30 feet or less; SN 72 for depths greater than 30 feet. Pipe shall be pressure class 200.

2. Resin Systems: The manufacturer shall use only polyester resin systems with a proven history of performance in this particular application. The historical data shall have been acquired from a composite material of similar construction and composition as the proposed product.

3. Glass Reinforcements: The reinforcing glass fibers used to manufacture the components shall be of highest quality commercial grade E-glass filaments with binder and sizing compatible with impregnating resins.

4. Silica Sand: Sand shall be minimum 98% silica with a maximum moisture content of 0.2%.

5. Additives: Resin additives, such as curing agents, pigments, dyes, fillers, thixotropic agents, etc., when used, shall not detrimentally effect the performance of the product.

6. Elastomeric Gaskets: Gaskets shall meet ASTM F477 and be supplied by qualified gasket manufactures and be suitable for the service intended.

C. Manufacture and Construction

1. Pipes: Manufacture pipe to result in a dense, nonporous, corrosion-resistant, consistent composite structure. The interior surface of the pipes exposed to sewer flow shall be manufactured using a resin & glass reinforced liner or resin with a 50% elongation (minimum) when tested in accordance with D638. The interior surface shall provide crack resistance and abrasion resistance. The exterior surface of the pipes shall be comprised of a glass reinforced resin or sand and resin layer which provides UV protection to the exterior. Pipes shall be Type 1, Liner 1, Grade 1 or Type 1, Liner 2, Grade 3 per ASTM D362.

2. Joints: Unless otherwise specified, the pipe shall be field connected with fiberglass sleeve couplings that utilized elastomeric sealing gaskets as the sole means to maintain joint watertightness. The joints must meet the performance requirements of ASTM D4161. Joints at tie-ins, when needed, may utilize gasket-sealed closure couplings.

3. Fittings: Flanges. Elbows, reducers, tees, wyes, laterals and other fittings shall be capable of withstanding all operating conditions when installed. They may be contact molded or manufactured from mitered sections of pipe joined by glass-fiber-reinforced overlays. Fittings shall be FRPM. Tees with 6 inch stub for laterals may have stubs constructed of FRPM or PVC SDR 35. Ductile iron (DI) fittings may be substituted for FRPM fittings. The **DI fittings shall be lined with Protecto 401 coating, or approved equal, and in accordance with DI pipe specification in this Section 02531.**

4. Acceptable Manufacturer: HOBAS Pipe USA or Flowtite.

D. Dimensions

1. Diameters: The actual outside diameter (18 inches to 48 inches) of the pipes shall be in accordance with ASTM D3517 and be in cast iron pipe sizes. For other diameters, OD's shall be per manufacturer's literature.

2. Lengths: Pipe shall be supplied in nominal lengths of 20 to 40 feet. Actual laying length shall be nominal +1, -4 inches. At least 90% of the total footage of each size and class of pipe, excluding special order lengths, shall be furnished in nominal length sections.

3. Wall Thickness: The minimum wall thickness shall be the stated design thickness.

4. End Squareness: Pipe ends shall be square to the pipe axis with a maximum tolerance of 1/8".

E. Testing

1. Pipes: Pipes shall be manufactured and tested in accordance with ASTM D3517.

2. Joints: Coupling joints shall meet the requirements of ASTM D4161.

3. Stiffness: Minimum pipe stiffness when tested in accordance with ASTM D2412 shall normally be 36 psi.

F. Installation

1. Burial: The bedding and burial of pipe and fittings shall be in accordance with the project plans and specifications and the manufacturer's requirements.

2. Pipe Handling: Use textile slings, other suitable materials or a forklift. Use of chains or cables is not allowed.

3. Jointing:

a. Clean ends of pipe and coupling components

b. Apply joint lubricant to pipe ends and elastomeric seals of coupling. Use only lubricants approved by the pipe manufacturer.

c. Use suitable equipment and end protection to push or pull the pipes together.

d. Do not exceed forces recommended by the manufacturer for coupling pipe.

e. Join pipes in straight alignment then deflect to required angle. Do not allow the deflection angle to exceed the deflection permitted by the manufacturer.

4. Field Tests:

a. Testing shall be in accordance with specification hereinafter in this Section 02531.

2.05 PRESTRESSED CONCRETE CYLINDER PIPE (PCCP)

A. Unless otherwise specified, the design materials and workmanship for pipe shall conform to the requirements of AWWA C301. Core and coating thickness for pipe shall be as specified in AWWA C301.

B. Prestressed concrete cylinder pipe and fittings shall be manufactured by Hanson Pressure Pipe, Grand Prairie, TX or equal.

C. Design Conditions

1. Pipe shall be designed in accordance with the AWWA C304 Standard, using the following design conditions; these conditions shall also be used in designing fittings that include a Portland cement mortar interior and exterior coating of the steel cylinder:

a. External Loading

(1) The earth load shall be taken as the greater of the following:

(a) Depth from existing ground level to top of pipe as shown on plans, or

(b) Five feet minimum in all cases.

(2) Earth loads shall be computed using the following parameters:

(a) Unit Soil Weight = 120 pounds per cubic foot

(b) TYPE R5 Bedding

(c) Bedding angle = 150°

(3) Live loads shall be calculated as:

(a) Pipe in streets and other paved areas: AASHTO HS-20 for two trucks passing

(b) Pipe within railroad right-of-way: AREA Cooper E-80

(c) Both HS-20 and E-80 live loads shall be computed in accordance with the American Concrete Pipe Association "Concrete Pipe Design Manual" or "Concrete Pipe Handbook".

b. Internal Pressure

(1) Design working pressure (Pw) shall be40 psi

(2) Surge Pressure (Pt) shall be 140 psi.

(3) Field Test Pressure (Pft) shall be 70 psi.

D. Fittings

1. Steel thickness of all fittings shall be designed in accordance with Chapter 8 of the AWWA M9 Manual. Fittings shall be designed for the same conditions as the adjacent pipe.

2. Fabrication of the fittings shall be as per AWWA M9 Manual and C301.

3. Interior and exterior concrete/mortar coating shall be as per AWWA C301.

E. The date of manufacture or a serial number traceable to the date of manufacture and the design strength classification shall be clearly marked by stencil with waterproof paint at the end of the pipe barrel. Unsatisfactory or damaged pipe will be permanently rejected, repaired in the field if permitted by the Engineer and the pipe manufacturer, or returned to the pipe plant for repairs. Pits, blisters, rough spots, minor concrete or mortar breakage, and other imperfections may be repaired unless prohibited by the Engineer. Repairs shall be carefully inspected before final approval. Cement mortar used for repairs shall have a minimum compressive strength of 3,000 psi at the end of 7 days and 4,500 psi at the end of 28 days, when tested in cylinders stored in the standard manner. Major breakage or spalling from interior of pipe may be reason for the rejection of pipe. Pipe may be repaired under unloaded conditions (removal of prestressing wire). Cement mortar used for repair shall have a minimum compressive strength of 3,000 psi at 7 days and 4,500 psi at 28 days when tested as standard cylinders. New prestressing wire may be applied when the compressive strength as determined by cylinder testing equals or exceeds the strength required for prestressing as stated in AWWA C301.

F. Cement shall be Type II and shall be in accordance with ASTM C150.

G. The pipe core shall be produced by the centrifugal method or the vertical casting method.

H. Wire shall be a minimum of No.6 gauge and shall meet the requirements of ASTM A648, Class III. Wire of a class strength greater than Class III will not be permitted.

I. Steel cylinders shall be No. 16 gauge minimum thickness and shall be hot rolled.

J. Mortar coating shall consist of one part cement to a maximum of three parts fine aggregate by weight. Rebound not to exceed one fourth of the total mix weight may be used provided the rebound is treated as fine aggregate.

K. Bell and spigot joint rings shall be steel, self-centering type, and otherwise specified in AWWA C301. Surfaces of the joint rings that will be exposed after fabrication is complete shall receive a zinc metalized coating of 4 mils thickness (0.004”). In areas of the alignment where the pipe will be subject to unbalanced hydrostatic thrust forces (bends, tees, bulkheads, wyes, and valves), the pipe joints shall be restrained (harnessed) by field welding joints or by mechanically restrained joints.

Lengths of restrained joint pipe shall be determined using the computational method as contained in Chapter 9 of the AWWA M9 Manual for Concrete Pressure Pipe. The steel cylinder thickness in pipe sections between the location of the maximum thrust force and the end of the harnessed section can be prorated on the basis of zero longitudinal thrust at the end of the harnessed section.

Two acceptable types of mechanically harnessed or restrained joints are the harness clamp and Snap Ring® types of flexible restrained joints. The clamp type consists of two semicircular steel clamps which fit over steel lugs that are factory welded or rolled into the steel bell and spigot sections. The semicircular clamps are drawn together by bolts at the springline on both sides of the pipe to form a flexible restrained joint.

The Snap Ring® type of flexible restrained joint consists of a split steel ring which is recessed in the special steel bell section of the pipe until the joint is made. Once the joint is made, the split steel ring is drawn down into position to form a lock between the bell and spigot by tightening a single steel bolt.

Both joint types shall be capable of transmitting the longitudinal thrust forces due to working pressure and test pressure and must be encased in grout after the joint has been completed and before the line is pressurized using special grout bands supplied by the pipe manufacturer.

Field welding of the joints for thrust restraint during initial installation can be done from inside the pipe or outside the pipe as permitted by the pipe manufacturer and applicable safety regulations.

L. The rubber gaskets shall be in accordance with AWWA C301 and shall be designed and manufactured so that the completed joint will withstand an internal water pressure in excess of the highest pressure to which the pipe will be subjected without showing any leakage by the gasket or displacement of it.

M. Bell and spigot wall fittings shall be the manufacturer's standard design. Wall fittings shall be supplied with adequate bracing to keep them round and true during transportation and installation.

N. Alignment for long-radius, curved sections as specified on the drawings may be produced by joint deflections of joints not to exceed that recommended by the manufacturer. Required deflections which are in excess of those recommendations shall be produced by beveling the spigot end of the pipe.

O. All Prestressed Concrete Cylinder Pipe shall include full thickness internal protection to prevent microbiologically induced corrosion with concrete admixture ConShield Technologies, Inc. or approved equal.

P. Pipe Manufacturer’s Field Service Representative:

1. Pipe manufacturer shall provide a qualified Field Service Representative, who shall be available to be on the project site, with proper notice, from the Contractor's, Engineer's, or Owner's representative.

2. The Field Service Representative, who shall be an employee of the pipe manufacturer, must have experience as a representative of the pipe manufacturer in the area of providing such services. The individual may be a Registered Professional Engineer possessing a minimum of 2 years of experience in the area of manufacture of pipe, sales and service representation.

3. It is the intent of the Owner to be assured that the installation of this pipeline is performed in accordance with the specified standards and manufacturer's recommendations. Good installation procedures will assure integrity of the pipeline with the minimum amount of pipe joints required for completion of the main. Therefore, the Contractor shall include in his Bid as a minimum that the pipe manufacturer's Field Service Representative will be on-site for the following periods:

    a. Initial construction training and monitoring.
    b. Provide problem-solving assistance during construction.

2.06 COUPLING AND ADAPTORS

A. Flexible couplings shall be of the sleeve type with a middle ring, two wedge shaped resilient gaskets at each end, two follower rings, and a set of steel trackhead bolts. The middle ring shall be flared at each end to receive the wedge portion of the gaskets. The follower rings shall confine the outer ends of the gaskets, and tightening of the bolts shall cause the follower rings to compress the gaskets against the pipe surface, forming a leak-proof seal. Flexible couplings shall be steel with minimum wall thickness of the middle ring or sleeve installed on pipe being 5/16-inch for pipe smaller than 10 inches, 3/8-inch for pipe 10 inches or larger. The minimum length of the middle ring shall be 5 inches for pipe sizes up to 10 inches and 7 inches for pipe 10 inches to 30 inches. The pipe stop shall be removed. Gaskets shall be suitable for 250 psi pressure rating or at rated working pressure of the connecting pipe. Couplings shall be harnessed and be designed for 250 psi.

B. Flanged adapters shall have one end suitable for bolting to a pipe flange and the other end of flexible coupling similar to that described hereinbefore. All pressure piping with couplings or adapters shall be harnessed with full threaded rods spanning across the couplings or adapters. The adapters shall be furnished with bolts of an approved corrosion resistant steel alloy, extending to the adjacent pipe flanges. Flanges on flanged adapter (unless otherwise indicated or required) shall be faced and drilled ANSI B16.1 Class 125.

C. Flexible couplings and flanged adapters shall be as manufactured by Dresser, Rockwell, or equal, unless otherwise specified and/or noted on the Drawings.

2.07 CONCRETE PIPE ANCHORS, THRUST BLOCKS, CRADLE OR ENCASEMENT

A. Where indicated on the Drawings, required by the specifications or as directed by the Engineer, concrete pipe anchors, thrust blocks, cradles or encasements shall be installed. Concrete shall be Class A. Thrust blocking shall be in accordance with LFUCG Standard Drawings.

2.08 ELECTRONIC MARKERS

A. Electronic markers shall be installed along the force main at intervals of 500 feet maximum, at all bends, and as noted on drawings or directed by Engineer. Maximum depth shall be 36". Markers shall be used regardless of the pipe material. Markers shall be green Tempo Omni Markers or equal.

2.09 AIR RELEASE VALVES (ARVs)

A. Air release, air vacuum valves, and/or combination air valves shall be installed along the force main as noted on drawings or directed by Engineer. ARVs shall be ARI or approved equal.

2.10 SEWAGE FORCE MAIN CAPS

A. All caps for DI, PVC, FRPM, and PCCP shall meet the fitting specifications herein. All caps should be watertight at the pressures indicated in this section.

B. Ductile Iron pipe caps shall blind flanges Lok-ring, or equal.

C. FRPM pipe caps shall be a deep hardness bulkhead by Forterra, or equal.

D. Sewer force main caps shall be backfilled with flowable fill. Flowable fill to be placed in accordance with the tee fitting thrust block detail located on the Thrust Block Detail for small diameter fittings.

PART 3 – EXECUTION

3.01 EXCAVATION FOR PIPELINE TRENCHES

A. See Section 02225 for trenching specification.

B. Minimum cover of 36" shall be provided for all force mains.

3.02 PIPE BEDDING

A. Bedding shall be in accordance with LFUCG Standard Drawings.

3.03 LAYING PIPE

A. The laying of pipe in finished trenches shall be commenced so the spigot ends point in the direction of flow.

B. All pipes shall be laid with ends abutting and true to line and grade as given by the Engineer. Supporting of pipes shall be as set out hereinbefore under "Pipe Bedding" and in no case shall the supporting of pipes on blocks be permitted.

C. Before each piece of pipe is lowered into the trench, it shall be thoroughly inspected to insure it's clean. Each piece of pipe shall be lowered separately unless special permission is given otherwise by the Engineer. No piece of pipe or fitting which is known to be defective shall be laid or placed in the lines. If any defective pipe or fitting shall be discovered after the pipe is laid, they shall be removed and replaced with a satisfactory pipe or fitting without additional charge. In case a length of pipe is cut to fit in a line, it shall be so cut as to leave a smooth end at right angles to the longitudinal axis of the pipe.

D. Pipe shall not be laid on solid rock. Pipe bedding shall be installed prior to laying pipe. Irregularities in subgrade in an earth trench shall be corrected by use of #9 crushed limestone.

E. When ordered by the Engineer, unsuitable materials in subgrades shall be removed below ordinary trench depth in order to prepare a proper bed for the pipe.

F. When laying of pipe is stopped for any reason, the exposed end of such pipe shall be closed with a plywood or fabricated plug fitted into the pipe bell, so as to exclude earth or other material, and precautions taken to prevent flotation of pipe by runoff into trench.

