CONTRACT DOCUMENTS AND SPECIFICATIONS

FOR

Floyd Drive Trunk Sewer

Wastewater System Improvements
Division of Water Quality
Lexington Fayette Urban County Government

Remedial Measures Plan ID No. NE-6

LFUCG Bid No. 154-2024

Date: 02/05/2025

PREPARED BY:

Stantec Consulting Services Inc.

Edition: Issued for Construction Submittal

VOLUME II of II

SECTION 01010
SUMMARY OF WORK

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Work to be done under this Contract and in accordance with these Specifications consists of furnishing all equipment, supervision, labor, skill, material and all other items necessary for the construction of the Floyd Drive Trunk Sewer. This project includes providing all construction supervision, labor, materials, tools, test equipment necessary for the Floyd Drive Trunk Sewer Wastewater System Improvements. The project includes the upsizing and replacement of existing trunk and collector sanitary sewers within the North Elkhorn sewershed. The proposed sewer improvements extend from 1150 Floyd Drive and 650 Gay Place (at the upstream ends) to 1441 Sunshine Lane. The total length of the proposed sewer improvements is approximately 2,680 linear feet (LF), ranging from 8-inch to 18-inch diameter. Two sections of sewer, totaling 530 LF, are to be constructed by tunneling methods. The proposed sewer crosses under an unnamed tributary to North Elkhorn at two locations.

B. The Contractor shall perform all work required for such construction in accordance with the Contract Documents and subject to the terms and conditions of the Contract, complete and ready for use.

C. The principal features of the Work to be performed under this Contract includes, but is not limited to:

1. Installation of gravity sanitary sewers and/or force mains, reinforced concrete manholes, and appurtenances.

2. Connections to existing sanitary sewers and service laterals, as necessary.

3. Maintenance of existing sanitary sewer flows during construction

D. The foregoing description(s) shall not be construed as a complete description of all work required.

1.02 CONTRACT DOCUMENTS

A. Work to be done is shown on the set of Drawings entitled: Floyd Drive Trunk Sewer Wastewater System Improvements, completed by Stantec Consulting Services Inc. The numbers and titles of all Drawings appear on the index sheet of the Drawings. All drawings so enumerated shall be considered an integral part of the Contract Documents as defined herein.

1.03 GENERAL ARRANGEMENT

A. Drawings indicate the extent and general arrangement of the work. If any departures from the Drawings are deemed necessary by the Contractor to accommodate the materials and equipment he proposes to furnish, details of such departures and reasons therefore shall be submitted as soon as practicable to the Engineer for approval. No such departures shall be made without the prior written approval of the Engineer. Approved changes shall be made without additional cost to the Owner for this work or related work under other Contracts of the Project.

1.04 CONSTRUCTION PERMITS, EASEMENTS AND ENCROACHMENTS

A. The Owner shall obtain or cause to be obtained all permanent and temporary construction easements as shown on the Drawings or required for completion of the Work. The Contractor shall verify that these easements have been obtained and shall comply with the conditions set forth in each easement.

B. The Contractor shall obtain, keep current and pay all fees for any necessary construction permits from those authorities, agencies, or municipalities having jurisdiction over land areas, utilities, or structures which are located within the Contract limits and which will be occupied, encountered, used, or temporarily interrupted by the Contractor's operations unless otherwise stated. Record copies of all permits shall be furnished to the Engineer.

C. When construction permits are accompanied by regulations or requirements issued by a particular authority, agency or municipality, it shall be the Contractor's responsibility to familiarize himself and comply with such regulations or requirements as they apply to his operations on this Project.

1.05 ADDITIONAL ENGINEERING SERVICES

A. In the event that the Engineer is required to provide additional engineering services as a result of substitution of materials or equipment by the Contractor which are not "or equal", or changes by the Contractor in dimension, weight, power requirements, etc., of the equipment and accessories furnished, or if the Engineer is required to examine and evaluate any changes proposed by the Contractor for the convenience of the Contractor, then the Engineer's charges in connection with such additional services shall be charged to the Contractor by the Owner.

B. In the event that the Engineer is required to provide additional engineering services as a result of Contractor's errors, omissions, or failure to conform to the requirements of the Contract Documents, or if the Engineer is required to examine and evaluate any changes proposed by the Contractor solely for the convenience of the Contractor, then the Engineer's charges in connection with such additional services shall be charged to the Contractor by the Owner.

1.06 ADDITIONAL OWNER'S EXPENSES

A. In the event the Work of this Contract is not completed within the time set forth in the Contract or within the time to which such completion may have been extended in accordance with the Contract Documents, the additional engineering or inspection charges incurred by the Owner may be charged to the Contractor and deducted from the monies due him. Extra work or supplemental Contract work added to the original Contract, as well as extenuating circumstances beyond the control of the Contractor, will be given due consideration by the Owner before assessing engineering and inspection charges against the Contractor.

B. Unless otherwise specifically permitted, the normal time of work under this Contract is limited to 40 hours per week, Monday through Friday. Work beyond these hours will result in additional expense to the Owner. Any expenses and/or damages, including the cost of the Engineer's on site personnel, arising from the Contractor's operations beyond the hours and days specified above shall be borne by the Contractor.

C. Charges assessed to the Contractor for additional engineering and inspection costs will be determined based on actual hours charged to the job by the Engineer. Daily rates will depend on the number and classifications of employees involved, but in no case shall such charges exceed $500 per day for field personnel based on an eight hour workday. Additional charges will apply if multiple personnel are needed or if engineering time is required as part of the work outside the contract times.

D. Charges for additional Owner's expenses shall be in addition to any liquidated damages assessed in accordance with the Contract.

1.07 TIME OF WORK

A. The normal time of work for this Contract is limited to 40 hours per week and shall generally be between the hours of **7:00 a.m. and 6:00 p.m., Monday through Friday**. The Contractor may work beyond these hours or on weekends with written approval from the Owner provided that all costs incurred by the Owner for any additional engineering shall be borne by the Contractor. The Owner shall deduct the cost of additional engineering from monies due the Contractor.

B. If it shall become imperative to perform work outside of the normal working hours the Owner and Engineer shall be informed a reasonable time in advance of the beginning of such work. Temporary lighting and all other necessary facilities for performing and inspecting the work shall be provided and maintained by the Contractor.

1.08 SURVEYS AND LAYOUT

A. All work under this Contract shall be constructed in accordance with the lines and grades shown on the Drawings or as directed by the Engineer. Elevations of existing ground and appurtenances are believed to be reasonably correct but are not guaranteed to be absolute and therefore are presented only as an approximation. Any error or apparent

discrepancy in the data shown or omissions of data required for accurately accomplishing the stake out survey shall be referred immediately to the Engineer for interpretation or correction.

B. All survey work for construction control purposes shall be made by the Contractor at his expense. The Contractor shall provide a Licensed Surveyor as Chief of Party, competently qualified survey party, all necessary instruments, stakes, and other material to perform the work.

C. Contractor shall establish all baselines for the location of the principal component parts of the work together with a suitable number of benchmarks adjacent to the work. Based upon the information provided by the Contract Drawings, the Contractor shall develop and make all detail surveys necessary for construction, including stakes for all working points, lines and elevations.

D. Contractor shall have the responsibility to carefully preserve the bench marks, reference points and stakes, and in the case of destruction thereof by the Contractor or resulting from his negligence, the Contractor shall be charged with the expense and damage resulting therefrom and shall be responsible for any mistakes that may be caused by the unnecessary loss or disturbance of such bench marks, reference points and stakes.

E. Existing or new control points, property markers and monuments that will be or are destroyed during the normal causes of construction shall be reestablished by the Contractor and all reference ties recorded therefore shall be furnished to the Engineer. All computations necessary to establish the exact position of the work shall be made and preserved by the Contractor.

F. The Engineer may check all or any portion of the work and the Contractor shall afford all necessary assistance to the Engineer in carrying out such checks. Any necessary corrections to the work shall be immediately made by the Contractor. Such checking by the Engineer shall not relieve the Contractor of any responsibilities for the accuracy or completeness of his work.

G. At completion of the work, the Contractor shall furnish Record Drawings indicating the final layout of all constructed piping and manholes and finished grades constructed or changed as part of this work.

1.09 FIRE PROTECTION

A. Contractor shall take all necessary precautions to prevent fires at or adjacent to the work and shall provide adequate facilities for extinguishing fires which do occur. Burning shall not be permitted on site.

B. When fire or explosion hazards are created in the vicinity of the work as a result of the locations of fuel tanks or similar hazardous utilities or devices, the Contractor shall immediately alert the local Fire Marshal, the Engineer, and the Owner of such tank or device. The Contractor shall exercise all safety precautions and shall comply with all

instructions issued by the Fire Marshal and shall cooperate with the Owner of the tank or device to prevent the occurrence of fire or explosion.

1.10 CHEMICALS

A. All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, or reactant of other classification, must show approval of either the EPA or USDA. Use of all such chemicals and disposal of residues shall be in strict conformance with all applicable rules and regulations.

1.11 FIRST AID FACILITIES AND ACCIDENTS

A. First Aid Facilities

1. The Contractor shall provide at the site such equipment and facilities as are necessary to supply first aid to any of his personnel who may be injured in connection with the work.

B. Accidents

1. The Contractor shall promptly report, in writing, to the Engineer and Owner all accidents whatsoever out of, or in connection with, the performance of the work, whether on or adjacent to the site, which cause death, personal injury or property damage, giving full details and statements of witnesses.

2. If death, serious injuries, or serious damages are caused, the accident shall be reported immediately by telephone or messenger to both the Owner and the Engineer.

3. If any claim is made by anyone against the Contractor or a Subcontractor on account of any accidents, the Contractor shall promptly report the facts, in writing, to the Engineer and Owner, giving full details of the claim.

1.12 ULTIMATE DISPOSITION OF CLAIMS BY ONE CONTRACTOR ARISING FROM ALLEGED DAMAGE BY ANOTHER CONTRACTOR

A. During the progress of the Work, other Contractors may be engaged in performing other work or may be awarded other Contracts for additional work on this project. In that event, the Contractor shall coordinate the work to be done hereunder with the work of such other Contractors and the Contractor shall fully cooperate with such other Contractors and carefully fit its own work to that provided under other Contracts as may be directed by the Engineer. The Contractor shall not commit or permit any act which will interfere with the performance of work by any other Contractor.

B. If the Engineer shall determine that the Contractor is failing to coordinate his work with the work of the other Contractors as the Engineer directed, then the Owner shall have the right to withhold any payments otherwise due hereunder until the Contractor completely complies with the Engineer's directions.

C. If the Contractor notifies the Engineer in writing that another Contractor is failing to coordinate his work with the work of this Contract as directed, the Engineer will promptly investigate the charge. If the Engineer finds it to be true, he will promptly issue such directions to the other Contractor with respect thereto as the situation may require. The Owner, the Engineer, nor any of their agents shall not, however, be liable for any damages suffered by the Contractor by reason of the other Contractor's failure to promptly comply with the directions so issued by the Engineer, or by reason of another Contractor's default in performance, it being understood that the Owner does not guarantee the responsibility or continued efficiency of any Contractor.

D. The Contractor shall indemnify and hold the Owner and the Engineer harmless from any and all claims of judgments for damages and from costs and expenses to which the Owner may be subjected or which it may suffer or incur by reason of the Contractor's failure to promptly comply with the Engineer's directions.

E. Should the Contractor sustain any damage through any act or omission of any other Contractor having a Contract with the Owner for the performance of work upon the site or of work which may be necessary to be performed for the proper execution of the work to be performed hereunder, or through any act or omission of a Subcontractor of such Contract, the Contractor shall have no claim against the Owner or the Engineer for such damage, but shall have a right to recover such damage from the other Contractor under the provision similar to the following provisions which have been or will be inserted in the Contracts with such other Contractors.

F. Should any other Contractor having or who shall hereafter have a Contract with the Owner for the performance of work upon the site sustain any damage through any act or omission of the Contractor hereunder or through any act or omission of any Subcontractor of the Contractor, the Contractor agrees to reimburse such other Contractor for all such damages and to defend at his own expense any suit based upon such claim and if any judgment or claims against the Owner shall be allowed, the Contractor shall pay or satisfy such judgment or claim and pay all costs and expenses in connection therewith and shall indemnify and hold the Owner harmless from all such claims.

G. The Owner's right to indemnification hereunder shall in no way be diminished, waived or discharged, by its recourse to assessment of liquidated damages as provided in the Contract, or by the exercise of any other remedy provided for by Contract Documents or by law.

1.13 BLASTING AND EXPLOSIVES

A. No blasting is allowed.

1.14 LIMITS OF WORK AREA

A. The Contractor shall confine his construction operations within the Contract limits shown on the Drawings and/or property lines and/or fence lines. Storage of equipment and

materials, or erection and use of sheds outside of the Contract limits, if such areas are the property of the Owner, shall be used only with the Owner's approval. Such storage or temporary structures, even within the Contract's limits, shall not be placed on properties designated as easements or rights-of-way unless specifically permitted elsewhere in the Contract Documents.

B. The Contractor shall secure, insure, maintain, rent/lease, and restore staging area.

C. The Contractor shall provide Engineer and Owner copy of agreement with landowner of staging areas.

1.15 WEATHER CONDITIONS

A. The Contractor shall take necessary precautions (in the event of impending storms) to protect all work, materials, or equipment from damage or deterioration due to floods, driving rain, or wind, and snow storms. The Owner reserves the right, through the opinion of the Engineer, to order that additional protection measures over and beyond those proposed by the Contractor, be taken to safeguard all components of the Project. The Contractor shall not claim any compensation for such precautionary measures so ordered, nor claim any compensation from the Owner for damage to the work from weather elements.

1.16 PERIODIC CLEANUP: BASIC SITE RESTORATION

A. During construction, the Contractor shall regularly remove from the site of the work all accumulated debris and surplus materials of any kind which result from his operations. Unused equipment and tools shall be stored at the Contractor's staging area for the Project.

B. As the work involves installation of sewers, drains, manholes, underground structures, or other disturbance of existing features in or across streets, rights-of-way, easements, or private property, the Contractor shall (as the work progresses) promptly backfill, compact, grade, and otherwise restore the disturbed area to the basic condition which will permit resumption of pedestrian or vehicular traffic and any other critical activity or functions consistent with the original use of the land. The requirements for temporary paving of streets, walks, and driveways are specified elsewhere. Unsightly mounds of earth, large stones, boulders, and debris shall be removed so that the site presents a neat appearance.

C. The Contractor shall perform the cleanup work on a regular basis and as frequently as ordered by the Engineer. Basic site restoration in a particular area shall be accomplished immediately following the installation or completion of the required facilities in that area. Furthermore, such work shall also be accomplished, when ordered by the Engineer, if partially completed facilities must remain incomplete for some time period due to unforeseen circumstances.

D. Upon failure of the Contractor to perform periodic cleanup and basic restoration of the site to the Engineer's satisfaction, the Owner may, upon five (5) days prior written notice to the Contractor, without prejudice to any other rights or remedies of the Owner, cause such work for which the Contractor is responsible to be accomplished to the extent deemed necessary by the Engineer, and all costs resulting therefrom shall be charged to the Contractor and deducted from the amounts of money that may be due him.

1.17 USE OF FACILITIES BEFORE COMPLETION

A. The Owner reserves the right to enter the site and use any portion of the constructed facilities before final completion of the whole work to be done under this Contract. However, only those portions of the facilities which have been completed to the Engineer's satisfaction, as evidenced by his issuing a Certificate of Substantial Completion covering that part of the work, shall be placed in service.

B. It shall be the Owner's responsibility to prevent premature connections to or use of any portion of the installed facilities by private or public parties, persons or groups of persons, before the Engineer issues his Certificate of Substantial Completion covering that portion of the work to be placed in service.

C. Consistent with the approved progress schedule, the Contractor shall cooperate with the Owner, his agents, and the Engineer to accelerate completion of those facilities, or portions thereof, which have been designated for early use by the Owner.

1.18 CONSTRUCTION VIDEO

A. For sites requiring blasting of rock, the Contractor shall video the entire project site prior to the start of construction. Blasting is not permitted for the project unless otherwise specified by the Owner or Engineer.

PART 2 – PART 2 – PRODUCT (NOT USED)

PART 3 – PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01025
MEASUREMENT AND PAYMENT

PART 1 – PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Contractor shall furnish all necessary labor, machinery, tools, apparatus, equipment, materials, equipment, service, other necessary supplies and perform all work including all excavation and backfilling (without additional compensation, except where specifically set out in these specifications) at the contract unit prices bid for the work described in Part 2 of this Section.

1.02 PROGRESS AND PAYMENTS SCHEDULES

A. Within fifteen (15) days after the date of formal execution of the Agreement (Contract), the Contractor shall prepare and submit to the Engineer, for approval, a construction schedule of the Critical Path Method (CPM) type which depicts the Contractor's plan for completing the contract requirements and show work placement in dollars versus contract time. The Contractor's construction schedule must be approved by the Engineer before any payments shall be made on this contract.

B. Within fifteen (15) days after the date of formal execution of the Agreement (Contract), the Contractor shall prepare and submit to the Engineer, for approval, a periodic estimate which depicts the Contractor's cost for completing the contract requirements and show by major unit of the project work, the Contractor's dollar value for the material and the labor (two separate amounts) to be used as a basis for the periodic payments. The Contractor's periodic estimate must be approved by the Engineer before any payments shall be made on this contract.

C. The Engineer's decision as to sufficiency and completeness of the Contractor's construction schedule and periodic estimate shall be final.

D. The Contractor must make current, to the satisfaction of the Engineer, the construction schedule and periodic estimate each time the Contractor requests a payment on this contract.

E. The Contractor's construction schedule and periodic estimate must be maintained at the construction site available for inspection and shall be revised to incorporate approved change orders as they occur.

F. When the Contractor requests a payment on this contract, it must be on the approved periodic estimate and be current. Further, the current periodic estimate and construction schedule (both updated and revised) shall be submitted for review and approval by the Engineer before monthly payments shall be made by the Owner. The Contractor shall submit as stored materials for pay purposes provided proper documentation is provided.

1. Documentation for stored materials includes at a minimum, an approved Shop Drawing, materials to be on site, etc. See Specification Section 00800-14.02.A.5 for additional information.

G. Refer to Section 00800, Articles 14.02.A.6-8 for retainage requirements.

1.03 CLAIMS FOR EXTRA WORK

A. If the Contractor claims that any instructions by Drawings or otherwise involve extra cost, the Contractor shall give the Engineer written notice of said claim within seven (7) days after the receipt of such instructions, and in any event before proceeding to execute the work, stating clearly and in detail the basis of its claim or claims. No such claim shall be valid unless so made.

B. Claims for additional compensation for extra work, due to alleged errors in spot elevations, contour lines, or benchmarks, shall not be recognized unless accompanied by certified survey data, made prior to the time the original ground was disturbed, clearly showing that errors exist which resulted, or would result, in handling more material, or performing more work than would reasonably be estimated from the Drawings and topographical maps issued.

C. Any discrepancies which may be discovered between actual conditions and those represented by the topographical maps and Drawings shall at once be reported to the Engineer, and work shall not proceed, except at the Contractor's risk, until written instructions have been received by the Contractor from the Engineer.

D. If, on the basis of the available evidence, the Engineer determines that an adjustment of the Contract Price or time is justifiable, the procedure shall then be as provided herein for "Changes in the Work".

E. By execution of this Contract, the Contractor warrants that it has visited the site of the proposed work and fully acquainted himself with the conditions there existing relating to construction and labor, and that it fully understands the facilities, difficulties, and restrictions attending the execution of the work under this Contract. The Contractor further warrants that it has thoroughly examined and is familiar with the Drawings, Specifications and all other documents comprising the Contract. The Contractor further warrants that by execution of this Contract its failure when it was bidding on this Contract to receive or examine any form, instrument or document, or to visit the site and acquaint himself with conditions there existing, in no way relieves the Contractor from any obligation under the Contract, and the Contractor agrees that the Owner shall be justified in rejecting any claim based on facts regarding which it should have been on notice as a result thereof.

1.04 DETERMINATION OF THE VALUE OF EXTRA (ADDITIONAL) OR OMITTED WORK

A. The value of extra (additional) or omitted work shall be determined in one or more of the following ways:

1. On the basis of the actual cost of all the items of labor (including on-the-job supervision), materials, and use of equipment, plus a maximum 15 percent for added work or a minimum 15 percent for deleted work which shall cover the Contractor's general supervision, overhead and profit.

    a. Labor may include on-site supervision, on-site project management, in addition to field personal associated with the work.

    b. In case of subcontracts, the 15 percent (maximum for added work and minimum for deleted work) is interpreted to mean the subcontractor's supervision, overhead and profit, and an additional 5 percent (maximum for added work and minimum for deleted work) may then be added to such costs to cover the General Contractor's supervision, overhead and profit.

    c. The cost of labor shall include required insurance, taxes and fringe benefits.

    d. Equipment costs shall be based on current rental rates in Lexington, KY.

2. By estimate and acceptance in a lump sum.

3. By unit prices named in the Contract or subsequently agreed upon.

B. Provided, however, that the cost or estimated cost of all extra (additional) work shall be determined in advance of authorization by the Engineer and approved by the Owner.

C. All extra (additional) work shall be executed under the conditions of the original Contract. Any claim for extension of time shall be adjusted according to the proportionate increase or decrease in the final total cost of the work unless negotiated on another basis.

D. Except for over-runs in contract unit price items, no extra (additional) work shall be done except upon a written Change Order from the Engineer, and no claim on the part of the Contractor for pay for extra (additional) work shall be recognized unless so ordered in writing by the Engineer.

PART 2 – PRODUCTS

2.01 MOBILIZATION

A. Payment for the Contractor's mobilization shall be made at the Contract lump sum price and shall include all costs incurred for moving equipment onto the project area, staging, security fencing, and any pertinent costs related thereto, for the duration of the contract term. Mobilization unit price shall not exceed four percent (4%) of the total Bid Amount.

2.02 BONDS AND INSURANCE

A. Payment for bonds and insurance shall be made at the Contract lump sum price and shall include the costs of all bonds provided under the Contract, and the premiums for insurance required under the Contract, for the duration of the contract term. Unit price shall be based on actual invoices and payment shall be made upon receipt of invoices attached to a monthly progress payment request.

2.03 GENERAL REQUIREMENTS

A. Payment for general requirements shall be made at the Contract lump sum price and shall include field supervision and support staff, office supervision and support staff, costs associated with maintaining the field operation, and other items required by the general requirements and conditions of the Contract. Payment for General Requirements shall be made on an equal distribution across the Contract term on a monthly basis.

2.04 DEMOBILIZATION

A. Payment for the Contractor's demobilization upon completion of the project shall be made at the Contract lump sum price and shall include all costs incurred for removing equipment and materials from the project area and any pertinent costs related thereto, for the duration of the Contract term. Demobilization unit price shall not exceed four percent (4%) of the total Bid Amount.

2.05 EROSION AND SEDIMENT CONTROL AND CONFORMANCE WITH SWPPP

A. Payment is for furnishing, installing, maintaining and removing erosion and sediment control devices. This is to be paid at the contract lump sum price, complete in place, which shall include compensation for materials, placing, cleaning, and maintaining the sediment and erosion control devices throughout the construction period and removal of the of the sediment and erosion control devices once vegetation is established. Payment shall be distributed as follows: 25% when all ESC measures are in place and operating correctly; 50% equally distributed across the Contract term; and 25% for the removal of the ESC measures and final stabilization/restoration.

2.06 CLEARING AND GRUBBING

A. Payment for clearing and grubbing shall be made at the Contract lump sum price and shall include all costs incurred for clearing, grubbing, scalping, removing trees and stumps and removing all vegetation and construction debris from the limits shown on the plans, except such objects that are to remain or are to be removed according to other items of work.

2.07 TREE PROTECTION

A. Payment for tree protection shall be paid for at the Contract unit price, per linear foot of fencing. Unit price shall include furnishing, installation, maintenance and removal of 4' tall orange plastic fencing attached to metal "tee" posts, securely driven into the ground. The Tree Protection unit price shall also include attaching tree protection signage (12"x 18" aluminum sign, provided by LFUCG DWQ) to the Tee posts at 25'+/- intervals. Zip ties or tie wire may be used. Signage shall be returned to LFUCG DWQ at the conclusion of the project. Maintenance of the fence shall cover repairs to fence, posts or signs, and grass and weed cutting, as required, for the duration of the project.

B. Coordination with LFUCG Division of Environmental Services, so they may cut tree roots, *prior to construction traffic/excavation* under or near significant trees shall be included. The Division of Environmental Services shall be notified 2 weeks before their services are required. The Contractor will not be allowed to proceed with their work if the roots have not been properly cut by DES. Failure to notify DES, 2 weeks prior to work in the area, shall not be grounds for additional contract time.

2.08 PVC (SDR 35) GRAVITY SEWER LATERAL (IN PAVEMENT)

A. Payment is for furnishing and installing gravity sewer laterals at the contract unit price per linear foot. This is to be paid at the contract unit price, complete in place, which shall include compensation for pipe, reducers, spool pieces, fittings (excluding items included in cleanout pay item), materials, hauling, excavation (including rock excavation), shoring, sheeting, removal of existing lateral, bedding, backfilling under pavement, cleanup, pavement restoration, testing, and all other items necessary for a complete installation.

2.09 PVC (SDR 35) GRAVITY SEWER LATERAL (NOT IN PAVEMENT)

A. Payment is for furnishing and installing gravity sewer laterals at the contract unit price per linear foot. This is to be paid at the contract unit price, complete in place, which shall include compensation for pipe, reducers, spool pieces, fittings (excluding items included in cleanout pay item), materials, hauling, excavation (including rock excavation), shoring, sheeting, removal of existing lateral, bedding, backfilling, cleanup, restoration, testing, and all other items necessary for a complete installation.

2.10 TEE FITTINGS FOR GRAVITY SEWER LATERAL CONNECTION (NON-DUCTILE IRON OR INSERTA TEE)

A. Payment is for furnishing and installing Tee Fittings for Gravity Sewers (non-ductile iron or Inserta Tee) at the contract unit price per each, based on the line size as indicated on the Bid Schedule. This is to be paid at the contract unit price, complete in place, which shall include compensation for materials, hauling, excavation (including rock excavation), shoring, sheeting, bedding, backfilling, cleanup, testing, and all other items necessary for a complete installation.

2.11 INSTALL CLEANOUT

A. Payment is for furnishing and installing a Cleanout at the contract unit price each, based on the line size as indicated on the Bid Schedule. This is to be paid at the contract unit price, complete in place, which shall include compensation for cleanout casting, two-way cleanout tee, spool piece of pipe between cleanout casting and two-way cleanout tee, Strongback Fernco adapter, connection to existing lateral, concrete collar, materials, hauling, excavation (including rock excavation), shoring, sheeting, bedding, backfilling, cleanup, testing, and all other items necessary for a complete installation.

2.12 GRAVITY SEWER PIPE

A. Payment is for furnishing and installing Gravity Sewer Pipe at the contract unit price per linear foot, based on the line size and burial depth as indicated on the Bid Schedule. Depth of burial is measured from existing ground surface to invert of sewer pipe and paid for accordingly. The quantity of sewer to be paid for shall be the actual length of installed in trench and into boot of manhole. Fittings and tees are paid for separately under a different pay item and not included in the length of pipe. Gravity sewer pipe is to be paid at the contract unit price, complete in place, which shall include compensation for pipe, materials, hauling, clearing and grubbing, excavation (including rock excavation), dewatering, shoring, sheeting, removal of existing pipe, bedding, backfilling, cleanup, restoration (excluding permanent seeding), testing, and all other items necessary for a complete installation. Pipe will have the same material specification between manholes.

2.13 TUNNELING AND INSTALLATION

A. Payment is for furnishing and installing a tunnel and sewer alignment at the contract unit price per lump sum, based on the line size as indicated on the Tunneling Method Table listed in the Project Specific Notes (PSN). This is to be paid at the contract unit price per lump sum, complete in place, which shall include: compensation for tunneling (as selected method), grade control monitoring/surveying, tunnel lining, grout (if required and incidental to the contract), carrier pipe(s), casing pipe, casing spacers, materials, hauling, excavation (including rock excavation) of shafts/pits, shoring, sheeting, stabilization of other utilities, dewatering, backfilling, temporary electricity and water, couplings, concrete brick and mortar end seals, grout ports, testing, cleanup, costs for

bonds and insurance, and all other items necessary for a complete tunnel installation as shown on the Construction Plans, Specifications and Tunneling Method Table.

Payments for tunnel progress shall be as follows:

1. Mobilization / Demobilization – LS (5% of total - maximum)
2. Furnish and Install Tunnel and Lining – LF (60% of total - maximum)
3. Shafts/Pits/Support Work – LS (10% of total)
4. Furnish and Install Carrier Pipe(s) – LF (20% of total - maximum)
5. Testing of Carrier Pipe(s) – LS (5% of total)

2.14 CONNECTION TO EXISTING TRUNK SEWER

A. For pipes 12" and larger, payment shall be made for furnishing and installing a Connection to Existing Sewer. This is to be paid at the contract unit price each, based on the line size as indicated on the Bid Schedule, complete in place, which shall include compensation for coupling, one full length of pipe, materials, hauling, tapping, excavation (including rock excavation), shoring, sheeting, bedding, forming and placing (constructing) concrete cradle, backfilling, cleanup, testing, and all other items necessary for a complete installation.