G. No backfilling (except for securing pipe in place) over pipe will be allowed until the Engineer has had an opportunity to make an inspection of the joints, alignment and grade, in the section laid.

3.04 BACKFILLING PIPELINE TRENCHES

A. Backfilling shall be in accordance with LFUCG Standard Drawings.

3.05 SETTLEMENT OF TRENCHES

A. Whenever lines are in, or cross, driveways and streets, the Contractor shall be responsible for any trench settlement which occurs within these rights-of-way within one year from the time of final acceptance of the work. If paving shall require replacement because of trench settlement within this time, it shall be replaced by the Contractor at no extra cost to the Owner. Repair of settlement damage shall meet the approval of the Owner and/or the State Department of Transportation.

3.0.6 CONCRETE THRUST BLOCKS OR ENCASEMENT

A. Concrete thrust blocks or encasement shall be placed at all bends or where shown on the Drawings and in accordance with LFUCG Standard Drawings.

3.07 INSTALLATION OF PCCP AND FITTINGS

A. Prestressed concrete cylinder pipe and fittings shall be installed in accordance with requirements of AWWA M9, except as otherwise provided herein. A firm, even bearing throughout the length of the pipe shall be provided by tamping select fill in the haunch area and at the side of the pipe to achieve the required bedding support angle. BLOCKING WILL NOT BE PERMITTED.

B. Gasket, gasket groove, and bell sealing surfaces shall be cleaned and lubricated with a lubricant furnished by the pipe manufacturer. The lubricant shall be approved for use in potable water and shall be harmless to the rubber gasket. Use only lubricant supplied by the pipe manufacturer. Pipe shall be laid with bell ends looking ahead in the direction of laying. As soon as the spigot ring is centered in the bell of the previously laid pipe, it shall be forced home with approved equipment. After the gasket is compressed, verify the position of the gasket in the spigot ring groove with a feeler gage provided by the pipe manufacturer.

C. The grout diaper for PCCP shall consist of a Typar synthetic fabric layer (gray in color) and a layer of closed cell foam. These layers are sewn together along with a pair of 5/8" wide steel bands at each edge which are used to secure the diaper to the pipe exterior. Use only grout diapers supplied by the pipe manufacturer. A stretching tool is used to tighten the steel bands. Once the bands are pulled tight, a steel clip is crimped around the bands to hold them in position. It is important that the diaper be carefully placed against the exterior surface of the pipe to insure that it is flush with no gaps or gathers. The closed cell foam surface is to be placed against the pipe exterior.

The wet grout will flow down to the bottom of the diaper and begin to bulge it out. It is often helpful to place some bedding material (or sandbags) directly under the diaper at the bottom to support the weight of the wet grout. Take care to not push excessive amounts of bedding material under the diaper such that the diaper is pushed up into the joint recess impeding the flow of wet grout.

Mix the grout using one part ASTM C150 Type 1 or Type 2 portland cement to not more than three parts clean sand with sufficient water to achieve a pourable consistency. The grout should look and pour like a thick cream. Carefully pour the mixed grout into the gap at the top of the diaper. As the pouring proceeds, the workers must inspect the diaper around the joint periphery to insure that the grout is flowing all around. Once the diaper is full and wet

grout is puddling at the gap at the top, apply a stiffer mix the consistency of wet brick mortar over the joint insuring that all steel components of the joint are covered.

3.08 TESTING

A. All ductile iron and PVC force mains shall be given a hydrostatic test to 150 psi or 250% of working design pressure, whichever is greater, and tested at the lowest level of the pipeline. In no case shall the pipe be tested at a pressure exceeding the pressure class rating of the pipe.

B. All prestressed concrete cylinder pipe shall be given a hydrostatic test to 120% of working design pressure, and tested at the lowest level of the pipeline. In no case shall the pipe be tested at a pressure exceeding the pressure class rating of the pipe.

C. Loss of pressure during the test shall not exceed 0 psi in a 4 hour period and 2 psi in a 24 hour period. Any test results that do not meet either of these requirements shall constitute a failure of the pressure test.

D. Leakage in force mains, when tested under the hydrostatic test described above, shall not exceed 10 gallons per 24 hours per inch of diameter per mile of pipe.

E. Contractor shall furnish a recording gauge and water meter for measuring water used during leakage test and recording pressure charts during duration of test. Recording pressure charts shall be turned over to the Engineer at conclusion of tests. The pressure recording device shall be suitable for outside service, with a range from 0-200 psig, 24-hour spring wound clock, designed for 9-inch charts, and shall be approved by the Engineer.

F. Duration of test shall be not less than 24 hours.

G. Where leaks are visible at exposed joints, evident on the surface where joints are covered and/or identified by isolating a section of pipe, the joints shall be repaired.

H. All pipe, fittings, valves, and other materials found to be defective under test shall be removed and replaced at no additional expense to the owner.

I. Lines which fail to meet tests shall be repaired and retested as necessary until test requirements are complied with.

J. The Contractor will provide water for testing the pressure piping.

K. The 60-inch force main shall be pressure tested in accordance with this specification to 150 psi regardless of pipe material.

END OF SECTION

SECTION 02532 – SEWAGE COLLECTION LINES

PART 1 – GENERAL

1.01 SUMMARY

A. The Contractor shall furnish all labor, material, and equipment necessary to install gravity sewer piping together with all appurtenances as shown and detailed on the Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Excavating, Backfilling, and Compacting for Sewers: Section 02225
B. Manholes: Section 02608

1.03 SUBMITTALS

A. The Contractor shall comply with the requirements of Section 01300 of these specifications.

B. A notarized certification shall be furnished for all pipe and fittings which verifies compliance with all applicable specifications.

PART 2 – PRODUCTS

2.01 DUCTILE IRON (DI) PIPE

A. **Ductile iron pipe and fittings shall be furnished with Protecto 401 lining as specified herein.** Ductile iron pipe shall be furnished with rubber gasket push-on joints except as may otherwise be noted on the drawings or in difficult working areas and with approval of the Engineer. All pipe inside of casing pipe shall have restraining gaskets as specified in this Section.

B. Pressure class shall be 150 psi minimum for mechanical and push-on joint pipe.

C. Thickness design of ductile iron shall conform in all aspects to the requirements of ANSI/AWWA C150/A 21.50 latest revision.

D. Manufacture and testing of ductile iron pipe shall conform in all aspects to the requirements of ANSI/AWWA C151/A 21.51 latest revision.

E. Pipe Coatings

1. Interior Lining

a. Condition of Ductile Iron Prior to Surface Preparation

All ductile pipe and fittings shall be delivered to the application facility without asphalt, cement lining, or any other lining on the interior surface. Because removal of old linings may not be possible, the intent of this specification is that the entire interior of the ductile iron pipe and fittings shall not have been lined with any substance prior to the application of the specified lining material and no coating shall have been applied to the first six (6) inches of the exterior of the spigot ends.

b. Lining Material

The standard of quality is Protecto 401 Ceramic Epoxy. The material shall be an amine cured novalac epoxy containing at least 20% by volume of ceramic quartz pigment. Any

request for substitution must be accompanied by a successful history of lining pipe and fittings for sewer service, a test report verifying the following properties, and a certification of the test results.

(1) A permeability rating of 0.00 when tested according to Method A of ASTM E-96-66, Procedure A with a test duration of 30 days.

(2) The following test must be run on coupons from factory lined ductile iron pipe:

(a) ASTM B-117 Salt Spray (scribed panel) – Results to equal 0.0 undercutting after two years.

(b) ASTM G-95 Cathodic Disbondment 1.5 volts @ 77°F. Results to equal no more than 0.5 mm undercutting after 30 days.

(c) Immersion Testing rated using ASTM D-714-87.

i. 20% Sulfuric Acid – No effect after two years.
ii. 25% Sodium Hydroxide – No effect after two years.
iii. 160°F Distilled Water – No effect after two years.
iv. 120°F Tap Water (scribed panel) – 0.0 undercutting after two years with no effect.

(3) An abrasion resistance of no more than 4 mils (.10mm) loss after one million cycles – European Standard EN 598: 1994 section 7.8 Abrasion resistance.

c. Application

(1) Applicator

The lining shall be applied by a competent firm with a successful history of applying linings to the interior of ductile iron pipe and fittings.

(2) Surface Preparation

Prior to abrasive blasting, the entire area to receive the protective compound shall be inspected for oil, grease, etc. Any areas where oil, grease, or any substance which can be removed by solvent is present, shall be solvent cleaned using the guidelines outlined in DIPRA-1 Solvent Cleaning. After the surface has been made free of grease, oil, or other substances, all areas to receive the protective compounds shall be abrasively blasted using compressed air nozzles with sand or grit abrasive media. The entire surface to be lined shall be struck with the blast media so that all rust, loose oxides, etc., are removed from the surface. Only slight stains and tightly adhering annealing oxide may be left on the surface. Any area where rust reappears before lining must be reblasted.

(3) Lining

After the surface preparation and within eight (8) hours of surface preparation, the interior of the pipe shall receive 40 mils nominal dry film thickness of Protecto 401. No lining shall take place when the substrate or ambient temperature is below 40 degrees Fahrenheit. The surface also must be dry and dust free. If flange pipe or fittings are included in the project, the lining shall not be used on the face of the flange.

(4) Coating of Bell Sockets and Spigot Ends

Due to the tolerances involved, the gasket area and spigot end up to six (6) inches back from the end of the spigot end must be coated with 6 mils nominal, 10 mils

maximum Protecto Joint Compound. The Joint Compound shall be applied by brush to ensure coverage. Care should be taken that the Joint Compound is smooth without excess buildup in the gasket seat or on the spigot ends. Coating of the gasket seat and spigot ends shall be done after the application of the lining.

(5) Number of Coats

The number of coats of lining material applied shall be as recommended by the lining manufacturer. However, in no case shall this material be applied above the dry thickness per coat recommended by the lining manufacturer in printed literature. The maximum or minimum time between coats shall be that time recommended by the lining material manufacturer. **No material shall be used for lining which is not indefinitely recoatable with itself without roughening of the surface.**

(6) Touch-Up and Repair

Protecto Joint Compound shall be used for touch-up or repair in accordance with manufacturer's recommendations.

d. Inspection and Certification

(1) Inspection

(a) All ductile iron pipe and fitting linings shall be checked for thickness using a magnetic film thickness gauge. The thickness testing shall be done using the method outlined in SSPC-PA-2 Film Thickness Rating.

(b) The interior lining of all pipe barrels and fittings shall be tested for pinholes with a non-destructive 2,500-volt test. Any defects found shall be repaired prior to shipment.

(c) Each pipe joint and fitting shall be marked with the date of application of the lining system along with its numerical sequence of application on that date and records maintained by the applicator of his work.

(2) Certification

The pipe or fitting manufacturer must supply a certificate attesting to the fact that the applicator met the requirements of this specification, and that the material used was as specified.

e. Handling

Protecto 401 lined pipe and fittings must be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, etc., shall be placed inside the pipe and fittings for lifting, positioning, or laying.

2. Exterior Coating

Bituminous outside coating shall be in accordance with ANSI/AWWA C151/A 21.51 for pipe and ANSI/AWWA C110/A 21.10 for fittings.

F. Fittings and gaskets for mechanical and push-on joint ductile and cast iron pipe shall conform to the latest revisions of ANSI/AWWA C110/A 21.10 for mechanical and push-on joint fittings, ANSI/AWWA C111/A 21.11 for gaskets, and ANSI/AWWA C153/A 21.53 for mechanical and push-on joint compact fittings.

G. All ductile and cast iron fittings shall be ductile iron grade 80-60-03 in accordance with ASTM A339-55.

H. Restrained joint pipe and fittings shall be a boltless system equal to "Field-Lok" restraining gaskets or "TRFLEX Joint" as manufactured by U.S. Pipe & Foundry Company.

I. Pipe shall be as manufactured by U.S. Pipe & Foundry Company, Clow, American Pipe Company, or equal.

J. Pipe or fitting shall have the ANSI/AWWA standard, pressure (or thickness) class, diameter, DI or ductile noted, manufacturer, and country and year where cast on the outside of the body.

K. Polyethylene Encasement

1. Polyethylene encasement shall be installed as indicated on the drawings or herein.

2. Polyethylene encasement material, size, sheet width, and markings shall meet all requirements set forth in AWWA C105/A21.5-10 Standards

3. Polyethylene encasement shall be installed in accordance to AWWA C105/A21.5-10 to prevent contact between the pipe and the surrounding backfill material. During installation, all lumps of soil shall be removed from the pipe surface and no soil of embedment material shall be trapped between the pipe and the encasement. The encasement shall be fitted to the pipe creating a snug encasement with minimum space between the polyethylene and the pipe. For installations below the water table, tube form polyethylene should be used, both ends shall be sealed with tape or plastic tie straps at joints.

4. Two methods of installation are set forth in AWWA C-105/A21.5-10 for polyethylene tubes and one for polyethylene sheets. The encasement shall be installed by a personnel trained or experienced in proper installation and application of the polyethylene encasement.

a. Method A for Polyethylene Tubes:

Cut the polyethylene tube to a length approximately 2 feet longer than the pipe section. Slip the tube around the pipe, centering the pipe within the tube, leaving approximately 12 inches overlap at each end of the section, bunch it accordion fashion until it clears the pipe end. Lower the pipe into the trench and make up the pipe joint with the preceding pipe section. To facilitate the installation of the tube, a shallow bell hole must be made at the joints. After the joint is assembled, make and overlap of the polyethylene tube, pull the bunched polyethylene from the preceding pipe, slip it over the end of the new pipe and secure it. Slip the end of the polyethylene from the new pipe section over the end of the first wrap until it overlaps the joint at the preceding end and secure the overlap in place. Take up the slack width at the top of the pipe to make it a snug fit along the barrel of the pipe, securing at quarter points.

Cuts, tears, punctures, or other damage to the polyethylene shall be repaired with adhesive tape or with a short length of polyethylene sheet or tube cut opened, wrapped around the pipe to cover the damaged area and secured in place.

b. Method B for Polyethylene Tubes:

Cut polyethylene tube to a length of approximately 12 inches shorter than the pipe section and slip the tube around the pipe centering the pipe in the tubing, leaving 6 inches care at each end of the pipe. Take the slack out of the top of the pipe to make a snug fit, not tight, along the barrel, securing at quarter points. Before making up a joint, slip a 3 foot length of polyethylene tube over the end of the preceding pipe section, bunching it accordion-fashion lengthwise. Alternatively, place a 3 foot length of polyethylene sheet in the trench under the joint to be made. After the joint is complete, pull the 3 foot length of tubing over or around the pipe, overlapping the polyethylene by at least 12 inches on each adjacent section of pipe. Make each end

snug and secure.

Cuts, tears, punctures, or other damage to the polyethylene shall be repaired with adhesive tape or with a short length of polyethylene sheet or tube cut opened, wrapped around the pipe to cover the damaged area and secured in place.

c. Method C for Polyethylene sheets

Cut polyethylene sheet to a length approximately 2 feet longer than the section of pipe. Center the cut on the section providing 12 inches of overlap at each end of the pipe section. Bunch the sheet until it clears the pipe ends. Wrap the polyethylene around the pipe so that it circumferentially overlap the top quadrant of the pipe. Secure the cut edge of polyethylene sheet at intervals of approximately 3 feet. Lower the wrapped pipe into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole is necessary and shall be made at the joints to facilitate installation of polyethylene. After completing the joint, make an overlap and secure the ends.

Cuts, tears, punctures, or other damage to the polyethylene shall be repaired with adhesive tape or with a short length of polyethylene sheet or tube cut opened, wrapped around the pipe to cover the damaged area and secured in place.