2.15 MANHOLE ABANDONMENT

A. Payment is for Manhole Abandonment at the contract unit price each. This is to be paid at the contract unit price, complete in place, which shall include compensation for excavation (including rock excavation), demolition, disposal, concrete, crushed stone fill, backfilling, cleanup, restoration, and all other items necessary for a complete installation.

2.16 STANDARD MANHOLE

A. Payment is for furnishing and installing a Manhole, based on the size and depth range (0' to 6.0') as indicated on the Bid Schedule. This is to be paid at the contract unit price each, complete in place, which shall include compensation for the manhole casting, cementitious crystalline admixture (see Specification Section 02608 for required admixtures), boots, steps, gaskets, exterior joint wraps with stainless steel bands, crushed stone, SS frame anchors, infiltration pans, frame and cover, grout, materials, removal of existing manhole, hauling, excavation (including rock excavation), dewatering, bedding, backfilling, testing, cleanup, and all other items necessary for a complete installation on new or existing sewer lines.

2.17 MANHOLE VERTICAL FOOT (VF)

Payment is for furnishing and installing additional vertical depth (6.1' and greater) to standard and/or drop manholes, based on the size as indicated on the Bid Schedule.

This is to be paid at the contract unit price per vertical foot (VF) for standard and drop manholes, complete in place cementitious crystalline admixture (see Specification Section 02608 for required admixtures), boots, steps, gaskets, exterior joint wraps with stainless steel bands, crushed stone, SS frame anchors, infiltration pans, frame and cover, grout, materials, removal of existing manhole, hauling, excavation (including rock excavation) bedding, backfilling, testing, cleanup, and all other items necessary for a complete installation on new or existing sewer lines.

2.18 RECONNECT EXISTING GRAVITY SEWER OR SERVICE LATERAL TO NEW MANHOLE

A. Payment is for furnishing and installing a new manhole connection to an existing gravity sewer or service lateral based on the size as indicated on the bid schedule. This is to be paid at the contract unit price each, complete in place, which shall include compensation for gasket, Fernco Strongback coupling, full length of pipe, grout, materials, furnishing, excavation (including rock excavation), bedding, backfilling, cleanup, coring, and all other items necessary for a complete installation.

2.19 CUT AND CAP EXISTING SEWER

A. Payment is for cutting and capping existing sewer, based on the size as indicated on the Bid Schedule. This is to be paid at the contract unit price each, complete in place, which shall include compensation for concrete, cutting pipe, materials, equipment, excavation (including rock excavation), backfilling, cleanup, restoration, and all other items necessary for a complete capping.

2.20 VIDEO INSPECTION OF NEW SEWER PIPE

A. Payment for video inspection shall be made at the contract price per linear foot, including dewatering of pipe, bypass pumping, maintenance of traffic, hydraulic jet cleaning, disposal of debris, furnishing all labor, materials, tools, equipment, and incidentals, and doing all the work involved to perform sewer video inspections, including delivery of DVDs and/or digital files (flash drive, etc.) and written logs of the sewer videos to the Owner for review and acceptance.

2.21 ASPHALT PAVING: TRENCH CONSTRUCTION, STREET, PARKING LOT, DRIVEWAY

A. Payment for asphalt paving relating to trench construction in streets, parking lots, and driveways shall be paid for at the Contract unit price per square yard, which shall include placement of aggregate, concrete bridge, compaction, asphalt, removal of existing surface, placement of asphalt, taper of new pavement into existing pavement, and all appurtenances necessary for a complete installation.

2.22 ASPHALT PAVING: OUTSIDE OF TRENCH CONSTRUCTION

A. Payment for asphalt paving outside of trench relating to construction in streets, parking lots, and driveways shall be paid for at the Contract unit price per square yard, which shall include placement of aggregate, compaction, asphalt, concrete bridge, removal of existing surface, placement of asphalt, proper grading, taper of new pavement into existing pavement, and all appurtenances necessary for a complete installation.

2.23 CONCRETE PAVING: PRIVATE PARKING LOTS/DRIVEWAYS/APRONS

A. Payment for concrete paving relating to private parking lots, driveways, and aprons shall be paid for at the Contract unit price per square yard, which shall include placement of aggregate, compaction, concrete, removal of existing surface, placement of concrete, proper grading, taper of new surface into existing surface, and all appurtenances necessary for a complete installation.

2.24 ROADWAY STRIPING

A. Payment for roadway striping shall be paid for at the Contract unit price per linear foot of striping placed, which shall include materials, placement of striping, all maintenance of traffic, including flaggers, arrow board, message board, etc., and all appurtenances and manpower necessary for a complete installation.

2.25 MISCELLANEOUS ROADWAY MARKINGS

A. Payment for miscellaneous roadway markings shall be paid for at the Contract lump sum, which shall include materials, placement of stop bars, lettering, etc., all maintenance of traffic, including flaggers, arrow board, message board, etc., and all appurtenances and manpower necessary for a complete installation.

2.26 SEEDING, TEMPORARY, EXTRA AS DIRECTED BY ENGINEER

A. Payment for temporary seeding shall be paid for at the Contract unit price per square yard, which shall include seed, fertilizer, lime, mulch/straw/netting, placement, watering and maintenance throughout the duration of the contract, and all appurtenances necessary for a complete installation.

2.27 SITE RESTORATION, METHOD A, EXTRA AS DIRECTED BY ENGINEER

A. Payment for site restoration method A (as defined in the General Notes), shall be paid for at the Contract unit price per square yard, which shall include sod, fertilizer, lime, placement, watering and maintenance throughout the duration of the contract, and all appurtenances necessary for a complete installation.

2.28 SITE RESTORATION, METHOD B

A. Payment for site restoration, method B (as defined in the General Notes), shall be paid for at the Contract unit price per square yard, which shall include seed, fertilizer, lime,

straw, placement, watering and maintenance throughout the duration of the contract, and all appurtenances necessary for a complete installation.

2.29 SITE RESTORATION, METHOD C

A. Payment for site restoration, method C (as defined in the General Notes), shall be paid for at the Contract unit price per square yard, which shall include seed, fertilizer, lime, mulch/straw/netting, placement, watering and maintenance throughout the duration of the contract, and all appurtenances necessary for a complete installation.

2.30 MONOLITHIC CONCRETE CURB AND GUTTER REMOVAL AND REPLACEMENT

A. Payment for monolithic concrete curb and gutter removal and replacement shall be paid for at the Contract unit price per linear foot, which shall include base, compaction, formwork, concrete, placement of monolithic concrete curb and gutter, curing compound, maintenance of traffic, removal of existing curb and gutter, and all appurtenances necessary for a complete installation.

2.31 MANHOLE ACCESSORIES FOR LOCATION WITHIN 100-YEAR FLOODPLAIN

A. Payment is for furnishing and installing a concrete anti-flotation collar cast into the manhole. This is to be paid at the contract unit price each, complete in place, which shall include compensation for concrete collar cast onto the manhole, materials, installation, and all other items necessary for a complete installation.

2.32 CREEK CROSSING AND BANK/BED RESTORATION

A. Payment is for furnishing, installing and maintaining each creek crossing and restoring the stream bank and bed. This is to be paid at the lump sum contract price, complete in place, which shall include compensation for excavation (including rock excavation), concrete, materials, bedding, backfilling, cleanup, restoration, seeding, plantings, and all other items necessary for a complete installation on new or existing sewer lines.

B. Tree protection fencing shall be installed at the direction of the Engineer and shall be placed a minimum of 3 weeks before any construction traffic occurs under or near significant trees.

2.33 DENSE GRADED AGGREGATE – DGA, EXTRA AS DIRECTED BY ENGINEER

A. Payment for dense graded aggregate shall be paid for at the Contract unit price per ton, which shall include placement of aggregate, compaction and all appurtenances necessary for a complete installation.

2.34 NO. 9 CRUSHED STONE, EXTRA AS DIRECTED BY ENGINEER

A. Payment for No. 9 crushed stone shall be paid for at the Contract unit price per ton, which shall include placement of aggregate, compaction and all appurtenances necessary for a complete installation.

2.35 NO. 57 CRUSHED STONE, EXTRA AS DIRECTED BY ENGINEER

A. Payment for No. 57 crushed stone shall be paid for at the Contract unit price per ton, which shall include placement of aggregate, compaction and all appurtenances necessary for a complete installation.

2.36 NO. 2 CRUSHED STONE, EXTRA AS DIRECTED BY ENGINEER

A. Payment for No. 2 crushed stone shall be paid for at the Contract unit price per ton, which shall include placement of aggregate, compaction and all appurtenances necessary for a complete installation.

2.37 FLOWABLE (CONTROLLED DENSITY) FILL

A. Payment for flowable fill shall be paid for at the Contract unit price per cubic yard measured in-place, which shall include placement of flowable fill, maintenance of traffic, and all appurtenances necessary for a complete installation.

2.38 BYPASS PUMPING AND SETUP

A. Payment is for operation and setup of bypass pumping required for installation of all items shown in Contract Documents. This is to be paid for at the Contract lump sum as indicated on the Bid Schedule. Work shall be complete in place, which shall include compensation for all mobilizations, set ups, testing (per section 01520), takedowns, relocations, and demobilization for the pumps, hoses, line plugs, generator, rental fees, fuel, monitoring, piping, duty and backup pumps, check valve, adapters, hose, labor, maintenance, and all appurtenances necessary for the continued setup and operation of the bypass pumping system throughout the project. Provision of redundant pumping capability per Section 01520 is incidental to the cost of bypass pumping and shall be included in this pay item.

2.39 TRAFFIC MAINTENANCE AND CONTROL

A. Payment is maintenance of traffic. This is to be paid at the contract lump sum price, complete in place, which shall include compensation for flaggers, arrow board, message board, etc., removal of equipment after work is completed, and all appurtenances and manpower necessary.

2.40 ALLOWANCE: THIRD PARTY PROFESSIONAL PRE-CONSTRUCTION PHOTOGRAPHIC DOCUMENTATION

A. An allowance has been established for pre-construction photographic documentation by a third-party professional. Payment is for all labor, materials, equipment, and other incidental costs required to perform the directed work per Section 01323.

2.41 ALLOWANCE: MISCELLANEOUS SITE IMPROVEMENTS

A. An allowance has been established for Miscellaneous Site Improvements or other work not included in the Contract Documents but deemed necessary for the project during construction. Miscellaneous Site Improvements will be as directed by the Engineer in a Field Order which will document costs associated with the directed Miscellaneous Site Improvement(s). Costs shall include all labor, equipment, materials and other incidental costs required to perform he directed work. Funds from the Miscellaneous Site Improvements allocation not encumbered by a Field Order will be credited to the final contract amount in a Final Adjusting Change Order.

2.42 ALLOWANCE: PRE-POST CONSTRUCTION SURVEY AT 617 EAST NEW CIRCLE ROAD

A. An allowance has been established for Pre-Post Construction Survey at 617 East New Circle Road not included in the Contract Documents but deemed necessary for the project before and after construction. Survey shall extend to the limits of the parcel, and include photographs, topography, structures, and other necessary or impacted appurtenances. Payment is for all labor, materials, equipment, and other incidental costs required to perform the directed work.

2.43 EASEMENT AND PROPERTY REQUIREMENTS (MOU CONDITIONS LS)

A. Payment is for fulfilling all easement and property requirements of Memorandums of Understanding (MOU Conditions) for properties affected by construction activities. These requirements are detailed on Drawing C-04.

PART 3 – EXECUTION

3.01 PAY ITEMS

A. The pay items listed hereinbefore refer to the items listed in the Bid Schedule and are the only pay items for this contract.

B. Any and all other items of work listed in the specifications or shown on the Contract Drawings for this contract shall be considered incidental to and included in the associated pay items.

END OF SECTION

SECTION 01040
COORDINATION

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall allow the Owner or his agents, and other project Contractors or their agents, to enter upon the work for the purpose of constructing, operating, maintaining, removing, repairing, altering, or replacing such pipes, sewers, conduits, manholes, wires, poles, or other structures and appliances which may be required to be installed at or in the work. The Contractor shall cooperate with all aforesaid parties and shall allow reasonable provisions for the prosecution of any other work by the Owner, or others, to be done in connection with his work, or in connection with normal use of the facilities.

B. Each Contractor shall cooperate fully with the Owner, the Engineer, and all other Contractors employed on the Work, to effect proper coordination and progress to complete the project on schedule and in proper sequence. Insofar as possible, decisions of all kinds required from the Engineer shall be anticipated by the Contractor to provide ample time for inspection, or the preparation of instructions.

C. Each Contractor shall assume full responsibility for the correlation of all parts of his work with that of other Contractors. Each Contractor's superintendent shall correlate all work with other Contractors in the laying out of work. Each Contractor shall lay out his own work in accordance with the Drawings, Specifications, and instructions of latest issue and with due regard to the work of other Contractors.

D. Monthly general progress coordination meetings will be held at regularly scheduled times convenient for all parties involved. These meetings are in addition to specific meetings held for other purposes, such as special pre-installation meetings. Representation at each meeting by every part currently involved in coordination or planning for the work of the entire project is requested. Meetings shall be conducted in a manner that will resolve coordination problems. Results of the meetings shall be recorded and copies distributed to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.02 COORDINATION OF CRAFTS, TRADES, AND SUBCONTRACTORS

A. The Contractor shall coordinate the work of all crafts, trades and subcontractors engaged on the Work, and he shall have final responsibility as regards the schedule, workmanship and completeness of each and all parts of the work.

B. Each Subcontractor is expected to be familiar with the General requirements and all sections of the detailed Specifications for all other trades and to study all Drawings

applicable to his work to the end that complete coordination between trades will be affected. Consult the Engineer if conflicts exist on the Drawings.

C. Contractor's Superintendent, or his designee who is employed by Contractor, must be on site at all times when work is being performed, except for periods which will not exceed 1 hour.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01200
PROJECT MEETINGS

PART 1 – GENERAL

1.01 PRECONSTRUCTION MEETING

A. A preconstruction meeting will be held after Award of Contract, but prior to starting work at the site. Contractor's Project Manager and Site Superintendent are required to attend, as are representatives of all major subcontractors. Progress schedule update shall be submitted in advance of each meeting.

1.02 PROGRESS MEETINGS

A. Progress meetings will be held monthly at the Division of Water Quality offices during the performance of the Work. Additional progress meetings may be called as progress of work dictates. Prior to each progress meeting, Contractor shall submit a progress report summarizing the work completed over the past month and providing a look ahead at the work to be done over the next month.

B. Minimum Agenda for meeting shall include:

1. Review and approve minutes of previous meetings.
2. Review progress of Work since last meeting.
3. Review proposed 30 day construction schedule.
4. Note and identify problems which impede planned progress.
5. Develop corrective measures and procedures to regain planned schedule.
6. Revise construction schedule as indicated and plan progress during next work period.
7. Maintaining of quality and work standards.
8. Complete other current business.
9. Schedule next progress meeting.

1.03 SPECIAL MEETINGS

A. Owner or Engineer may schedule special meetings at the site or at Division of Water Quality offices to resolve construction issues. Contractor and when appropriate, subcontractors, shall attend upon request. No additional compensation shall be paid for meeting attendance.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01210
ALLOWANCES

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. This Section includes administrative and procedural requirements governing allowances. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:

1. Defined allowances. Defined allowances include equipment, systems, or services that have been selected by the Owner from a designated supplier. These will be handled in accordance with paragraph 1.06 of this specification.

2. Undefined allowances. Undefined allowances are intended for work which has an unknown scope at the time of bidding. These will be handled in accordance with paragraph 1.07 of this specification.

C. The following allowances shall be included in the Contractor's bid:

1. 3rd Party Professional Photography Pre-Construction Documentation - $3,000 has been established for 3rd Party Professional Photography Pre-Constrution documentation. An allocation has been established for 3rd Party Professional Photography or other work not included in the Contract Documents but deemed necessary for the project prior to construction. Payment is for all labor, materials, equipment, and other incidental costs required to perform the directed work per Section 01323.

2. Miscellaneous Site Improvements (undefined allowance) - $300,000 has been established for owner selected miscellaneous site improvements. An allocation has been established for Miscellaneous Site Improvements or other work not included in the Contract Documents but deemed necessary for the project during construction. Miscellaneous Site Improvements will be as directed by the Engineer in a Field Order which will document costs associated with the directed Miscellaneous Site Improvement(s). Costs shall include all labor, equipment, materials, and other incidental costs required to perform the directed work. Funds from the Miscellaneous Site Improvements allocation not encumbered by a Field Order will be credited to the final contract amount in a Final Adjusting Change Order.

3. Pre-Post Construction Survey at 617 E. New Circle Road - $10,000 has been established for owner selected for Pre-Post Construction Survey at 617 E. New

Circle Road. An allocation has been established for Pre-Post Construction Survey or other work not included in the Contract Documents but deemed necessary for the project before and after construction, including photographs, topography, structures, and other appurtenances on the property. Payment is for all labor, materials, equipment, and other incidental costs required to perform the directed work.

1.02 RELATED DOCUMENTS

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

1.03 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, Contractor shall advise Engineer of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Engineer's request, obtain proposals for each allowance for use in making final selections and include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by the Engineer from the designated supplier.

1.04 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.05 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.06 DEFINED ALLOWANCES

A. Defined allowances shall include cost to Contractor of specific products and materials ordered by the Contractor under allowance and shall include taxes, freight, and delivery to the project site. Defined allowances are the same as Cash Allowances as defined in Article 11.02 of the General Conditions.

B. Contractor's costs at the Project site for labor, installation, overhead and profit, and similar costs related to the equipment ordered under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Contractor shall not be allowed any markup of subcontractors work or materials under the allowances. Markup shall be included as part of the Contract sum and not part of the allowance.

1.07 UNDEFINED ALLOWANCES

A. Undefined allowances shall include work for which the scope is not yet determined. The allowance amount is not guaranteed and is solely for the purpose of determining an initial Contract Price. Undefined allowances are the same as Contingency Allowances as defined in Article 11.02 of the General Conditions.

B. Once the scope of work is defined, the Contractor shall present cost and schedule as listed in 1.04.A above.

1.08 UNUSED MATERIALS

A. Contractor shall be responsible for returning unused materials purchased under an allowance to the manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

B. When it is not economically practical to return material for credit, Contractor shall be responsible for preparing and delivering unused material to Owner's designated storage location. Otherwise, disposal of unused material shall be Contractor's responsibility.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.02 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

END OF SECTION

THIS PAGE LEFT BLANK INTENTIONALLY

SECTION 01300
SUBMITTALS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Progress Schedule

1. Within thirty (30) days after execution of the Agreement, but at least 20 days prior to submitting the first application for a progress payment, the Contractor shall prepare and submit three (3) copies of his proposed progress schedule to the Engineer for review and approval.

2. If so required, the schedule shall be revised until it is approved by the Engineer.

3. The schedule shall be updated monthly, depicting progress to the last day of the month and three (3) copies submitted to the Engineer not later than the fifth day of the month with the application for progress payment.

4. The schedule shall be prepared in the form of a horizontal bar chart showing in detail the proposed sequence of the work and identifying construction activities for each structure and for each portion of work.

5. The schedule shall be time scaled, identifying the first day of each week. The Schedule shall be provided with estimated dates for Early Start, Early Finish, Late Start and Late Finish as applicable. The work shall be scheduled to complete the Project within the Contract time. The Late Finish date shall equal the Contract Completion Date.

6. The schedule shall show duration (number of days) and float for each activity. Float shall be defined as the measure of leeway in starting or completing a scheduled activity without adversely affecting the project completion date established by the Contract Documents.

7. The updated schedule shall show all changes since the previous submittal.

8. All revisions to the schedule must have the prior approval of the Engineer.

B. Equipment and Material Orders Schedule

1. Contractor shall prepare and submit three (3) copies of his schedule of principal items of equipment and materials to be purchased to the Engineer for review and approval.

2. If so required, the schedule shall be revised until it is approved by the Engineer.

3. The schedule shall be updated monthly and three (3) copies submitted to the Engineer not later than the fifth day of every month with the application for progress payment.

4. The updated schedule shall be based on the Progress Schedule developed under the requirements of Paragraph 1.01(A) of this Section.

5. The schedule shall be in tabular form with appropriate spaces to insert the following information for principal items of equipment and materials:

    a. Dates on which Shop Drawings are requested and received from the manufacturer.

    b. Dates on which certification is received from the manufacturer and transmitted to the Engineer.

    c. Dates on which Shop Drawings are submitted to the Engineer and returned by the Engineer for revision.

    d. Dates on which Shop Drawings are revised by manufacturer and resubmitted to the Engineer.

    e. Date on which Shop Drawings are returned by Engineer annotated either "Furnish as Submitted" or "Furnish as Corrected".

    f. Date on which accepted Shop Drawings are transmitted to manufacturer.

    g. Date of manufacturer's scheduled delivery.

    h. Date on which delivery is actually made.

C. Working Drawings

1. Within thirty (30) days after the Notice to Proceed, each prime Contractor shall prepare and submit three (3) copies of his preliminary schedule of Working Drawing submittals to the Engineer for review and approval. If so required, the schedule shall be revised until it is approved by the Engineer.

2. Working Drawings include, but are not limited to, Shop Drawings, layout drawings in plan and elevation, installation drawings, etc. Contractor shall be responsible for securing all of the information, details, dimensions, Drawings, etc., necessary to prepare the Working Drawings required and necessary under this Contract and to fulfill all other requirements of his Contract. Contractor shall secure such information, details, Drawings, etc., from all possible sources including the Drawings, Working Drawings prepared by subcontractors, Engineers, suppliers, etc.

3. In the event that the Engineer is required to provide additional engineering services as a result of a substitution of materials or equipment by the Contractor, the additional services will be provided in accordance with Section 01010 - Summary of Work, and will be covered in supplementary or revised Drawings which will be issued to the Contractor. All changes indicated that are necessary to accommodate the equipment and appurtenances shall be incorporated into the Working Drawings submitted to the Engineer.

4. Shop Drawings

   a. Contractor shall submit for review by the Engineer Shop Drawings for all fabricated work and for all manufactured items required to be furnished by the Contract Documents. Shop Drawings shall be submitted to the Engineer via a secured file sharing server.

   b. Structural and all other layout Drawings prepared specifically for the Project shall have a plan scale of not less than 1/4-inch = 1 foot.

   c. The submitted documents shall provide information indicating that the materials are in conformance with the Technical Specifications and Contract Documents.

   d. Where manufacturer's publications in the form of catalogs, brochures, illustrations or other data sheets are submitted in lieu of prepared Shop Drawings, such submittals shall specifically indicate the item for which approval is requested. Identification of items shall be made in ink, and submittals showing only general information are not acceptable.

5. Contractor Responsibilities

   a. All submittals from subcontractors, manufacturers or suppliers shall be sent directly to the Contractor for checking. Contractor shall thoroughly check all Drawings for accuracy and conformance to the intent of the Contract Documents. Drawings found to be inaccurate or otherwise in error shall be returned to the subcontractors, manufacturers, or suppliers by the Contractor for correction before submitting them to the Engineer.

   b. All submittals shall be bound, dated, properly labeled and consecutively numbered. Information on the label shall indicate Specification Section, Drawing number, subcontractors', manufacturer's or supplier's name and the name or type of item the submittal covers. Each part of a submittal shall be marked and tabulated.

   c. Working Drawings shall be submitted as a single complete package including all associated drawings relating to a complete assembly of the various parts necessary for a complete unit or system.

d. Shop Drawings shall be submitted as a single complete package for any operating system and shall include all items of equipment and any mechanical units involved or necessary for the functioning of such system.

e. ALL SUBMITTALS SHALL BE THOROUGHLY CHECKED BY THE CONTRACTOR FOR ACCURACY AND CONFORMANCE TO THE INTENT OF THE CONTRACT DOCUMENTS BEFORE BEING SUBMITTED TO THE ENGINEER AND SHALL BEAR THE CONTRACTOR'S STAMP OF APPROVAL CERTIFYING THAT THEY HAVE BEEN SO CHECKED. SUBMITTALS WITHOUT THE CONTRACTOR'S STAMP OF APPROVAL WILL NOT BE REVIEWED BY THE ENGINEER AND WILL BE RETURNED TO THE CONTRACTOR. Any comments added to the drawings by the Contractor shall be done in green ink so as to denote any Contractor notes.

f. If the submittals contain any departures from the Contract Documents, specific mention thereof shall be made in the Contractor's letter of transmittal. Otherwise, the review of such submittals shall not constitute approval of the departure.

g. No materials shall be ordered, fabricated or shipped or any work performed until the Engineer returns to the Contractor the submittals, herein required, annotated either "Furnish as Submitted" or "Furnish as Corrected".

h. Where errors, deviations, and/or omissions are discovered at a later date in any of the submittals, the Engineer's prior review of the submittals does not relieve the Contractor of the responsibility for correcting all errors, deviations, and/or omissions.

6. Procedure for Review

a. Submittals shall be transmitted in sufficient time to allow the Engineer at least thirty (30) working days for review and processing.

b. Contractor shall transmit two (2) prints of each submittal to the Engineer for review for all Drawings greater than 11-inches by 17-inches in size, as well as six (6) copies of all other material. If electronic submittals are used, the Contractor shall transmit two (2) hardcopies of each submittal to the Engineer once the submittal has been reviewed. The submittals shall be placed onto a secured file sharing server.

c. Submittal shall be accompanied by a letter of transmittal, in duplicate, containing date, project title, Contractor's name, number and titles of submittals, notification of departures and any other pertinent data to facilitate review.

d. Submittals will be annotated by the Engineer in one of the following ways:
"Furnish as Submitted" - no exceptions are taken.

"Furnish as Corrected" - minor corrections are noted and shall be made.

"Revise and Resubmit" - major corrections are noted and a resubmittal is required.

"Rejected" - Based on the information submitted, the submission is not in conformance with the Contract Documents. The deviations from the Contract Documents are too numerous to list and a completely revised submission of the proposed equipment or a submission of other equipment is required.

e. If a submittal is satisfactory to the Engineer, the Engineer will annotate the submittal "Furnish as Submitted" or "Furnish as Corrected", retain four (4) copies and return remaining copies to the Contractor.

f. If a resubmittal is required, the Engineer will annotate the submittal "Revise and Resubmit" and transmit five (5) copies to the Contractor for appropriate action.

g. Contractor shall revise and resubmit submittals as required by the Engineer until submittals are acceptable to the Engineer. It is understood by the Contractor that Owner may charge the Contractor the Engineer's charges for review in the event a submittal is not approved (either "Furnish as Submitted" or "Furnish as Corrected") by the third submittal for a system or piece of equipment. These charges shall be for all costs associated with engineering review, meetings with the Contractor or manufacturer, etc., commencing with the fourth submittal of a system or type of equipment submitted for a particular Specification Section.

h. Acceptance of a Working Drawing by the Engineer will constitute acceptance of the subject matter for which the Drawing was submitted and not for any other structure, material, equipment, or appurtenances indicated or shown.

7. Engineer's Review

a. Engineer's review of the Contractor's submittals shall in no way relieve the Contractor of any of his responsibilities under the Contract. An acceptance of a submittal shall be interpreted to mean that the Engineer has no specific objections to the submitted material, subject to conformance with the Contract Drawings and Specifications. The Engineer will denote any notes in red ink so as to record his comments.

b. Engineer's review will be confined to general arrangement and compliance with the Contract Drawings and Specifications only, and will not be for the

purpose of checking dimensions, weights, clearances, fittings, tolerances, interferences, coordination of trades, etc.

8. Record Working Drawings

   a. Prior to final payment, the Contractor shall furnish the Engineer one complete set of all accepted Working Drawings, including Shop Drawings, for equipment, piping, electrical work, heating system, ventilating system, air conditioning system, instrumentation system, plumbing system, structural, interconnection wiring diagrams, etc.

   b. Manufacturer's publications, submitted in lieu of prepared Shop Drawings, will not be required in reproducible form. However, three (3) sets of such material shall be furnished by the Contractor to the Engineer.

   c. Working Drawings furnished shall be corrected to include any departures from previously accepted Drawings.

D. Construction Photographs

1. The General Contractor shall take photographs at the locations and at such stages of the construction as directed by the Engineer. Digital format shall be used. Provide all pictures for a given period on a CD or DVD.

2. Provide the equivalent of 36 different exposures per month for the duration of the Contract time. When directed by the Engineer, frequency of photographs may be increased to weekly sessions provided that the equivalent number of exposures is not exceeded. Engineer may waive requirements for photographs during inactive construction periods in favor of increased photographs during active construction sequences.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01320
PROGRESS SCHEDULES

PART 1 – GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

A. Scheduling Responsibilities:

1. In order to provide a definitive basis for determining job progress, a construction schedule of a type approved by the Owner will be used to monitor the project.

2. Each week the Contractor shall be responsible for preparing the schedule and updating it based on a tentative two week basis. It shall at all times remain the Contractor's responsibility to schedule and direct his forces in a manner that will allow for the completion of the work within the contractual period.