2.02 POLYVINYL CHLORIDE (PVC) PIPE (SOLID WALL)

A. PVC pipe and fittings less than 15 inches in diameter shall conform to the requirements of ASTM Standard Specifications for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings, Designation D 3034. Pipe and fittings shall have a minimum cell classification of 12454B or 12454C as defined in ASTM D-1784. For depths 10 feet and less, pipe shall have a pipe diameter to wall thickness ratio (SDR) of 35. For depths greater than 10 feet up to 20 feet maximum, pipe shall be SDR 26. If the PVC pipe is encased in a steel pipe, PVC pipe shall be SDR 35 regardless of buried depth.

B. PVC pipe and fitting with diameters 18-inch through 48-inch shall conform to the requirements of ASTM D-17845 and ASTM F-679. Pipe and fittings shall have a minimum cell classification of 14545C. The minimum wall thickness shall conform to T-1 as specified in ASTM F-679. For depths 10 feet and less, pipe shall have pipe stiffness 46 (SDR 35). For depths greater than 10 feet up to 20 feet maximum, pipe shall have pipe stiffness of 115 (SDR 26). If the PVC pipe is encased in a steel pipe, PVC pipe shall be SDR 35 regardless of buried depth.

C. Joints shall be push-on bell and spigot type using elastomeric ring gaskets conforming to ASTM D 3212 and F 477. The gaskets shall be securely fixed into place in the bells so that they cannot be dislodged during joint assembly. The gaskets shall be of a composition and texture which is resistant to common ingredients of sewage and industrial wastes, including oils and groundwater, and which will endure permanently under the conditions of the proposed use.

D. Pipe shall be furnished in lengths of not more than 13 feet. The centerline of each pipe section shall not deviate from a straight line drawn between the centers of the openings at the ends by more than 1/16 inch per foot of length.

E. PVC pipe shall not have a filler content greater than ten percent (10%) by weight relative to PVC resin in the compound.

F. PVC pipe shall be clearly marked at intervals of 5 feet or less with the manufacturer’s name or trademark, nominal pipe size, PVC cell classification, the legend “Type PSM SDR 35 PVC Sewer Pipe” and the designation “ASTM D 3034”, or “ASTM F-679”. Fittings shall be clearly marked with the manufacturer’s name or trademark, nominal size, the material designation “PVC”, “PSM” and the designation ‘ASTM D 3034”, or “ASTM F-679”.

G. PVC pipe shall have minimum pipe stiffness of 46 psi (SDR 35) or 115 psi (SDR 26) for each

diameter when measured at 5 percent vertical ring deflection and tested in accordance with ASTM D 2412.

H. PVC pipe installation shall conform to ASTM D-2321 latest revision.

I. Pipe shall be as manufactured by JM Eagle, H & W Pipe Company, or equal.

2.03 FIBERGLASS REINFORCED POLYMER MORTAR PIPE (FRPM)

A References

1. ASTM D3262 – Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe.

2. ASTM D4161 – Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastorneric Seals.

3. ASTM D2412 – Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.

4. ASTM D3681 – Standard Test Method for Chemical Resistance of “Fiberglass” Pipe in a Deflected Condition.

5. ASTM D638 – Test Method for Tensile Properties of Plastics.

B. Materials

1. Pipe Class: Pipe shall be stiffness class SN 72.
2. Resin Systems: The manufacturer shall use only polyester resin systems with a proven history of performance in this particular application. The historical data shall have been acquired from a composite material of similar construction and composition as the proposed product.

3. Glass Reinforcements; The reinforcing glass fibers used to manufacture the components shall be of highest quality commercial grade E-glass filaments with binder and sizing compatible with impregnating resins.

4. Silica Sand: Sand shall be minimum 98% silica with a maximum moisture content of 0.2%.

5. Additives: Resin additives, such as curing agents, pigments, dyes, fillers, thixotropic agents, etc., when used, shall not detrimentally effect the performance of the product.

6. Elastomeric Gaskets: Gaskets shall meet ASTM F477 and be supplied by qualified gasket manufactures and be suitable for the service intended.

C. Manufacture and Construction

1. Pipes: Manufacture pipe to result in a dense, nonporous, corrosion-resistant, consistent composite structure. The interior surface of the pipes exposed to sewer flow shall be manufactured using a resin & glass reinforced liner or resin with a 50% elongation (minimum) when tested in accordance with D638. The interior surface shall provide crack resistance and abrasion resistance. The exterior surface of the pipes shall be comprised of a glass reinforced resin or sand and resin layer which provides UV protection to the exterior. Pipes shall be Type 1, Liner 1, Grade 1 or Type 1, Liner 2, Grade 3 per ASTM D362.

2. Joints: Unless otherwise specified, the pipe shall be field connected with fiberglass sleeve couplings that utilized elastomeric sealing gaskets as the sole means to maintain joint watertightness. The joints must meet the performance requirements of ASTM D4161. Joints at tie-ins, when needed, may utilize gasket-sealed closure couplings.

3. Fittings: Flanges. Elbows, reducers, tees, wyes, laterals and other fittings shall be capable of withstanding all operating conditions when installed. They may be contact molded or manufactured from mitered sections of pipe joined by glass-fiber-reinforced overlays. Fittings shall be FRPM. Tees with 6 inch stub for laterals may have stubs constructed of FRPM or PVC SDR 35. Ductile iron (DI) fittings may be substituted for FRPM fittings. The **DI fittings shall be lined with Protecto 401 coating, or approved equal, and in accordance with DI pipe specification in this Section 02531.**

4. Acceptable Manufacturer: HOBAS Pipe USA or Flowtite.

D. Dimensions

1. Diameters: The actual outside diameter (18 inches to 48 inches) of the pipes shall be in accordance with ASTM D3262 and be in cast iron pipe sizes. For other diameters, OD's shall be per manufacturer's literature.

2. Lengths: Pipe shall be supplied in nominal lengths of 20 to 40 feet. Actual laying length shall be nominal +1, -4 inches. At least 90% of the total footage of each size and class of pipe, excluding special order lengths, shall be furnished in nominal length sections.

3. Wall Thickness: The minimum wall thickness shall be the stated design thickness.

4. End Squareness: Pipe ends shall be square to the pipe axis with a maximum tolerance of 1/8".

E. Testing

1. Pipes: Pipes shall be manufactured and tested in accordance with ASTM D3262.

2. Joints: Coupling joints shall meet the requirements of ASTM D4161.

3. Stiffness: Minimum pipe stiffness when tested in accordance with ASTM D2412 shall normally be 72 psi.

4. Strain Corrosion: The extrapolated 50-year strain corrosion value meet the requirements of Table 4 in ASTM D3262 when tested in accordance with ASTM 3681.

F. Installation

1. Burial: The bedding and burial of pipe and fittings shall be in accordance with the project plans and specifications and the manufacturer's requirements.

2. Pipe Handling: Use textile slings, other suitable materials or a forklift. Use of chains or cables is not allowed.

3. Jointing:

a. Clean ends of pipe and coupling components.

b. Apply joint lubricant to pipe ends and elastomeric seals of coupling. Use only lubricants approved by the pipe manufacturer.

c. Use suitable equipment and end protection to push or pull the pipes together.

d. Do not exceed forces recommended by the manufacturer for coupling pipe.

e. Join pipes in straight alignment then deflect to required angle. Do not allow the deflection angle to exceed the deflection permitted by the manufacturer.

4. Field Tests:

    a. Testing shall be in accordance with specification hereinafter in this Section 02532.

2.04 PRESTRESSED CONCRETE CYLINDER PIPE (PCCP)

A. Unless otherwise specified, the design materials and workmanship for pipe shall conform to the requirements of AWWA C301. Core and coating thickness for pipe shall be as specified in AWWA C301.

B. Prestressed concrete cylinder pipe and fittings shall be manufactured by Hanson Pressure Pipe, Grand Prairie, TX or equal.

C. Design Conditions

1. Pipe shall be designed in accordance with the AWWA C304 Standard, using the following design conditions; these conditions shall also be used in designing fittings that include a Portland cement mortar interior and exterior coating of the steel cylinder:

    a. External Loading

        (1) The earth load shall be taken as the greater of the following:

            (a) Depth from existing ground level to top of pipe as shown on plans, or

            (b) Five feet minimum in all cases.

        (2) Earth loads shall be computed using the following parameters:

            (a) Unit Soil Weight = 120 pounds per cubic foot

            (b) TYPE R5 Bedding

            (c) Bedding angle = 150°

        (3) Live loads shall be calculated as:

            (a) Pipe in streets and other paved areas: AASHTO HS-20 for two trucks passing

            (b) Pipe within railroad right-of-way: AREA Cooper E-80

            (c) Both HS-20 and E-80 live loads shall be computed in accordance with the American Concrete Pipe Association "Concrete Pipe Design Manual" or "Concrete Pipe Handbook".

D. Fittings

1. Steel thickness of all fittings shall be designed in accordance with Chapter 8 of the AWWA M9 Manual. Fittings shall be designed for the same conditions as the adjacent pipe.

2. Fabrication of the fittings shall be as per AWWA M9 Manual and C301.

3. Interior and exterior concrete/mortar coating shall be as per AWWA C301.

E. The date of manufacture or a serial number traceable to the date of manufacture and the design strength classification shall be clearly marked by stencil with waterproof paint at the end of the pipe barrel. Unsatisfactory or damaged pipe will be permanently rejected, repaired in the field if permitted by the Engineer and the pipe manufacturer, or returned to the pipe plant for repairs. Pits, blisters, rough spots, minor concrete or mortar breakage, and other imperfections may be

repaired unless prohibited by the Engineer. Repairs shall be carefully inspected before final approval. Cement mortar used for repairs shall have a minimum compressive strength of 3,000 psi at the end of 7 days and 4,500 psi at the end of 28 days, when tested in cylinders stored in the standard manner. Major breakage or spalling from interior of pipe may be reason for the rejection of pipe. Pipe may be repaired under unloaded conditions (removal of prestressing wire). Cement mortar used for repair shall have a minimum compressive strength of 3,000 psi at 7 days and 4,500 psi at 28 days when tested as standard cylinders. New prestressing wire may be applied when the compressive strength as determined by cylinder testing equals or exceeds the strength required for prestressing as stated in AWWA C301.

F. Cement shall be Type II and shall be in accordance with ASTM C150.

G. The pipe core shall be produced by the centrifugal method or the vertical casting method.

H. Wire shall be a minimum of No.6 gauge and shall meet the requirements of ASTM A648, Class III. Wire of a class strength greater than Class III will not be permitted.

I. Steel cylinders shall be No. 16 gauge minimum thickness and shall be hot rolled.

J. Mortar coating shall consist of one part cement to a maximum of three parts fine aggregate by weight. Rebound not to exceed one fourth of the total mix weight may be used provided the rebound is treated as fine aggregate.

K. Bell and spigot joint rings shall be steel, self-centering type, and otherwise specified in AWWA C301. Surfaces of the joint rings that will be exposed after fabrication is complete shall receive a zinc metalized coating of 4 mils thickness (0.004”).

Joints must be encased in grout after the joint has been completed and before the line is testing using special grout bands supplied by the pipe manufacturer.

L. The rubber gaskets shall be in accordance with AWWA C301 and shall be designed and manufactured so that the completed joint will withstand an internal water pressure in excess of the highest pressure to which the pipe will be subjected without showing any leakage by the gasket or displacement of it.

M. Bell and spigot wall fittings shall be the manufacturer's standard design. Wall fittings shall be supplied with adequate bracing to keep them round and true during transportation and installation.

N. All Prestressed Concrete Cylinder Pipe shall include full thickness internal protection to prevent microbiologically induced corrosion with concrete admixture ConShield Technologies, Inc. or approved equal.

O. Pipe Manufacturer’s Field Service Representative:

1. Pipe manufacturer shall provide a qualified Field Service Representative, who shall be available to be on the project site, with proper notice, from the Contractor’s, Engineer’s, or Owner’s representative.

2. The Field Service Representative, who shall be an employee of the pipe manufacturer, must have experience as a representative of the pipe manufacturer in the area of providing such services. The individual may be a Registered Professional Engineer possessing a minimum of 2 years of experience in the area of manufacture of pipe, sales and service representation.

3. It is the intent of the Owner to be assured that the installation of this pipeline is performed in accordance with the specified standards and manufacturer’s recommendations. Good installation procedures will assure integrity of the pipeline with the minimum amount of pipe joints required for completion of the main. Therefore, the Contractor shall include in his Bid as

a minimum that the pipe manufacturer's Field Service Representative will be on-site for the following periods:

a. Initial construction training and monitoring.
b. Provide problem-solving assistance during construction.

2.05 CONNECTION TO EXISTING GRAVITY PIPE

A. Connections between new and existing gravity pipe shall use a Fernco Strong Back, Straub-Flex coupling, Arpol or approved equal.

B. Connections between ductile iron and ductile iron, a Maxifit Mechanical Ductile Iron coupling as manufactured by Viking Johnson, or approved equal, may be used.

C. For pipes 12 inches in diameter and larger, concrete cradle shall be poured under each coupling. The length of the cradle (longitudinally along the pipe) shall be at least one pipe diameter and centered on the coupling. The depth of the cradle shall be half a pipe diameter (measured from the bottom of the cradle to the invert of the pipe). Cradles shall be formed and poured in place and reach from springline to springline.

2.06 GRAVITY PIPE SEWER LINE CAPS

A. All caps for DI, PVC, FRPM, and PCCP shall meet the fitting specifications herein and in Section 02531 – Sewage Force Mains. All caps should be watertight at the pressures indicated in this section.

B. Ductile Iron pipe caps shall be blind flanges or Lok-rings, or equal.

C. FRPM pipe caps shall be a deep hardness bulkhead by Forterra, or equal.

PART 3 – EXECUTION

3.01 PIPE LAYING

A. Excavation, trenching, backfilling, and bedding requirements are set forth in Section 02225.

B. All pipe shall be laid with ends abutting and true to the lines and grades indicated on the Drawings. The pipe shall be laid straight between changes in alignment and at uniform grade between changes in grade. Pipe shall be fitted and matched so that when laid in the trench, it will provide a smooth and uniform invert.

C. Before each piece of pipe is lowered into the trench, it shall be thoroughly swabbed out to insure its being clean. Any piece of pipe or fitting which is known to be defective shall not be laid or placed in the lines. If any defective pipe or fitting shall be discovered after the pipe is laid, it shall be removed and replaced with a satisfactory pipe or fitting without additional charge. In case a length of pipe is cut to fit in a line, it shall be so cut as to leave a smooth end at right angles to the longitudinal axis of the pipe and beveled to match the factory bevel for insertion into gasketed joints. Bevel can be made with hand or power tools.

D. The interior of the pipe, as work progresses, shall be cleaned of dirt, jointing materials, and superfluous materials of every description. When laying of pipe is stopped for any reason, the exposed end of such pipe shall be closed with a plywood plug fitted into the pipe bell so as to exclude earth or other material and precautions taken to prevent flotation of pipe by runoff into trench.

E. All pipe shall be laid starting at the lowest point and installed so that the spigot ends point in the direction of flow.

3.02 JOINTING

A. All joint surfaces shall be cleaned immediately before jointing the pipe. The bell or groove shall be lubricated in accordance with the manufacturer's recommendation. Each pipe unit shall then be carefully pushed into place without damage to pipe or gasket. All pipe shall be provided with home marks to insure proper gasket seating. Details of gasket installation and joint assembly shall follow the direction of the manufacturer's of the joint material and of the pipe. The resulting joints shall be watertight and flexible**. No solvent cement joints shall be allowed.**

3.03 INSTALLATION OF PCCP AND FITTINGS

A. Prestressed concrete cylinder pipe and fittings shall be installed in accordance with requirements of AWWA M9, except as otherwise provided herein. A firm, even bearing throughout the length of the pipe shall be provided by tamping select fill in the haunch area and at the side of the pipe to achieve the required bedding support angle. BLOCKING WILL NOT BE PERMITTED.

B. Gasket, gasket groove, and bell sealing surfaces shall be cleaned and lubricated with a lubricant furnished by the pipe manufacturer. The lubricant shall be approved for use in potable water and shall be harmless to the rubber gasket. Use only lubricant supplied by the pipe manufacturer. Pipe shall be laid with bell ends looking ahead in the direction of laying. As soon as the spigot ring is centered in the bell of the previously laid pipe, it shall be forced home with approved equipment. After the gasket is compressed, verify the position of the gasket in the spigot ring groove with a feeler gage provided by the pipe manufacturer.

C. The grout diaper for PCCP shall consist of a Typar synthetic fabric layer (gray in color) and a layer of closed cell foam. These layers are sewn together along with a pair of 5/8" wide steel bands at each edge which are used to secure the diaper to the pipe exterior. Use only grout diapers supplied by the pipe manufacturer. A stretching tool is used to tighten the steel bands. Once the bands are pulled tight, a steel clip is crimped around the bands to hold them in position. It is important that the diaper be carefully placed against the exterior surface of the pipe to insure that it is flush with no gaps or gathers. The closed cell foam surface is to be placed against the pipe exterior.

   The wet grout will flow down to the bottom of the diaper and begin to bulge it out. It is often helpful to place some bedding material (or sandbags) directly under the diaper at the bottom to support the weight of the wet grout. Take care to not push excessive amounts of bedding material under the diaper such that the diaper is pushed up into the joint recess impeding the flow of wet grout.

   Mix the grout using one part ASTM C150 Type 1 or Type 2 portland cement to not more than three parts clean sand with sufficient water to achieve a pourable consistency. The grout should look and pour like a thick cream. Carefully pour the mixed grout into the gap at the top of the diaper. As the pouring proceeds, the workers must inspect the diaper around the joint periphery to insure that the grout is flowing all around. Once the diaper is full and wet grout is puddling at the gap at the top, apply a stiffer mix the consistency of wet brick mortar over the joint insuring that all steel components of the joint are covered.

3.04 UTILITY CROSSING CONCRETE ENCASEMENT

A. At locations shown on the Drawings, required by the Specifications, or as directed by the Engineer, concrete encasement shall be used when the clearance between the proposed sanitary sewer pipe and any existing utility pipe is 18 inches or less. Utility pipe includes underground water, gas, telephone and electrical conduit, storm sewers, and any other pipe as determined by the Engineer.

B. There are two cases of utility crossing encasement. Case I is applicable when the proposed sanitary sewer line is below the existing utility line. Case II is applicable when the proposed sanitary sewer line is laid above the utility line. In either case, the concrete shall extend to at least the spring line of each pipe involved.

C. Concrete shall be Class A and shall be mixed sufficiently wet to permit it to flow between the pipes to form a continuous bridge. In tamping the concrete, care shall be taken not to disturb the grade or line of either pipe or damage the joints.

3.05 TESTING OF GRAVITY SEWER LINES

A. After the gravity piping system has been brought to completion, and prior to final inspection, the Contractor shall rod out the entire system by pushing through each individual line in the system, from manhole to manhole, appropriate tools for the removal from the line of any and all dirt, debris, and trash. If necessary during the process of rodding the system, water shall be turned into the system in such quantities to carry off the dirt, debris, and trash.

B. During the final inspection the Engineer will require all flexible sanitary sewer pipe (PVC and FRP) to be mandrel deflection tested after installation.

1. The mandrel (go/no-go) device shall be cylindrical in shape and constructed with nine (9) evenly spaced arms of prongs. The mandrel dimension shall be 95 percent of the flexible pipe's published ASTM average inside diameter. Allowances for pipe wall thickness tolerances of ovality (from shipment, heat, shipping loads, poor production, etc.) shall not be deducted from the ASTM average inside diameter, but shall be counted as part of the 5 percent allowance. The contact length of the mandrel's arms shall equal or exceed the nominal diameter of the sewer to be inspected. Critical mandrel dimensions shall carry a tolerance ± 0.001 inch.

2. The mandrel inspection shall be conducted no earlier than 30 days after reaching final trench backfill grade provided, in the opinion of the Engineer, sufficient water densification or rainfall has occurred to thoroughly settle the soil throughout the entire trench depth. Short-term (tested 30 days after installation) deflection shall not exceed 5 percent of the pipe's average inside diameter. The mandrel shall be hand pulled by the contractor through all sewer lines. Any sections of the sewer not passing the mandrel test shall be uncovered and the Contractor shall replace and recompact the embedment backfill material to the satisfaction of the Engineer. These repaired sections shall be retested with the go/no-go mandrel until passing.

3. The Engineer shall be responsible for approving the mandrel. Proving rings may be used to assist in this. Drawings of the mandrel with complete dimensioning shall be furnished by the Contractor to the Engineer for each diameter and type of flexible pipe.

C. Low-pressure air tests shall be performed on all gravity sanitary sewers to verify water tightness of pipe joints and connections. The Contractor shall perform testing on each manhole-to-manhole section of sewer line after placement of backfill.

1. Testing of Polyvinyl Chloride (PVC), Fiberglass Reinforced Polymer Mortar (FRPM), and Ductile Iron (DI) pipe sewer lines shall be performed in accordance with the current editions of ASTM F1417, "Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air," and UNI-B-6, "Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe," respectively. Testing of reinforced concrete pipe sewer lines shall be performed in accordance with the current edition of ASTM C 924, "Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method" and ASTM C 1103-03 Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.

2. All testing equipment shall be inspected by the Engineer to ensure that equipment is functioning properly.

3. The rate of air loss in the section under test shall be determined by the time-pressure drop method. The time required in minutes for the pressure in the section under test to decrease from 3.5 to 2.5 psig shall be not less than that indicated in the referenced standards.

4. Immediately following the low-pressure air test, the Contractor shall notify the Engineer of the test results. A Low-Pressure Air Test Report shall be completed by the Contractor during testing. The report shall be completed according to the procedures outlined in LFUCG's Construction Inspection Manual, current edition. A copy of the completed Low-Pressure Air Test Report shall be provided to the Engineer and LFUCG-Division of Water Quality for each test.

5. Pipes failing the pressure test will not be accepted and shall be repaired or replaced until a successful test is achieved.

6. When conducting a low-pressure air test, the Contractor shall securely install and brace all plugs prior to pressurizing the pipe. Personnel shall not be permitted to enter manholes when the sewer pipe is pressurized.

D. TV Survey

1. TV survey and cleaning shall be performed on all gravity sewers.

2. Hydraulic cleaning and vacuum must be done prior to TV survey.

3. TV survey must be of dry pipe.

4. TV survey shall be Pipe Assessment Certification Program (PACP) level of quality and TV equipment must include a slope-inclinometer.

5. Acceptance of TV survey, completed sewers, and the repairs needed are to be determined at sole discretion of LFUCG.

6. TV survey shall include:

   a. Video file and shall be re-named to LFUCG's assets.

   b. PACP database must be in Microsoft Access format, version 4.4.2 which includes photos embedded in database.

   c. Report shall be provided in electronic version in PDF format.

E. The Contractor shall furnish suitable test plugs, water pumps, and appurtenances, and all labor required to properly conduct the tests. Suitable bulkheads shall be installed, as required, to permit the test of the sewer. The Contractor shall construct weirs or other means of measurements as may be necessary.

F. Should the sections under test fail to meet the requirements, the Contractor shall do all work of locating and repairing the leaks and retesting as the Engineer may require without additional compensation.

END OF SECTION

SECTION 02540 – PIPE ABANDONMENT

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. This Section covers pipe abandonment procedures. The Contractor shall furnish all labor, materials and equipment to abandon pipe as described here or as shown on the Drawings.

B. Unless otherwise indicated, pipes 18-inches and larger which are located under pavement with public access shall be safeloaded. All other abandoned sewer pipe shall be plugged.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 02225 – Excavating, Backfilling, and Compacting

B. Section 02240 – Dewatering

1.03 SUBMITTALS

A. The Contractor shall submit to the Engineer for review and approval a plan for all pipe abandonment. Submittal shall be in accordance with Section 01300.

PART 2 – PRODUCTS

2.01 LEAN CONCRETE

A. Fill shall be a flowable, lean mix of concrete and sand, by the mix given as follows, per cubic yard batch:

Cement	30 pounds
Fly Ash, Class F	300 pounds
Natural Sand (S.S.D.)	3,000 pounds
Water (Maximum)	550 pounds

PART 3 - EXECUTION

3.01 SAFELOAD

A. The Contractor shall safeload the pipe by utilizing the lean concrete mix as described in paragraph 2.01 of this specification.

3.02 PLUG

A. The Contractor shall expose and cut the pipeline where shown or directed and construct a minimum 9-inch thick 3,000 psi concrete plug at the pipe openings. Approved mechanical plug may be used in lieu of the concrete plug.

3.03 CUT AND CAP

A. The Contractor shall cut existing pipes to be abandoned as required for new construction.

B. RCP pipe shall be capped in accordance with this Specification for abandonment. A watertight seal is required.

C. PVC or ductile iron shall be capped by means of mechanical plugs. A watertight seal is required.

END OF SECTION

SECTION 02608 – MANHOLES

PART 1 - GENERAL

1.01 SUMMARY

A. The Contractor shall furnish all labor, material, and equipment necessary to construct manholes for sanitary storm sewers, including steps, frames, and covers, together with all appurtenances as shown and detailed on the Drawings and specified herein. Manhole materials shall be precast concrete.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Rock Removal: Section 02221

B. Sewage Collection Lines: Section 02532

C. Precast Concrete: Section 03400

1.03 SUBMITTALS

A. The Contractor shall comply with the requirements of Section 01300 of these specifications.

B. Descriptive literature, catalog cuts, parts lists, and dimensional prints clearly indicating all dimensions and materials of construction, shall be submitted on all items specified herein to the Engineer for review before ordering.

1.02 DEFINITIONS

A. Standard Manhole: A standard manhole is defined as any manhole that is greater than 5 feet in depth, as measured from the invert of the manhole base at its center to the top (rim) of the manhole cover.

B. Shallow Manhole: A shallow manhole is defined as any manhole that is 5 feet or less in depth, as measured in the preceding sentence.

PART 2 - PRODUCTS

2.01 CONCRETE MANHOLES - GENERAL

A. Manholes shall conform in shape, size, dimensions, materials, and other respects as shown on the Drawings or specified herein.

B. All concrete manholes shall have precast reinforced concrete developed bases. No other type of base will be allowed. Invert channels shall be factory constructed when the base is made. Sloping invert channels shall be constructed whenever the difference between the inlet and outlet elevation is 2 feet or less.

C. The concrete manhole walls (barrels and cones) and base shall be precast concrete sections manufactured with **cementitious crystalline admixture at dosage of 3.5% by weight of cement.** The cementitious crystalline admixture shall be **Xypex C-1000 RED, KIM K-301, or Crystal-X Admix-R**. The top of the cone shall be built of reinforced concrete to allow adjustment rings to be added for adjustment of the frame to meet the finished surface. Minimum strength of the concrete for the precast sections shall be 4,000 psi at the time of shipment.

D. Manholes that receive sewage from a force main discharge, and within 2,000 LF downstream or to the nearest manhole beyond the 2,000 LF, shall have concrete admixture ConShield, or approved equal, as specified in Section 02532 for reinforced concrete pipe.

E. Manholes located in the 100-year floodplain shall have a concrete base that includes an anti-flotation collar. The collar shall have a radius 6-inches larger than the exterior wall of the base section.

F. For concrete manholes, the inverts of the developed bases shall conform accurately to the size of the adjoining pipes. Side inverts shall be curved and main inverts (where direction changes) shall be laid out in smooth curves of the longest possible radius which is tangent, within the manhole, to the centerlines of adjoining pipelines.

G. For concrete manholes, the cast iron frames and covers shall be the standard frame and cover as indicated on the LFUCG Standard Drawings.

H. Manholes shall be manufactured by Sherman Dixie, Oldcastle Precast or approved equal.

2.02 PRECAST CONCRETE SECTIONS

A. Precast concrete sections and appurtenances shall conform to the ASTM Standard Specifications for Precast Reinforced Concrete Manhole Sections, Designation C478, latest revision, with the following exceptions and additional requirements.

B. The base section shall be monolithic for 4-foot and 5-foot diameter manholes. Manholes with diameter of 6 feet or larger shall have a monolithic base or base slab.

C. The wall sections shall be not less than 5 inches thick.

D. Type II or type III cement shall be used except as otherwise permitted.

E. Perforated Sections:

1. Perforated precast concrete sections shall be used as part of the precast drywell / springbox as required by drawings.

2. All perforated sections shall have perforations cleanly cut and uniformly spaced along the length of the section.

3. The minimum diameter of all perforations shall be 1.5 inches.

4. There shall be twelve (12) rows of perforations located at 30 degrees apart around the circumference and with a longitudinal spacing of twelve (12) inches unless otherwise indicated on the Drawings.

5. Perforated sections shall have solid top and base slabs without any holes.

6. Perforated sections shall be manufactured by Sherman Dixie, or approved equal.

2.03 CONCRETE MANHOLE - FRAMES AND COVERS

A. The Contractor shall furnish all cast iron manhole frames and covers as shown in LFUCG Standard Drawings.

B. Castings shall be designed for H-20 traffic loading.

C. The castings shall be of good quality, strong, tough, evengrained cast iron, smooth, free from scale, lumps, blisters, sandholes, and defects of every nature which would render them

unfit for the service for which they are intended. Contact surfaces of covers and frame seats shall be machined to prevent rocking of covers.

D. Frames shall be set in mastic and bolted down in non-traffic areas with four ¾" SS Hilti anchor bolts and washers. Hilti anchor bolts shall be embedded a minimum of 4-inches into precast concrete cone section. In traffic areas, the frame shall be set in mastic and Class A concrete donut poured around frame to the top of concrete cone section. The concrete donut shall be 12-inches in width and in depth up to within 1 ½-inches of surface for bituminous asphalt pavement.

E. All casting shall be thoroughly cleaned and subject to a careful hammer inspection.

F. Castings shall be at least Class 25 conforming to the ASTM Standard Specifications for Gray Iron Casting, Designation A48, latest revision.

G. Unless otherwise specified, manhole covers shall be 22-3/4 inches in diameter, weighing not less than 305 pounds per frame and cover. Manhole covers shall set neatly in the rings, with contact edges machined for even bearings and tops flush with ring edge. They shall have sufficient corrugations to prevent slipperiness. The covers shall have two (2) pick holes about 1-1/4 inches wide and 1/2 inch deep with 3/8-inch undercut all around. Covers shall not be perforated. Frames and covers shall be J.R. Hoe and Sons Mc-350, or approved equal.

H. Watertight lids shall have neoprene T-gasket and concealed pickhole.

I. All covers shall be marked in large letters "LEXINGTON KENTUCKY SANITARY SEWER" as shown in LFUCG Standard Drawings.

2.04 MANHOLE STEPS (CONCRETE MANHOLES)

A. Manholes steps shall be the polypropylene plastic type reinforced with a 1/2 inch diameter deformed steel rod. The step shall be 10-3/4 inches wide and extend 5-3/4 inches from the manhole wall. Steps shall line up over the downstream invert of the manhole. The steps shall be embedded into the manhole wall a minimum of 3-3/8 inches. Steps shall be uniformly spaced at 12-inch to 16-inch intervals.