B. Construction Hours: see Section 01010 – Summary of Work – for construction working hours requirements.

C. Progress of the Work:

1. The work shall be started within ten (10) days following the Notice to Proceed and shall be executed with such progress as may be required to prevent delay to other Contractors or to the general completion of the project. The work shall be executed at such times and in or on such parts of the project, and with such forces, material and equipment, to assure completion of the work in the time established by the Contract.

2. The Contractor agrees that whenever it becomes apparent from the current monthly schedule update that delays have resulted and, hence, that the Contract completion date will not be met or when so directed by the Owner, he will take some or all of the following actions at no additional cost to the Owner:

a. Increase construction manpower in such quantities and crafts as will substantially eliminate the backlog of work.

b. Increase the number of working hours per shift, shifts per working day or days per week, the amount of construction equipment, or any combination of the foregoing to substantially eliminate the backlog of work.

c. Reschedule activities to achieve maximum practical concurrency of accomplishment of activities, and comply with the revised schedule.

d. The Contractor shall submit to the Owner or the Owner's representative for review a written statement of the steps he intends to take to remove or arrest the delay to the critical path in the accepted schedule.

1.02 CONSTRUCTION SCHEDULE

A. Within ten (10) calendar days of the Notice to Proceed, the Contractor shall submit to the Engineer five (5) copies of his proposed schedule. The schedule will be the subject of a schedule review meeting with the Contractor, the Engineer and the Owner or the Owner's representative within one (1) week of its submission. The Contractor will revise and resubmit the schedule until it is acceptable and accepted by the Owner or the Owner's representative.

1.03 CONTRACT COMPLETION TIME

A. Causes for Extensions:

1. The Contract completion time will be adjusted only for causes specified in this Contract. In the event the Contractor requests an extension of any Contract completion date, he shall furnish such justification and supporting evidence as the Owner or the Owner's representative may deem necessary for a determination as to whether the Contractor is entitled to an extension of time under the provisions of this Contract. The Owner, with the assistance of the Engineer, will, after receipt of such justification and supporting evidence, make findings of fact and will advise the Contractor in writing thereof.

B. Requests for Time Extension:

1. Each request for change in any Contract completion date shall be initially submitted to the Owner within the time frame stated in the General Conditions. All information known to the Contractor at that time concerning the nature and extent of the delay shall be transmitted to the Owner at that time. Within the time frame stated in the General Conditions but before the date of final payment under this Contract, all information as required above concerning the delay must be submitted to the Owner. No time extension will be granted for requests which are not submitted within the foregoing time limits.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01323
THIRD PARTY PROFESSIONAL PRE-CONSTRUCTION PHOTOGRAPHIC DOCUMENTATION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Procurement and Contracting Requirements, and General Requirements.

1.02 SUMMARY

A. Section Includes:

1. Photographic documentation.

1.03 PRICE AND PAYMENT PROCEDURES

A. Refer to Division 1 for general requirements for Allowances, Unit Prices, and Alternates.

1.04 PHOTOGRAPHIC AND VIDEO DOCUMENTATION VENDORS

A. Provide services from the following, or OWNER approved equal:

1. Multivista, Website: www.multivista.com, Email: m.rolfe@multivista.com, (614) 352-0555, 1001 Eastwind Drive, Suite 110, Westerville, Ohio 43081.

2. Self-performed pre-construction photographic documentation will not be accepted.

1.05 QUALITY ASSURANCE

A. Vendor Qualifications, General: Specialist (not the General Contractor or Construction Manager), experienced in construction photographic and video documentation for each type of equipment, technology, and service specified, carrying OSHA certifications, related insurance coverage(s), and other certification and clearances required for operations on the Project site, having a minimum of five years' experience engaged as a professional photographer/videographer of construction projects while using an advanced software platform, indexing system, and navigation interface, and having examples of at least 5 construction projects in the past 2 years of similar type, size, duration and complexity to this Project. Demonstrate the ability to contract through the project schedule. Must have a local office within 100 miles of the project site and be able to respond to site visit requests with qualified personnel within 24 hours of notice. Must respond to service and support requests/inquiries within 24 hours. Submit qualifications upon request.

1. In-House Software Programming And Development Team: Photographic and Video Documenter directly employs in-house software programming and development team to support, maintain, and when needed customize the software platform, online interface, mobile application, and BIM model integration services.

2. Attend Project meetings as required. Participate in any required project safety training.

1.06 PROJECT CONDITIONS

A. Verification for Photographic and Video Documentation, General:

1. Verify site conditions are acceptable for documentation work to proceed.

2. Notify Client of obstructions that impede documentation progress.

3. Verify necessity for access to neighboring properties and/or buildings, if any.

a. Notify Client of required access to neighboring property 7 calendar days prior to proceeding with field work.

1.07 PHOTOGRAPHIC AND VIDEO DOCUMENTATION, GENERAL

A. Single Source: Perform each type of documentation specified in this Section under a single Photographic and Video Documenter's responsibility, who meets the Vendor Qualifications specified in this Section's Quality Assurance Article.

B. Provide factual presentation. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.

C. Use overlapping photographic techniques to ensure maximum coverage, including 360 degrees of exterior and interior features, where applicable.

D. Identification for Each Photograph and Video:

1. Project name.

2. Orientation in Key Plan.

3. Date taken.

E. Milestone Documentation: Document conditions prior to each construction milestone, including but not limited to each of the following:

1. Site Existing Conditions:

a. Document site to limits of the Work as indicated on Contract Drawings, and immediately surrounding area.

b. Document access roads/properties, a minimum of 250' from the construction limits, and immediately surrounding areas.

F. Permanent Record: Provide offline, digital media copies of final standard photographic, video, and webcam documentation ("The Permanent Record") upon completion of the contract.

1. Permanent Record shall include the underlying software platform, indexing and navigation system, typically as a DVD flash drive or external hard drive. Include one multiple-user license for the underlying software, indexing and navigation for accessing the digital media.

2. Online access shall terminate upon delivery of the final documentation copies or as otherwise agreed by the Client.

3. Intellectual property rights associated with the documentation prepared in direct service of the Project shall transfer to the Client, along with the digital media itself.

G. Additional Types of Documentation: If requested by Client or Client's agent in writing, make proposal for additional documentation not covered in the scope of this Section. Provide such additional documentation if approved by written Change Order.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

THIS PAGE LEFT BLANK INTENTIONALLY

SECTION 01400
QUALITY CONTROL

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Testing Laboratory Services

1. Laboratory testing and checking required by the Specifications, including the cost of transporting all samples and test specimens, shall be provided and paid for by the Owner unless otherwise indicated in the Specifications.

2. Materials to be tested include, but are not necessarily limited to the following: cement, concrete aggregate, concrete, and reinforcing steel.

3. Tests required by the Owner shall not relieve the Contractor from the responsibility of supplying test results and certificates from manufacturers or suppliers to demonstrate conformance with the Specifications.

4. In place testing of compacted materials will be conducted as specified or recommended by Engineer.

5. Procedure

   a. The Contractor shall plan and conduct his operations to permit taking of field samples and test specimens, as required, and to allow adequate time for laboratory tests.

   b. The collection, field preparation and storage of field samples and test specimens shall be as directed by the Engineer with the cooperation of the Contractor.

6. Significance of Tests

   a. Test results shall be binding on both the Contractor and the Owner, and shall be considered irrefutable evidence of compliance or noncompliance with the Specification requirements, unless supplementary testing shall prove, to the satisfaction of the Owner, that the initial samples were not representative of actual conditions.

7. Supplementary and Other Testing

   a. Nothing shall restrict the Contractor from conducting tests he may require. Should the Contractor at any time request the Owner to consider such test results, the test reports shall be certified by an independent testing

laboratory acceptable to the Owner. Testing of this nature shall be conducted at the Contractor's expense.

1.02 IMPERFECT WORK OR MATERIALS

A. Any defective or imperfect work or materials furnished by the Contractor which is discovered before the final acceptance of the work, as established by the Certificate of Substantial Completion, or during the subsequent guarantee period, shall be removed immediately even though it may have been overlooked by the Engineer and estimated for payment. Any materials condemned or rejected by the Engineer shall be tagged as such and shall be immediately removed from the site. Satisfactory work or materials shall be substituted for that rejected.

B. The Engineer may order tests of imperfect or damaged work or materials to determine the required functional capability for possible acceptance, if there is no other reason for rejection. The cost of such tests shall be borne by the Contractor; and the nature, tester, extent and supervision of the tests will be as determined by the Engineer. If the results of the tests indicate that the required functional capability of the work or material was not impaired, consistent with the final general appearance of same, the work or materials may be deemed acceptable. If the results of such tests reveal that the required functional capability of the questionable work or materials has been impaired, then such work or materials shall be deemed imperfect and shall be replaced. The Contractor may elect to replace the imperfect work or material in lieu of performing the tests.

1.03 INSPECTION AND TESTS

A. The Contractor shall allow the Engineer ample time and opportunity for testing materials to be used in the work. He shall advise the Engineer promptly upon placing orders for material so that arrangements may be made, if desired, for inspection before shipment from the place of manufacture. The Contractor shall at all times furnish the Engineer and his representatives, facilities including labor, and allow proper time for inspecting and testing materials and workmanship. The Contractor must anticipate possible delays that may be caused in the execution of his work due to the necessity of materials being inspected and accepted for use. The Contractor shall furnish, at his own expense, all samples of materials required by the Engineer for testing, and shall make his own arrangements for providing water, electric power, or fuel for the various inspections and tests of structures and material.

B. Where other tests or analyses are specifically required in other Sections of these Specifications, the cost thereof shall be borne by the party (Owner or Contractor) so designated in such Sections. The Owner will bear the cost of all tests, inspections, or investigations undertaken by the order of the Engineer for the purpose of determining conformance with the Contract Documents if such tests, inspection, or investigations are not specifically required by the Contract Documents, and if conformance is ascertained thereby. Whenever nonconformance is determined by the Engineer as a result of such tests, inspections, or investigations, the Contractor shall bear the full cost thereof or shall reimburse the Owner for said cost. In this connection, the cost of any additional tests

and investigations, which are ordered by the Engineer to ascertain subsequent conformance with the Contract Documents, shall be borne by the Contractor.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

THIS PAGE LEFT BLANK INTENTIONALLY

SECTION 01510
TEMPORARY UTILITIES

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The General Contractor shall provide temporary sanitary facilities for the construction operations of this Contract. The temporary services shall be provided for use throughout the construction period.

B. Temporary Sanitary Service

1. Sanitary conveniences, in sufficient numbers, for the use of all persons employed on the work and properly screened from public observation, shall be provided and maintained at suitable locations by the General Contractor, all as prescribed by State Labor Regulations and local ordinances. The contents of same shall be removed and disposed of in a manner consistent with local and state regulations, as the occasion requires. Sanitary facilities shall be removed from the site when no longer required.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

THIS PAGE LEFT BLANK INTENTIONALLY

SECTION 01515
FIELD OFFICES

PART 1 – GENERAL

1.01 CONTRACTOR'S FIELD OFFICE

A. The Contractor shall establish and maintain a field office on this project and have available at the office a responsible representative who can officially receive communications from the Owner and the Engineer. The Contractor shall have one complete, up-to-date set of Drawings, Specifications and Contract Documents (including all Addenda and Change Orders) in this office at all times, available for reference at any time. The office shall be provided with telephone service, toilet facilities, light, air conditioning and heat; the cost of which shall be borne by the Contractor. Notices, instructions, orders, directions or other communications from the Engineer, left at this office, shall be considered as received by the Contractor.

B. Field office and utilities shall be in accordance with all applicable codes and ordinances.

1.02 RESIDENT REPRESENTATIVE'S FIELD OFFICE

A. No field office for the resident representative will be required.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

THIS PAGE LEFT BLANK INTENTIONALLY

SECTION 01520

MAINTENANCE OF UTILITY OPERATIONS DURING CONSTRUCTION

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The sanitary sewer system shall be maintained in continuous operation during the entire construction period of all Contracts as hereinafter specified. The intent of this section is to outline the minimum requirements necessary to provide continuous transference of wastewater throughout the construction period.

B. Work under each Contract shall be scheduled and conducted by each Contractor so as to not reduce the quality of near-by water streams or cause odor or other nuisance except as explicitly permitted hereinafter. In performing the work shown and specified, the Contractor shall plan and schedule his work to meet the plant and collection system operating requirements, and the constraints and construction requirements as outlined in this Section. No discharge of raw or inadequately treated wastewater shall be allowed. The Contractor shall pay all civil penalties, costs, and assessments associated with any discharge of raw or inadequately treated wastewater associated with the Contractor's work.

C. The General Contractor shall be responsible for coordinating the general construction and for ensuring that permanent or temporary power is available for all existing, proposed, and temporary facilities that are required to be online at any given time.

D. The Contractor has the option of providing additional temporary facilities that can eliminate a constraint, provided it is done without cost to the Owner and provided that all requirements of these Specifications are fulfilled and approved by the Engineer.

1.02 TEMPORARY BYPASS PUMPING

A. Requirements for this section shall apply to all pumping required for Contractor to perform tie-ins, shutdowns, etc. for construction of the work. Temporary bypass pumping shall be performed in accordance with this section unless noted otherwise herein. Temporary pumping system design calculations and equipment information shall be submitted for review by Engineer per Section 01300. Calculations shall be stamped by a professional engineer (PE).

B. Contractor shall furnish, install, maintain, and operate temporary bypass pumping facilities as required to complete the Work. Contractor shall be responsible for all construction necessary to accommodate pumps and piping including but not limited to structure modifications, pump base construction, pipe supports, etc.

C. The Contractor shall perform a test run of the bypass pumping set-up before being allowed to continue with the full-scale bypass pumping.

D. Contractor shall design the temporary bypass pumping facilities to convey flows from the upstream manholes where existing manhole or sewer tie-ins, replacement, or modifications will be conducted in a manner that will prevent backup of the existing system.

E. All tie-ins, replacement, or modifications shall be performed during low flow conditions.

F. All tie-ins, replacement, or modifications Work shall be accomplished as quickly as possible. If Work required extends beyond 8-hours or weather causes higher flows in the existing system during the Work, the new Work shall be stopped and the existing system shall be placed back into service. The new Work shall be properly protected from damage. Any damage to the new Work or damage to surrounding areas caused by the new Work shall be repaired or replaced at the Owner's decision by the Contractor at the Contractor's sole expense.

G. Contractor shall provide all power, fuel, maintenance materials, parts, and other expendables in order to maintain temporary pumping through the duration of the Work.

H. Contractor shall provide one standby pump equal in capacity to the largest pump installed. If temporary pumping requires non-identical pumps in series, a standby pump of each type shall be provided. Temporary control system shall start standby pump on high level and dial-out to local contact who will respond and be on-site within an hour to check and address problem. High-high level shall also alarm and dial-out indicating that standby pump is not maintaining level. Temporary pumping system shall be provided by company that has spare pumps ready to be delivered and installed locally if problems occur.

I. Contractor shall provide standby power or 48-hour on-site fuel storage capacity for diesel engine type pumps to ensure continuous operation at all times.

J. Contractor shall provide sound attenuation for temporary pumping facilities to limit noise levels to no more than 85 dBA at a distance of 21 feet from the noise source.

K. Temporary pumping system shall remain fully operational until all modifications are complete and approved by Owner or Engineer.

L. Following successful completion of the new Work, Contractor shall remove all temporary pumps, piping and appurtenances and restore area and/or structures to original condition prior to start of work.

M. Contractor shall prepare Temporary Bypass Plan and submit to Owner and Engineer at pre-construction conference for review and approval.

N. Contractor shall reconnect to existing gravity sewer at the end of each day, weather delay, or completion of Work so that bypass pumping does <u>not</u> occur when not on jobsite. Overnight bypass pumping will only be allowed when directed by Engineer and Owner.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

THIS PAGE LEFT BLANK INTENTIONALLY

SECTION 01530
PROTECTION OF EXISTING FACILITIES

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Contractor shall be responsible for the preservation and protection of property adjacent to the work site against damage or injury as a result of his operations under this Contract. Any damage or injury occurring on account of any act, omission or neglect on the part of the Contractor shall be restored in a proper and satisfactory manner or replaced by and at the expense of the Contractor to an equal or superior condition than previously existed.

B. Contractor shall comply promptly with such safety regulations as may be prescribed by the Owner or the local authorities having jurisdiction and shall, when so directed, properly correct any unsafe conditions created by, or unsafe practices on the part of, his employees. In the event of the Contractor's failure to comply, the Owner may take the necessary measures to correct the conditions or practices complained of, and all costs thereof will be deducted from any monies due the Contractor. Failure of the Engineer to direct the correction of unsafe conditions or practices shall not relieve the Contractor of his responsibility hereunder.

C. In the event of any claims for damage or alleged damage to property as a result of work under this Contract, the Contractor shall be responsible for all costs in connection with the settlement of or defense against such claims. Prior to commencement of work in the vicinity of property adjacent to the work site, the Contractor, at his own expense, shall take such surveys as may be necessary to establish the existing condition of the property. Before final payment can be made, the Contractor shall furnish satisfactory evidence that all claims for damage have been legally settled or sufficient funds to cover such claims have been placed in escrow, or that an adequate bond to cover such claims has been obtained.

1.02 PROTECTION OF WORK AND MATERIAL

A. During the progress of the work and up to the date of final payment, the Contractor shall be solely responsible for the care and protection of all work and materials covered by the Contract.

B. All work and materials shall be protected against damage, injury or loss from any cause whatsoever, and the Contractor shall make good any such damage or loss at his own expense. Protection measures shall be subject to the approval of the Engineer.

1.03 EXISTING UTILITIES AND APPURTENANT STRUCTURES

A. The term existing utilities shall be deemed to refer to both publicly-owned and privately-owned utilities such as electric power and lighting, telephone, water, gas, storm drains, sanitary sewers and all appurtenant structures.

B. Where existing utilities and structures are indicated on the Drawings, it shall be understood that all of the existing utilities and structures affecting the work may not be shown and that the locations of those shown are approximate only. It shall be the responsibility of the Contractor to ascertain the actual extent and exact location of existing utilities and structures. In every instance, the Contractor shall notify the proper authority having jurisdiction and obtain all necessary directions and approvals before performing any work in the vicinity of existing utilities.

C. Prior to beginning any excavation work, the Contractor shall, through field investigations, determine any conflicts or interferences between existing utilities and new utilities to be constructed under this project. This determination shall be based on the actual locations, elevations, slopes, etc., of existing utilities as determined in the field investigations, and locations, elevation, slope, or other information of new utilities as shown on the Drawings. If an interference exists, the Contractor shall bring it to the attention of the Engineer as soon as possible. If the Engineer agrees that an interference exists, he shall develop a plan to address the interference as required, and obtain the Owner's approval. Additional costs to the Contractor for this change shall be processed through a Change Order as detailed elsewhere in these Contract Documents. In the event the Contractor fails to bring a potential conflict or interference to the attention of the Engineer prior to beginning excavation work, any actual conflict or interference which does arise during the Project shall be corrected by the Contractor, as directed by the Engineer, at no additional expense to the Owner.

D. The work shall be carried out in a manner to prevent disruption of existing services and to avoid damage to the existing utilities. Temporary connections shall be provided, as required, to insure uninterruption of existing services. Any damage resulting from the work of this Contract shall be promptly repaired by the Contractor at his own expense in a manner approved by the Engineer and further subject to the requirements of any authority having jurisdiction. Where it is required by the authority having jurisdiction that they perform their own repairs or have them done by others, the Contractor shall be responsible for all costs thereof.

E. Where excavations by the Contractor require any utility lines or appurtenant structures to be temporarily supported and otherwise protected during the construction work, such support and protection shall be provided by the Contractor. All such work shall be performed in a manner satisfactory to the Engineer and the respective authority having jurisdiction over such work. In the event the Contractor fails to provide proper support or protection to any existing utility, the Engineer may, at his discretion, have the respective authority to provide such support or protection as may be necessary to insure the safety of such utility, and the costs of such measures shall be paid by the Contractor. This is not a pay item.

1.04 DOCUMENTATION OF EXISTING STRUCTURES

A. The term existing structures shall be deemed to refer to both publicly-owned and privately-owned buildings, structures, and other facilities on the ground surface and any foundations or extensions below the ground surface.

B. Prior to beginning any excavation work in close proximity to existing structures, the Contractor shall complete a Pre-Construction Survey to assess the condition of existing structures surrounding the work site. The survey must be performed a maximum of 7 days prior to excavation and submitted to the Engineer and Owner.

C. Documentation for the Pre-Construction Survey shall be provided as photographs, videos, and report forms to document each structure. Prior to the Pre-Construction Survey, the construction limits must be flagged. Take photographs and video to show existing conditions adjacent to property and to show existing buildings either on or adjoining property to accurately record physical conditions. Include video and photographs of the visible foundation and wall of the buildings, both inside and outside of each structure. Any existing deformities or cracks must be clearly documented in the video and photographs, and shall be documented from different vantage points.

D. All photographs and videos shall be digital and provided on compact disc (CD), digital video disc (DVD), or flash drive. Digital photographs and videos shall be time and date stamped. See Section 01010 for additional video requirements.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

THIS PAGE LEFT BLANK INTENTIONALLY

SECTION 01531
TREE AND PLANT PROTECTION

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall be responsible for the protection of existing trees, shrubs, and plants on or adjacent to the work site that are shown or designated to remain in place by the Owner against unnecessary cutting, breaking, or skinning of trunk, branches, bark, or roots. Any damaged trees and plants that die or suffer permanent injury on account of any act, omission, or neglect on the part of the Contractor shall be removed when ordered by the Engineer and replaced by a specimen of equal or better quality at the expense of the Contractor.

1.02 PROTECTION OF TREES AND PLANTS

A. The term DBH (Diameter at Breast Height) shall be deemed to refer to the total cross sectional diameter in inches of a tree measured at a height of four and one-half (4 ½) feet.

B. The term Tree Protection Area (TPA) shall be deemed to refer to the circular area surrounding a tree of which the center is the center of the bole of the tree and the radial measurement is one (1) foot per inch up to twenty-four (24) inches DBH and 1.5 feet per inch DBH or trees over twenty-four (24) inches DBH or a lesser distance provided it will not adversely affect the health of protected tree(s).

C. All areas designated for existing tree preservation by the Engineer shall be protected during construction activity. The Contractor is responsible for furnishing, installation, maintenance and removal of orange plastic fencing at least four (4) feet tall attached to metal "tee" posts, securely driven into the ground, and attaching tree protection signage (12" x 18" aluminum sign, provided by LFUCG DWQ) to the "tee" posts at twenty-five (25) foot intervals. Maintenance of the fence, and surrounding area, shall cover repairs to fence, posts or signs, and grass and weed cutting, as required, for the duration of the project. Tree protection fencing shall be placed for a minimum of three (3) weeks before any construction traffic occurs under or near significant trees.

D. No vehicles, construction materials, equipment, fuel, or temporary or permanent earth fill shall be placed within a TPA. There shall not be any movement of any vehicles into nor within a TPA. No nails, rope, cable, signs, or fencing is to be attached to a tree within a TPA.

E. Fires shall not be permitted under or adjacent to trees and plants.

F. The Contractor shall contact the Division of Environmental Services (DES) 2 weeks prior to needing their root protection services and prior to construction traffic/excavation under

or near significant trees. The Contractor will not be allowed to proceed with their work if the roots have not been properly cut by DES. Failure to notify DES 2 weeks prior to work in the area shall not be grounds for additional contract time. All exposed roots shall be covered with earth as soon as possible. The Contractor shall protect root systems from mechanical damage and damage by erosion, flooding, run-off or noxious materials in solution.

G. If branches or trunks are damaged, it is the responsibility of the Contractor to prune branches immediately and protect the cut or damaged areas with emulsified asphalt compounded specifically for horticultural use in a manner approved by the Engineer.

PART 2 – PRODUCT (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01540

DEMOLITION AND REMOVAL OF EXISTING STRUCTURES AND EQUIPMENT

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. This Section covers the demolition, removal, and disposal of structures, pavement, curbs, sidewalk, and any existing equipment. The Contractor shall furnish all labor, materials and equipment to demolish and remove structures and equipment designated to be removed on Drawings.

1.02 TITLE TO EQUIPMENT AND MATERIALS

A. Contractor shall have no right or title to any of the equipment, materials or other items to be removed from the existing structures unless authorized by Owner.

1.03 CONDITION OF STRUCTURES AND EQUIPMENT

A. The Owner does not assume responsibility for the actual condition of structures and equipment to be demolished and removed.

PART 2 – PRODUCTS (NOT USED)

PART 3 – PART 3 - EXECUTION

3.01 DEMOLITION AND REMOVALS

A. The removal of all equipment and piping, and all materials from the demolition of structures shall, when released by the Owner and Engineer, be done by the Contractor and become the Contractor's property, unless otherwise noted, for disposition in any manner not contrary to the Contract requirements and shall be removed from the site to the Contractor's own place of disposal.

B. Any equipment piping and appurtenances removed without proper authorization, which are necessary for the operation of the existing facilities shall be replaced to the satisfaction of the Engineer at no cost to the Owner.

C. Excavation caused by demolitions shall be backfilled with fill free from rubbish and debris.

D. All materials removed by demolition or excavation shall be lawfully and properly handled and disposed according to applicable local, state, and federal laws. Where materials shall be disposed at landfill, manifests and documentation shall be provided to Owner showing / documenting that materials have been properly handled and disposed.

E. Manhole frames and covers that have been removed shall become the property of the Contractor and shall be disposed on in a legal manner.

END OF SECTION

SECTION 01550
SITE ACCESS AND STORAGE

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Access Roads

1. The General Contractor shall construct and maintain such temporary access roads as required to perform the work of this Contract.

2. Access roads shall be located within the property lines of the Owner unless the Contractor independently secures easements for his use and convenience. Contractor shall submit written documentation to the Engineer for any Contractor secured easements across privately held property. Easement agreement shall specify terms and conditions of use and provisions for site restoration. A written release from the property owner certifying that all terms of the easement agreement have been complied by the Contractor shall be furnished to the Engineer prior to final payment.

3. Existing access roads used by the Contractor shall be suitably maintained by the Contractor at his expense during construction. Contractor shall not be permitted to restrict Owner access to existing facilities. Engineer may direct Contractor to perform maintenance of existing access roads when Engineer determines that such work is required to insure all weather access by the Owner.

4. The Contractor will maintain the primary roads to be free of mud and dirt. All mud and dirt carried from the access roads to the primary roads shall be washed and cleaned.

5. The Contractor shall obtain and pay all cost associated with any bonds required by the Kentucky Department of Transportation for the use of State maintained roads.

B. Parking Areas

1. Each Contractor shall construct and maintain suitable parking areas for his construction personnel on the project site where approved by the Engineer and the Owner.

C. Restoration

1. At the completion of the Work, the surfaces of land used for access roads and parking areas shall be restored by the Contractor to its original condition and to the satisfaction of the Engineer.

D. Traffic Regulations

1. Contractor shall obey all traffic laws and comply with all the requirements, rules and regulations of the Kentucky Transportation Cabinet, LFUCG, and other local authorities having jurisdiction to maintain adequate warning signs, lights, barriers, etc., for the protection of traffic on public roadways.

E. Storage of Equipment and Materials

1. Contractor shall store his equipment and materials at the job site in accordance with the requirements of the Contract Documents, and as hereinafter specified. All equipment and materials shall be stored in accordance with manufacturer's recommendations and as directed by the Owner or Engineer, and in conformity to applicable statutes, ordinances, regulations and rulings of the public authority having jurisdiction.

2. Contractor shall secure a site for staging area and material storage, including portable restroom facilities. Contractor shall not store materials or encroach upon private property without the written consent of the owners of such private property. Use of public lands must be with the written approval of the Owner.

3. Contractor shall not store unnecessary materials or equipment on the job site, and shall take care to prevent any structure from being loaded with a weight which will endanger its security or the safety of persons.

4. Materials shall not be placed within ten (10) feet of fire hydrants. Gutters, drainage channels and inlets shall be kept unobstructed at all times.

5. Contractor shall provide adequate temporary storage buildings/facilities, if required, to protect materials or equipment on the job site.

6. Contractor shall provide Engineer with copy of agreement with property owner of staging area. Contractor will be responsible for all restoration. Agreement between Contractor and property owner shall include language holding the Owner harmless from responsibility and liability.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01560
TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 – GENERAL

1.01 GENERAL

A. Provide and maintain equipment and temporary construction, as necessary to provide controls over environmental and safety conditions at the construction site and adjacent areas. Remove physical evidence of temporary facilities at completion of Work.

B. Prohibited Construction Activities:

1. Dumping/disposing of excess or unsuitable excavated material in wetlands or floodplains, even with the permission of the property owner.

2. Locating stockpile storage areas in environmentally sensitive areas.

3. Indiscriminate, arbitrary, or capricious operation of equipment in any stream corridors, any wetlands, any surface waters, or outside the construction limits.

4. Pumping of sediment-laden water from trenches or other excavations directly into any surface waters, any stream corridors, any wetlands, or storm sewers; all such water will be properly filtered or settled to remove silt prior to release.

5. Discharging pollutants such as chemicals, fuels, lubricants, bituminous materials, raw sewage and other harmful waste into or alongside of rivers, streams, impoundments, or into natural or manmade channels leading thereto.