B. Manhole steps shall be in accordance with LFUCG Standard Drawings.

2.05 PREMOLDED ELASTOMERIC-SEALED JOINTS

A. All holes for pipe connections in concrete barrels and bases shall have a factory-installed flexible rubber gasket to prevent infiltration. The manhole boots shall conform to the latest revision of ASTM-C923. The boots shall be Contour Seal or Kor-N-Seal manufactured by National Pollution Control Systems, Inc., Nashua, NH; A-Lok Manhole Pipe Seal manufactured by A-Lok Corporation, Trenton, NJ; or an approved equal.

2.06 MANHOLE DIAPHRAGM (FOR WATERTIGHT LID APPLICATIONS)

A. Diaphragm manhole inserts shall be manufactured from corrosion-proof material suitable for atmospheres containing hydrogen sulfide and diluted sulfuric acid. Diaphragm shall be installed in manholes susceptible to inflow as indicated on the Drawings.

B. The body of the manhole insert shall be made of high density ethylene hexene-1 copolymer material meeting ASTM Specification D 1248, Class A, Category 5 (the insert shall have a minimum impact brittleness temperature of -180 degrees Fahrenheit). The thickness shall be uniform 1/8 inch or greater. The manhole insert shall be manufactured to dimensions as shown on the Drawings to allow easy installation within the manhole frame.

C. Gaskets shall be made of closed cell neoprene. The gasket shall have a pressure sensitive adhesive on one side and shall be placed under the weight bearing surface of the insert by the manufacturer. The adhesive shall be compatible with the manhole insert material so as to form a long lasting bond in either wet or dry conditions.

D. Lift strap shall be attached to the rising edge of the bowl insert. The lift strap shall be made of 1 inch wide woven polypropylene web and shall be seared on all cut ends to prevent unraveling. The lift strap shall be attached to the manhole insert by means of a stainless steel rivet. Location of the lift strap shall provide easy visual location.

E. Standard ventilation shall be by means of a valve or vent hole. Vent holes shall be on the side wall of the manhole insert approximately 3/4 inch below the lip. The valve or vent hole will allow a maximum release of 5 gallons per 24 hours when the insert is full.

F. The manhole insert shall be manufactured to fit the manhole frame rim upon which the manhole cover rests. The Contractor is responsible for obtaining specific measurements of each manhole cover to insure a proper fit. The manhole frame shall be cleaned of all dirt, scale and debris before placing the manhole insert on the rim.

G. Diaphragm shall be Rainstopper manufactured by Rainstopper, Inc. in color white, or approved equal.

2.07 CLEANOUTS

A. Cleanouts shall be cast iron and extend to the finish grade and capped with a clean-out plug in accordance with details and at locations shown on the Drawings. Pipe shall be the same size as the gravity sewer line in which the cleanout is located. A 4-inch thick concrete pad, with 6" x 6", 1.9 x 1.9 wire mesh, 24 inches square, with the valve box lid section, shall be provided around each cleanout.

B. Cleanouts shall be in accordance with LFUCG Standard Drawings.

2.08 DROP CONNECTIONS

A. Drop connections shall be installed on exterior of manhole as shown on the LFUCG Standard Drawings. The pipe material inside the drop manhole shall be of the same material as the sanitary sewer line.

PART 3 - EXECUTION

3.01 FABRICATION - PRECAST SECTIONS

A. Manhole sections shall contain manhole steps accurately positioned and embedded in the concrete when the section is cast.

B. All precast concrete manhole sections shall be cured in a manner to assure the highest quality:

1. Results of initial set tests (per ASTM C 403) shall be provided upon request. New test will be run in the event of change of cement supplier, mix design, or as otherwise necessary to maintain a quality product.
2. Forms on wet-cast concrete shall not be removed until the concrete attains compressive strength equal to 2500 psi based upon field-cured cylinders, cured under conditions which equal the most severe conditions to which the product is exposed.
3. Test cylinders for determining “shipping strength” shall be cured with similar methods as the product that they represent. In lieu of actual curing with the product, cylinders may be cured in curing chambers correlated in temperature and humidity with the product

conditions.

4. Any precast concrete manhole section which freezes before attaining 500 psi compressive strength will be rejected.

C. No more than two (2) lifting hooks may be cast or drilled in each section.

D. Flat slab tops shall have a minimum thickness of 6 inches and reinforcement in accordance with ASTM C478.

E. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the precast sections.

F. Acceptance of the sections will be on the basis of material tests and inspection of the completed product and test cylinders if requested by the Engineer.

G. Cones shall be precast sections of similar construction.

H. It shall be the responsibility of the precast manufacturer to handle all materials in such a manner as to avoid all damage to the product before and during delivery. This damage is defined as, but is not limited to, structural or spiderweb cracking, chips, spalls, pop-outs, or other damage.

I. All precast concrete manhole sections shall be stored in a manner that will maintain product quality, as well as provide damage protection from yard traffic. All concrete pipe greater than 36” in diameter shall be “stulled” with a minimum of two each, 4” x 4” wood posts providing vertical support during storage. This requirement shall apply both at the manufacturer’s storage yard and on the jobsite.

J. No precast concrete manhole sections shall be delivered to a jobsite or transported from the facility of origin until adequate quality and maturity has been attained, as described in these specifications.

1. All precast concrete manhole sections shall be a minimum age of 7 days.
2. All precast concrete manhole sections shall attain compressive strength equal to 4000 psi.
3. No precast concrete manhole sections shall be delivered without Certification. Any product delivered without acceptable Certification will be subject to rejection.

3.02 SETTING PRECAST MANHOLE SECTIONS

A. Precast-reinforced concrete manhole sections shall be set so as to be vertical and with sections and steps in true alignment.

B. Butyl mastic sealant shall be installed in all manhole joints in accordance with the manufacturer's recommendations and as shown in LFUCG Standard Drawings. Butyl mastic sealant shall meet Federal Spec SS-S-210A, AASHTO M-19875l, and ASTM C990. Butyl mastic sealant shall be NPC Bidco C-56 as manufactured by Trelleborg Engineered Systems, or approved equal. Sealant shall be a minimum bead of 1 inch in rope configuration.

C. All holes in sections used for their handling shall be thoroughly plugged with rubber plugs made specifically for this purpose.

3.03 ADJUSTING MANHOLE FRAMES AND COVERS TO GRADE

A. Except where shown on the Drawings, the top of the precast concrete eccentric cone of a standard manhole or the top of the flat slab of a shallow manhole shall terminate 6 inches below existing grade in an unpaved non-traffic area except in a residential yard and 13 inches below existing grade in a paved or unpaved traffic area and in a residential yard. The remainder of the manhole shall be adjusted to the required grade.

B. When a manhole is located in an unpaved non-traffic area other than in a residential yard, the frame and cover shall be adjusted to an elevation 1 inch above the existing grade at the center of the cover. If field changes have resulted in the installed manhole invert elevation to be lower than the invert elevation shown on the Drawings, the adjustment to an elevation of 1 inch above existing grade shall be accomplished by the use of precast concrete or cast iron adjusting rings. The area around the adjusted frame and cover shall be filled with the required material, sloping it away from the cover at a grade of 1 inch per foot.

C. When a manhole is located in a bituminous, concrete, or crushed stone traffic area, or in a residential yard, the frame and cover shall be adjusted to the grade of the surrounding area by the use of precast concrete or cast iron adjusting rings. The adjusted cover shall conform to the elevation and slope of the surrounding area.

    1. The Contractor shall coordinate elevations of manhole covers in paved streets with the local public works department. If resurfacing of the street in which sewers are laid is expected within twelve (12) months, covers shall be set 1-1/2 inches above the existing pavement surface in anticipation of the resurfacing operations.

3.04 ADJUSTING SECTIONS

A. Only clean adjusting sections shall be used. Each adjusting section shall be laid in a bead of butyl mastic sealant and shall be thoroughly bonded.

3.05 SETTING MANHOLE FRAMES AND COVERS

A. Manhole frames shall be set with the tops conforming to the required elevations set forth hereinbefore. Frames shall be set concentric with the top of the concrete and in a full bead (1”) of butyl mastic sealant so that the space between the top of the masonry and the bottom flange of the frame shall be completely watertight.

B. Manhole covers shall be left in place in the frames on completion of other work at the manholes.

3.06 VACUUM TESTING (ASTM C1244)

A. Scope

    1. This test method covers procedures for testing precast concrete manhole sections when using the vacuum test method to demonstrate the integrity of the installed materials and the construction procedures. This test method is used for testing concrete manhole sections utilizing mortar, mastic, or gasketed joints.

B. References, ASTM Standards:

    1. C 822 Terminology Relating to Concrete Pipe and Related Products.

    2. C 924 Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.

3. C 969 Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.

C. Summary of Practice

All lift holes and any pipes entering the manhole are to be plugged. A vacuum will be drawn and the vacuum drop over a specified time period is used to determine the acceptability of the manhole.

D. Significance and Use

This is not a routine test. The values recorded are applicable only to the manhole being tested and at the time of testing.

E. Preparation of the Manhole

1. All lift holes shall be plugged.

2. All pipes entering the manhole shall be temporarily plugged, taking care to securely brace the pipes and plugs to prevent them from being drawn into the manhole.

F. Procedure

1. The test head shall be placed at the top of the manhole in accordance with the manufacturer's recommendations.

2. A vacuum of 10 inches of mercury shall be drawn on the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off. The time shall be measured for the vacuum to drop to 9 inches of mercury.

3. The manhole shall pass if the **minimum time** for the vacuum reading to drop from 10 inches of mercury to 9 inches of mercury **exceeds 60 seconds (one minute)**.

4. If the manhole fails the initial test, necessary repairs shall be made by an approved method. The manhole shall then be retested until a satisfactory test is obtained.

5. Use or failure of this vacuum test shall not preclude acceptance by appropriate water infiltration or exfiltration testing, (see Practice C 969), or other means.

G. Precision and Bias

No justifiable statement can be made either on the precision or bias of this procedure, since the test result merely states whether there is conformance to the criteria for the success specified.

END OF SECTION

SECTION 02620 – STORM UTILITY PIPING

PART 1 - GENERAL

1.01 SUMMARY

The Contractor shall furnish all labor, material, and equipment necessary to install storm utility drainage piping together with all appurtenances as shown and detailed on the Drawings and specified herein.

1.02 SUMMARY

1. Excavating, Backfilling, and Compacting for Utilities – Section 02225
2. Manholes – Section 02608
3. Cast-in-Place Concrete – Section 03300

1.03 SUBMITTALS

A. The Contractor shall comply with the requirements of Section 01300 of these specifications.

B. A notarized certification shall be furnished for all pipe and fittings which verifies compliance with all applicable specifications.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

A. Polyvinyl Chloride (PVC) Pipe

1. Solid Wall PVC Pipe (DR 18). PVC pipe may only be used on the Gutter Drainage piping as shown on the plans.

   a. PVC pipe and fittings less than 15 inches in diameter shall conform to the requirements of ASTM Standard Specifications for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings, Designation D 3034. Pipe and fittings shall have a minimum cell classification of 12454B or 12454 C as defined in ASTM D-1784. All pipe shall have a pipe diameter to wall thickness ratio (DR) of a maximum of 18.

   b. PVC pipe and fitting with diameters 18-inch through 27-inch shall conform to the requirements of ASTM D-17845 and ASTM F-679. Pipe and fittings shall have a minimum cell classification of 14545C. The minimum wall thickness shall conform to T-1 as specified in ASTM F-679.

c. Joints shall be push-on bell and spigot type using elastomeric ring gaskets conforming to ASTM D 3212 and F 477. The gaskets shall be securely fixed into place in the bells so that they cannot be dislodged during joint assembly. The gaskets shall be of a composition and texture which is resistant to common ingredients of sewage and industrial wastes, including oils and groundwater, and which will endure permanently under the conditions of the proposed use.

d. Pipe shall be furnished in lengths of not more than 13 feet. The centerline of each pipe section shall not deviate from a straight line drawn between the centers of the openings at the ends by more than 1/16 inch per foot of length.

e. PVC pipe shall not have a filler content greater than ten percent (10%) by weight relative to PVC resin in the compound.

f. PVC pipe shall be clearly marked at intervals of 5 feet or less with the manufacturer's name or trademark, nominal pipe size, PVC cell classifications, the legend "Type PSM DR 18 PVC Sewer Pipe" and the designation "ASTM D 3034", or "ASTM F-679". Fittings shall be clearly marked with the manufacturer's name or trademark, nominal size, the material designation "PVC", "PSM" and the designation "ASTM D 3034", or :ASTM F-679".

g. PVC pipe shall have minimum pipe stiffness of 46 psi for each diameter when measured at 5 percent vertical ring deflection and tested in accordance with ASTM D 2412.

h. Five (5) copies of directions for handling and installing the pipe shall be furnished to the Contractor by the manufacturer at the first delivery of pipe to the job. PVC pipe installation shall conform to ASTM D-2321 latest revision.

B. Reinforced Concrete Pipe

1. All reinforced concrete pipe shall conform to the requirements of ASTM C76, latest edition. All RCP shall be class III with wall thickness "B".

2. Joints shall be bell and spigot type using rubber Forsheda 138 or Forcheda 103 gaskets (or approved equal) and shall conform to ASTM C443.

3. The pipe shall be furnished in standard lengths of 8 feet to 16 feet.

4. The pipe shall be permanently marked showing the nominal inside diameter, manufacture date, ASTM C76 class, and manufacturer's name. These markings for 30-inch diameter and larger shall be inscribed on the pipe exterior and stenciled on the interior with paint or permanent ink.

5. There shall be no lift holes.

6. Pipe Coatings

a. Interior Lining

(1) Description

All concrete pipe and fittings shall have a high build protective lining on the interior. All surface areas must be smooth without voids and projections, i.e.

casting or manufacturing imperfections. Any patching of the interior of the concrete pipe shall be satisfactorily repaired by the pipe manufacturer by using a two component epoxy grout. No patching compounds containing a latex or acrylic base, or curing compounds shall be used on the interior surfaces of the concrete pipe to be lined. All rough and sharp edges on bells and spigots shall be rounded smooth with at least 1/8 inch radius.

(2) Lining Material

The material must be a high build multi-component amine cured nobalac epoxy polymeric lining. The standard of quality is Inner-Liner by Culvan Painters, Birmingham, Alabama. Equal products considered are Protecto Pipe Lining 1011 and PERMITE 9043 Type 2 polyamide epoxy. Any other alternates must be accompanied by the following:

(a) The permeability rating equal to the specified material when tested according to Method A of ASTM E-96-66, Procedure A, with a test duration of 42 days as reported by an independent laboratory.

(b) A statement form the Manufacturer of the submitted material attesting to the fact that at least 20% of the volume of the lining contains ceramic quartz pigment or similar inert material that will not be affected by the storm sewer liquids.

(c) A laboratory report containing test data for immersion in acids, bases, and deionized water equal to the performance of the specified material using ASTM D-714-56 (1974) for the rating method.

(d) A statement concerning recoatability and repair to the lining.

C. Polyethylene (HDPE) Pipe and Fittings

1. HDPE pipe may only be used on the Gutter Drain pipe as shown on the plans.

2. Scope

This section covers the design and manufacture of high density polyethylene (HDPE) pipe manufactured of grade P34 resin material with a hydrostatic - design basis (HDB) rating of 1,600 psi at 73.4º F (23º C).

3. Specific Requirements

The Contractor shall furnish and install high density polyethylene pipe meeting these specifications at the locations indicated on the drawings.

a. HDPE pipe shall be manufactured and tested in conformance to the requirements of the latest revision of ASTM D-3350 and AWWA C906.

b. HDPE pipes and fittings should have pressure ratings of 100 psi (SDR 17) unless noted otherwise on the Drawings; 160 psi (SDR 11) as indicated on the Drawings.

c. HDPE pipe shall have a grade designation of PE 3406 and a cell classification value of 345434C. HDPE pipe shall have dimensions and workmanship in accordance with ASTM F-714.

d. HDPE pipe shall be joined by means of butt fusion.

e. HDPE pipe shall be supplied in standard lengths of at least 12 feet 6 inches. Longer lengths are permitted.

f. HDPE pipe shall be marked with the manufacturer's name, production lot number, ASTM designation, minimum cell classification, dimension ratio (DR), and nominal diameter.

g. All HDPE shall be solid wall pipe, SDR 9, per ASTM F-714.