6. Permanent or unspecified alteration of the flow line of any stream.

7. Damaging vegetation outside of the construction area.

8. Disposal of trees, brush, and other debris in any stream corridors, any wetlands, any surface waters, or at unspecified locations.

9. Open burning of project debris without a permit.

10. Discharging injurious silica dust concentrations into the atmosphere resulting from breaking, cutting, chipping, drilling, buffing, grinding, polishing, shaping or surfacing closer than 200 feet to places of residences or commercial, professional, quasi-public or public places of human occupation.

11. Storing construction equipment and vehicles and/or stockpiling construction materials on property, public or private, not previously authorized for such purposes as noted in Section 01550.

12. Running well point or pump discharge lines through private property or public property and rights-of-way without an easement or the written permission of the property owner and the consent of the ENGINEER.

13. Non-compliance with the Contractor's, OSHA's, or the Owner's safety requirements.

14. Operations entailing the use of vibratory hammers or compactors outside the hours listed in Section 01010 - Summary of Work, or outside the hours allowed for construction by local ordinances or regulations.

1.02 SAFETY ADVISORY

A. Scope: Sewer Installation

1. Maintaining jobsite safety

2. Maintaining traffic safety

B. LFUCG-funded projects have a contractual and legal obligation for performance and breech of contract in regard to the safety of all exposed personnel. Reference the Occupational Safety Health Administration (OSHA) Multi Employer Citation Policy: Multi-employer Worksites, The Creating Employer, The Exposing Employer, The Correcting Employer, The Controlling Employer, Multiple Roles.

C. The Contractor shall at all times conduct the work safely in order to assure a safe work site. The Contractor shall be responsible for the safety of the Contractor's employees, agents and subcontractors, Owner's personnel and all other personnel or persons at the work site. The Contractor shall be responsible for the adequacy and safety of all construction methods or procedures and the safe prosecution of the work.

D. The Contractor shall be responsible at all times to conduct the work and keep the work site in compliance with federal, state, and local safety Laws and Regulations, including but not limited to Occupational Safety and Health (OSHA) requirements. This includes shaft drilling operations, concrete moving and placement, confined space entry requirements for trench construction, including use of a trench box or other shoring to support trench walls and proper means of exit from an excavation.

E. The Contractor shall have an authorized and competent safety representative as defined above on the work site at frequent and regular intervals, or more often, as conditions require. Failure to have such a person at the site as specified herein constitutes an unsafe practice.

F. The Contractor shall be responsible to suspend Work whenever a Work method or procedure or condition at work site is unsafe.

G. The Contractor shall submit a written notification to the Owner of any accident or injury. Such notification shall include the Contractor's investigation and what measures are

appropriate to avoid such accidents. Payment applications will not be authorized until such notice is provided.

H. Failure of the Contractor to comply with any provision of this Specification section or the Owner's safety requirements or any federal, state or local safety Laws and Regulations constitute just cause for the Owner to order suspension of Work.

I. None of the provisions of the section are intended to, nor shall be construed to, create any duty or responsibility on the Owner or Engineer to provide or enforce safety requirements of the Contractor. The duty, responsibility, and liability for safety shall remain with the Contractor.

1.03 AIR POLLUTION AND NOISE CONTROL

A. Contractor's vehicles and equipment shall be such as to minimize noise to the greatest degree practicable. Noise levels shall conform to the latest OSHA standards and in no case will noise levels be permitted which interfere with the work of the Owner or others.

1. Construction activities will be limited to hours specified in Section 01010 – Summary of Work.

2. Construction equipment will be provided with intake silencers and mufflers, as required by safety standards.

3. All construction vehicles should be equipped with proper emissions control equipment.

4. Periodically check equipment and machinery for proper tuning to minimize exhaust emissions and noise.

1.04 DUST CONTROL

A. Contractor shall be responsible for controlling objectionable dust caused by his operation of vehicles and equipment, clearing or for any reason whatever. Contractor shall apply water or use other methods subject to the Engineer's approval which will keep dust in the air to a minimum. Dust control measures shall be implemented multiple times throughout each working day if necessary.

1.05 PEST AND RODENT CONTROL

A. Provide rodent and pest control as necessary to prevent infestation of construction or storage area.

1. Employ methods and use materials which will not adversely affect conditions at the site or on adjoining properties.

1.06 WATER CONTROL

A. Contractor shall comply with the Storm Water Pollution Prevention Plan (SWPPP) approved by LFUCG.

B. Provide methods to control surface water and water from excavations and structures to prevent damage to the Work, the site, or adjoining properties.

C. Provide, operate and maintain equipment and facilities of adequate size to control surface water.

D. Dispose of drainage water in a manner to prevent flooding, erosion, or other damage to any portion of the site or to adjoining areas and in conformance with all environmental requirements.

1.07 POLLUTION CONTROL

A. Provide methods, means and facilities required to prevent contamination of soil, water or atmosphere by the discharge of noxious substances from construction operations.

B. Provide equipment and personnel, perform emergency measures required to contain any spillages, and to remove contaminated soils or liquids.

1. Excavate and dispose of any contaminated earth offsite, and replace with suitable compacted fill and topsoil.

C. Take special measures to prevent harmful substances from entering public waters.

1. Prevent disposal of wastes, effluents, chemicals, or other such substances adjacent to streams, or in sanitary or storm sewers.

D. Provide systems for control of atmospheric pollutants.

1. Prevent toxic concentrations of chemicals.

2. Prevent harmful dispersal of pollutants into the atmosphere.

E. All Contractor's equipment used during construction shall conform to all current federal, state and local laws and regulations.

1.08 EROSION AND SEDIMENT CONTROL

A. See Section 02370 for erosion and sediment control requirements.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

THIS PAGE LEFT BLANK INTENTIONALLY

SECTION 01580
PROJECT IDENTIFICATION AND SIGNS

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall provide signs near the site of the Work. The sign shall set forth the description of the Work and the names of the Owner, Engineer, and Contractor.

PART 2 – PRODUCTS

2.01 IDENTIFICATION SIGN

A. Basic design shall be as shown in the sample on page 01580-2 below, and shall include at a minimum the names of the Project, the Owner, the Contractor, and the Engineer. This sign shall be 3' x 6' and provided and installed by the Contractor.

B. "Working Hard" sign (as shown on page 01580-3) shall be provided by the Owner and mounted and installed by the Contractor. Contractor shall provide posts and backing.

C. Colors shall be as selected by the Engineer.

D. Number Required: 2

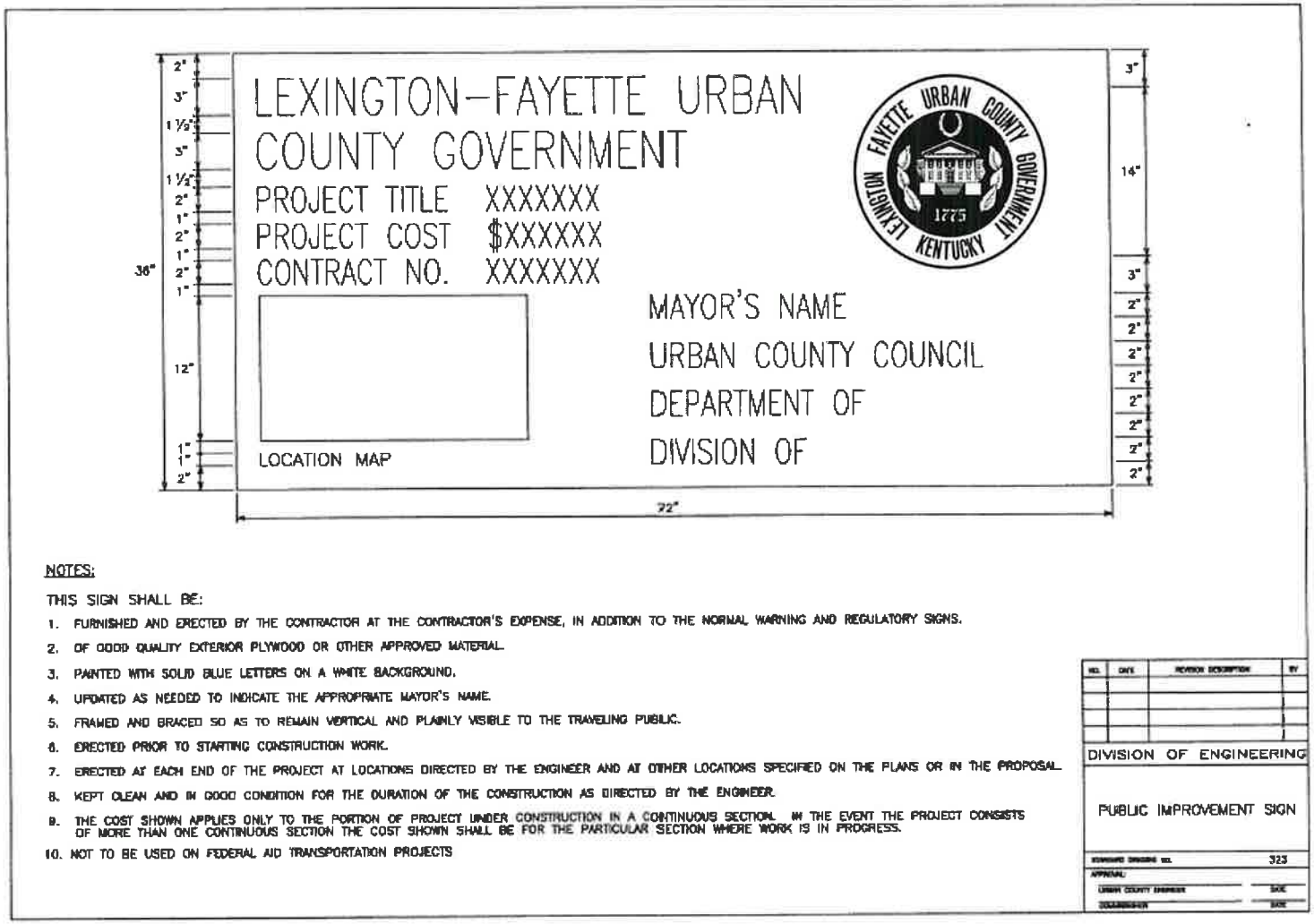
PART 3 – EXECUTION

3.01 INSTALLATIONS

A. Signs shall be installed at locations specified by the Engineer and installed in accordance with the detail below.

3.02 MAINTENANCE

A. The signs shall be maintained in good condition until the completion of the Project and then removed by the Contractor.



NOTES:

THIS SIGN SHALL BE:

1. FURNISHED AND ERECTED BY THE CONTRACTOR AT THE CONTRACTOR'S EXPENSE, IN ADDITION TO THE NORMAL WARNING AND REGULATORY SIGNS.
2. OF GOOD QUALITY EXTERIOR PLYWOOD OR OTHER APPROVED MATERIAL.
3. PAINTED WITH SOLID BLUE LETTERS ON A WHITE BACKGROUND.
4. UPDATED AS NEEDED TO INDICATE THE APPROPRIATE MAYOR'S NAME.
5. FRAMED AND BRACED SO AS TO REMAIN VERTICAL AND PLAINLY VISIBLE TO THE TRAVELING PUBLIC.
6. ERECTED PRIOR TO STARTING CONSTRUCTION WORK.
7. ERECTED AT EACH END OF THE PROJECT AT LOCATIONS DIRECTED BY THE ENGINEER AND AT OTHER LOCATIONS SPECIFIED ON THE PLANS OR IN THE PROPOSAL.
8. KEPT CLEAN AND IN GOOD CONDITION FOR THE DURATION OF THE CONSTRUCTION AS DIRECTED BY THE ENGINEER.
9. THE COST SHOWN APPLIES ONLY TO THE PORTION OF PROJECT UNDER CONSTRUCTION IN A CONTINUOUS SECTION. IN THE EVENT THE PROJECT CONSISTS OF MORE THAN ONE CONTINUOUS SECTION THE COST SHOWN SHALL BE FOR THE PARTICULAR SECTION WHERE WORK IS IN PROGRESS.
10. NOT TO BE USED ON FEDERAL AID TRANSPORTATION PROJECTS

NO.	DATE	REVISION DESCRIPTION	BY

DIVISION OF ENGINEERING

PUBLIC IMPROVEMENT SIGN

STANDARD DRAWING NO. 323

APPROVAL:

URBAN COUNTY ENGINEER _____ DATE _____

DIRECTOR _____ DATE _____

END OF SECTION

THIS PAGE LEFT BLANK INTENTIONALLY

SECTION 01631
PRODUCTS AND SUBSTITUTIONS

PART 1 – GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

A. General: Substitution of materials and/or equipment is defined in the General Conditions and more fully hereinafter.

B. Substitutions: The Contractor's requests for changes in the products, materials, equipment and methods of construction required by the Contract Documents are considered requests for "substitutions", and are subject to the requirements specified herein. The following are not considered as substitutions:

1. Revisions to the Contract Documents, where requested by the Owner and Engineer are considered as "changes" not substitutions.

2. Substitutions requested during the bidding period, which have been accepted prior to the Contract Date, are included in the Contract Documents and are not subject to the requirements for substitutions as herein specified.

3. Specified Contractor options on products and construction methods included in the Contract Documents are choices available to the Contractor and are not subject to the requirements for substitutions as herein specified.

4. Except as otherwise provided in the Contract Documents, the Contractor's determination of and compliance with governing regulations and orders as issued by governing authorities do not constitute "substitutions" and do not constitute a basis for change orders.

1.02 SUBMITTALS

A. The information required to be furnished for evaluation of product substitution will be as follows:

1. Performance capabilities, and materials and construction details will be evaluated based upon conformance with the Specifications. Products that do not conform with the Specification shall not be accepted.

2. Manufacturer's production and service capabilities, and evidence of proven reliability will be acceptable if the following is furnished.

a. Written evidence that the manufacturer has not less than (3) years' experience in the design and manufacture of the substitute product.

b. Written evidence of at least one application, of a type and size similar to the proposed substitute product, in successful operation in a wastewater treatment plant or collection system for a period of at least one year.

c. In lieu of furnishing evidence of a manufacturer's Experience and successful operation of an application of the product to be substituted, the Contractor has the option of furnishing a cash deposit or bond which will guarantee replacement if the product the furnished does not satisfy the other requirements specified in this section. The amount of each deposit or bond will be subject to the approval.

3. Specific reference to characteristics either superior or inferior to specified requirements will be evaluated based on their net effect on the project. Products with any characteristics inferior to those specified will not be acceptable unless offset by characteristics that, in the opinion of the Engineer, will cause the overall effect of the product on the project to be at least equal to that of those specified.

1.03 QUALITY ASSURANCE

A. Source Limitations: To the fullest extent possible, provide products of the same generic kind, from a single source, for each unit of work.

B. Compatibility of Options: Compatibility of products is a basic requirement of product selection. When the Contractor is given the option of selecting between two or more products for use on the project, the product selected must be compatible with other products previously selected, even if the products previously selected were also Contractor options. The complete compatibility between the various choices available to the Contractor is not assured by the various requirements of the Contract Documents, but must be provided by the Contractor.

C. The detailed estimate of operating and maintenance costs will be evaluated based on comparison with similar data on the specified products. Proposed substitute products which have an operating and maintenance cost that, in the opinion of the Engineer, exceeds that of the specified products will not be considered equal and will not be acceptable.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: Deliver, store, and handle products in accordance with manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft. Control delivery schedules to minimize long-term storage at the site and to prevent overcrowding of construction spaces. In particular coordinate delivery and installation to ensure minimum holding or storage times for items known or recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other sources of loss.

1. Deliver products to the site in the manufacturer's sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.

2. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.

3. Store heavy materials away from the project construction in a manner that will not endanger the supporting construction.

PART 2 – PRODUCTS

2.01 GENERAL PRODUCT COMPLIANCE

A. General: Requirements for individual products are indicated in the Contract Documents; compliance with these requirements is in itself a Contract Requirement. These requirements may be specified in any one of several different specifying methods, or in any combination of these methods. These methods include the following:

1. Proprietary

2. Descriptive

3. Performance

4. Compliance with Reference Standards

    a. Compliance with codes, compliance with graphic details and similar provisions of the Contract Documents also have a bearing on the review and approval outcome.

B. Procedures for Selecting Products: Contractor's options in selecting products are limited by requirements of the Contract Documents and governing regulations. They are not controlled by industry traditions or procedures experienced by the Contractor on previous construction projects.

2.02 SUBSTITUTIONS

A. Conditions: Contractor's request for substitution will be received and considered when extensive revisions to the Contract Documents are not required, when the proposed changes are in keeping with the general intent of the Contract Documents, when the request is timely, fully documented and properly submitted, and when one or more of the following conditions is satisfied, all as judged by the Engineer; otherwise the requests will be returned without action except to record non-compliance with these requirements.

1. The Engineer will consider a request for substitution where the request is directly related to an "or equal" clause or similar language in the Contract Documents.

2. The Engineer will consider a request for substitution where the specified product or method cannot be provided within the Contract Time. However, the request will not be considered if the product or method cannot be provided as a result of the Contractor's failure to pursue the work promptly or to coordinate the various activities properly.

3. The Engineer will consider a request for substitution where the specified product or method cannot receive necessary approval by a governing authority, and the requested substitution can be approved.

4. The Engineer will consider a request for a substitution where a substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. These additional responsibilities may include such considerations as additional compensation to the Engineer for redesign and evaluation services, the increased cost of other work by the Owner or separate contractors, and similar considerations.

5. The Engineer will consider a request for substitution when the specified product or method cannot be provided in a manner which is compatible with other materials of the work, and where the Contractor certifies that the substitution will overcome the incompatibility.

6. The Engineer will consider a request for substitution when the specified product or method cannot be properly coordinated with other materials in the work, and where the Contractor certifies that the proposed substitution can be properly coordinated.

7. The Engineer will consider a request for substitution when the specified product or method cannot receive a warranty as required by the Contract Documents and where the Contractor certifies that the proposed substitution receive the required warranty.

8. The Contractor shall reimburse the Owner any costs for review by the Engineer of proposed product substitutions which require major design changes, as determined by the Owner, to related or adjacent work made necessary by the proposed substitutions.

B. Work-Related Submittals: Contractor's submittal of and the Engineer's acceptance of shop drawings, product data or samples which relate to work not complying with requirements of the Contract Documents, does not constitute an acceptable or valid request for a substitution, nor approval thereof.

2.03 GENERAL PRODUCT REQUIREMENTS

A. General: Provide products that comply with the requirements of the Contract Documents and that are undamaged and, unless otherwise indicated, unused at the time of

installation. Provide products that are complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.

1. Standard Products: Where they are available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

2. Continued Availability: Where, because of the nature of its application, the Owner is likely to need replacement parts or additional amounts of a product at a later date, either for maintenance and repair or replacement, provide standard, foreign or domestically produced products for which the manufacturer has published assurances that the products and its parts are likely to be available to the Owner at a later date. Domestically produced products are preferred, but not required.

PART 3 – EXECUTION

3.01 INSTALLATION OF PRODUCTS

A. General: Except as otherwise indicated in individual sections of these Specifications, comply with the manufacturer's instructions and recommendations for installation of the products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other work. Clean exposed surfaces and protect surfaces as necessary to ensure freedom from damage and deterioration at Time of Acceptance.

END OF SECTION

THIS PAGE LEFT BLANK INTENTIONALLY

SECTION 01731
CUTTING AND PATCHING

PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. The Contractor shall be responsible for all cutting, fitting or patching that may be required to complete the work or to make its parts fit together properly.

C. The Contractor shall not damage or endanger any portion of the Work or the Work of the Owner or any separate contractors by cutting, patching or otherwise altering any work, or by excavation.

D. Any cutting of existing structures or facilities shall be approved in advance by Owner or Engineer. Approval shall not impact Contractor's full liability for any damage caused.

1.02 QUALITY ASSURANCE

A. Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that result in increased maintenance or decreased operational life or safety.

1.03 WARRANTY

A. Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 – PRODUCTS

2.01 MATERIALS

A. General: Comply with requirements specified in other Sections of these Specifications.

B. Existing Materials: Use materials identical to existing materials, to the extent practicable.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the functional performance of existing materials.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

3.02 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

3.03 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.

5. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

END OF SECTION

THIS PAGE LEFT BLANK INTENTIONALLY

SECTION 01740
CLEANING

PART 1 – GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

A. Maintain premises free from accumulations of waste, debris, and rubbish.

B. At completion of work, remove waste materials, rubbish, tools, equipment, machinery and surplus materials, and clean all exposed surfaces. Leave project clean and ready for occupancy.

1.02 RELATED DOCUMENTS

A. Cutting and Patching: Section 01731.

B. Project Closeout: Section 01770.

C. Cleaning for Specific Products of Work: Specification Section for that work.

1.03 SAFETY REQUIREMENTS

A. Hazards Control:

1. Store volatile wastes in covered metal containers and remove from premises daily.

2. Prevent accumulation of wastes which create hazardous conditions.

3. Provide adequate ventilation during use of volatile noxious substances.

B. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.

1. Do not burn or bury rubbish and waste materials on project site.

2. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.

3. Do not dispose of wastes into streams or waterways.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

B. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 – EXECUTION

3.01 DURING CONSTRUCTION

A. Execute cleaning to ensure that building, grounds, and public properties are maintained free from accumulations of waste materials and rubbish.

B. Wet down dry materials and rubbish to lay dust and prevent blowing dust.

C. At reasonable intervals during progress of work, clean site and public properties, and dispose of waste materials, debris and rubbish.

D. Provide on-site containers for collection of waste materials, debris, and rubbish.

E. Remove waste materials, debris and rubbish from site and legally dispose of at public or private dumping areas off Owner's property.

F. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.

G. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.

3.02 FINAL CLEANING

A. Employ experienced workmen, or professional cleaners, for final cleaning.

B. In preparation for substantial completion or occupancy, conduct final inspection of sight-exposed interior and exterior surfaces, and of concealed spaces.

C. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials, from sight-exposed interior or exterior finished surfaces; polish surfaces so designated to shine finish.

D. Repair, patch and touch up marred surfaces to specified finish, to match adjacent surfaces.

E. Broom clean paved surfaces; rake clean other surfaces of grounds.

F. Maintain cleaning until project, or portion thereof, is occupied by Owner.

END OF SECTION

THIS PAGE LEFT BLANK INTENTIONALLY

SECTION 01770
PROJECT CLOSEOUT

PART 1 – GENERAL

1.01 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Liquidated Damages: Supplemental General Conditions

B. Cleaning: Section 01740.

C. Project Record Documents: Section 01785.

1.02 SUBSTANTIAL COMPLETION

A. In order to initiate project closeout procedures, the Contractor shall submit the following:

1. Written certification to Engineer that project is Substantially Complete.

2. List of major items to be completed or corrected.

B. Engineer will make an inspection within seven (7) days after receipt of certification, together with Owner's Representative.

C. Should Engineer consider that work is Substantially Complete:

1. Contractor shall prepare, and submit to Engineer, a list of items to be completed or corrected, as determined by the inspection.

2. Engineer will prepare and issue a Certificate of Substantial Completion, containing:

a. Date of Substantial Completion.

b. Contractor's list of items to be completed or corrected, verified and amended by Engineer.

c. The time within which Contractor shall complete or correct work of listed items.

d. Time and date Owner will assume possession of work or designated portion thereof.

e. Responsibilities of Owner and Contractor for:

1) Insurance

2) Utilities

3) Operation of Mechanical, Electrical, and Other Systems.

4) Maintenance and Cleaning.

5) Security.

f. Signatures of:

1) Engineer

2) Contractor

3) Owner

3. Owner occupancy of Project or Designated Portion of Project:

a. Contractor shall:

1) Obtain certificate of occupancy.

2) Perform final cleaning in accordance with Section 01740.

b. Owner will occupy Project, under provisions stated in Certificates of Substantial Completion.

4. Contractor: Complete work listed for completion or correction, within designated time.

D. Should Engineer consider that work is not Substantially Complete:

1. Engineer shall immediately notify Contractor, in writing, stating reasons.

2. Contractor: Complete work, and send second written certification to Engineer, certifying that Project or designated portion of Project is substantially complete.

3. Engineer will reinspect work.

E. Should Engineer consider that work is still not finally complete:

1. Engineer shall notify Contractor, in writing, stating reasons.

2. Contractor shall take immediate steps to remedy the stated deficiencies, and send third written notice to the Engineer certifying that the work is complete.

3. Engineer and Owner will reinspect work at Contractor's expense.

1.03 FINAL INSPECTION

A. Contractor shall submit written certification that:

1. Contract Documents have been reviewed.

2. Project has been inspected for compliance with Contract Documents.

3. Work has been completed in accordance with Contract Documents.

4. Equipment and systems have been tested in presence of Owner's Representative and are operational.

5. Project is completed, and ready for final inspection.

B. Engineer will make final inspection within seven (7) days after receipt of certification.

C. Should Engineer consider that work is finally complete in accordance with requirements of Contract Documents, he shall request Contractor to make Project Closeout submittals.

D. Should Engineer consider that work is not finally complete:

1. Engineer shall notify Contractor in writing, stating reasons.

2. Contractor shall take immediate steps to remedy the stated deficiencies and send second written notice to Engineer certifying that work is complete.

3. Engineer will reinspect work.

1.04 CLOSEOUT SUBMITTALS

A. Project Record Documents: To requirements of Section 01785.

B. Guarantees, Warranties and Bonds: To requirements of particular technical Specifications and Section 01782.

C. Project Closeout Checklist: Contractor shall submit all required items to the Engineer and/or Owner with their responsibility identified. See Project Closeout Checklist included in this section.

1.05 INSTRUCTION

A. Instruct Owner's personnel in operation of all systems, mechanical, electrical, and other equipment.

1.06 FINAL APPLICATION FOR PAYMENT

A. Contractor shall submit final applications in accordance with requirements of General Conditions.

1.07 FINAL CERTIFICATE FOR PAYMENT

A. Engineer will issue final certificate in accordance with provisions of general conditions.

B. Should final completion be materially delayed through no fault of Contractor, Engineer may issue a Semi-Final Certificate for Payment.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 PROJECT CLOSEOUT CHECKLIST

A. See attached Project Closeout Checklist.

RMP Project Closeout Checklist

DWQ Project Manager (DWQ PM): Bob Peterson, PE

RMP Project Manager (RMP PM):

Engineer of Record (EOR):

Contractor:

File Manager: Diann Williams

Project Name:

Legend
EOR
Contractor
DWQ PM
RMP PM

	Task	From	To	CC	Complete/ Submitted	Approved	Closeout Requirement
	Contract Administration Closeout Checklist						
1	Plan of Operation (Pump Station and Wet Weather Storage Projects Only)	EOR	DWQ PM				Copy of plan to file (plan will include description of facility, how it was design to work, etc] DWQ PM will provide copy to Pump Station Maintenance or Plant Staff
2	Manufacturer's Startup (Pump Station and Wet Weather Storage Projects Only)	EOR	DWQ PM				Report from EOR/Manufacturer with date of startup
3	Training (Pump Station and Wet Weather Storage Projects Only)	Contractor	LFUCG Staff				Letter or email from EOR with attendees to file
4	Startup with LFUCG (Pump Station and Wet Weather Storage Projects Only)	Contractor	EOR / LFUCG Staff				Letter or email from EOR with date of startup and attendees to file
5	Deliver copies of CCTV Logs	Contractor	EOR/DWQ PM				Hard Copies in File
6	Declaration of Beneficial Occupancy (Consent Decree Compliance)	EOR	DWQ PM	File Manager			Memo from EOR to file
7	Request for Substantial Completion and Punchlist	Contractor	EOR	File Manager			Memo from Contractor to file
8	Verify all easements requirements (as listed in the MOU) have been satisfied	EOR	DWQ PM	Contractor			EOR Memo to File
9	~~Obtain Property Owner signatures acknowledging easement requirements have been satisfied~~	~~EOR~~	~~DWQ PM~~		n/a		~~Copies of all releases to file~~
10	EOR coordinates final inspection and prepares *Punchlist*	EOR	Contractor	DWQ PM			Punchlist to file
11	Recommendation of release of retainage (less 200% of remaining work estimate)	EOR	DWQ PM	File Manager			Memo from EOR to file
12	Release of retainage less 200% of remaining work estimate	DWQ PM	Contractor	EOR			Pay app to file
13	Prepare Final Adjusting Change Order	EOR	DWQ PM	RMP PM			EOR Memo to File
14	Distribution of final adjusting Change Order for signature	EOR	Contractor, RMP PM				Copy of signed final change order
15	(Upon completion of punchlist) Letter requesting final pay and release of all retainage. Must include:	Contractor	EOR	DWQ PM			Letter to file
16	*DBE Utilization Report*	Contractor	EOR	DWQ PM			EOR Document to File
17	*Waiver of Release, Claims, and Liens*	Contractor	EOR	DWQ PM			EOR Document to File
18	*Warranty Bond*	Contractor	EOR	DWQ PM			EOR Document to File
19	Recommendation for final pay and release of all retainage	EOR	DWQ PM	Contractor			EOR Memo to file
20	Final Pay Application	Contractor	EOR	DWQ PM			Final Pay App to file
21	Recommendation for project acceptance and initiation of warranty period	EOR	DWQ PM	RMP PM			EOR Memo to file
22	Release of ESC Bonds	DWQ PM	Contractor	EOR			Copy to file
23	Release of Performance Bond	DWQ PM	Contractor	EOR			Copy to file
24	Release of Payment Bond	DWQ PM	Contractor	EOR			Copy to file

Notes

END OF SECTION

THIS PAGE LEFT BLANK INTENTIONALLY

SECTION 01782
WARRANTIES AND BONDS

PART 1 – GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

A. Compile specified warranties and bonds.

B. Compile specified service and maintenance contracts.

C. Co-execute submittals when so specified.

D. Review submittals to verify compliance with Contract Documents.

E. Submit to Engineer for review and transmittal to Owner.

1.02 RELATED DOCUMENTS

A. Bid Bond: Instructions to Bidders.

B. Performance and Payment Bonds: General Conditions and Supplemental General Conditions.

C. Guaranty: General Conditions and Supplemental General Conditions.

D. General Warranty of Construction: General Conditions.

E. Project Closeout: Section 01770.

F. Warranties and Bonds required for specific products: As listed herein.

G. Provisions of Warranties and Bonds, Duration: Respective specification sections for particular products.

1.03 SUBMITTALS REQUIREMENTS

A. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers and subcontractors.