2.02 CONCRETE

1. All concrete shall be in accordance with Section 03300 of the Specifications.

PART 3 - EXECUTION

3.01 PIPING INSTALLATION

A. Pipe installation shall be in accordance with Specification Section 02225 – Excavation, Backfilling, and Compacting for Utilities.

B. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

C. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

D. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

E. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

F. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping with 36-inch minimum cover. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.

G. Clear interior of piping and manholes of dirt and superfluous material as work progresses.

3.02 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:

1. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-gasket joints.

2. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.03 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.

2. Defects requiring correction include the following:

a. Alignment: Less than full diameter of inside of pipe is visible between structures.

b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.

c. Crushed, broken, cracked, or otherwise damaged piping.

d. Infiltration: Water leakage into piping.

e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.

4. Reinspect and repeat procedure until results are satisfactory.

H. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.

2. Test completed piping systems according to requirements of authorities having jurisdiction.

3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.

4. Submit separate report for each test.

5. Air Tests: Test storm drainage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

a. Option: Test plastic gravity sewer piping according to ASTM F 1417.

I. Leaks and loss in test pressure constitute defects that must be repaired.

J. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

- END OF SECTION -

SECTION 02650 - SEWER LINE CLEANING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required to clean all sewer pipe, laterals and fittings installed and/or rehabilitated, as specified herein.

B. Cleaning shall include the proper high pressure water jetting, rodding, snaking, bucketing, brushing and flushing of sewers, laterals, and manholes prior to inspection by closed circuit television, pipeline rehabilitation or replacement, point repairs, manhole preparation, and testing operations.

C. Cleaning shall dislodge, transport and remove all sludge, mud, sand, gravel, rocks, bricks, grease, roots, sticks, and all other debris from the interior of the sewer pipe and manholes as required for pipeline rehabilitation.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Hydraulically propelled Sewer Cleaning Equipment

1. Hydraulically propelled sewer cleaning equipment shall be the movable dam type constructed such that a portion of the dam may be collapsed during cleaning to prevent flooding of the sewer.

2. The movable dam shall be the same diameter as the pipe being cleaned and shall provide a flexible scraper around the outer periphery to ensure total removal of grease.

3. Contractor shall take precautions against flooding prior to using sewer cleaning balls or other such equipment that cannot be collapsed instantly.

B. High Velocity Hydro-Cleaning Equipment shall have the following:

1. A minimum of 500-ft of high pressure hose.

2. Two or more high velocity nozzles capable of producing a scouring action from 15 to 45 degrees in all size lines to be cleaned.

3. A high velocity gun for washing and scouring manhole walls and floor.

4. Capability of producing flows from a fine spray to a long distance solid stream.

5. A water tank, auxiliary engines and pumps and a hydraulically driven hose reel.

6. Equipment operating controls located above ground.

C. Mechanical cleaning equipment for sewer mains shall be either power buckets or power rodders by the Sewer Equipment Company of America or equal.

1. Bucket machines

a. Be furnished with buckets in pairs

b. Use V-belts for power transmission or have an overload device. No direct drive

machines will be permitted.

c. Be equipped with a take up drum and a minimum of 500-ft of cable.

d. Have sufficient dragging power to perform the work efficiently.

2. Power rodding machine

a. Either sectional or continuous.

b. Hold a minimum of 750-ft of rod.

c. The machine shall have a positive rod drive to produce 2000 pounds of rod pull.

PART 3 - EXECUTION

3.01 PERFORMANCE

A. Selection of cleaning equipment shall be based on the conditions of the manholes and lines at the time the work commences based on the pre-construction CCTV inspection to be conducted by the Contractor under this Contract.

B. Use properly selected equipment to remove all dirt, grease, rock and other deleterious materials and obstructions.

C. Protect existing sewer lines from damage caused by improper use of cleaning equipment.

D. Take precautions to avoid damage or flooding to public or private property being served by the line being cleaned.

E. Use sewage flow in the sewer lines to provide necessary pressures for hydraulic cleaning devices whenever possible.

F. Removal of Materials

1. Remove all solids and semi-solids at the downstream manhole of the section being cleaned.

2. Passing material from one section of a line to another will not be permitted.

G. Remove from the site and properly dispose of all solids or semi-solids recovered during the cleaning operation.

H. No sewer cleaning shall take place in a particular sewer segment until all upstream pipe segments have been cleaned. If cleaning is done in a downstream pipe segment in order to facilitate overall cleaning operations, the segment shall be re-cleaned at no additional cost, after all pipes upstream of that segment have been cleaned.

3.02 FIELD QUALITY CONTROL

A. Acceptance of this portion of the work shall be dependent upon the results of the television inspection. Lines not acceptably clean as to permit television inspection and rehabilitation shall be re-cleaned and re-inspected at no additional cost to the Owner.

3.03 FINAL SEWER CLEANING

A. Prior to final inspection and acceptance of each manhole-to-manhole section of the sewer system by the Engineer, the sewer shall be cleaned. Remove all accumulated construction debris, rocks, gravel, sand, silt and other foreign material from the sewer system. Once the large debris is removed, the sewer shall be flushed.

B. Following final cleaning, the Contractor shall inspect each manhole-to-manhole section in accordance with Specifications Section 2651 – Television Inspection.

C. Upon the Engineer's final manhole-to-manhole inspection of the sewer system, if any foreign matter is still present in the system, clean the sections and portions of the lines as required.

D. Place the new line in service as soon as is practical after acceptance by the Engineer.

END OF SECTION

SECTION 02651 - TELEVISION INSPECTION

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all necessary labor, materials, equipment, services and incidentals required to visually inspect by means of closed-circuit television (CCTV) designated sewer line sections and sewer laterals, including, but not limited to, recording and playback equipment, materials and supplies.

B. The inspection shall be performed on one sewer line section (i.e. manhole to manhole) or one sewer lateral (i.e. sewer main toward property) at a time. The section being inspected shall be suitably isolated from the remainder of the sewer system.

C. Video recordings shall be made of the television inspections and copies of both the recordings and printed inspection logs shall be supplied to the Owner.

D. Contractor may have to perform point repairs, remove obstructions or remove protruding service connections to complete pre-rehabilitation TV inspection.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. The television camera used for sewer main inspection shall be one specifically designed and constructed for such inspection. Lighting for the camera shall be suitable to allow a clear picture for the entire periphery of the pipe. The camera, television monitor and other components of the video system shall be capable of producing a minimum 500-line resolution color video picture. Picture quality and definition shall be to the satisfaction of the Engineer and if unsatisfactory, inspection shall be performed again with the appropriate changes made as designated by the Engineer at no additional cost to the Owner. The television inspection equipment shall have an accurate footage counter that shall display on the monitor, the exact distance of the camera from the centerline of the starting manhole.

PART 3 - EXECUTION

3.01 PROCEDURE

A. The camera shall be moved through the sewer main in either direction at a uniform rate, stopping when necessary to ensure proper documentation of the sewer's condition but in no case will the television camera be pulled at a speed greater than 30 fpm. Manual winches, power winches, TV cable and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line. If, during the inspection operation, the television camera will not pass through the entire sewer line section, the equipment shall be removed and repositioned in a manner so that the inspection can be performed from the opposite manhole. All set-up costs for the inspection shall be included in the unit prices bid. If, again, the camera fails to pass through the entire section, the Contractor shall perform point repairs as required on the Drawings, remove or cut protruding service connections, or re-clean or further remove roots or blockage at no additional cost to the Owner.

B. Whenever non-remote powered and controlled winches are used to pull the television camera through the line, telephones, radios, or other suitable means of communication shall be set up between the two manholes of the sewer line being inspected to ensure that good communications exist between members of the crew.

C. Measurement for location of defects shall be above ground by means of a meter device. Marking on cable, or the like, which would require interpolation for depth of manhole, shall not be allowed. Measurement meters shall be accurate to two-tenths of a foot over the length of the sewer line section being inspected. Accuracy of the measurement meters shall be checked daily by use of a walking meter, roll-a-tape, or other suitable device, and the accuracy shall be satisfactory to the Owner's representative.

D. The camera height shall be adjusted such that the camera lens is always centered (1/2 I.D. or higher) in the pipe being televised. Flow shall be controlled such that depth of flow shall not exceed 20% of pipe's diameter.

E. Lighting system shall be adequate for quality pictures.

3.02 RECORDING OF FIELD OBSERVATIONS

A. Television Inspection logs

1. Printed location records shall be kept which shall clearly show the location, in relation to adjacent manholes, of each source of infiltration discovered. In addition, other data of significance including the locations of building and house service connections, along with an estimation of infiltration from such services, joints, unusual conditions, roots, storm sewer connections, cracked or collapsed sections, presence of scale and corrosion, sewer line sections that the camera failed to pass through and reasons for the failure and other discernible features shall be recorded and annotated using the PACP system and a copy of such records shall be supplied to both the Owner and the Engineer.

B. Digital Recordings

1. The purpose of digital recording shall be to supply a visual and audio record of areas of interests of the pipe segments that may be replayed by the Owner. Digital recording playback shall be at the same speed that it was recorded and shall be made in color. The Contractor shall be required to have all digital media and necessary playback equipment readily accessible for review by the Owner/Engineer during the project.

2. The Contractor shall perform CCTV inspection of each newly installed or rehabilitated pipe segment (manhole to manhole) after testing and before re-introducing any sewage flow into the pipe. Each test shall be witnessed by the Engineer and/or Owner.

3. The Contractor shall record each CCTV inspection on a DVD and submit such recordings to the Engineer as a prerequisite for Partial Utilization/Substantial Completion.

4. CCTV inspections shall be performed after all backfill has been placed and final grades have been established, and after all manhole and pipe testing has been performed and approved by the Engineer.

5. CCTV inspections shall be performed by a PACP certified and trained person.

6. Inspections shall include narration that notes the location and type of defects, if any.

7. At the completion of the project, the Contractor shall furnish all of the original digital recordings to the Owner. Each disc shall be labeled as to its contents. Labels shall include the disc number, date televised, sewer segment reach designation, street location, and manhole numbers on the disc. The Contractor shall keep a copy of the discs for 30 days after the final payment for the project, at which time the discs may be erased at the Contractor's option.

END OF SECTION

SECTION 02675 - DISINFECTION OF WATER SYSTEMS

PART 1 - GENERAL

1.01 STERILIZATION

A. General

It is the intent of this section to present essential procedures for disinfecting new and repaired water mains. The section is patterned after AWWA C651. The basic procedure comprises:

1. Preventing contaminating materials from entering the water mains during construction or repair and removing by flushing materials that may have entered the water main.

2. Disinfecting any residual contamination that may remain.

3. Determining the bacteriologic quality by laboratory test after disinfection.

B. Preventive Measures During Construction

1. Precautions shall be taken to protect pipe interiors, fittings, and valves against contamination. Pipe delivered for construction shall be strung so as to minimize entrance of foreign material. When pipe laying is not in progress, as for example, at the close of the day's work, all openings in the pipeline shall be closed by watertight plugs. Joints of all pipe in the trench shall be completed before work is stopped. If water accumulates in the trench, the plugs shall remain in place until the trench is dry.

   If dirt, that, in the opinion of the Engineer, will not be removed by the flushing operation (Article 1.01-C.) enters the pipe, the interior of the pipe shall be cleaned and swabbed as necessary, with a five percent (5%) hypochlorite disinfecting solution.

2. Packing Materials and Joints

   No contaminated material or any material capable of supporting prolific growth of micro-organisms shall be used for sealing joints. Packing material shall be handled in such a manner as to avoid contamination. Where applicable, packing materials must conform to AWWA standards. Packing material for cast iron pipe must conform to AWWA C600. Yarning or packing material shall consist of molded or tubular rubber rings, or treated paper. Materials such as jute or hemp shall not be used. The lubricant used in the installation of sealing gaskets shall be suitable for use in potable water. It shall be delivered to the job in enclosed containers and shall be kept clean.

C. Preliminary Flushing

No site for flushing should be chosen unless it has been determined that drainage is adequate at the site. The main shall be flushed prior to disinfection, except when the tablet or granular methods are used (Articles 1.01-E.3. and 1.01-E.4.). It is recommended that the flushing velocity be not less than 2.5 ft/sec. The rate of flow required to produce this velocity in various diameters is shown in the following table:

REQUIRED OPENINGS TO FLUSH PIPELINES (40-psi Residual Pressure)				
Flow Required to Produce 2.5 ft./sec.		Minimum Outlet Size		
			Hydrant Nozzle	
Pipe Size (in.)	Flow Rate (gpm)	Flushing Pipe Size (in)	Number	Size (in)
4	100	1	1	2½
6	220	1½	1	2½
8	390	2	1	2½
10	610	3	1	2½
12	880	3	2	2 ½
14	1,200	4	2	2½
16	1,565	4	2	2½
18	1,980	6	2	2½

D. Form of Chlorine for Disinfection

The most common forms of chlorine used in the disinfecting solutions are liquid chlorine (gas at atmospheric pressure), calcium hypochlorite tablets, calcium hypochlorite granules, and sodium hypochlorite solutions.

1. Liquid Chlorine Use

Liquid chlorine shall be used only when suitable equipment is available and only under the direct supervision of a person familiar with the physiological, chemical, and physical properties of this element and who is properly trained and equipped to handle any emergency that may arise. Introduction of chlorine gas directly from the supply cylinder is unsafe and shall not be permitted.

Note: The preferred equipment consists of a solution fed chlorinator in combination with a booster pump for injecting the chlorine gas water mixture into the main to be disinfected. Direct feed chlorinators are not recommended because their use is limited to situations where the water pressure is lower than the chlorine cylinder pressure.

2. Hypochlorites

a. Calcium Hypochlorite - Calcium hypochlorite contains sixty-five percent (65%) available chlorine by weight. It is either tabular or granular in form. The tablets, 6-8 to the ounce, are designed to dissolve slowly in water. Calcium hypochlorite is packaged in containers of various types and sizes ranging from small plastic bottles to 100-pound drums.

A chlorine-water solution is prepared by dissolving the granules in water in the proportion requisite for the desired concentration.

b. Sodium Hypochlorite - Sodium hypochlorite is supplied in strengths from five and one-quarter percent (5.25%) to sixteen percent (16%) available chlorine. It is packaged in liquid form in glass, rubber, or plastic containers ranging in size from one (1) quart bottles to five (5) gallon carboys. It may also be purchased in bulk for delivery by tank truck.

The chlorine water solution is prepared by adding hypochlorite to water. Product deterioration must be reckoned with in computing the quantity of sodium hypochlorite required for the desired concentration.

E. Methods of Chlorine Application

1. Continuous Feed Method - This method is suitable for general application.

a. Water from the existing distribution system or other approved sources of supply shall be made to flow at a constant, measured rate into the newly laid pipeline. The water shall receive a dose of chlorine, also fed at a constant, measured rate. The two rates shall be proportioned so that the chorine concentration in the water in the pipe is maintained at a minimum of 50 mg/L available chlorine. To assure that this concentration is maintained, the chlorine residual should be measured at regular intervals in accordance with the procedures described in the current edition of Standard Methods and AWWA M12--Simplified Procedures for Water Examination.

Note: In the absence of a meter, the rate may be determined either by placing a pitot gauge at the discharge or by measuring the time to fill a container of known volume.