B. Furnish two (2) original signed copies.

C. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.

1. Product, equipment or work item.

2. Firm name, address and telephone number.

3. Scope

4. Date of beginning of warranty, bond or service and maintenance contract.

5. Duration of warranty, bond or service and maintenance contract.

6. Provide information for Owner's personnel:

   a. Proper procedure in case of failure.

   b. Instances which might affect the validity of warranty or bond.

7. Contractor name, address and telephone number.

1.04 FORM OF SUBMITTALS

A. Prepare in duplicate packets.

B. Format:

1. Size 8-1/2 in. x 11 in., punch sheets for 3-ring binder.

   a. Fold larger sheets to fit into binders.

2. Cover: Identify each packet with typed or printed title "WARRANTIES AND BONDS." List:

   a. Title of Project

   b. Name of Contractor

C. Binders: Commercial quality, three-ring, with durable and cleanable plastic covers.

1.05 TIME OF SUBMITTALS

A. For equipment or component parts of equipment put into service during progress of construction:

1. Submit documents within 10 days after inspection and acceptance.

B. Otherwise make submittals within 10 days after date of substantial completion, prior to final request for payment.

C. For items of work, where acceptance is delayed materially beyond the Date of Substantial Completion, provide updated submittal within 10 days after acceptance, listing the date of acceptance as the start of the warranty period.

1.06 SUBMITTALS REQUIRED

A. Submit warranties, bonds (see section 00600), service and maintenance contracts as specified in the respective sections of the Specifications.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

THIS PAGE LEFT BLANK INTENTIONALLY

SECTION 01785
PROJECT RECORD DOCUMENTS

PART 1 – GENERAL

1.01 MAINTENANCE OF DOCUMENTS

A. Maintain at job site, one copy of:

1. Contract Drawings
2. Specifications
3. Addenda
4. Reviewed Shop Drawings
5. Change Orders
6. Other Modifications to Contract

B. Store documents in approved location, apart from documents used for construction.

C. Provide files and racks for storage of documents.

D. Maintain documents in clean, dry, legible condition.

E. Do not use record documents for construction purposes.

F. Make documents available at all times for inspection by Engineer and Owner.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 01300.

1.03 MARKING DEVICES

A. Provide colored pencil or felt-tip marking pen for all marking.

1.04 RECORDING

A. Label each document "PROJECT RECORD" in 2-inch high printed letters.

B. Keep record documents current.

C. Do not permanently conceal any work until required information has been recorded.

D. Contract Drawings: Legibly mark to record actual construction:

1. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.

2. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.

3. Field changes of dimension and detail.

4. Changes made by Change Order or Field Order.

5. Details not on original Contract Drawings.

E. Specifications and Addenda: Legibly mark up each section to record:

1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.

2. Changes made by Change Order or Field Order.

3. Other matters not originally specified.

F. Shop Drawings: Maintain as record documents; legibly annotate shop drawings to record changes made after review.

1.05 SUBMITTALS

A. At completion of project, deliver two hard copies and one CD with pdf of all record documents to Engineer.

B. Accompany submittal with transmittal letter, in duplicate, containing:

1. Date.

2. Project Title and Number.

3. Contractor's Name and Address.

4. Title and Number of each Record Document.

5. Certification that each Document as Submitted is Complete and Accurate.

6. Signature of Contractor, or His Authorized Representative.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

THIS PAGE LEFT BLANK INTENTIONALLY

SECTION 02100
CLEARING, GRUBBING, AND SITE PREPARATION

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Includes all labor, material, and equipment required for the complete execution of the proposed construction work as shown on the Drawings and specified herein.

B. Principal items of work include:

1. Notifying all authorities owning utility lines running to or on the property. Protecting and maintaining all utility lines to remain and capping those that are not required in accordance with instructions of the Utility Companies, and all other authorities having jurisdiction.

2. Clearing the site within the Temporary Construction Easement, including removal of grass, brush, shrubs, trees, loose debris and other encumbrances except for trees marked to remain.

3. Boxing and protecting all trees, shrubs, lawns and the like within areas to be preserved. Relocating trees and shrubs, so indicated on the Drawings, to designated areas.

4. Repairing all injury to trees, shrubs, and other plants caused by site preparation operations shall be repaired immediately. Work shall be done by qualified personnel in accordance with standard horticultural practice and as approved by the Engineer.

5. Removing topsoil to its full depth from designated areas and stockpiling on site where approved by the Engineer for future use.

6. Disposing from the site all debris resulting from work under this Section.

1.02 STREET AND ROAD BLOCKAGE

A. Closing of streets and roads during progress of the work shall be in compliance with the requirements of the Owner and other authorities having jurisdiction. Access shall be provided to all facilities remaining in operation.

1.03 PROTECTION OF PERSONS AND PROPERTY

A. All work shall be performed in such a manner to protect all personnel, workmen, pedestrians and adjacent property and structures from possible injury and damage.

B. All conduits, wires, cables and appurtenances above or below ground shall be protected from damage.

C. Provide warning and barrier fence where shown on the Drawings and as specified herein.

PART 2 – EXECUTION

2.01 CLEARING OF SITE

A. Before removal of topsoil, and start of trenching for utility installation, the areas within the Temporary Construction Easement shall be cleared and grubbed.

B. Clearing shall consist of cutting, removal, and satisfactory disposal of all trees, fallen timber, brush, bushes, rubbish, sanitary landfill material, fencing, and other perishable and objectionable material within the areas to be excavated or other designated areas.

C. Excavation resulting from the removal of trees, roots and the like shall be filled with suitable material, as approved by the Engineer, and thoroughly compacted to ensure stability.

D. Unless otherwise shown or specified, the Contractor shall clear and grub a strip at least 15 ft. wide along all permanent fence lines installed under this Contract.

E. In temporary construction easement locations, only those trees and shrubs shall be removed which are in actual interference with excavation or grading work under this Contract, and removal shall be subject to approval by the Engineer. However, the Engineer reserves the right to order additional trees and shrubs removed at no additional cost to the Owner, if such, in their opinion, are too close to the work to be maintained or have become damaged due to the Contractor's operations.

F. All clearing, and grubbing is incidental to this pay item unless specifically called out in the plans.

2.02 STRIPPING AND STOCKPILING EXISTING TOPSOIL

A. Existing topsoil and sod on the site within areas designated on the Drawings shall be stripped to whatever depth it may occur and stored in locations directed by the Engineer.

B. The topsoil shall be free of stones, roots, brush, rubbish, or other unsuitable materials before stockpiling the topsoil.

C. Care shall be taken not to contaminate the stockpiled topsoil with any unsuitable materials.

2.03 GRUBBING

A. Grubbing shall consist of the removal and disposal of all stumps, roots, logs, sticks and other perishable materials to a minimum depth of 6-inches below ground surfaces.

B. Large stumps located in areas to be excavated may be removed during grading operations, subject to the approval of the Engineer.

2.04 DISPOSAL OF MATERIAL

A. All debris resulting from the clearing and grubbing work shall be disposed of by the Contractor as part of the work of this Contract. Material designated by the Engineer to be salvaged shall be stored on the construction site as directed by the Engineer for reuse in this Project or removal by others.

B. Burning of any debris resulting from the clearing and grubbing work will not be permitted at the site.

2.05 WARNING AND BARRIER FENCE

A. The fence shall be made of a visible, lightweight, flexible, high strength polyethylene material. The fence shall be MIRASAFE as manufactured by Mirafi, Inc., or equal.

B. Physical Properties

Fence:

Color:	International Orange
Roll Size:	4' x 164'
Roll weight:	34 lbs.
Mesh opening:	1-1/2" x 3"

Posts:

ASTM Designation:	ASTM 702
Length:	5 feet long (T-Type)
Weight:	1.25 #/Foot (min)
Area of Anchor Plate:	14 Sq. In.

C. Drive posts 12 to 18 inches into ground every 10' to 12'. Wrap fence material around first terminal post allowing overlap of one material opening. Use metal tie wire or plastic tie wrap to fasten material to itself at top, middle and bottom. At final post, cut with utility knife or scissors at a point halfway across an opening. Wrap around and tie at final post in the same way as the first post.

D. Use tie wire or tie wrap at intermediate posts and splices as well. Thread ties around a vertical member of the fence material and the post and bind tightly against the post. For the most secure fastening, tie at top, middle and bottom. Overlap splices a minimum of four fence openings, tie as above, fastening both edges of the fence material splice overlap.

END OF SECTION

SECTION 02222
EXCAVATION FOR TUNNEL SHAFTS

PART 1 – GENERAL

1.01 SCOPE

A. The work described by this Section consists of furnishing all labor, materials, equipment and supplies as required to construct launching and exit shafts associated with tunnel construction.

B. Work shall be done in strict accordance with the Contract Documents, and in accordance with all Federal, State and local laws, regulations, and requirements.

C. All available and known geotechnical reports, logs, borings, and laboratory testing performed within close proximity of the project corridor have been made available as "technical data" and are not part of the Contract Documents. This is provided as information only and solely for the convenience of Bidders. The Owner and/or the Engineer do not warrant or guarantee the accuracy or correctness of this material with respect to actual subsurface conditions. Subsurface conditions are considered unclassified and no expectation of quantity, specific location of ground conditions, or geotechnical baselines are provided or assumed herein.

D. For all shafts defined under this Section, Contractor shall excavate and support of excavation using techniques and methods selected by the Contractor that are appropriate for prevailing ground conditions. Contractor shall review all available geotechnical reports and data and perform any additional subsurface investigations they deem necessary at their own expense for the planning and the selection of shaft construction techniques and methods in order to enable proper construction as shown on the Drawings and other requirements of the Contract Documents.

E. Shaft installation techniques and methods of construction shall include all equipment, materials, and selection of associated support of excavation best suited for ground conditions, as required to maintain face stability, reduce wear, advance heading within line and grade tolerances, transport spoils, and accomplish productivity assumed in Bid.

F. Where warranted in the experience of the Contractor or where identified on the Drawings, ground modification shall be provided as part of the appropriate preparation for tunneling activities to reduce risk of surface settlement and heaving, protect nearby structures and utilities, and successfully install the piping system within line and grade tolerances. Contractor shall design and include in their Bid the furnishing of all labor, equipment, materials, and supplies necessary for ground stabilization by jet grouting, compaction grouting, void filling, soil mixing, slurry walls or other ground modification technologies to meet project objectives specified herein.

G. Dewatering shall be controlled such that the launching and exit shafts are free of water, but the surrounding groundwater table is not substantially lowered such that settlement along the tunnel drive or nearby existing structures and foundations does not occur.

H. The Contractor shall furnish all labor, equipment, and material required to complete the work including but not limited to the following:

1. Initial support system and all related components.

2. Spoil transportation, removal, and disposal.

3. Safety and security.

4. Hoisting and lifting.

5. Control equipment and required power.

6. Launching and exit shafts construction including, but not limited to, rehandling and disposal of unsuitable and excess materials, control of groundwater and surface water, utility adjustment/supports, tests, excavation, sheeting and shoring, shaft wall thrust blocking, backfilling, cleanup, and restoration of surface features, and all other work necessary for construction as specified and/or shown on the Drawings.

I. Follow all OSHA regulations regarding tunnel construction including but not limited to OSHA 29 CFR Part 1926. Obtain all permits required associated with OSHA regulations and requirements for confined space entry.

J. Conform with all requirements of the Kentucky Transportation Cabinet (KYTC) for work within their rights-of-way.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 02225 – Excavation, Backfilling and Compaction for Sewers

B. Section 02441 – Tunneling by Slurry Microtunnel Boring Machine

C. Section 02442 – Tunneling by Tunnel Boring Machine

D. Section 02444 – Tunneling by Pipe Jacking with Shield Method

E. Section 02445 – Utility Hand Tunneling

F. Section 02446 – Tunneling by Guided Bore and Jack Method

G. Tunneling Method Table in Project Specific Notes (PSN)

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of the other requirements of the Specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. Applicable codes, ordinances, statutes and governing rules and regulations of governing municipalities and counties, the Commonwealth of Kentucky, and the Federal Government.

2. American Association of State Highway and Transportation Officials (AASHTO).

3. American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual for Railway Engineering.

4. Occupational Safety and Health Administration (OSHA) Regulations and Standards for Underground Construction 29 CFR Part 1926, subpart S and other applicable OSHA parts.

5. Applicable ASTM and AWWA Standards for materials and methods.

6. Kentucky Transportation Cabinet (KYTC) Permit Guidance Manual

7. All applicable guidelines and restrictions of the United States Army Corps of Engineers (USACE) and Department of Environmental Protection (DEP).

1.04 DEFINITIONS

A. Unless otherwise stated or context otherwise requires, the definitions and provisions contained in this section shall govern the construction, meaning, and application of words and phrases utilized in this specification. For purposes of this specification, the following terms are defined as follows:

1. Exit Shaft or Retrieval Shaft: Shaft utilized for retrieval of tunneling equipment.

2. Ground Modification: soil stabilization by jet grouting, compaction grouting, void filling, soil mixing, slurry walls, or other ground stabilization technologies to meet project objectives specified herein.

3. Support of Excavation: The support system selected, designed and installed by Contractor to support launching shafts, exit shafts, and rescue shafts.

4. Launching Shaft or Entrance Shaft: Shaft utilized at the start of the tunneling operation.

5. Rescue Shaft: Shaft utilized to access tunneling equipment for repair or removal of obstruction.

6. Spoil: Excavated soil and bedrock material that has been generated by the shaft construction process.

1.05 DESIGN CRITERIA

A. The Contractor is responsible for the design, installation, maintenance and safety of the shaft's excavation and its support of excavation. All design calculations provided by the Contractor as part of the required submittals shall be sealed by a Licensed Professional Engineer registered in the Commonwealth of Kentucky.

1.06 SUBMITTALS

A. Conform to Section 01300 – Submittals.

B. Detailed shaft construction methodology sufficient to convey the following:

1. Proposed method of shaft excavation and support of excavation system

2. Drawings and design details for launching and exit shafts, indicating number required, proposed spacing, criteria for installing, and method of operation.

3. Number and duration of shifts planned to be worked each day in accordance with restrictions on work hours.

4. Sequence of work/operations.

5. Procedures for handling, control and disposal of surface water, and groundwater inflow.

6. Method of spoil transportation, surface storage, and disposal location. A description indicating the locations of material disposal sites and releases from property owners.

7. Survey methods and proposed procedures for alignment and grade control.

8. Identification of critical utility crossings and special precautions proposed.

C. Ground Modification Plan: Contractor shall design and submit proposed ground modification strategies for review and acceptance including soils stabilization methods and surface settlement prevention plan for areas adjacent to shafts.

D. Ventilation Plan. Provide shaft ventilation plan. Ventilation plan to include a written description, calculations, drawings, fan curves, and manufacturer's catalogue cut sheets. Ventilation plan shall be designed by a competent person with at least five (5) years of recent on-the-job experience on similar projects, involving shafts of similar size constructed by similar methods. Provide qualifications of Designer.

E. Settlement Monitoring Plan and Site Assessment:

1. Submit a settlement monitoring plan for review prior to construction. The plan shall be in accordance with Article 3.03.

F. Daily Reports. A shift log shall be maintained on a daily basis by Contractor. Submit reports no later than 24 hours after the end of the shift to the Engineer. Daily reports shall include at a minimum the following:

1. Details of shaft excavation progress.

2. Hours worked per shift, equipment and materials used, and the duration of different activities performed.

3. Groundwater control operations, groundwater inflow location and rates.

4. Observation of any lost ground or other ground movement.

5. Any unusual conditions or events.

6. Reasons for operational shutdown whenever construction is halted.

7. Air quality reports for dust, toxic and hazardous gases, and other atmospheric impurities in the working environment.

G. Record Drawings: Maintain at construction site a complete set of field drawings for recording of as-built conditions. All marks and notes shall be dated and thorough.

H. Permits: The Contractor shall be responsible for executing the requirements of permits obtained from the KYTC, United States Army Corps of Engineers, and any State and local authority where the project is located. The Contractor shall be responsible for any phase submittals required by the permits. All submittal information required by the project permits shall be channeled through the Engineer.

1.07 QUALIFICATIONS

A. The Contractor or Subcontractor performing shaft construction must demonstrate in writing that he has requisite past project experience constructing shafts similar to those for this Project.

B. The Contractor or Subcontractor shall have the following minimum experience related to shaft construction:

1. A minimum of five (5) years of experience performing utility tunneling with shafts of similar size.

2. Three (3) tunnel projects with shafts of similar size and depth completed within the last 10 years.

1.08 QUALITY ASSURANCE

A. Work shall be supervised by at least one (1) person with five (5) years of recent previous experience in shaft and tunnel construction. Experience shall be in a minimum of five (5) previous tunneling projects of similar size and scope.

B. All shaft excavation and support operations shall be performed under the supervision of experienced shift foremen with at least five (5) years of recent on-the-job supervision experience on similar projects involving shafts of similar size constructed using similar methods.

C. Operators shall be experienced in shaft excavation and support with prior knowledge and ability to properly operate the systems being employed. All operators shall have minimum of five (5) years' experience on shaft construction of similar size.

1.09 PRE-INSTALLATION MEETING

A. At least three weeks prior to commencing the work of this section, convene a Pre-Installation Meeting at the job site to be attended by:

1. Contractor and any sub-contractor performing any related work.

2. Project Owner.

3. Engineer.

4. Any other pertinent stakeholders.

B. Meeting shall cover settlement monitoring, work hours, safety, staging and storage of materials, schedule, any changes to on-site staff from original Work Plan submittal, permitting, and the development of record drawings, etc. to ensure successful implementation of all requirements of this specification during shaft construction.

1.10 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall accept material on site and inspect for damage.

B. The Contractor shall handle, support and store materials to prevent injury or damage.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Conduct operations to not interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

B. Conduct operations to not interfere with roadway traffic, except with prior approval by the Kentucky Transportation Cabinet (KYTC) (where applicable), Lexington-Fayette Urban County Government, and the Owner.

C. Provide temporary facilities to prevent erosion of disturbed construction area in accordance with the approved Erosion & Sedimentation Control Plan and Contract Documents.

D. Maintain existing stormwater flow patterns or submit measures to temporarily bypass in accordance with the Erosion & Sedimentation Control Plan and Contract Documents.

1.12 COORDINATION

A. Coordinate work with local, State, and Federal authorities and utility owners to avoid interference with or damage to existing facilities in or adjacent to construction areas.

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 shall be in serviceable conditions.

B. Structural Steel: ASTM A 36.

C. Steel Sheet Piles: ASTM A 328.

D. Timber Lagging: Any species, rough-cut, mixed hardwood, nominal three inches thick.

E. Portable Steel Trench Box shall be OSHA approved.

PART 3 – EXECUTION

3.01 PROJECT SITE CONDITIONS

A. Shaft construction shall not begin until the following have been completed:

1. Required submittals have been made and the Engineer has reviewed and accepted all submittals.

2. Notify the Owner and Engineer at least 14 days before beginning any excavation.

3. Installation of ground modification, if required.

4. Groundwater control, if required.

5. A Safety Officer has been designated and prepared a Health and Safety Plan in accordance with OSHA requirements for tunnel construction. The Safety Officer shall have held safety meetings and provided safety instruction for new employees as required by OSHA.

6. Pre-Installation Meeting has been held and all comments have been addressed from the meeting.

7. Settlement monitoring system is in place and pre-construction readings have been provided to the Engineer.

8. Pre-construction survey documents have been submitted to the Engineer.

B. Perform shaft construction to the extent indicated on the Drawings so as not to interfere with, interrupt or endanger surface activity thereon, and minimize subsidence of surface, structures, and utilities. Roadway, utilities, and/or structures damaged by shaft construction operations shall be repaired or replaced as necessary to restore them to their condition prior to beginning shaft construction in a timely manner, unless otherwise directed by the Engineer, at no additional cost to Owner.

C. Furnish all necessary equipment, power, water, and utilities for shaft construction, removal and disposal of spoil, grouting, and other associated work required for the Contractor's methods of construction.

D. Promptly clean up, remove, and dispose of all spoil.

E. Furnish all maintenance of traffic and establish and maintain all safety procedures on any highways whose thoroughfare is interrupted due to the tunneling operation.

F. Inspect the locations where shaft construction will be conducted, verify conditions under which the work will be performed, and provide all necessary details, whether shown or specified on the Drawings or not, for the orderly prosecution of the Work.

3.02 PREPARATION

A. Existing utilities shown on Drawings are shown for general information only. Contractor shall verify locations, sizes, and configurations of existing utility systems within potential conflict of installation operations.

B. Complete any required testing, inspection, surveying, etc., of any existing utilities required by the Contract Documents.

C. Call Local Utility Line Locate Service (811) not less than five working days before performing Work.

D. Request underground utilities to be located and marked within and surrounding the construction areas.

E. Locate, identify, and protect utilities indicated to remain from damage.

F. Protection

1. Protect plant life, lawns, rock outcroppings and other features remaining as portion of final landscaping.

2. Protect benchmarks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic. Repair or replace all items damaged during construction.

3. Repair or replace structures raised more than 0.50-inch due to shaft construction operations including pavement and sidewalk.

G. Ventilation

1. Furnish and operate a temporary ventilation system and air monitoring system in accordance with the approved ventilation plan and conforming to the requirements of OSHA at all times that personnel are present in the shaft. Operate and maintain a ventilation system that provides a sufficient supply of fresh air and maintains an atmosphere free of toxic or flammable gases in all underground work areas.

2. Before any personnel enters the shaft, the air quality must be tested and verified that the OSHA requirements pertaining to air quality are met or exceeded.

H. Barricades

1. Protect shafts and other open excavations with barricades and security fencing as indicated on the Drawings and with additional measures approved by the Engineer and Owner as required to prevent unauthorized personnel from accessing.

2. During non-work hours, isolate with additional measures approved by the Engineer and Owner as required to prevent unauthorized personnel from accessing.

3. Remove equipment daily from vehicular and pedestrian roads, sidewalk, and pathways not contained within the direct work area to permit access and use by public.

3.03 SETTLEMENT MONITORING

A. The Contractor will be held solely responsible for damages to highway and street surfaces, railroads, pavements, structures, structural embankments, sidewalks, curbing, and public utilities resulting from subsidence, failure of support of excavation system, or ground losses and for the refilling of voids with grout. Where such ground losses are so severe that they result in damage to surface pavement, existing utilities or structures, the Contractor shall be solely responsible for remedying such damage.

B. As a minimum, surface monitoring points shall be established consisting of settlement markers to detect surface movement of roadways and pavements.

C. Survey the site showing locations and elevations of existing ground, pavement, and other permanent features to establish a baseline for existing conditions adjacent to each

shaft. All surveying performed for settlement monitoring shall be performed by a Professional Land Surveyor licensed in the Commonwealth of Kentucky at the Contractors expense.

D. Surface settlement marks:

1. Surface settlement markers shall be located adjacent to each shaft as designed by the Contractor and approved by the Engineer.

E. All markers/points shall be surveyed as follows:

1. Prior to beginning any work.

2. Every 24 hours by the licensed surveyor during shaft construction.

3. At the completion of shaft construction.

4. The same points shall also be surveyed 90 days after the work is completed and both shafts have been backfilled.

F. Ground Surface Movement:

1. Shaft construction shall be performed to prevent settlement and loss of ground.

2. Unless more stringent requirements are set forth by third party agencies, settlement of the ground surface shall not exceed 0.25-inch.

3. If the ground subsidence exceeds 0.25-inch, shaft construction operations shall stop, and remedial measures approved by the Engineer shall be implemented.

4. If any movement or settlement occurs which causes or might cause damage to an existing structure over, along or adjacent to the work, immediately stop any or all work except that which assists in making the work secure and in preventing further movement, settlement, or damage. Resume shaft construction only after all necessary precautions have been taken to prevent further movement, settlement, or damage, and repair the damage at the Contractor's expense and to the satisfaction of the Engineer.

G. Lateral Displacements: Unless more stringent requirements are set forth by third party agencies, lateral movement or deflection of shaft excavation support system shall be limited to 0.50-inch.

i. Report any settlement or movement immediately to the Engineer and applicable agency and take immediate remedial action.

3.04 GROUNDWATER CONTROL

A. Intercept and divert surface drainage, precipitation, and groundwater away from shaft excavations through use of dikes, curb walls, ditches, pipes, sumps, or other means within the conditions permitted by the approved Erosion & Sedimentation Control Plan and the Contract Documents.

B. Develop substantially dry shaft subgrades for prosecution of subsequent tunneling operations.

C. Shaft subgrades shall be kept continuously free from ground and surface waters during tunneling operations. Dewatering shall be controlled such that the launching and exit shafts are free of water, but the surrounding groundwater table is not substantially lowered.

D. Keep removal of soil particles to a minimum.

E. Water discharge from dewatering operations shall be directed into approved receiving basins or silt bags in accordance with all applicable regulatory requirements and the approved Erosion & Sedimentation Control Plan.

F. Should settlement or displacement be detected, notify the Engineer and applicable agency immediately and act to maintain safe conditions and prevent damage.

3.05 GROUND MODIFICATION PRIOR TO SHAFT CONSTRUCTION

A. Ground modification grout requirements are set forth in Section 02431 – Tunnel Grout.

B. The use of jet grouting, compaction grouting, void filling, soil mixing, slurry walls, permeation grouting, compensation grouting, ground freezing, or other ground modification technologies shall be carefully considered by the Contractor to safely permit Contractor's selected shaft construction method in loose and flowable soils or in rock that is fractured with joints, bedding planes, shears, or fault zones beneath the groundwater table. Contractor shall determine if ground modification is needed to maintain a stabilized shaft excavation by Contractor's selected means of excavation and be fully responsible for the determination of the necessity, selection, design, and implementation of ground modification strategies.

C. Ground modification strategies shall be designed to work in concert with Contractor's selected shaft excavation methods and implemented as needed to increase bearing capacity, provide settlement control, reduce permeability, and increase stand-up time at the face within the shaft, and shall be included in the Bid.

D. Contractor shall furnish all labor, equipment, materials, and supplies necessary for ground modifications required to meet project objectives specified herein.

3.06 EQUIPMENT

A. Contractor shall employ shaft excavation and support equipment capable of handling the various anticipated ground conditions and which minimize loss of ground and allow for satisfactory support of the excavation.

B. Fire Suppression: Contractor shall furnish, install, and maintain a fire suppression system in accordance with the General Conditions, and all local, State and Federal requirements.

3.07 SHAFT EXCAVATION AND INSTALLATION OF SUPPORT OF EXCAVATION

A. Shaft excavation shall remain within the easements and rights-of-way indicated on the Drawings, and to the lines and grades shown on the Drawings.

B. Contractor shall be responsible for developing procedures to support the ground in a safe manner, for maintaining stability of the ground, and for safety during excavation and support installation. Contractor's method shall ensure full bearing of the ground against the support of excavation without significant settlement or movement of the surrounding ground.

C. Keep the excavation braced or otherwise supported where required to prevent falls, excessive raveling, or erosion. Maintain standby supports for immediate use when needed.

3.08 SPOIL TRANSPORT AND DISPOSAL

A. Transport and dispose of all excavated materials properly away from the construction site. Shaft spoil and muck shall be disposed of at legal disposal facilities and proof of such disposal shall be provided to the Engineer.

3.09 VENTILATION

A. Perform all shaft construction operations by methods and with equipment which will positively control dust, fumes, vapors, gases, fibers, fogs, mists, and other atmospheric impurities in accordance with OSHA safety requirements.

3.10 CONTROL OF ALIGNMENT

A. Establish benchmarks and survey control points. Benchmarks and control points shall be established by a licensed surveyor registered in the Commonwealth of Kentucky at the Contractors expense.

B. Verify benchmarks prior to start of construction and report any errors or discrepancies to the Engineer.

C. When satisfied that all benchmarks are correct, use these benchmarks to furnish and maintain all reference lines and grades for shaft construction. Submit to the Engineer

copies of field notes used to establish all lines and grades and allow the Engineer to check set up prior to beginning shaft construction. The Contractor remains fully responsible for the accuracy of the work and the correction of it, as required.

D. Benchmark Movement. Contractor shall ensure that if settlement of the ground surface occurs during construction which affects the accuracy of the temporary benchmarks, Contractor shall detect and report such movement and reestablish temporary bench marks.

3.11 REPORTS

A. Maintain and submit daily activity reports in accordance with Article 1.06.F

3.12 SITE AND WORK SAFETY

A. Comply with applicable regulations of Federal Government, OSHA 29CFR 1926, and applicable criteria of ANSI A 10.16 "Safety Requirements for Tunnels, Shafts, and Caissons", as amended to date.

B. Safety is the sole responsibility of the Contractor.

3.13 SITE RESTORATION

A. Site restoration shall be in accordance with the Drawings and applicable sections of these Specifications.

B. At the conclusion of all tunneling operations, remove excavation support systems for launching and exit shafts. If withdrawal should damage or disturb the roadway subgrade, leave supports in place and cut off five (5) feet below finished grade unless otherwise directed by Engineer.

END OF SECTION

THIS PAGE LEFT BLANK INTENTIONALLY

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. Excavation for Tunnel Shafts: Section 02222

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

C. Stream Restoration: Section 02373

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. 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 on the drawings.

C. 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.

D. On-site soils shall be tested for suitability for use as structural fill material. The old fill material may be used as structural fill if tests show suitability and all deleterious materials are removed and large boulders are crushed to meet maximum particle size criteria specified in this section.

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

F. 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.

G. All structures bearing on rock 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 one (1) foot of width on each side of the structure for every one (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.

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

I. 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 one (1) foot width on each side of the structure for every one (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 02373 – Stream Restoration.

PART 3 – EXECUTION

3.01 GENERAL

A. Granular and soil fill shall be placed in maximum 8-inch thick loose lifts and compacted to 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 and clayey 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 moisture content of backfill material to attain required compaction density as specified in the geotechnical report. 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 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. See geotechnical report for additional guidance.

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. Structures bearing on rock 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 structures bearing on soil, 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. 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.

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 1:1 (one to one) 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 1:1 (one to one) 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 to 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 crushed 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.

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 compacted 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 per 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 testing service reports and inspection show subgrade or fills which have been placed are below specified density, provide additional compaction and testing at no additional cost to the Owner if requested by the Owner or Engineer.

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. Additional stabilization may be required per the design engineers and specific design.

END OF SECTION

THIS PAGE LEFT BLANK INTENTIONALLY

SECTION 02225
EXCAVATING, BACKFILLING, AND COMPACTING FOR SEWERS

PART 1 – GENERAL

1.01 SUMMARY

A. Excavating of trenches.

B. Bedding of pipe.

C. Backfilling trenches.

D. Installing identification tape.

1.02 PRODUCTS

1.03 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. Bedding Stone: No. 9 Crushed Limestone

C. Backfill Stone: No. 9 Crushed Limestone or No. 57 Crushed Stone

PART 2 – EXECUTION

2.01 GENERAL REQUIREMENTS

A. Trenching may be accomplished by means of a backhoe, trenching machine, hydro-excavation or by hand depending on the construction area. At the Contractor's option, trenching by a trenching machine or by backhoe is acceptable.

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 a manner 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 Engineer will not be responsible for determining requirements for bracing or sheeting.

2.02 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 RMP Standard Drawings.

C. Trench Depth:

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

2.03 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.

2.04 FORCE MAIN BACKFILLING

A. Refer to LFUCG Standard Drawings.

2.05 GRAVITY SEWER PIPE BEDDING

A. Refer to LFUCG Standard Drawings.

2.06 GRAVITY SEWER PIPE BACKFILLING

A. Refer to LFUCG Standard Drawings.

2.07 INSTALLING IDENTIFICATION TAPE

A. Detectable underground marking tape shall be installed over pipes (gravity sewers and force mains). Care shall be taken to ensure that the buried marking tape is not broken when installed and shall be Lineguard brand or equal encased aluminum foil, Type III.

The identification tape is manufactured by Lineguard, Inc., P.O. Box 426, Wheaton, IL 60187 or equal.

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.

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 accumulate groundwater to a depth that will cause pipe to float.

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

THIS PAGE LEFT BLANK INTENTIONALLY

SECTION 02370
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 shown in the Erosion and Sediment Control Plan or Stormwater Pollution Prevention Plan (hereinafter referred to generally as the SWPPP) and as specified herein and as required by the LFUCG Land Disturbance Permit, Chapter 16-Article X, Division 5 of the LFUCG Code of Ordinances, 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) on the site, and prevent them from being discharged offsite or into or alongside any body of water or into natural or man-made conveyances leading thereto.

C. The Contractor shall at all times minimize land disturbance and the period of time that the disturbed area is exposed without stabilization practices. In "critical areas" (within 25 feet of a perennial or intermittent stream, wetland, sinkhole, inlet or other waterbody) erosion prevention measures such as working during dry periods, use of sediment controls, and use of 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 sodding, mulching, seeding, providing erosion control blankets and turf reinforcement mats on all disturbed surfaces including waste area surfaces and stockpile and borrow area surfaces; covering small disturbed areas with tarps or other materials; scheduling work to minimize erosion; and providing diversion or interceptor ditches to minimize the discharge of sediment.

E. Temporary sedimentation controls include, but are not limited to, silt fences, rock check dams, berms, traps, barriers, fiber logs, storm drain inlet filters, and appurtenances on sloped surfaces to minimize the discharge of sediment.

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 and the site is stabilized in accordance with state and local requirements.

G. Prior to construction, the Contractor shall obtain an LFUCG Land Disturbance 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) if required. The Contractor shall be responsible for placement of pollutant, erosion, and sedimentation controls as shown in the Stormwater Pollution Prevention Plan (SWPPP) prior to excavation, fill, or grade work. If during the course of construction, the state and/or LFUCG determine additional controls are required, the Contractor shall furnish, install, and maintain additional seeding, mulch, blankets, sediment barriers, diversion or other ditches, 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 rainfall event of 0.5 inch or greater (or 4 inches of snow or greater).

I. Final stabilization practices on those portions of the project where land disturbance activities have permanently ceased shall be initiated within fourteen (14) days of the date of cessation of land disturbance activities. Temporary stabilization for those portions of the project where land disturbance has temporarily ceased (e.g., temporary seeding, mulching, etc.) shall be initiated within fourteen (14) days of the date of cessation of land disturbance activities.

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

1.02 PERMITS AND NOTIFICATION REQUIREMENTS

A. The Contractor is responsible to submit a Stormwater Pollution Prevention Plan (SWPPP) for inclusion with permit applications. The Contractor may elect one of the following options to meet this requirement:

1. Utilize the SWPPP (which includes the Erosion and Sediment Control Plan) provided in the Construction Drawings and prepared by the Owner's Engineer as a basis for an updated SWPPP, and take sole responsibility for updating and implementing the SWPPP, or

2. Provide a SWPPP, including an Erosion and Sediment Control Plan, prepared by a professional engineer licensed in the Commonwealth of Kentucky, meeting all of the requirements of KYR10, Chapter 11 of the LFUCG Stormwater Manual, and Chapter 16-Article X, Division 5 of the LFUCG Code of Ordinances.

B. If applicable (i.e., for projects with a disturbed area of one acre or more), the Contractor shall submit a KPDES Notice of Intent specifically for Construction Activities (NOI-

SWCA) and receive notification of coverage 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 Land Disturbance Permit shall be obtained from the Lexington-Fayette Urban County Government Division of Engineering. 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, including those associated with construction across or along a stream channel, if applicable, have been obtained prior to initiation of construction. Some permits are obtained during the design phase of the project. Typically, they should be included in the contract documents.

1.03 RELATED WORK

A. Section 02371 – Stormwater Pollution Prevention Plan (SWPPP)

B. Section 02373 – Stream Restoration

PART 2 – PART 2 – PRODUCTS

2.01 MULCH

A. Mulch or erosion control blankets / turf reinforcement mats (see Section 2.08) shall be used as a soil stabilization measure for any disturbed area inactive (i.e., not undergoing grading or excavation) for 14 days or longer. Areas requiring stabilization during December through February shall receive only mulch held in place with bituminous material. Mulching, blankets, or mats shall be used whenever permanent or temporary seeding is used. The anchoring of mulch, blankets, and mats 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 or mats 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 are appropriate for areas with less than five percent slopes, and do not require tacking. Wood chips shall be applied at 270 cubic yards per acre or 6 cubic yards 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 are appropriate for areas with less than five percent slopes, and 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. Recommended buffer distances between applied products and waterbodies shall be strictly followed.

G. Gravel or stone aggregate may be used in relatively small areas when incorporated into an overall landscaping plan. Before the gravel or crushed stone is applied, it shall be washed.

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 control blanket or turf reinforcement matting 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 run-on and runoff as necessary with diversions, grassed waterways, terraces, or sediment ponds.

D. Contractor shall use the following Permanent Seed Mix, 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 seed mix.

The Permanent Seed Mix shall consist of the following mix spread at a rate of 5 pounds/1,000 square feet:

Common Name	%	lbs per 1,000 sq. ft.
Tall Fescue (turf type)	75	3.75
Annual Rye	15	0.75
Bluegrass	10	0.50
TOTAL	100%	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 determined by a soil test obtained by the Contractor. Fertilizer shall not be applied within 50 feet of a stream or other waterbody. 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 48 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 determined by a soil test obtained by the Contractor. Fertilizer shall not be applied within 50 feet of a stream or other waterbody. 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.

K. Sod shall be kept watered after installation until the project is considered substantially complete.

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. 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 EROSION CONTROL BLANKETS AND TURF REINFORCEMENT MATS

A. Mulch netting, erosion control blankets (ECBs), 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 when selected and installed in accordance with manufacturer's recommendations. TRMs shall be used at the water line to control toe erosion along stream banks and wave action in wet ponds. Erosion control blankets may be used to stabilize small ditches and swales and on recently planted slopes to protect seedlings until they become established.

B. Effective ECB and TRM installation 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. ECBs or TRMs shall be used in critical areas such as banks along waterways where concentrated flows are expected. Manufacturer's specifications shall be followed.

D. ECBs, TRMs, and netting shall be suitable for their intended purpose and shall be used as indicated in the Construction Drawings.

E. The ECB shall have a minimum useful life span of two (2) years. The material shall consist of interlocking, curled wood fibers and be capable of withstanding shear stresses up to 2.25 pounds per square foot and a velocity of nine (9) feet per second. The acceptable ECB shall be Curlex II as manufactured by American Excelsior Company or approved equal.

F. Product Documentation

The manufacturer shall provide the Engineer or other designated party with the QA/QC certifications for each shipment of ECB/TRM. 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. ECB/TRM lot and roll numbers (with corresponding shipping information)

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

3. Manufacturer's test data for finished production.

G. Product Labeling

1. Prior to shipment, the Manufacturer shall affix a label to each roll identifying the following characteristics:

2. Product identification information (manufacturer name and address, brand name, product code)

3. Lot number and roll number

4. Roll length and width

5. Total roll weight.

H. Packaging

1. The ECB/TRM shall be wound around a cardboard core to facilitate handling. The core is not intended to support the roll for lifting but should be sufficiently strong to prevent collapse during transit.

2. All rolls shall be labeled and bagged in packaging that is resistant to photodegradation by ultraviolet light.

I. The Contractor shall furnish the following to the Engineer:

1. Manufacturer's quality assurance/quality control certifications for each shipment to verify that the materials supplied for the project are in accordance with the requirements of this specification.

2. Manufacturer's warranty covering materials and workmanship.

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 and/or other ditches require stabilization, with seed, blankets, mats, or mulch.

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 if they discharge to landscaped areas. 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, ECBs, 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 a 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 or armoring 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. If used, check dams shall be constructed prior to the establishment of vegetation.

E. The maximum height at the center 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. Containment berms of earth or rock may be used. High velocity areas (e.g., overflows) shall be armored with rock, TRMs, or other suitable material.

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.

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 pounds/linear inch (minimum)
Flow Rate	0.3 gallons/square foot/minute (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. Posts shall be no more than 6 feet apart.

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 shall be utilized on drop inlets and curb inlets that receive sediment-laden runoff from disturbed areas.

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	10 10 4 6 6	Well-Drained
Ladino *Plus* Timothy *Or* Orchardgrass *Or* Bromegrass	0.5 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 shall be designed by a professional engineer licensed in Kentucky, and shall be considered a permanent structure. Stream crossings shall be as close to perpendicular to the stream flow as possible.

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 the compacted earth fill shall be covered with at least six inches of KYTC No. 2 stone.

F. KYTC No. 2 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 – PART 3 – EXECUTION

3.01 GENERAL

A. Erosion and sediment control practices shall be consistent with the requirements of Chapter 11 of the LFUCG Stormwater Manual and other state and local regulatory agencies and in any case shall be adequate to minimize erosion of disturbed and/or regraded areas and discharge of sediment from the site.

B. Contractor is responsible for notifying and obtaining coverage from the Kentucky Division of Water concerning inclusion under the KPDES General Permit for Stormwater 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, or filtered through a sediment removal device. 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. Clean Water Act Section 401 and 402 requirements enforced by the US Army Corps of Engineers and the Kentucky Division of Water and 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 (where needed) 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

H. Erosion control blankets and turf reinforcement mats are considered protective mulches and may be used alone on erodible soils and during all times of year. Blankets and 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 (if needed) 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, overseed 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 if 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 inch 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 (if needed) 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 shall 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 shall 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 EROSION CONTROL BLANKETS AND TURF REINFORCEMENT MATS

A. Blankets 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.

B. Placement

1. The blankets and mats shall be unrolled in the direction of surface water flow.

2. When using two blankets or mats side by side, the seams shall not be placed in the center of a channel but shall be offset by a minimum of one (1) foot.

3. Blankets and mats shall be stapled in place using U-shaped staples of the size, and at the prescribed intervals and arrangement, specified by the manufacturer.

4. When blankets or mats are laid side by side, they shall be stapled so as to anchor the edge of each roll.

5. The overlap of blankets and mats shall be in accordance with the manufacturer's recommendations.

6. If blanket/mat is unrolled along (parallel) to the contour installation must begin at the lower elevation and progress up slope with the upper blanket overlapping the lower as with roofing shingles.

C. Damage Repair

1. The patch material used for the repair of a hole or tear shall be the same type of material as the damaged blanket/mat.

2. The patch shall extend at least 12 inches beyond any portion of the damaged blanket/mat.

3. The repair patch shall be stapled in place as per manufacturer's recommendations.

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 (or blanket/mat) 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 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 ensure 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 ensure 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 seeded and mulched as needed to establish vegetative cover. Blankets or mats may be used instead of mulch, according to manufacturer's specifications.

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 secured to the slope using stakes 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 and mulching of the sediment trap berm and any 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 6 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. Where used, the 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.

N. Silt fence shall terminate in a "J" hook to prevent bypassing at the end of a row.

3.19 STORM DRAIN INLET PROTECTION

A. All storm drains receiving sediment-laden flows from disturbed areas shall be protected. Approved inlet protection methods include net or sand bags filled 2/3 with rock, geotextile filtration products, and Contractor-fabricated structures.

B. For a silt fence drop inlet protection structure, 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.

C. 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.

D. 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 shall 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.

E. 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.

F. 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.

G. The inlet protection structure shall be inspected after each rain, and repairs made as needed.

H. Sediment shall be removed and the device restored to its original dimensions when 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.

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

J. Structures shall be removed after the area draining to the inlet protection structure has been properly stabilized.

3.20 FILTER STRIP

A. When planting filter strips, Contractor shall prepare seedbed, incorporate fertilizer based on a soil test, and apply mulch consistent with the seeding sections of this Specification. Fertilizer shall not be applied within 50 feet of a stream or other waterbody. 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 during low-flow conditions and 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 check dams.

3.23 CONSTRUCTION DEWATERING

A. All dewatering discharges shall pass through a sediment removal device. 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 STORMWATER 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 waterbody

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:

   1. 1542 – Building Construction, nonresidential, except industrial and warehouses

   2. 1623 – Water Main Construction, Sewer Construction

   3. 1629 – Water and Wastewater Treatment Plant Construction

   4. 1711 – Water Pump Installation

5. 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 shall be kept at the site and available for review by LFUCG and state 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. Plan amendments that involve engineering design shall be prepared by an engineer licensed in Kentucky.

N. The Contractor shall submit the Notice of Termination (NOT) form to the Kentucky Division of Water, the LFUCG Division of Water Quality, and the LFUCG Division of Engineering when final stabilization has been achieved on all portions of the site and the erosion/sediment controls have been removed.

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

   Division of Engineering
   Lexington-Fayette Urban County Government
   101 E. Vine St.
   4th Floor
   Lexington, KY 40507

3.25 LFUCG LAND DISTURBANCE PERMIT

A. The Contractor shall obtain a Land Disturbance Permit from the LFUCG Division of Engineering, after the LFUCG Division of Water Quality inspects the installation of the best management practices as required by the Stormwater Pollution Prevention Plan (SWPPP). The site grading plan shall show the original and finish grade contours. The grading plan shall be in conformance with the SWPPP and shall clearly show the initial phase of best management practices to be installed.

B. The Land Disturbance Permit checklist appears on the following page. It can be obtained from:

   Division of Engineering
   Lexington-Fayette Urban County Government
   101 E. Vine St.
   4th Floor
   Lexington, KY 40507
   (859) 258-3410
   Attn: Land Disturbance Permit Section
   https://www.lexingtonky.gov/new-development

C. All excess earthen/rock materials hauled off the site to a location in Fayette County shall be hauled to a site permitted by the Kentucky Division of Water and the LFUCG. The haul site shall be permitted in accordance with these specifications.

LFUCG Land Disturbance Permit Application & Erosion and Sediment Control Plan Checklist v23Feb2018

Permittee (Owner or Contractor):		Date:
Contact Person:		Contact Phone:
Site Address:		Zone:
Contractor Name:	Reg #:	Contractor Phone:
Mailing Address:		Email:

Permitting Information and ESC Plan Narrative	Yes	No	N/A	Page#	Notes
KY DOW Construction NOI / KYR10 Permit					Required for disturbance ≥ 1 acre
US ACE Section 404 Permit					Required for stream crossings, wetland fills
KY DOW Stream Construction Permit / WQ Certif.					Required for stream crossings / encroachment
FEMA LOMR or CLOMR					If applicable
Project description and purpose					Brief summary
Land cover, soils, percent impervious area					Pre and post construction
Land cover / land use of adjacent property					Can designate on plan sheets
Work schedule with start/end dates					Sequencing, clearing, grading, revegetation
Phasing plan for large projects					25 acre limit on total disturbed area
BMP installation schedule					Can be included on plan sheets (see below)
Inspection and BMP maintenance schedule					Every 7 days, or every 14 days and after ½" rain
Material storage, waste & litter pollution prevention					Covered, away from drainage system, etc.
Fueling / vehicle maintenance pollution prevention					Conducted away from drainage system, etc.
Spill prevention, control, and countermeasures					If reportable quantities present at the site
Dust control plan					Consider if neighbors are present
Stabilized site exit inspection plan					For keeping offsite pavement clear of soil/debris
Stabilization plan and schedule for site areas					Seed/mulch/etc. within 14 days of inactivity
ESC Plan Site Map and Drawing Detail *(See LFUCG Stormwater Manual for BMP Design and Installation Information)*					
Plans stamped by a licensed professional					Required for engineered plan components
Location of the project; property lines					Include small locational map; street address
Limits of construction, disturbed area location/size					Flag off "no disturbance" areas
Topography and drainage patterns (pre and post)					1" = 50 ft; 2 ft contours
Buildings, utilities, paved areas, ditches, culverts					Show stormwater inlets within 100 ft of site
Retention ponds, detention basins, sediment traps					Stabilize immediately after construction
Access and haul roads					Consider dust control where neighbors present
Stabilized exit (50 ft #2 rock pad, shaker rack, etc.)					Must drain to a sediment control BMP
Silt fence or etc. at downslope perimeters					Super silt fence along critical areas
Diversion ditches/berms above disturbed areas					Stabilize immediately after construction
Protection for post-construction BMPs					Keep sediment out of post-construction BMPs
Slope stabilization (seed with mulch/blanket/mat)					See Figure 11-1 in Stormwater Manual
Inlet protection measures					Specify type(s) and location(s)
Outlet erosion protection measures					Specify type(s) and location(s)
Ditch stabilization (sod, or seed with blanket/mat)					Stabilize immediately after construction
Sediment basins (> 5 ac) and traps (< 5 ac)					Stabilize immediately after construction
Dewatering sites and methods					Must use sediment controls
50 ft natural vegetated buffer for all critical areas					Applies to streams, wetlands, sinkholes
Stream crossings					Crossing type, detail; USACE 404 permit req'd
Stockpile areas, equipment storage/fueling areas					Keep away from drainage system if possible
Waste and concrete wash water storage/disposal					Show initial area; can be moved as needed

LFUCG Use Only: *Review Date:* *Status – In Compliance:* *Yes* *No*	*Additional Info Needed:* *Yes* *No*
Reviewed By:	*Department:* *DOE* *DWQ* *DES*
Comments / Missing Items:	

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: _____

END OF SECTION

SECTION 02371

STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

PART 1 – GENERAL

1.01 GENERAL

A. The Contract Documents include a SWPPP that has been reviewed by LFUCG Division of Water Quality. This SWPPP shall be used for establishing quantities and a lump sum price for providing the Erosion and Sediment Control Measures. The included SWPPP is largely complete but will require additional information from the contractor such as concrete washout locations, inlet protection types, etc. prior to being approved by LFUCG Division of Water Quality.

B. The Contractor may use this SWPPP, with necessary additions, to obtain the required permits, i.e. Land Disturbance Permit. If Contractor chooses to use this SWPPP, the Contractor takes sole responsibility for the content of the SWPPP and the implementation of the SWPPP during construction. If Contractor chooses to use this SWPPP, the contractor will be required to submit the SWPPP with necessary additions to LFUCG Division of Water Quality for approval.

C. Contractor may also choose to prepare its own SWPPP and submit to LFUCG Division of Water Quality for approval. No additional payment will be allowed for the Erosion and Sediment Control and conformance with SWPPP pay item.

END OF SECTION

THIS PAGE LEFT BLANK INTENTIONALLY

Construction Site Stormwater Pollution Prevention and Erosion and Sediment Control Plan

This Erosion and Sediment Control / Stormwater Pollution Prevention Plan (ESC/SWPPP) narrative and the attached plan sheets address requirements of the Kentucky Division of Water's KPDES Construction General Permit and the Lexington-Fayette Urban County Government's Erosion and Sediment Control (ESC) Plan, which is required by ordinance for certain projects and required to obtain an LFUCG Grading Permit.

Plan Preparer: Jason Maxwell, PE, 859-422-3005, Jason.Maxwell@stantec.com

Date: November 19, 2024 **LFUCG Checklist and KY DOW NOI Attached:** Yes _X_ No:___

1. CONTACT INFORMATION AND SITE DESCRIPTION

Project Name and Location
FLOYD DRIVE TRUNK SEWER WASTEWATER SYSTEM IMPROVEMENTS
(Project runs perpendicular to East New Circle Road, and parallel to Floyd Drive to 1151 Floyd Dr)
Lexington, KY

Site Owner Name and Contact Information
Robert Peterson, PE
Remedial Measures Project Manager
Division of Water Quality
Lexington-Fayette Urban County Government (LFUCG)
125 Lisle Industrial Avenue, Suite 180
Lexington, KY 40511
859.425.2438
rpeterson@lexingtonky.gov

Construction Site ESC/SWPPP Plan Manager and Contact Information
Company:
Address:
Phone Number:
Email:

Project Start and End Dates
Start: _____
End: _____

Description – Existing Site Conditions, Purpose, and Types of Soil Disturbing Activities
The existing site begins on a main roadway within Fayette County in Lexington, KY. The beginning of the project will be mostly within the asphalt roadway. It will cross a small stream before entering the backyards of homes off Gay Pl where the project will be completed. The project will consist of mostly open-cut trenches, and bore pits to tunnel underneath New Circle Road (KY-4). The purpose of the project is to upsize the existing sanitary sewer to stop surcharging. The project crosses over a small stream. There are no endangered species or historical sites within the project limits. Soil disturbing activities will include: Clearing and grubbing, installation of silt fence and other erosion and sediment controls, boring, trenching, sewer placement, and backfill/final pavement.

Runoff Coefficient
Current Runoff Coefficient = 0.80; Final Runoff Coefficient = 0.80

Site Area and Disturbed Acreage

The project is approximately 2,600 linear feet. The entirety of this length 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 – initial construction routes, initial areas designated for vehicle parking	This is the first land-disturbing activity 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 – sediment fences, outlet protection	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 25 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 Stormwater Manual. Erosion control blankets and turf reinforcement mats will be used on slopes in accordance with the Stormwater Manual.
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 (INCLUDED BELOW OR ATTACHED)

EROSION PREVENTION AND SEDIMENT CONTROL (EPSC) MEASURES INCLUDED PROJECT DRAWINGS NO. C-10 THRU C-11 AND INCLUDED IN SECTION 02371 OF THE PROJECT SPECIFICATIONS.

Name of Receiving Waters
The entirety of the site will enter North Elkhorn Creek.

TMDLs and Pollutants of Concern in Receiving Waters
North Elkhorn Creek is listed on the Kentucky impaired waters (303d) list; The TMDL lists Escherichia Coli (E. coli) as the creek impairment. No threatened and endangered species are present in North Elkhorn Creek downstream from the project.

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

3. EROSION PREVENTION AND SEDIMENT CONTROL MEASURES

All erosion, sediment, stormwater, and housekeeping practices will be consistent with the LFUCG Stormwater Manual and KY Division of Water field and technical guidance, at a minimum.

Limits of Disturbance and Project Phasing
Without exception, no more than 25 acres will be disturbed at any one time. If 25 acres of disturbed area exist on the site, no new disturbed areas will be created until previously disturbed areas are temporarily or permanently stabilized on an acre-for-acre basis. 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.

Stabilization Practices
Temporary Stabilization – Top soil 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 KY EPSC Field Guide. Lime and fertilizer will be applied only when indicated by a soil test. After seeding, each area shall be covered by erosion blanket or mulched with at least two tons/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 as needed in 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 KY EPSC 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
Earthen Berm – will be constructed along the uphill perimeter (north) of the site. This berm will divert clean run-on water around the construction site. Another berm on the east side will collect runoff from the disturbed area and direct the runoff to the sediment basin. Berms will be seeded and mulched immediately after construction. Erosion control blankets will be used on top of seed in berm ditches with

slopes of 5-10 percent. Turf reinforcement mats will be used in berm ditches with slopes exceeding 10 percent. Blankets or mats will be used on slopes in accordance with the LFUCG Stormwater Manual.

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.

Site Runoff Management
Sediment will be prevented from leaving the site to the maximum extent practicable. Storm water drainage will be provided mostly by grassed swales, with sheet runoff from parking lots and building drains leading to a permanent stormwater pond on the south side of the site. The pond will be modified for sediment retention during the construction phase. 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. Two acres of the site, along existing drainage areas and some slopes, will be flagged off-limits to equipment and remain in its current natural state. When construction is complete the entire site will drain to the south side detention basin (the detention basin will be in the location of the temporary sediment basin). The areas on the sides of the basin will be seeded and mulched after construction. The detention pond is designed with a permanent pool volume of 1,333 cubic yards. This is equivalent to one inch of runoff for the drainage area. It is expected that this detention pond design will remove 80 percent removal of total suspended solids in the site runoff. The pond has been designed by a professional engineer to keep peak flow rates from the two and ten year 24-hour storms at pre-development rates. The outlet of the detention basin will be stabilized by a riprap apron. The inlet will be modified during construction by installation of a 3 ft high rock berm around the inlet to increase detention time and sediment removal. The berm will be removed after the entire site is stabilized.

4. OTHER CONTROL MEASURES

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 100 ft where possible, and at least 50 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.

Streams and Wetlands
A 50 ft natural vegetated buffer will be maintained adjacent to the top-of-bank at all streams, wetlands, and springs. Any work the buffer will be completed as soon as possible and stabilized within 24 hours.

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 rented from the ABC Waste Management Company, which is a licensed solid waste management company in Lexington. The dumpster will meet all Lexington 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 Mark Smith, the individual who manages the day-to-day site operations, 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 Mark Smith, the individual who manages day-to-day site operations, 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 by the TIDEE Company, a licensed Lexington sanitary waste management contractor, as required by local regulation. 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 reflects Kentucky Division of Water and LFUCG requirements for stormwater management and erosion and sediment control, as established in LFUCG ordinances. To ensure compliance, this plan was prepared in accordance with the Kentucky BMP Planning and Technical Specifications Manual published by KY DOW and KY DOC and the LFUCG Stormwater Manual. There are no other local, state, or federal permits (e.g., Clean Water Act Section 404 dredge/fill permit, KY DOW Section 401 Water Quality Certification, KY DOW Floodplain Permit, etc.) needed for this project.