Solutions of one percent (1%) chlorine may be prepared with sodium hypochlorite or calcium hypochlorite. The latter solution requires approximately one (1) pound of calcium hypochlorite in eight and five-tenths (8.5) gallons of water. The following table gives the amount of chlorine residual required for each 100 feet of pipe of various diameters:

CHLORINE REQUIRED TO PRODUCE 50 mg/L CONCENTRATION IN 100 FT. OF PIPE (By Diameter)

Pipe Size (in)	100 Percent Chlorine (lb)	1 Percent Chlorine Solutions (gal)
4	0.027	0.33
6	0.061	0.73
8	0.108	1.3
10	0.170	2.04
12	0.240	2.88

b. During the application of the chlorine, valves shall be manipulated to prevent the treatment dosage from flowing back into the line supplying the water. Chlorine application shall not cease until the entire main is filled with the chlorine solution. The chlorinated water shall be retained in the main for at least twenty-four (24) hours during which time all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances. At the end of this 24-hour period, the treated water shall contain no less than 25 mg/L chlorine throughout the length of the main.

2. Slug Method

This method is suitable for use with mains of large diameter for which, because of the volumes of water involved, the continuous feed method is not practical.

a. Water from the existing distribution system or other approved source of supply shall be made to flow at a constant, measured rate (see Article 1.01-E.1.a.) into the newly laid pipeline. The water shall receive a dose of chlorine also fed at a constant, measured rate. The two rates shall be proportioned so that the concentration in the water entering the pipeline is maintained at no less than 300 mg/L. The chlorine shall be applied continuously and for a sufficient period to develop a solid column or "slug" of chlorinated water that will, as it passes along the line, expose all interior surfaces to a concentration of at least 300 mg/L for at least three (3) hours. The application shall be checked at a tap near the upstream end of the line by chlorine residual measurements.

b. As the chlorinated water flows past tees and crosses, related valves and hydrants shall be operated as to disinfect appurtenances.

3. Tablet Method

Tablet disinfection is best suited to short extension (up to 2,500 feet) and smaller diameter mains (up to 12 inches). Because the preliminary flushing step must be eliminated, this method shall be used only when scrupulous cleanliness has been exercised. It shall not be used if trench water or foreign material has entered the main or if the water is below 5 degrees C (41 degrees Fahrenheit).

a. Placement of Tablets - Tablets are placed in each section of pipe and also in hydrants, hydrant branches, and other appurtenances. They shall be attached by an adhesive, except for the tablets placed in hydrants and in the joints between the pipe sections. All the tablets within the main must be at the top of the main. If the tablets are fastened before the pipe section is placed in the trench, their position should be marked on the section to assure that there will be no rotation. When placing tables in joints, they are either crushed and placed on the inside annular space, or, if the type of assembly does not permit, they are rubbed like chalk on the butt ends of the sections to coat them with calcium hypochlorite.

The adhesive may be Permatex No. 1 or any alternative approved by the Engineer of the purchaser. There shall be no adhesive on the tablet except on the broad side next to the surface to which the tablet is attached. The following table gives the number of hypochlorite tablets required for various pipe diameters and lengths:

NUMBER OF 5G HYPOCHLORITE TABLETS REQUIRED FOR DOSE OF 50 mg/L

Length of Pipe (ft)	Pipe Diameter					
	2	**4**	**6**	**8**	**10**	**12**
13 or less	1	1	2	2	3	5
18	1	1	2	3	5	6
20	1	1	2	3	5	7
30	1	2	3	5	7	10
40	1	2	4	6	9	14

b. Filling and Contact - When installation has been completed, the main shall be filled with water at a velocity of less than one (1) foot per second. This water shall remain in the pipe for at least twenty-four (24) hours.

Valves shall be manipulated so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water.

4. Granule Method

Granular disinfection should only be used in the same instances when tabular disinfection can be used; that is, it may be used if the pipes and appurtenances are kept clean and dry during construction.

a. Placement of Granules - Granules of calcium hypochlorite shall be placed during construction at the upstream end of the first section of pipe, at the upstream end of each branch main, and at 500-ft intervals.

Note: These granules cannot be used on solvent-welded plastic or on screwed-joint pipe because of the danger of fire or explosion from the reaction of the joint compounds with the calcium hypochlorite.

The following table gives the ounces of hypochlorite granules required for various pipe diameters:

OUNCES OF CALCIUM HYPOCHLORITE GRANULES TO BE PLACED AT BEGINNINGS OF MAIN AND AT 500-ft INTERVALS

Pipe Diameter (in.)	Calcium Hypochlorite Granules (oz.)
4	0.5
6	1.0
8	2.0
12	4.0
16 and larger	8.0

b. Filling and Contact - When installation has been completed, the main shall be filled with water at a velocity of less than one (1) foot per second. This water shall remain in the pipe for at least twenty-four (24) hours. If the water temperature is less than 41^{o}F (5 ^{o}C), the water shall remain in the pipe for at least forty-eight (48) hours.

Valves shall be manipulated so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water.

F. Final Flushing

After the applicable retention period, the heavily chlorinated water shall be flushed from the main until the chlorine concentration in the water leaving the main is no higher than that generally prevailing in the system, or less than 1 mg/L. Chlorine residual determination shall be made to ascertain that the heavily chlorinated water has been removed from the pipeline.

G. Bacteriologic Tests

1. After final flushing, and before the water main is placed in service, a sample or samples shall be collected from the end of the line and tested for bacteriologic quality and shall show the absence of coliform organisms. If the number and frequency of samples is not prescribed by the public health authority having jurisdiction, at least one sample shall be collected from chlorinated supplies where a chlorine residual is maintained throughout the new main. From unchlorinated supplies at least two samples shall be collected at least twenty-four (24) hours apart.

2. Samples for bacteriologic analysis shall be collected in sterile bottles treated with sodium thiosulphate. No hose or fire hydrant shall be used in collection of samples. A suggested

sampling tap consists of a standard corporation cock installed in the main with a copper tube gooseneck assembly. After samples have been collected, the gooseneck assembly may be removed, and retained for future use.

H. Repetition of Procedure

If the initial disinfection fails to produce satisfactory samples, disinfection shall be repeated until satisfactory samples have been obtained. The tablet method cannot be used in these subsequent disinfections. When the sample tests indicate that disinfection has been effective, the main may be placed in service.

I. Procedure After Cutting Into or Repairing Existing Mains

The procedures outlined in the Article apply primarily when mains are wholly or partially dewatered. Leaks or breaks that are repaired with clamping devices while the mains remain full of water under pressure present little danger of contamination and require no disinfection.

1. Trench "Treatment"

When an old line is opened, either by accident or by design, the excavation will likely be wet and may be badly contaminated from nearby sewers. Liberal quantities of hypochlorite applied to open trench areas will lessen the danger from such pollution. Tablets have the advantage in such a situation because they dissolve slowly and continue to release hypochlorite as water is pumped from the excavation.

2. Main Disinfection

The following procedure is considered as a minimum that may be used.

a. Swabbing with Hypochlorite Solution - The interior of all pipe and fittings used in making the repair (particularly couplings and tapping sleeves) shall be swabbed with five percent (5%) hypochlorite solution before they are installed.
b. Flushing - Thorough flushing is the most practical means of removing contamination introduced during repairs. If valving and hydrant locations permit, flushing from both directions is recommended. Flushing shall be started as soon as the repairs are completed and continued until discolored water is eliminated.

c. Slug Method - Where practicable, in addition to the above procedures, a section main in which the break is located shall be isolated, all service connections shut off, and the section flushed and chlorinated as described in Article 2.5.2, except that the dose may be increased to as much as 500 mg/L, and the contact time reduced to as little as one-half (1/2) hour. After chlorination, flushing shall be resumed and continued until discolored water is eliminated.

3. Sampling

Bacteriologic samples shall be taken after repairs to provide a record by which the effectiveness of the procedures used can be determined. If the direction of flow is unknown, samples shall be taken on each side of the main break.

1.02 DISINFECTION OF WATER PLANT PROCESS BASINS AND CONNECTING PIPING

All water treatment plant basins and connecting piping downstream of the filter influent shall be disinfected to the same specification as given for the disinfection and bacteriological testing of mains. The Contractor shall take all necessary precautions to assure that there is no damage due to chlorine fumes during or after the disinfection process.

1.03 ALTERNATIVE METHOD FOR DISINFECTION OF LARGE TANKS

Fill tank with enough water (containing a free chlorine concentration of at least 250 mg/L) to spray all inside tank surfaces with the chlorinated water. Repeat the spraying again at no less than 60 minutes from the end of the first spraying. Drain the tank at no less than 30 minutes from the end of the second spraying before filling for use.

1.04 DECHLORINATION

All water discharged to the environment that could reach streams or ponds shall be properly dechlorinated prior to discharge.

- END OF SECTION -

SECTION 02700 - ASPHALTIC CONCRETE PAVING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The asphalt concrete paving replacement work includes the construction of an aggregate base course, asphalt binder and wearing courses to match existing courses and as specified herein. This work is to replace paving disturbed by the construction and any damages to paving by Contractor's operations, as well as new pavement and driveways, within the limits shown on the plans.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract apply to the Work specified in this Section.

B. Section 02225 – Excavating, Backfilling and Compacting for Sewers

PART 2 - PRODUCTS

2.01 MATERIALS

A. All roads shall be constructed in accordance with the following sections of the Kentucky Transportation Cabinet's (KTC) Standard Specifications for Road and Bridge Construction.

1.	Embankment	Division 200
2.	Excavation	Division 200
3.	Subgrade	Division 200
4.	Dense Graded Aggregate	Division 300
5.	Bituminous Concrete	Division 400
6.	Concrete Paving	Division 500
7.	Chemical Stabilization	Division 200

2.02 SUBGRADE

A. The subgrade shall be free from ruts, large stones, and excessive dust. The subgrade shall be subjected to a subgrade proof-roll test so that soft, wet, or pumping areas may be identified. The minimum total weight of the loaded dump truck shall be 37 tons. The truck shall be operated at walking speed over the entire subgrade. Any excessive deflections such as rutting or pumping shall be stabilized as directed by the Engineer.

B. Typical treatments of soft or wet areas of the pavement subgrade include removal and replacement (undercutting), "working-in" No. 2 stone, or installation of a geogrid/geotextile system and crushed stone. The extent and performance requirements of such improvements shall be set forth in the Contract Documents or as directed by the Engineer. Other means to stabilize the subgrade such as lime stabilization or cement modification as described in KTC Section 304, may be necessary.

C. The pavement subgrade shall be compacted to a uniform density throughout according to the requirements of the Contract Documents. If the density of the subgrade has been diminished

by exposure or weather, after having been previously compacted, it shall be recompacted to the required density and moisture content.

D. Subgrade drainage systems or perforated pipe underdrains shall be installed in accordance with LFUCG Standard Drawings where indicated on the Improvement Plans.

2.03 GRANULAR BASE COURSE

A. The granular base course shall consist of compacted dense-graded aggregate (DGA) meeting the requirements set forth in Kentucky Transportation Cabinet's (KTC) Standard Specifications for Road and Bridge Construction. The Contractor shall submit to the Engineer the results of physical tests performed on the material to verify that it meets the requirements referenced above.

B. The DGA shall be applied in thicknesses of no less than 3 inches and no more than 6 inches in thickness. Each lift of DGA shall be compacted to a density no less than 84 percent of the solid volume density based on the oven-dry bulk specific gravity as determined by KM 64-607. A field density test of DGA placement may be required if deemed necessary by Engineer. The tests shall be conducted at a frequency of one test per 2,000 square feet with a minimum of one test per shift during which DGA is placed. The DGA shall be compacted using a vibratory roller or vibratory plate. The DGA shall be placed to achieve a moisture content less than 5%, and shall be stable with no rutting or pumping.

C. Before arriving at the site, the DGA shall be adequately mixed with water in a pugmill. During transportation and storage on site, the DGA shall be covered to prevent loss of moisture. If drying of the DGA occurs, the Contractor shall add water to the DGA and shall thoroughly mix the material before its placement.

2.04 ASPHALT BASE AND SURFACE COURSES

A. The materials and methods for construction for the asphalt base course and surface course shall meet the requirement of Kentucky Transportation Cabinet's (KTC) Standard Specifications for Road and Bridge Construction. The Contractor shall submit test results of the aggregate gradation and asphalt content to the Engineer.

B. The pavement course thicknesses and construction tolerances shall be specified in the Contract Documents. The surface of each course shall be checked with templates, straightedges, and/or stringlines for uniformity. All irregularities exceeding the allowable tolerances must be repaired as required by the Contract Documents or as directed by the Engineer.

2.05 TACK COAT

A. The tack coat shall be type SS-1h. Before applying the tack coat the area to receive pavement shall be cleaned. The tack coat shall be applied well in advance of the paving operation to allow all water to evaporate before the surface course is placed. Work shall be planned so that no more tack coat than is necessary for the day's operation is placed on the surface.

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 02713 - FOUNDATION DRAINAGE

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

The extent of foundation drainage system work is shown on the Drawings and includes the following:

A. Foundation perimeter drainage systems.

B. Deep under floor drainage system.

C. Foundation pressure relief flap valves.

1.02 RELATED WORK

A. Section 02223 – Structural Fill Embankment

B. Section 02270 – Geotextiles

1.03 SUBMITTALS

Shop drawings and test reports shall be submitted to the Engineer in accordance with Section 01300.

PART 2 – PRODUCTS

2.01 DRAINAGE PIPE AND FITTINGS

A. Scope

This section covers the design and manufacture of high density polyethylene (HDPE) pipe manufactured of grade P34 resin material with a hydrostatic - design basis (HDB) rating of 1,600 psi at 73.4º F (23º C).

B. Specific Requirements

The Contractor shall furnish and install high density polyethylene pipe meeting these specifications at the locations indicated on the drawings.

1. HDPE pipe shall be manufactured and tested in conformance to the requirements of the latest revision of ASTM D-3350 and AWWA C906.

2. HDPE pipes and fittings should have pressure ratings of 100 psi (SDR 17) unless noted otherwise on the Drawings.

3. HDPE pipe shall have a grade designation of PE 3408 and a cell classification value of 345464C. HDPE pipe shall have dimensions and workmanship in accordance with ASTM F-714.

4. HDPE pipe shall be joined by means of butt fusion.

5. HDPE pipe shall be supplied in standard lengths of at least 12 feet 6 inches. Longer lengths are permitted.

6. HDPE pipe shall be marked with the manufacturer's name, production lot number, ASTM designation, minimum cell classification, dimension ratio (DR), and nominal diameter.

7. HDPE Perforated Drain Pipe

a. The HDPE perforated drain pipe shall be SDR 9 (unless noted otherwise on the Drawings) per ASTM F- and meet the requirements listed above.

b. All perforated pipe shall have perforations cleanly cut and uniformly spaced along the length of the pipe.

c. The diameter of all perforations shall be 0.5 inches.

d. There shall be four (4) rows of perforations located at 90 degrees apart around the circumference and with a longitudinal spacing of six (6) inches unless otherwise indicated on the Drawings.

e. The pipe shall be installed where shown on the Drawings and as specified in Section 02713 Part 3.

8. HDPE Solid Wall Pipe

a. The HDPE solid wall pipe shall be SDR 9 (unless noted otherwise on the Drawings) per ASTM F-714 and meet the requirements listed above.

b. The pipe shall be installed where shown on the Drawings and as specified in Section 02713 Part 3.

2.02 FILTER FABRIC

A. Furnish synthetic drainage filter fabric in accordance with the following:

1. The geotextile fabric shall consist of long chain polymeric filaments of either polyester or polypropylene formed into a stable network. Fabric shall be tear and puncture resistant, maintain the following minimum physical properties when wet or dry, and be inert to commonly encountered chemicals in the soil.