6. MAINTENANCE PROCEDURES

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

- Less than ½ of the site or 5 acres, whichever is less, will be cleared of vegetation at one time; areas at final grade will be seeded and mulched within 14 days.
- All 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 ESC/SWPPP 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 halfway up the height of the fence.
- The sediment basin will be inspected for depth of sediment, and built-up sediment will be removed when it reaches 30 percent of the design capacity and at the end of the job.
- 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 Mark Smith of Smith Homebuilders, who has been trained on inspecting construction site BMPs at workshops sponsored by the KY DOW and the Kentucky Erosion Protection 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 Mark Smith, who has been trained by the KY DOW and KEPSC. Mr. Smith will train three people who will be responsible for assisting in the inspections and installing, maintaining, and repairing the controls on the site.
- 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 basin, 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
- Tar
- Fertilizers
- Petroleum Based Products
- Cleaning Solvents
- Wood
- Masonry Block
- Roofing Shingles
- Concrete, paint, stucco wash water

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 exposure 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 for tamp and pump) 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 storm water. 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. Washout locations are indicated on the attached drawings. Washouts will be constructed and maintained in accordance with the LFUCG Stormwater Manual.

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.
- Mark, Smith, the site superintendent responsible for the day-to-day site operations, 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

ESC/SWPPP Files, Updates, and Amendments
This ESC/SWPP Plan and related documents (e.g., NOI, inspection reports, US ACE permits, etc.) will be kept on file at the construction site by Mark Smith, the Site Manager. The ESC/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 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 ESC/SWPPP on site and available for review; project activities compliant with 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 ESC/SWPPP 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:** _____

02371 - 13

Stantec

3052 Beaumont Centre Circle
Lexington, Kentucky 40513-1703
www.stantec.com

Client/Project
LEXINGTON-FAYETTE URBAN COUNTY GOVERNMENT (LFUCG)

FLOYD DRIVE TRUNK SEWER IMPROVEMENTS
REMEDIAL MEASURES PLAN ID NO. NE-6
LEXINGTON, KENTUCKY

Title
ENVIRONMENTAL PROTECTION AND SEDIMENT CONTROL (EPSC) PLAN

Permit-Seal

STATE OF KENTUCKY JASON C. MAXWELL 28686 LICENSED PROFESSIONAL ENGINEER 11/14/2024

Project Number: 175569443

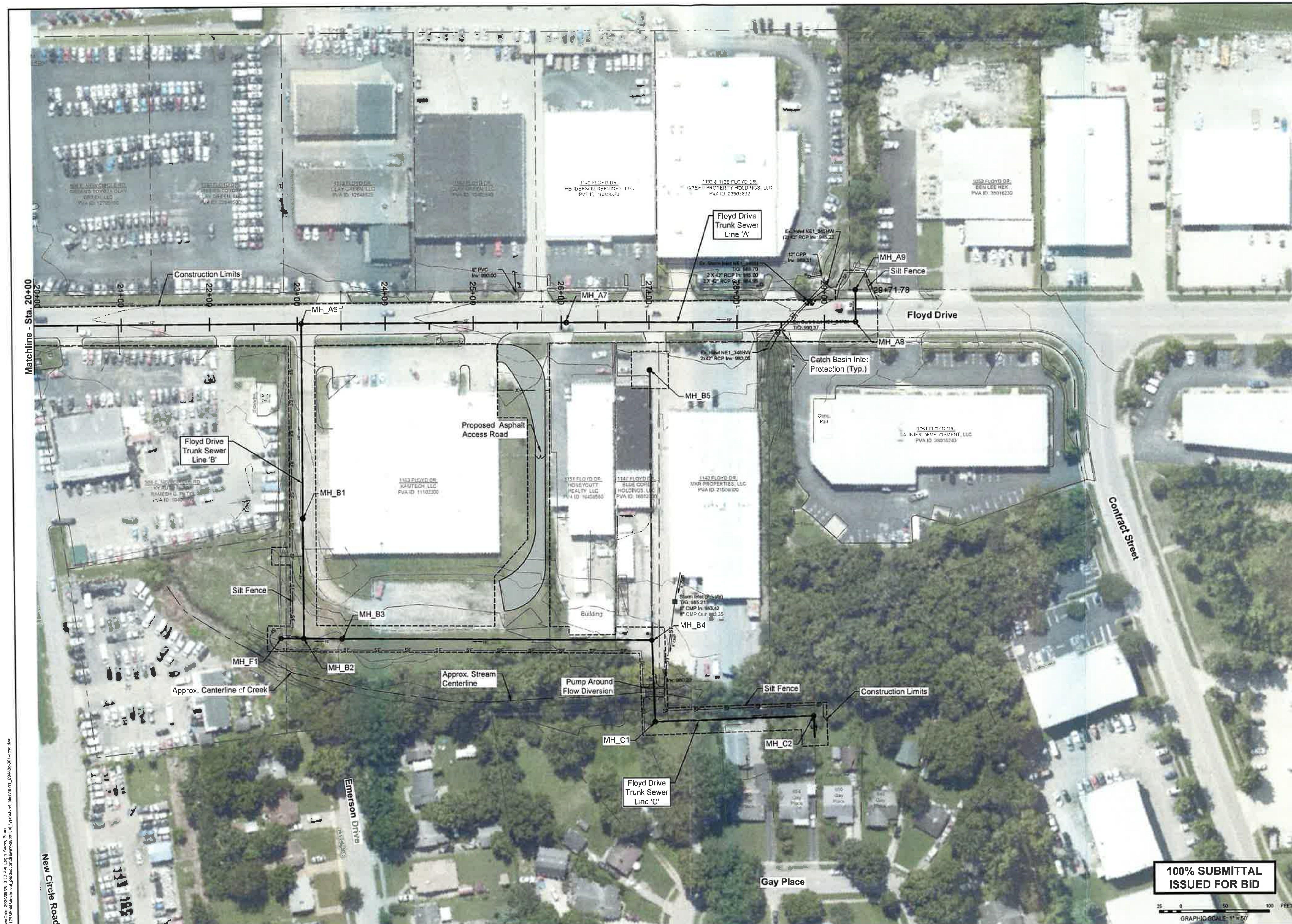
File Name: 10-11_69443c-301-epsc.dwg

BFS	JJH	JCM	24.10.31
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No. C-10

Revision 0

Sheet 10 of 17



Stantec
3052 Beaumont Centre Circle
Lexington, Kentucky 40513-1703
www.stantec.com

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Client/Project
LEXINGTON-FAYETTE URBAN COUNTY GOVERNMENT (LFUCG)

FLOYD DRIVE TRUNK SEWER IMPROVEMENTS
REMEDIAL MEASURES PLAN ID NO. NE-6
LEXINGTON, KENTUCKY

Title
ENVIRONMENTAL PROTECTION AND SEDIMENT CONTROL (EPSC) PLAN

Permit-Seal
STATE OF KENTUCKY
JASON C. MAXWELL
28686
PROFESSIONAL ENGINEER
11/14/2024

Project Number: 175569443

File Name: 10-11_69443c-301-epsc.dwg

BFS	JJH	JCM	24.10.31
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No. C-11

Revision 0 | Sheet 11 of 17

100% SUBMITTAL ISSUED FOR BID

GRAPHIC SCALE: 1" = 50' (0, 25, 50, 100 FEET)

SECTION 02373
STREAM 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/creek crossings and streambank restoration areas. Work in this section may include installation of Temporary Stream Crossings and/or Streambank Restoration.

B. The Contractor shall take all measures necessary to minimize the use of equipment within the banks of a stream.

C. The Contractor shall follow the Streambank Restoration Phase I Details included in the RMP Standard Detail Drawings.

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. Permanent Seed Mixture as listed in Section 02370 – Erosion and Sediment Control 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.

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 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 Streambank Restoration Phase I Details.

2.04 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

B. 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 PERMANENT SEED

A. Permanent Seed shall be conducted in accordance with the specifications of Section 02370 – Erosion and Sediment Control.

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 02370 - Erosion and Sediment Control.

C. Fabric shall be trenched, placed and staked in according to the Streambank Restoration Phase I Details.

D. Biodegradable wooden stakes shall be inserted sporadically within void spaces and areas with puckers in the fabric.

3.04 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 in according to the Streambank Restoration Phase I Details.

3.05 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.

3.06 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.

3.07 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.

END OF SECTION

SECTION 02374

ESC PERMITTING, INSPECTION, AND PERMITTING PROCEDURES

THIS PAGE LEFT BLANK INTENTIONALLY

Permitting, Inspection, and Enforcement Procedures for Erosion and Sediment Control on Capital Projects

Division of Water Quality

Lexington-Fayette
Urban County Government

September 2024

Permitting, Inspection, and Enforcement Procedures for Erosion and Sediment Control on Capital Projects

Division of Water Quality

Date of Original Publication:

October 2013

Date of Current Publication:

September 2024

This publication was developed by the Tetra Tech / Third Rock Consultants Stormwater Program Management Team under contract to LFUCG for purposes of implementing the stormwater provisions of its Clean Water Act Consent Decree and/or its Kentucky Division of Water (KDOW) Municipal Separate Storm Sewer System (MS4) Permit.

02374-4

Permitting, Inspection, and Enforcement Procedures for Erosion, Sediment, and Stormwater Control on Division of Water Quality Capital Construction Projects

DWQ Remedial Measures Plan Projects

DWQ RMP Program Manager: Bob Peterson
DWQ Program Management Consultant: Hazen and Sawyer
Construction Contract Administrators (CA): DWQ Consultants
Resident Project Representative (RPR): DWQ Consultants
ESC Plan Reviewer: DWQ Stormwater Section – Amad Al-Humadi
Land Disturbance Permit (LDP) Issuer: DOE New Development
LFUCG Erosion and Sediment Control Compliance Inspector: RPR
Accela Data Entry: DWQ Compliance & Monitoring (C&M) – Kevin Lyne
Land Disturbance Permit (LDP) Permittee: Contractor

DWQ Wastewater Treatment Plant Capital Projects

DWQ Plant Engineer: Tiffany Rank
DWQ Project Manager: Varies
Construction Contract Administrators (CA): Rick Day, Rick Bowman
Resident Project Representatives (RPR): DWQ Consultant or DWQ Construction Management (Rick Day, Bill Warren, Phoebe Belew)
ESC Plan Reviewer: DWQ Stormwater Section – Amad Al-Humadi
Land Disturbance Permit (LDP) Issuer: DOE New Development
LFUCG Erosion and Sediment Control Compliance Inspector: RPR
Accela Data Entry: DWQ Construction Management – Brenda Whittington
Land Disturbance Permit (LDP) Permittee: Contractor

DWQ Stormwater and Sanitary Sewer Projects:

DWQ Section Managers: Mark Sanders, Chris Dent, Tiffany Rank, Bailee Young
Construction Contract Administrator (CA): Rick Day
Resident Project Representatives (RPR): DWQ Construction Management (Rick Day, Bill Warren, Phoebe Belew)
ESC Plan Reviewer: DWQ Stormwater Section – Rick Day or Amad Al-Humadi
Land Disturbance Permit (LDP) Issuer: DOE New Development
LFUCG Erosion and Sediment Control Compliance Inspector: RPR
Accela Data Entry: DWQ Construction Management – Brenda Whittington
Land Disturbance Permit (LDP) Permittee: Contractor

Permitting Procedures

1. Contractor shall develop a Stormwater Pollution Prevention Plan/Erosion and Sediment Control Plan (SWPPP/ESC Plan). A SWPPP/ESC Plan template is on the LFUCG website at https://www.lexingtonky.gov/new-development. On some projects, the construction contract documents may contain a SWPPP/ESC Plan prepared by LFUCG's consultant for purposes of establishing bid quantities. If the Contractor chooses to use this SWPPP/ESC Plan to obtain the required permits, the Contractor takes sole responsibility for the content of the SWPPP/ESC Plan and the implementation of the plan during construction.
2. Contractor must submit an application for a Land Disturbance Permit to the LFUCG Division of Engineering before beginning project construction. The permit application is available at https://aca3.accela.com/lexky/.
3. For projects with a disturbed area of ≥ 1 acre, the contractor must submit a Notice of Intent (NOI) to the KY Division of Water (KDOW) and obtain KYR10 Permit coverage before beginning construction of any kind on the site. The NOI can be submitted electronically at http://dep.ky.gov/formslibrary/Documents/KYR10PermitPage.pdf.
4. Contractor cannot start project work until they have obtained the LFUCG Land Disturbance Permit and KYR10 Permit coverage (if applicable – see above).
5. DWQ will review the SWPPP/ESC Plan, confirm that the Contractor has obtained KYR10 Permit coverage (if applicable – see above), and authorize the Contractor to install the initial BMPs.
6. Contractor then installs the initial BMPs, prior to project work (general excavation, grading, etc.).
7. DWQ inspects the installation of the initial BMPs and authorizes DOE New Development to issue the Land Disturbance Permit. Contractor then begins the project.

Contractor Responsibilities

Contractor shall:

1. Develop a SWPPP/ESC Plan, or review and agree to use the SWPPP/ESC Plan prepared by LFUCG's consultant, or amend it as needed.

2. Attend a pre-construction conference with LFUCG.

3. Post the LFUCG Land Disturbance Permit and KYR10 Permit (if applicable) on the project sign at the site, and keep a copy of the SWPPP/ESC Plan on site and available for review.

4. Follow the SWPPP/ESC Plan; revise and redline it as conditions change on the site.

5. Install and maintain BMPs to prevent sediment from washing into streets, storm sewers, and streams. All runoff from disturbed areas must pass through a BMP before leaving the site.

6. Maintain a 50-foot vegetative buffer strip along perennial and intermittent streams (including impounded streams), wetlands, sinkholes, and inlets.

7. If work must be done within 50 feet of a perennial or intermittent stream, wetland, sinkhole, or inlet, complete work as soon as possible and stabilize the area within 24 hours after completing work.

8. Conduct an ESC inspection at least once every 7 calendar days and within 24 hours after each rainfall of 0.5 inches or greater (or 4 inches of snow or greater).

9. Complete and sign the inspection form after each inspection. Keep the completed inspection forms on site and available for review. Keep a backup record of inspection forms (photos or scans).

10. Stabilize inactive portions of the site with straw, blanket, seed, or other cover within 14 days of no activity, and provide permanent stabilization within 14 days of reaching final grade.

11. If the project has a KYR10 Permit, file a Notice of Termination with the KY Division of Water and forward to the LFUCG Division of Engineering and LFUCG Division of Water Quality when construction has been completed and the site is stabilized. 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 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 equivalent stabilization measures (such as the use of riprap, gabions, or geotextiles) have been employed."

12. Respond promptly to Verbal Warnings and Notices of Violation from LFUCG regarding correcting ESC problems.

Inspection Procedures for the Resident Project Representative

Weekly Field Inspections

1. Inspect the site each week and the next working day after a storm event of 0.5 inches or greater
2. Ensure the LFUCG Land Disturbance Permit and KYR10 Permit are posted at the site
3. Ensure SWPPP/ESC Plan is available for review
4. Ensure that the weekly and rain event completed inspection forms are available for review
5. Walk the perimeter of the entire site
6. Note downgradient controls:
    - Inspect ditches and sheet flow areas
    - Silt fences working?
    - Ditches vegetated / stabilized?
    - Significant sediment discharges?
7. Walk around internal disturbed areas
    - Idle for more than 14 days . . . stabilized?
8. Inspect all inlets and ditches
    - Inlets protected, ditches stabilized?
9. Check out material / fuel storage areas
    - Spills? Leaks? Leaching pollutants? Litter / waste managed?
10. Inspect concrete washout(s)
11. Inspect the construction entrance / exit
12. Inspect the 50-foot vegetative buffer strip adjacent to waterways. The buffer strip must be stabilized within 24 hours of any approved construction activity in the buffer strip.
13. Communicate inspection findings to Contractor, note issues that need attention
14. Complete the LFUCG inspection checklist
15. Submit an electronic copy of the completed checklist to the Project Manager and the Accela Data Entry Contact person on page 1 **the week of the inspection**.

Important Items for the Permittee / Contractor / RPR to Verify:

- Posted permits, plans, and inspection reports
- Graded / inactive areas stabilized with seed, mulch, blankets, mats, etc.
- Stabilized, non-eroding ditches
- Maintained silt fences and protected curb / drop inlets
- No mud on the street
- Trash and litter managed
- No disturbance in the 50-foot buffer zone adjacent to streams, wetlands, sinkholes, and inlets, unless approved; areas within the 50-foot buffer must be stabilized within 24 hours

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 ESC maintenance for each month that the BMPs are maintained and functioning properly.
2. The RPR shall follow the attached ***Compliance Assistance Guidance for DWQ Capital Project RPRs*** and implement the **Escalating Enforcement Process** described below.

Table 1 – ESC Escalating Enforcement Process

DWQ Capital Project	Escalating Enforcement Process
Remedial Measures Program	The RPR shall escalate the issue to the RMP Program Manager and RMP Program Management Consultant's Project Manager
Wastewater Treatment Plants Stormwater Section MS4/Water Quality Section Sanitary Sewers Capacity Assurance Program	The RPR shall escalate the issue to the DWQ Section Manager and the DWQ Construction Contract Administrator

3. DWQ will use all available means in the contract to obtain compliance, including:
   a. withholding payment
   b. 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
   c. initiating the process for calling the ESC Performance Bond
   d. issuing Notices of Violation (NOVs)
   e. stopping work

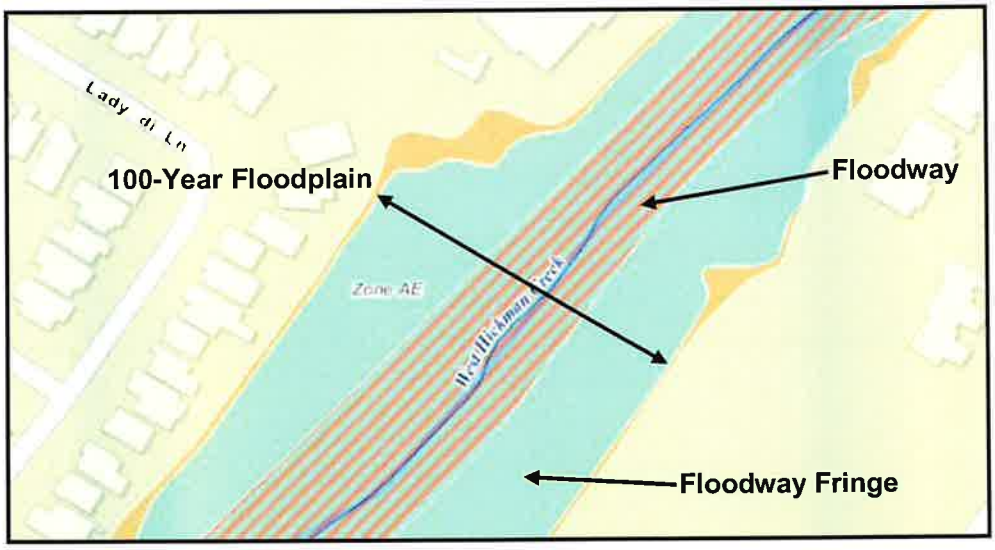
Compliance Assistance Guidance for DWQ Capital Project RPRs

Observed Condition	Verbal Warning to Correct within 3-5 days (See Note 1)	Verbal Warning to Correct within 24 hours (See Note 1)	Escalate the Issue Immediately in Accordance with Table 1
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[2] 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 SWPPP/ESC Plan but critical areas[2] and roads are protected	Silt fence not installed per plan and critical areas[2] and roads are not protected	
	Does not comply with Stormwater Manual but is functional	Blowouts have occurred with discharge of sediment to critical areas[2]	Large quantities of sediment in critical areas[2]
	Needs maintenance/repair, but is not near an inlet or surface water	Not trenched in, is not functional	
		Silt fence needs repairs in critical areas[2]	
Soil Stockpiles	No perimeter controls, downstream BMPs in place	No perimeter controls, downstream BMPs not in place	
Permit Violations		Permit expired	Site not permitted (No LDP or KDOW NOI)
		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	
		SWPPP/ESC Plan not on site	
			Unapproved construction activities in 50-foot buffer zone around sinkholes, streams, wetlands, etc.
			Construction has started, BMPs not installed

1. Escalate the issue in accordance with Table 1 after the 2nd Verbal Warning.
2. Critical areas are areas within 25 feet of a stream, wetland, sinkhole, or inlet.

Policy for Storing Construction Material in the Floodway/Floodplain
Division of Water Quality Capital Projects
October 1, 2019

1. Excavated residual spoils from excavation may be stored in the floodway or floodway fringe under the following conditions:
   a. Spoil material may be stored no longer than 30 days in the floodway. Any material in the floodway after 30 days shall be removed.
   b. Spoil material may be stored in the floodway fringe (the area in the floodplain that is outside of the floodway) no longer than 180 days.
   c. Spoil material stored in the floodway or floodway fringe shall be enclosed by reinforced silt fence (Coir logs are not acceptable). Diversion berms/ditches shall be constructed upslope of stockpiles to minimize run-on water.
   d. Any evidence of erosion of the stored material shall be immediately mitigated.
2. Construction materials stored in the floodway shall be anchored to prevent floatation or displacement during a flood event.
3. Fuel tanks, lubricants, fertilizer, and chemical products or other potentially hazardous materials shall not be stored in the floodway or floodway fringe.
4. Prior to beginning construction, the contractor shall submit a Spoils Management Plan to LFUCG for review and acceptance. The plan shall be kept on site at all times.



THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 02425
INITIAL TUNNEL SUPPORT

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. The Work described by this Section consists of furnishing all materials and incidentals required for the initial support system(s) proposed by the Contractor to be provided as a part of the tunneling operations.

B. The work shall be done in accordance with all Federal, State, and local laws, regulations and requirements as shown on the Drawings and as specified herein.

C. All available and known geotechnical reports, logs, borings, and laboratory testing performed within close proximity of the project corridor have been made available as "technical data" and are not part of the Contract Documents. These reports are provided as information only and solely for the convenience of Bidders. The Owner and/or the Consultant do not warrant or guarantee the accuracy or correctness of this material with respect to actual subsurface conditions. Subsurface conditions are considered unclassified and no expectation of quantity, specific location of ground conditions, or geotechnical baselines are provided or assumed herein.

D. Contractor shall review all available geotechnical reports and data and perform any additional subsurface investigations the Contractor deems necessary at his own expense for the planning and the selection of tunneling techniques and methods in order to enable proper construction as shown on the Drawings and other requirements of Contract Documents.

E. Contractor shall be responsible for designing, furnishing and installing the initial tunnel support system(s) that complement the means and methods selected in excavating the tunnels and shafts proposed for the Project.

F. Contractor may increase the diameter of the initial support system(s) from that indicated on the Drawings and as listed in the Tunneling Method Table in Project Specific Notes (PSN), at no additional cost to the Owner, if the Contractor deems it necessary to provide additional internal work area to account for all project site conditions, variability in subsurface conditions, selected tunnel construction methods, operational procedures, carrier pipe support and restraint systems, steering and guidance system accuracy, and line and grade tolerances to meet the carrier pipe acceptance criteria for the project. Contractor may also elect to increase the diameter of the initial support system(s) from that indicated on the Drawings and as listed in the Tunneling Method Table in Project Specific Notes (PSN), at no additional cost to the Owner, to best fit the Contractor's selected tunnel excavation equipment diameter, worker safety, tunnel construction production efficiency, or to otherwise reduce project risk. If Contractor elects to modify

the diameter from the minimum size shown in the Contract Documents, the Contractor accepts all responsibility for clearance from existing buried conflicts, acquiring approval for any modification or addenda to all right-of-way encroachment agreements, occupancy permits, or other established requirements and specifications of the entity being crossed. Contractor shall not increase the diameter of the initial tunnel support system if the combination of the selected tunnel construction means and methods and the increased tunnel lining diameter increases the potential for surface settlement or damage to existing structures.

G. Follow all OSHA regulations regarding confined space for installation of the initial support system(s).

H. Conform with all Kentucky Transportation Cabinet (KYTC) and Federal Highway Administration requirements for work within their respective highway rights-of-way and any additional requirements of the contiguous property and utility owners.

I. The Contractor shall retain the service of a professional engineer registered in the Commonwealth of Kentucky to design the initial support system(s) and prepare submittals as described herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 02426 – Installation of Carrier Pipe in Tunnel

B. Section 02431 – Tunnel Grout

C. Section 02432 – Low Density Cellular Grout

D. Section 02441 – Tunneling by Slurry Microtunnel Boring Machine

E. Section 02442 – Tunneling by Tunnel Boring Machine

F. Section 02444 – Tunneling by Pipe Jacking with Shield Method

G. Section 02445 – Utility Hand Tunneling

H. Section 02446 – Tunneling by Guided Bore and Jack Method

I. Tunneling Method Table in Project Specific Notes (PSN).

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. Applicable codes, ordinances, statutes and governing rules and regulations of governing municipalities and counties, the State of Kentucky, and the Federal Government.

2. American Association of State Highway and Transportation Officials (AASHTO).

3. American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual for Railway Engineering.

4. Occupational Safety and Health Administration (OSHA) Regulations and Standards for Underground Construction 29 CFR Part 1926, subpart S and other applicable OSHA parts.

5. Applicable ASTM and AWWA Standards for materials and methods.

6. Kentucky Transportation Cabinet (KYTC) Permits Guidance Manual.

7. All applicable guidelines and restrictions of the United States Army Corps of Engineers (USACE) and Kentucky Department for Environmental Protection (DEP).

1.04 DEFINITIONS

A. Unless otherwise stated or particular context otherwise requires, the definitions and provisions contained in this section shall govern the construction, meaning and application of words and phrases utilized in this specification. For purposes of this specification, the following terms are defined as follows:

1. Face: The vertical surface and associated area where installation of initial support is ongoing at the head of a tunnel excavation.

2. Foot Block: Cement mortar, concrete or timber block foundation element that provides a reaction to the loads developed in a steel set.

3. Ground: Undifferentiated rock/soil materials encountered during excavation.

4. Ground Class: Characterization of the ground based upon physical observations and analysis.

5. Initial Tunnel Support: Any combination of ground support elements installed in the underground excavations prior to placement of the final lining or carrier pipe. Initial tunnel support includes all forms of segmental and pipe jacked liners, jacking pipe, casings, or sleeves. Initial support is required to be installed within the tunnel excavations to fully support the ground until such time as the final lining is in place and is structurally capable of resisting the ground loads.

6. Lagging: Short structural members used in ground requiring continuous support to bridge between steel sets and allow transfer of ground loads from the space between the steel sets to the steel sets. Lagging may be made from dimensional timber, steel mat lagging (heavy gauge wire mesh), or solid steel lagging.

7. Overbreak: Earth excavated beyond the limits required to install the initial support system.

8. Steel Set: A structural steel member for use in a tunnel or shaft consisting of structural steel sections, butt and foot plates, bolts, nuts, washers, tie rods, spreaders, blocking, collar braces, lagging, and other associated support components as required to assemble, brace and fix the steel member, and continuously support ground loads, including those generated between the steel sets. Steel sets are rolled to an arch or circular shape and to the intended shape of the tunnel excavation. Steel sets may be provided with an invert strut member made from structural steel or concrete where ground conditions warrant this type of support. Steel sets are also referred to as Ribs or Ring Beams and shall be defined the same herein.

1.05 DESIGN CRITERIA

A. The Contractor is responsible for the design, installation, maintenance, and safety of the tunnel initial support system(s). All design calculations provided by the Contractor as part of the required submittals shall be sealed by a Licensed Professional Engineer registered in the Commonwealth of Kentucky.

1.06 SUBMITTALS

A. Conform to Section 01300 – Submittals

B. Submit manufacturer's product data for all materials required to be incorporated in the work.

C. Shop Drawings for fabricated materials, including:

1. Complete geometry, grade of materials used, and dimensions of all steel set support elements and assemblages, including butt and foot plates, welds, nuts and bolts, tie rods, braces, and lagging.

2. Details of anchorage systems, end hardware, bending radii, connections, shim plates, extensions, splices, longitudinal connectors and other accessories required for rock reinforcement systems.

D. Working Drawings and Method Statements

1. Working Drawings for all initial support system(s) proposed indicating the following:

a. Sizes, details, dimensions, spacing, and arrangement of elements, method of assembly, lists of materials, and such other data for all support elements and systems of elements, as required to check the adequacy of the proposed installation.

b. Design calculations for initial support systems and pre-support and face support measures, including estimates of support deformations for each ground class.

c. Design calculations for pipe jacked support systems, such as casings and jacking pipe, including estimates of jacking loads, the allowable axial compressive force of the jacking pipe or casing, and joint tolerances for each ground class.

2. Method Statements

a. Sequence of installation of initial support systems and pre-support measures integrated into the excavation process, including requirements for assuring the transfer of ground loads to initial support systems.

b. Dimensions, spacing, and general pattern sequence of installation of the support systems with respect to the excavations and final lining tolerances.

c. Proposed construction methods and equipment for excavating and installing support systems, including pre-support measures.

d. Methods and details for supporting and grouting areas of overbreak or voids, if encountered.

e. Methods and details for repairing damage to initial support.

3. See Sections 02425, 02426, 02431, 02432, 02441, 02442, 02444, 02445 and 02446 for additional submittal requirements for tunneling support systems.