2. The geotextile fabric shall meet the following minimum requirements;

Property	Requirement	Specification
Weight	6.0 or 8.0 oz./sq.yd.*	---
Grab Tensile	110 lbs.	ASTM D 1682-64
Modulus	900 lbs.	ASTM D 1682-64
Trapezoidal Tear	40 lbs.	ASTM D 2263-68
Mildew, Rot Resistance	100 %	---
Coeff. Of Permeability (K)	1 x 10^{-3} cm/sec.	EURM-100

**As required on plans*

2.03 CRUSHED ROCK MATERIALS

A. Drainage Fill and Filter Material

Crushed stone shall be No. 57 meeting the applicable requirements of the Kentucky Transportation Cabinet, Department of Highways, Standard Specifications for Road and Bridge Construction.

2.04 PRESSURE RELIEF FLAP VALVES

Pressure relief flap valves shall be as manufactured by Clow Valve Company, 902 South Second Street, Oskaloosa, Iowa; Kennedy Valve, 1021 East Water Street, Elmira, New York; or equal.

2.05 PRECAST DRAINAGE BOX / SPRINGBOX

Precast drainage boxes shall be in accordance with Section 02608 and Section 03400.

PART 3 – EXECUTION

3.01 INSTALLATION OF DRAINAGE SYSTEMS

A. Install drainage filter fabric, crushed rock, pipe, pressure relief valves, and accessories as indicated on the Drawings, and per manufacturer's written instructions.

B. Test or check pipe and appurtenances to assure free flow before backfilling with drainage fill. Remove obstructions, replace damaged components, and retest system until acceptable.

C. Carefully place drainage fill over pipe, encapsulating with filter fabric as indicated on the Drawings, taking care to preserve the drainage pipe system and appurtenances.

D. Pressure relief flap valves shall be provided as shown on the Drawings, and shall be installed per manufacturer's instructions.

E. Installation for precast drainage boxes shall be in accordance with the drawings and Section 02608.

END OF SECTION

SECTION 02740 – COLD MIX BITUMINOUS PATCHING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The cold mix bituminous patching includes all labor, equipment, materials, and any required incidentals necessary for the installation of cold mix bituminous asphalt. The cold mix bituminous asphalt is to be used for maintenance purposes during cold weather operations to match existing surfaces and as specified herein. This work is to replace pavement within the designated haul routes that are disturbed or damaged by the Contractor's operations during construction.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cold Mix Bituminous Patching Materials.

The cold mix bituminous patching materials shall be in accordance with the Kentucky Transportation Cabinet's (KTC) Standard Specifications for Road and Bridge Construction, latest edition.

B. Tack Coat

The tack coat shall be type SS-1h. Before applying the tack coat the area to receive pavement shall be cleaned. The tack coat shall be applied well in advance of the paving operation to allow all water to evaporate before the surface course is placed. Work shall be planned so that no more tack coat than is necessary for the day's operation is placed on the surface.

PART 3 – EXECUTION

3.01 INSTALLATION

A. The area to be patch is to be cleaned of all dirt and debris.

B. Remove, as necessary, any wet base.

C. Square up pothole or damage pavement so that it has neat lines both perpendicular and parallel to the centerline and has vertical sides

D. Prime the pothole or damage area with asphaltic tack coat.

E. Fill pothole or damaged area to match the existing surface elevations of adjacent pavement.

END OF SECTION

SECTION 02745 - BITUMINOUS PAVEMENT MILLING & TEXTURING

PART 1 - GENERAL

1.01 DESCRIPTION OF THE WORK

A. Remove existing pavement by milling and texturing.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Asphaltic Concrete Paving: Section 02700

PART 2 - PRODUCTS

2.01 NOT USED

PART 3 - EXECUTION

3.01 MILLING AND TEXTURING

A. Bituminous pavement shall be removed to a depth of 1 ½" inches, measured at the cutting edge of the drum. Equipment shall be capable of removing pavement to required depth while providing cross slope and surface texture.

B. After milling and texturing, confirm finish surface provides required cross slope for drainage. Also verify the surface is smooth free of imperfections such as gouges, ridges, and oil film.

C. All milled and textured pavement shall be swept and removed from surface and hauled immediately.

D. Elevations of longitudinal edges of adjacent cuts shall not exceed1/8 inch.

E. Surface Tolerances shall conform with the KTC Standard Specifications.

F. Approaches and tapers shall be textured to match the final finish cut and shall transition to match the adjoining pavement.

G. When necessary, apply water for dust control.

H. Construction Methods: Construction requirements shall conform to applicable requirements of KTC Standard Specifications.

- END OF SECTION -

SECTION 02775 - SIDEWALKS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and services required for constructing concrete sidewalks where shown on the Drawings and as specified herein.

PART 2 - PRODUCTS

2.01 GENERAL

A. Sidewalks shall be in accordance with LFUCG Standard Drawings.

2.02 CRUSHED STONE

A. Stone for sidewalk base shall be dense grade aggregate (DGA).

2.03 CONCRETE

A. Concrete for sidewalks shall be Class A concrete per Section 03300.

2.04 PREMOLDED EXPANSION JOINT FILLER

A. Premolded expansion joint filler shall be closed cell polyethylene foam type, Sonneborn Sonoflex F, Williams Products Expand-O-Foam, or equal. Seal joint with one-part self-leveling polyurethane sealant, Sonneborn Sonolastic SL 1, or equal, maximum 3/8 inches deep. Prepare and prime joints per manufacturer's instructions.

2.05 CURING COMPOUND

A. A white pigmented curing compound is required on all sidewalks per LFUCG Standard Drawings.

PART 3 - EXECUTION

3.01 BASE

A. Following finished grading, a base course of DGA shall be placed to a compacted thickness of four (4) inches. Immediately prior to placing concrete, DGA base shall be thoroughly wetted.

3.02 SURFACE

A. Concrete shall be in thickness shown on LFUCG Standard Drawings, struck off and worked with a float until mortar appears on the top. After surface has been thoroughly floated, it shall be brushed to leave markings of a uniform type, providing non-slip finish. No dusting or plastering will be allowed. Water shall not be added to the surface of the concrete at any time during the finishing procedure.

3.03 FINISHING

A. All joints and edges shall be finished with an edging tool. Dummy joints shall be formed about five (5) feet apart to form rectangular blocks. Expansion joints of 1/2 inch premolded

expansion joint material shall be provided at the intersection of all vertical surfaces with the sidewalks slabs and at approximately 32 foot intervals along the walks.

END OF SECTION

SECTION 02872 – REMOVABLE BOLLARDS

PART 1 - GENERAL

1.01 SUMMARY

A. The Contractor shall furnish all labor, material, and equipment necessary to install removable bollards and base (ground sleeve).

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Cast in Place Concrete – Section 03300

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. ASTM A36 – Standard Specification for Carbon Structural Steel

B. ASTM A312 – Standard Specifications for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes

C. ASTM A500 – Standard Specifications for Cold-formed Welded, and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

1.04 SUBMITTALS

A. The Contractor shall comply with the requirements of Section 01300 of these specifications.

B. Descriptive literature, catalog cuts, parts lists, and dimensional prints clearly indicating all dimensions and materials of construction, shall be submitted on all items specified herein to the Engineer for review before ordering.

1.05 QUALITY CONTROL

A. The entire removable bollard unit shall be supplied by a single manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package units appropriately to protect the finish, store units to avoid damage from moisture, abrasion, and other construction activities.

PART 2 - PRODUCTS

2.01 REMOVABLE BOLLARD

A. The removable bollard shall be capable of withstanding the impact of an automobile without collapsing.

B. The bollard shall have a rigid connection to the ground sleeve. The bollard shall not deflect under impact loads.

C. The removable bollard post shall remove from the ground sleeve to provide a flush surface with the surrounding grade.

D. The bollard post shall be a steel tube (ASTM A36) not less than 4-inches in diameter, protruding from the ground a minimum of 36-inches.

E. The removable bollard shall be provided with a locking mechanism, either a chain or padlock.

F. The removable bollard shall be provided with a ground sleeve cover plate. The cover plate shall be of the same material as the ground sleeve. The cover plate shall fully cover the ground sleeve opening when the bollard is removed.

G. Removable bollards shall have a polyester powder coat and be painted full height safety yellow.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with manufacturer's provided installation requirements and drawings.

B. Ensure that a minimum of 3-inches gravel base is set prior to installation of the bollard to ensure drainage of the ground sleeve.

C. The ground sleeve shall be impeded into a 2'-6" diameter concrete footing, as shown on the Cast-in-place bollard detail, depth of concrete as required by manufacturer's recommendations. Concrete shall be in accordance with Section 03300 – Cast-in-place Concrete.

D. Ground sleeves should be installed with the top of the sleeve set flush with the finished surface.

END OF SECTION

SECTION 02920 - LAWNS AND GRASSES

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Provide all labor, materials, equipment, and services required for seeding of all disturbed areas caused by construction activities and for installation of sod where indicated on the Contract Drawings or specified herein.

1.02 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to Work of this Section.

1.03 MAINTENANCE

A. Maintenance shall begin immediately following the last operation of installation for each portion of lawn.

B. Lawns shall be maintained by watering, mowing, and for resodding for a period of forty-five (45) days. At the end of this period an inspection will be made and any deficiencies, which may be attributable to the Contractor, will be noted in writing. At this time, the Owner will assume the maintenance. Another inspection will be made at the beginning of the next planting season, and any of the previously noted deficiencies still existing shall be repaired by the Contractor.

1.04 INSPECTION FOR ACCEPTANCE

A. The Inspection of the Work:

The inspection of the work of lawns to determine the completion of contract work exclusive of the possible replacement of plants, will be made by the Architect/Engineer upon written notice requesting such inspection submitted by the Contractor at least ten (10) days prior to the anticipated date.

B. Acceptance:

After inspection, the Contractor will be notified in writing by the Owner of acceptance of all work of this Section, exclusive of the possible replacement of plants subject to guaranty, or if there are any deficiencies of the requirements of completion of the Work.

PART 2 - PRODUCTS

2.01 WATER

A. Water used in this work shall be suitable for irrigation and free from ingredients harmful to plant life.

B. Hose and other watering equipment required for the Work shall be furnished by the Contractor.

2.02 TOPSOIL

A. The Contractor shall furnish and place sufficient topsoil for the seeding and installation of sod.

2.03 FERTILIZER

A. Commercial fertilizer for lawn areas shall be complete fertilizer, formula 10-10-10, for lawns and shall conform to the applicable state fertilizer laws. Fertilizer shall be uniform in composition, dry and free flowing and shall be delivered to the site in the original, unopened containers, each bearing the manufacturer's guarantee analysis. Any fertilizer which becomes caked or otherwise damaged making it unsuitable for use will not be accepted.

B. Fertilizer shall be applied at the rate of 25 pounds per 1,000 square feet.

2.04 GRASS SEED

A. The seed mixture to be sown shall be in the following proportions:

Common Name	Proportion By Weight	% of Purity	% of Germination
Fine Lawn Fescue	40	90	85
Chewings Fescue	25	90	85
Italian Rye Grass	20	90	85
Red Top	10	90	85
White Clover	5	95	90

B. All seed shall be fresh and clean and shall be delivered mixed, in unopened packages, bearing a guaranteed analysis of the seed mixture.

C. Germination must be certified to conform to the following minimums:

Purity	90%
Germination	85%

2.05 SOD

A. Sod shall be at least 70% Bluegrass, strongly rooted and free of pernicious weeds.

B. It shall be mowed to a height not to exceed 3" before lifting, and shall be of uniform thickness with not over 1-1/2" or less than 1" of soil.

2.06 MULCH

A. Mulch for seeded areas shall be Conwed Hydro Mulch, Silva-Fiber, or equal. It shall be suitable for use in a water slurry or for application with hydraulic equipment.

B. Clean straw is acceptable as mulch. It shall be spread at the rate approximately 2 inch loose depth.

C. Mulch on slopes greater than 1: 3 shall be held in place with erosion control netting.

D. Mulch on areas subject to surface water run-off or in drainage ditches shall be held in place with erosion control netting.

PART 3 - EXECUTION

3.01 TIME OF PLANTING

A. Planting operations shall be conducted under favorable weather conditions during seasons which are normal for such work as determined by accepted practice in the locality of the project. At the option and on full responsibility of the Contractor, planting operations may be conducted under unseasonable conditions without additional compensation.

3.02 LAWNS

A. Areas to be sodded are designated on the Drawings. All other lawn areas, including areas of cut and fill and where existing ground has been disturbed by construction operations shall be seeded.

B. Fertilizer:

Fertilizer shall be applied at the rate of 25 pounds per 1,000 square feet to the lawn area being prepared for planting and mixed lightly into the top few inches of topsoil. Fertilizer may be mixed with and distributed with grass seed.

C. Planting of Lawns:

1. Sowing of Seed:

Immediately before any seed is to be sown, the ground shall be scarified as necessary, and shall be raked until the surface is smooth, friable and of uniformly fine texture. Lawn areas shall be seeded evenly with a mechanical spreader at the rate of 4 pounds per 1,000 square feet of area, lightly raked, rolled with a 200-pound roller and watered with a fine spray. The method of seeding may be varied at the discretion of the Contractor on his own responsibility to establish a smooth, uniform turf composed of the grasses specified. The sowing of seed shall be done only within the season extending from March 1st to May 15th and from September 1st to October 15th, unless other seasons may be approved by the Owner.

2. Laying of Sod:

Before any sod is laid, all soft spots and inequalities in grade shall be corrected. Fertilizer spread shall be raked in. Sod shall be laid so that no voids occur, tamped or rolled and then thoroughly watered. The complete sodded surface shall be true to finished grade, even and firm at all points. Sodding shall be done only within the seasons extending from March 1st to May 15th and from September 1st to October 15th, unless other seasons may be approved by the Owner.

3. Sod on Slopes:

Sod on slopes 2 to 1 or steeper shall be held in place by wooden pins about 1-inch square and about 6 inches long driven through the sod into the soil until they are flush with the top of the sod, or by other approved methods for holding the sod in place.

4. Mulching:

All seeded areas are to be mulched with Conwed Hydro Mulch, Silva-Fiber, or equal, or with clean straw as specified under PRODUCTS. Mulch shall be applied at the rate of 1,500 pounds per acre. It may be applied with hydraulic equipment or may be added to the water slurry in a hydraulic seeder and the seeding and mulching combined in one operation. Clean straw may be spread by hand to cover the seeded areas at a depth of two (2) inches. Erosion control netting shall be installed and anchored per manufacturer's instructions in areas of slopes, ditches, or surface water runoff.

3.03 CLEAN UP

A. All soil, peat or similar material which has been brought over paved areas by hauling operations or otherwise, shall be removed promptly, keeping these areas clean at all times. Upon completion of the planting all excess soil, stone and debris which have not previously been cleaned up shall be removed from the site or disposed of as directed by the Owner. All lawns shall be prepared for final inspection.

3.04 OTHER WORK

A. The Contractor also shall be responsible for the repair of any damage caused by his activities or those of his subcontractors, such as the storage of topsoil or other materials, operations or equipment, or other usages to all on-site areas outside the contract limits. Such repair operations shall include any regrading, seeding or other work necessary to restore such areas to an acceptable condition.

3.05 QUALITY CONTROL

A. Areas seeded shall be protected until a uniform stand develops, when it will be accepted and the Contractor relieved of further responsibility for maintenance. Displaced mulch shall be replaced or any damage to the seeded area shall be repaired promptly, both in a manner to cause minimum disturbance to the existing stand of grass. If necessary to obtain a uniform stand, the Contractor shall refertilize, reseed and remulch as needed. Scattered bare spots up to one (1) square yard in size will be allowed up to a maximum of 10 percent of any area.

END OF SECTION