E. Quality Control:

1. Identify how the quality of materials and installation will be controlled including:

a. A written statement of site-specific quality control plans required by the Contractor's design engineer.

b. Methods for and frequency of monitoring initial support elements for loosening, deformation, or distress; and means for tightening, or supplementing with additional initial support.

c. Contingency support measures in the event that ground loads exceed the capacity of the initial support.

F. Provide resume and written documentation of the qualifications of the project manager, superintendent and shift foremen in accordance with Article 1.07.

G. Recordkeeping:

1. As-built records of all erected support, including locations, spacing, lengths, types, thicknesses, weights, and number. Integrate this information into daily records specified for tunnel excavation.

2. Records of all testing performed as required by the Contractor's design engineer.

1.07 QUALITY ASSURANCE

A. Work shall be supervised by at least one (1) person with five (5) years of recent experience in installation of the type of initial support system being installed. Experience shall include at least 2 projects of similar size and in similar ground conditions.

1.08 DELIEVERY, STORAGE, AND HANDLING

A. The Contractor shall accept material on site and inspect for damage.

B. The Contractor shall handle, support and store material to prevent injury or damage to the material.

PART 2 – MATERIALS

2.01 STEEL CASING PIPE

A. The casing pipe shall be smooth wall or spiral welded carbon steel pipe. The minimum interior diameter of the casing pipe shall be as indicated on the Drawings. Casing pipe shall be leak-proof construction and be capable of withstanding highway or railroad loadings where applicable. Casing pipe shall be steel pipe in sizes 12-inches and larger manufactured from steel having a minimum yield stress strength of 35,000 psi and shall have a minimum wall thickness as indicated by the table below.

Pipe Diameter Nominal Pipe Size (in.)	Minimum Nominal Wall Thickness (in.)
18	0.312
20	0.344
24	0.375
30	0.469
36	0.532
42	0.625
48	0.688

B. All joints shall be butt welded with a full depth, single "V" groove weld. Machined, interlocking, press-fit joints such as made by Northwest Pipe Company of Vancouver, WA or equal may be substituted if written acceptance has been acquired by all property owners and permitting authorities associated with crossing.

C. The casing pipe shall conform to ASTM A 139, Grade B (without hydro-test) or ASTM A53, Grade B (without hydro-test), and AWWA C200-75.

2.02 SEGMENTAL STEEL LINER PLATE

A. All segmental steel liner plate selected and installed by the Contractor shall be designed by a registered Professional Engineer licensed in the State of Kentucky and shall meet the latest AREMA specifications Chapter 1, Part 4 with the following factors of safety:

1. Joint Strength = 3.0,

2. Minimum Stiffness = 3.0 for 2-flange and 1.5 for 4-flange,

3. Critical Buckling = 2.0, and

4. To meet all appropriate corrosion protection through the selection of coatings and cathodic protection as needed.

B. All 2-flange liner plate shall be minimum 10 gage or thicker.

C. All 4-flange liner plate shall be minimum 8 gage or thicker.

D. The maximum width of liner plate shall be 18-inches.

E. Liner plate shall be fabricated from structural quality, hot rolled, new carbon-steel sheets or plates conforming to ASTM Specification A 569. The plate shall be hot-dip galvanized in accordance with ASTM Specification A 123 and AASHTO Designation M 167 but shall not be applied at a rate less than two (2) ounces of "Prime Western" zinc per square foot total of both sides.

F. All plates shall be punched for bolting on both longitudinal and circumferential seams and shall be so fabricated as to permit complete erection from the inside of the tunnel.

G. Structural Grout, see Section 02431, shall be placed under pressure to fill any voids which exist between the initial tunnel lining and the undisturbed earth through threaded grout holes with plugs. Holes shall be provided in every third ring of liner plate (a minimum of three grout holes per ring required unless otherwise directed by the Engineer) to permit grouting as the erection of tunnel liner plate progresses.

H. Bolts and nuts shall be a minimum of 5/8-inch diameter and length as recommended by the manufacturer of the liner plate and be manufactured domestically. For plate thicknesses equal to or greater than 0.209 inches, bolts shall conform to ASTM Specification A 449. For plate thicknesses less than 0.209 inches, bolts shall conform to

ASTM A307. All nuts and bolts shall be galvanized in accordance with ASTM Specification A 153.

2.03 RIBS AND LAGGING

A. Structural steel for use in initial support shall be manufactured in accordance with ASTM A36.

B. Bolts, nuts, and fasteners conforming to ASTM A307.

C. End plates and foot plates shall be fabricated from steel conforming to ASTM A36.

D. Timber used for blocking, cribbing or any other structural use shall be Douglas Fir No. 1 grade or equal and of rectangular cross section.

E. Geotextile fabric shall be a monofilament synthetic fabric consisting of polyester or polypropylene in a manner approved by the Engineer. Geotextile shall be treated to resist degradation due to exposure to ultraviolet light and shall have a minimum of 90% retention of strength after 500 hours of exposure to UV. Geotextile fabric shall be Mirafi FW700 as manufactured by Mirafi, Inc., or approved equal.

PART 3 – EXECUTION

3.01 INSTALLATION – GENERAL

A. Work shall not begin until the required submittals have been made and the Engineer has reviewed and accepted all submittals related to the initial support system(s) to be utilized.

B. Continuously support the ground using a combination of steel sets, blocking, lagging, liner plate, casing, jacking pipe, structural sleeve, and ancillary support using the materials, methods, sequences, and contingency plans submitted, reviewed, and accepted.

C. Contractor shall notify Engineer of any changes that may be required or proposed due to unforeseen conditions.

3.02 INSTALLATION OF STEEL CASING

A. Steel casing shall be installed using one of the tunneling methods listed in the Tunneling Method Table in Project Specific Notes (PSN).

B. Promptly following completion of the casing installation, pressure grout to fill all voids existing outside of the casing pipe for all casings 36-inches and larger in outside diameter. If the outside diameter is less than 36-inches then the annular space outside the casing is to be grouted if the excavated diameter is more that 1inch larger than the outside diameter of the casing.

C. Grouting shall be performed from the interior of the casing pipe through grouting holes. Lubricant shall be displaced by the grout. Grouting shall be started in the lowest connections and shall proceed until grout begins to flow from upper connections. The void shall be completely filled. Displaced lubricant shall be disposed of off-site in accordance with applicable regulations and codes of all Federal, State, and local agencies.

D. Grout shall be in accordance with Section 02431 – Tunnel Grout.

E. Liquid grout pressure shall not exceed one-half of the existing overburden pressure.

F. After grouting is complete, pressure shall be maintained by means of stopcocks or other suitable devices until the grout has set sufficiently in the judgment of the Engineer, or for a minimum of 24 hours, whichever is longer. After the grout is set, grout holes shall be completely filled with dense concrete and finished neatly without evidence of voids or projections.

3.03 INSTALLATION OF STEEL LINER PLATES

A. Steel liner plates shall be assembled in accordance with the manufacturer's instructions.

B. The bottom 25% of culvert periphery shall be covered with concrete (or asphalt) to a depth of 1 inch above the crest of the corrugations. The concrete pavement shall be reinforced with 6 x 6 (W2.9 x W2.9) welded wire fabric. This wire shall be attached to the liner plate by either directly welding to the liner plate or by mechanical attachment to the bolts.

C. Exterior grouting of all segmental tunnel lining shall be kept as close to the heading as possible, using grout stops behind the liner plates if necessary. Grouting shall proceed as needed to cut off inflow of groundwater and material and stabilize the excavation, but in no event shall more than 6 lineal feet of tunnel excavation be progressed beyond the grouting. Grout shall be in accordance with Section 02431 – Tunnel Grout.

3.04 INSTALLATION OF RIBS AND LAGGING

A. Scale excavated surfaces and remove loose material prior to placing and blocking steel ribs. Brace each steel rib with blocking, collar braces, shims, and wedges as necessary to transfer ground loads to the steel sets.

B. Secure steel ribs against horizontal movement and distortion using tie rods and collar braces.

C. Immediately install lagging in the form of substantial timber or steel lagging.

D. Immediately crib areas of overbreak or over excavation with timber to provide contact between excavation and steel sets.

E. Perform all surveys necessary in a timely manner such that steel sets do not encroach on the necessary clearance for the final lining and any embedments.

F. Monitor installed support to ensure that any increase of loading with time, i.e. squeezing loads, is detected. Monitor for excessive deformations and instability locally. Install additional support in a timely manner to mitigate overstressing of the initial support system.

G. Final exterior grouting for rib & lagging shall take place immediately following installation of the rib & lagging. The distance from the face of tunnel to grouted segment section shall not exceed 6 feet. Grout shall be in accordance with Section 02431 – Tunnel Grout.

H. Liquid grout pressure shall not exceed one-half of the existing overburden pressure.

I. Low Density Cellular Grout shall be placed within the tunnel for all tunneling methods which include ribs and lagging.

3.05 CARRIER PIPE INSTALLATION

A. Contractor shall install carrier pipe in casing in accordance with Section 02426 – Installation of Carrier Pipe in Tunnel.

3.06 SITE AND WORK SAFETY:

A. Comply with applicable regulations of Federal Government, OSHA 29CFR 1926, and applicable criteria of ANSI A 10.16 "Safety Requirements for Tunnels, Shafts, and Caissons", as amended to date.

B. Safety is the full responsibility of the Contractor.

END OF SECTION

SECTION 02426

INSTALLATION OF CARRIER PIPE IN TUNNELS

PART 1 – GENERAL

1.01 SCOPE

A. This Section covers handling, transporting, and installing carrier pipe in two-pass tunnels.

1.02 SUBMITTALS

A. The following information shall be submitted in accordance with Section 01300 – Submittals.

1. Carrier pipe installation plan. A brief description of method of lowering pipe into shaft; method of transporting carrier pipe into the tunnel; method of positioning, aligning, and jointing pipe; and blocking plan. Include sketches for means of carrier pipe transporting, hoisting, and positioning and sketch of carrier pipe blocking plan.

2. Shop Drawings for casing spacers shall be prepared and submitted if casing spacers are the proposed means of carrier pipe support.

3. Buoyant force calculations, provisions to prevent floating, bulkhead design, and blocking details. The calculations shall include an analysis of the stresses and deformation induced on the carrier pipe. Submittal shall be signed and sealed by a Professional Engineer registered in the Commonwealth of Kentucky. Professional liability insurance shall be provided as specified in the Supplementary Conditions and Encroachment Permits.

PART 2 – PRODUCTS

2.01 PIPE MATERIAL

A. The carrier pipe shall be as listed in the Tunneling Method Table in Project Specific Notes (PSN).

B. Contractor shall be responsible for selecting appropriate pipes and pipe joints to safely carry the loads imposed during construction.

2.02 ANNULAR BACKFILL GROUT

A. Grout for filling of the annular space between pipe and tunnel initial support is required when Contractor utilizes ribs and lagging tunnel lining. In such case, the annular backfill

grout shall be as specified in Section 02431 - Tunnel Grout, or Section 02432 - Low Density Cellular Concrete. Annular backfill grout is not required when Contractor utilizes jacking pipe as initial tunnel lining.

2.03 CASING SPACERS

A. Stainless Steel Casing Spacers: Stainless steel casing spacers shall be bolt-on style with a shell made in two (2) sections of heavy T-304 stainless steel. Connecting flanges shall be ribbed for extra strength. The shell shall be lined with a PVC liner 0.090-inches thick with 85-90 durometer. All nuts and bolts are to be 18-8 stainless steel. Runners shall be made of ultra high molecular weight polymer with inherent high abrasion resistance and a low coefficient of friction. Runners shall be supported by risers made of heavy T-304 stainless steel. The supports shall be mig welded to the shell and all welds shall be fully passivated. Stainless steel casing spacers shall be made by Cascade Waterworks Mfg. Co., or equal.

B. Solid Polyethylene Casing Spacers (to be used with PVC pipe only): Solid polyethylene casing spacers shall be bolt-on style with a shell made in two (2) sections. Carrier pipe shall be wrapped with rubber strap inside casing spacer to prevent slippage. All nuts and bolts are to be 18-8 stainless steel. Solid polyethylene casing spacers shall be made by Calpico Inc., Advance Products & Systems, Inc., or equal.

C. Casing spacers shall be installed a maximum of eight (8) feet apart along the length of the carrier pipe with the casing pipe, within two (2) feet of each side of a pipe joint, and the rest evenly spaced. Each segment of pipe shall have a minimum of four (4) spacers installed on it. Manufacturer's recommendations may govern these requirements.

2.04 TUNNEL END SEALS

A. The ends of the tunnel shall be filled with concrete brick or cap block and mortar with two (2) weep holes at the bottom. Weep holes shall use 1-inch PVC pipe

PART 3 – EXECUTION

3.01 ACCEPTANCE CRITERIA FOR LINE AND GRADE TOLERANCES

A. Prior to installing the carrier pipe, Contractor shall verify that the initial support has been constructed so that the carrier pipe may be placed in conformance with the Contract Documents and all specified tolerances.

B. Deviation tolerances from line and grade shown on the Drawings for the carrier pipe installed within the initial tunnel support are as listed in the Tunneling Method Table in Project Specific Notes (PSN). Water shall be free draining between any two points at the pipe invert. Reverse grades and low points or sags shall NOT be permitted or accepted. Notify Engineer should misalignment of the initial support system preclude installation of the carrier pipe to the tolerances specified. For areas where alignment is installed with a

curve, maximum pipe segment length shall be coordinated with pipe manufacturer to assure that the maximum joint opening and deflection are not exceeded.

3.02 PIPE HANDLING

A. Handle and transport pipe into the tunnel in a manner that prevents damage to the pipe, joints and gaskets. Do not install pipe damaged during placement operations. If any damage occurs the Contractor may propose repair procedures for review and approval of Engineer or replace the pipe at no additional expense to the Owner.

3.03 TUNNEL CLEANUP

A. Prior to pipe placement in the tunnel, remove temporary tunnel utilities, such as electrical cord and ventilation piping. Remove loose material, dirt, standing water, and debris prior to pipe placement.

B. Temporary steel construction tracks may be left in place if they do not interfere with alignment of the carrier pipe or interfere with final placement of the annular grout.

3.04 PIPE MANUFACTURER REPRESENTATIVE

A. At the discretion of the Engineer, during the carrier pipe installation and annular backfill grouting, each pipe manufacturer shall provide his own supervisor to instruct the Contractor's pipe laying personnel in the correct procedure to be followed at no additional expense to the Owner.

3.05 CARRIER PIPE BLOCKING AND SUPPORT

A. Provide support and anti-flotation blocking adequate to:

1. Establish final pipe grade.

2. Support weight of carrier pipe without deformation or collapse during installation.

3. Provide restraint to hold carrier pipe stable to prevent flotation or movement during grouting operations.

B. Support and anti-flotation blocking may include steel beams, wooden blocking, casing spacers, initial grout or concrete bedding, liquid ballasting, or other methods as designed by Contractor's Engineer.

C. If casing spacers are used, then a minimum of four (4) casing spacers shall be provided per 20-foot joint of pipe with one (1) near each end and two (2) equally spaced along the carrier pipe with a maximum spacing of 8-feet apart. Additional casing spacers shall be provided as recommended by the casing pipe manufacturer.
   A. Secure the pipe support to the pipe and initial support in accordance with approved design.

3.06 JOINING PIPE IN TUNNELS

A. Join pipe segments to properly compress the gaskets and allow for the correct final positioning of the pipe for line and grade. Closely align pipes by bringing them loosely together by means of hydraulic jacks, locomotives, pipe mobiles, or winches. Once pipes have been loosely joined, pull them home by means of a hydraulic tugger or other similar method while suitably protecting pipe and joints against damage. Impact jointing such as ramming with locomotives or other mechanical equipment is not permitted. All joining of pipe shall at minimum be in accordance with manufacturer's recommendations.

B. When diameter allows for personnel entry, provide stationing on the inside of the pipe at the spring line of the tunnel carrier pipe written in bright fluorescent orange paint every 50 feet in numbers at least two (2) inches in height that will be visible during the internal videotaping process as described in Section 02532 – Sewage and Collection Lines, Section 3.05-D TV Survey.

3.07 3.7 LIMIT ON LENGTHS OF CARRIER PIPE INSTALLATION

A. Carrier pipe installation shall be constructed in reaches of manageable length that can be surveyed, inspected, and tested for acceptance, then grouted in place (only when ribs and lagging is used as initial tunnel support) prior to installing the next carrier pipe reach. Carrier pipe installation reaches shall be limited in length to the maximum reach lengths indicated in the table below. Under no circumstances shall the grouting pressures, reach lengths, lift heights, or heat of hydration during curing exceed carrier pipe manufacturer recommendations.

SCHEDULE - ANNULAR BACKFILL GROUTING MAXIMUM REACH LENGTH

TESTED IN-PLACE WET DENSITY	MAXIMUM REACH LENGTH
≥ 130 pcf	≤ 50 feet
120 pcf – 129 pcf	≤ 100 feet
110 pcf – 119 pcf	≤ 125 feet
100 pcf – 109 pcf	≤ 200 feet
90 pcf – 99 pcf	≤ 250 feet
80 pcf – 89 pcf	≤ 300 feet
75 pcf – 79 pcf	≤ 350 feet

B. Maximum reach length of annular backfill grout pours shall not exceed annular backfill grouting maximum reach lengths given in the schedule above unless Contractor can clearly demonstrate that placement beyond these maximum reach lengths can be accomplished assuring complete backfill of the annulus with no thermal or pressure damage to the carrier pipe.

C. Grout set times for selected mix design can be used to modify the maximum reach lengths provided in the table above. Reach lengths must be limited to appropriate length and volume such that the complete reach length can be monolithically grouted prior to initial grout set and loss of fluidity.

3.08 BULKHEADS AND CRADLE SUPPORTS

A. Construct bulkheads to withstand imposed grout pressure without excessive leakage at the terminal ends of the casing/tunnel in accordance with the Drawings and at intermediate points as required.

B. Terminal bulkheads shall be constructed using concrete brick and mortar and have air and water vent holes. Wall shall be constructed flush with casing pipe opening. Brick shall have a nominal size 2-1/4 inches by 3-3/4 inch by 8 inch. Mortar shall be one part Portland cement blended with three parts sand (100% passing #4 sieve and minimum 95% passing No. 8 sieve) and have a minimum 7-day compressive strength of 500 psi. Prepared bag mixes are acceptable if approved by the Engineer.

C. Provide concrete cradles using concrete having a minimum strength of 3,000 psi at 28 days at terminal ends of casing/tunnel. Cradles shall be provided from the end of the casing/tunnel bulkhead to the first pipe joint outside the casing/tunnel.

3.09 TESTING PRIOR TO GROUTING ANNULAR SPACE

A. Carrier pipe invert shall be surveyed and hydraulic grade line verified prior to grouting of annular space.

B. After carrier pipe is installed in the initial support system the carrier pipe shall be pressure tested or joint tested in accordance with Section 02532 – Sewage and Collection Lines

3.10 ACCEPTANCE TESTING

A. Perform an as-built survey on installed carrier pipe of man-entry size pipe after grouting (All pipe 36 inches diameter or larger). Take invert elevations at each pipe joint in man-entry size pipe. Take two diameter readings, at right angles, randomly at an average of 20 feet spacing or less in man-entry size pipe. Pull a mandrel through non-man-entry size pipe to check for excessive deflection in accordance with Section 02532 Sewage and Collection Lines.

END OF SECTION

SECTION 02431
TUNNEL GROUT

PART 1 – GENERAL

1.01 SCOPE

A. This Section covers mix design requirements, testing, furnishing and production of grout for:

1. Grouting of annular space between initial support system/casing and excavation.

2. Grouting of annular space between carrier and initial support system/casing;

3. Grouting voids in ground resulting from caving, loss of ground or settlement;

4. Cutoff grouting after excavation for eliminating or retarding groundwater infiltration into the underground excavations;

5. Consolidation grouting at tunnel face prior to excavation to provide excavation stability for tunneling operations;

6. Permeation Grouting near the exit shaft to fill the pores in soil and voids/fractures in disintegrated rock.

B. Requirements for furnishing and installing low density cellular concrete (LDCC) are covered in Section 02432 – Low Density Cellular Concrete.

1.02 DEFINITIONS

A. Annular Backfill Grout: Fluid grout mix used to fill the annular space, including all voids, between the tunnel carrier pipe and the initial support system/casing under low-pressure.

B. Final Exterior Grouting: Grouting of the exterior of tunnel support system/casing and the unexcavated ground.

C. Ground Stabilization Grouting: Grout injected under gravity or pressure from the surface, through the initial tunnel support or at the face of the tunnel as selected and designed by the Contractor. Ground stabilization grouting includes the following:

1. Grout used to fill voids, fissures, or under-slab settlement due to caving or loss of ground.

2. Grout used to retard the flow of groundwater.

3. Grout used for consolidation prior to excavation to provide stability at tunnel face.

4. Grout used to fill pores, voids, and fractures in disintegrated rock.

D. Void Repair Grouting: Pressure grouting of the exterior of the initial tunnel support or jacking pipe for the immediate filling of voids or larger overcut space to prevent settlement during tunnel excavation.

1.03 REFERENCE STANDARDS

A. ASTM C 138. Standard Test Method for Unit Weight, Yield and Air Content (Gravimetric) of Concrete.

B. ASTM C 144. Standard Specification for Masonry Mortar. ASTM C 150. Standard Specification for Portland Cement.

C. ASTM C 494. Standard Specification for Chemical Admixtures for Concrete.

D. ASTM C 618. Standard Specification for Fly Ash and Raw or Calcinated Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete.

E. ASTM C 869. Standard Specification for Foaming Agents and in Making Preformed Foam for Cellular Concrete.

F. ASTM C 937. Standard Specification for Grout Fluidifier for Preplaced Aggregate Concrete.

G. ASTM C 939. Test Method for Flow of Grout for Preplaced Aggregate Concrete.

H. ASTM C 940. Standard Test Method for Expansion and Bleeding of Freshly Mixed Grout for Preplaced Aggregate Concrete.

I. ASTM C 942. Standard Test Method for Compressive Strength of Grout for Preplaced Aggregate Concrete into Laboratory.

J. ASTM C 953. Standard Test Method for Time of Setting of Grout for Preplaced Aggregate Concrete in the Laboratory.

K. ASTM C 1017. Standard Specification for Chemical Admixture for use in Producing Flowing Concrete.

L. U.S. Army Corps of Engineers Specification CRD C 621, Non-shrink Grout.

1.04 SUBMITTALS. THE FOLLOWING INFORMATION SHALL BE SUBMITTED IN ACCORDANCE WITH THE SUBMITTALS SECTION:

A. A grout work plan addressing all four (4) grout type applications as defined in section 1.02 of this specification, including,

1. Description of materials and grout mix.

2. Working drawings and descriptions of proposed grouting systems and methods detailing type and location of equipment and operational procedures to accomplish each grouting operation, injection points, means of accurately measuring grout pressures and volumes, venting method, flowlines, grouting sequence, schedule and limits of lift segments, and stage volumes.

B. Copies of independent laboratory test reports, including all test data certifying that the selected products will produce grouts with the characteristics and the qualities required for completion of the Work.

C. A grout mix design report, including:

1. Grout type and designation.

2. Grout mix constituents and proportions, including materials by weight and volume.

3. Grout densities and viscosities, including wet density at point of placement per ASTM C567.

4. Initial set time of grout per ASTM 403.

5. Flow per ASTM C939.

6. Bleeding, shrinkage/expansion per ASTM C827 and CRD-C621.

7. Compressive strength per ASTM 495.

D. Logs of grouting operations indicating pressure, density, and volume for each grout placement.

E. The carrier pipe manufacturer's maximum allowable pressure that can be applied during backfilling accounting for grout density (unit weight) and volume of annular space (difference in outside diameter of carrier pipe and inside diameter of initial tunnel lining). Grouting pressure calculations showing grout pressure during annular space grouting will not exceed the carrier pipe manufacturer's recommendations for allowable grouting pressure and safety factor for each lift.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Grouting Materials: Conform to this section or Section 02432 - Low Density Cellular Concrete (LDCC), except as modified in the following paragraphs.

B. Grout Type Applications.

1. Grout for Annular Backfill Grouting. Standard sand-cement mix, structural sand-cement mix or LDCC for all carrier pipe installations. See Specification Section 02426 – Installation of Carrier Pipe in Tunnel.

2. Ground Stabilization. Standard sand-cement mix or structural sand-cement mix.

3. Final Exterior Grouting: Structural sand-cement mix.

4. Void Repair Grouting: Bentonite slurry or bentonite-cement mix.

C. Do not include toxic or poisonous substances in the grout mix or otherwise inject such substances underground.

2.02 GROUT

A. Employ and pay for a commercial testing laboratory, acceptable to Engineer, to prepare and test the grout mix design. Develop one or more mixes based on the following criteria as applicable:

1. Size of the annular void between final lining and initial support, or size of the void between initial support and the surrounding soil.

2. Absence or presence of groundwater.

3. Adequate retardation.

4. Non-shrink characteristics.

5. Pumping distances.

B. Prepare mixes that satisfy the required application. Materials used in sand-cement grout mixes shall meet the following standards:

1. Cement: ASTM C 150, Type II.

2. Fly Ash: ASTM C 618.

3. Water: Potable.

4. Slurry: ASTM C 138.

5. Sand for sand-cement mortar mix: ASTM C 144.

C. Prepare mixes that satisfy the required application. Materials used in bentonite-cement grout mix shall meet the following standards:

1. Cement: ASTM C 150, Type II.

2. Fly Ash: ASTM C 618.

3. Water: Potable.

4. Slurry: ASTM C 138.

5. Easy-to-mix, finely ground (200-mesh), premium-grade, high-yielding Wyoming sodium bentonite.

D. Provide grout that meets the following minimum requirements:

1. Standard sand-cement mortar grout and bentonite-cement mortar grout shall have minimum compressive strength (ASTM C495) of 100 psi, attained within 3 days, and sufficiently flowable to inject through lining and fill voids, with prompt setting to control grout flow and carrier pipe buoyancy. Wet density (unit weight) at placement shall be minimum 75 pcf.

2. Standard sand-cement mortar grout and bentonite-cement mortar grout shall have minimum compressive strength (ASTM C495) of 200 psi, attained within 28 days.

3. Structural sand-cement mortar grout shall have minimum 28-day unconfined compressive strength of 1,000 psi.

4. Laboratory Determine strength by ASTM C 942.

E. Fluidifier. Use a fluidifier, meeting ASTM C 937, which holds the solid constituents of the grout in colloidal suspension and is compatible with the cement and water used in the grouting operations.

F. Admixtures.

1. Use admixtures meeting ASTM C 494 and ASTM C 1017 as required, to improve pumpability, to control time of set, to hold sand in suspension and to reduce segregation and bleeding.

2. Do not use admixtures that promote steel corrosion.

3. Ensure that admixtures used in a mix are compatible. Provide written confirmation from the admixture manufacturers of their compatibility.

2.03 QUALITY ASSURANCE

A. Pipe Manufacturer Representative. Refer to Section 02426 – Installation of Carrier Pipe in Tunnel for pipe manufacturer field services employee requirements during annular backfill grouting.

PART 3 – EXECUTION

3.01 PREPARATION

A. Notify Engineer at least 24 hours in advance of grouting operations.

B. Select and operate grouting equipment to avoid damage to new or existing underground utilities and structures.

C. In selection of grouting placement consider pipe flotation, length of pipe, length of tunnel, depth from surface, type of final lining, type of pipe blocking and bulkheading, grout volume and length of pipe to be grouted between bulkheads.

D. Operate any dewatering systems until the grouting operations are complete.

3.02 EQUIPMENT

A. Batch and mix grout in equipment of sufficient size and capacity to provide the necessary quality and quantity of grout for each placement stage.

B. Use equipment for grouting of a type and size generally used for the work, capable of mixing grout to a homogeneous consistency, and providing means of accurately measuring grout component quantities and accurately measuring pumping pressures. Use pressure grout equipment which delivers grout to the injection point at a steady pressure.

3.03 GROUND STABILIZATION GROUTING

A. General

1. Ground stabilization grouting operations shall be carried out in accordance with approved shop drawings for each type of grout employed.

2. Carry out all hole washing, pressure testing, and grout injection operations in the presence of the Engineer.

3. Contractor shall modify the grout mixes as necessary to meet the characteristics of each hole.

4. All sanded grout mixtures shall contain a fluidifier, as required.

B. Materials Storage.

1. Furnish in undamaged, moisture proof sacks or other containers bearing manufacturer's label.

2. Store adequate supply at site to prevent delays.

3. Protect and keep dry, observing all manufacturer's recommendations.

4. Cement. Use 100 mesh screen to remove any cement lumps or other deleterious materials, if found in the cement.

5. Fluidifier. Reject material which has become hard due to moisture absorption.

C. Equipment

1. Drilling Equipment.

   a. Use rotary and/or percussion drilling equipment.

   b. Dry drilling shall not be permitted.

2. Grouting Equipment – General.

   a. Designed for mixing and injecting grout, maintained in satisfactory operating condition at all times, and capable of satisfactorily mixing and agitating the grout and forcing it into the grout holes in a uniform flow and at a constant pressure.

   b. The grouting equipment shall be on hand and in working order prior to start of tunnel and shaft excavation.

   c. Clean equipment and tanks by constant recirculation of grout and by periodic flushing with water.

   d. Pipe system designed so that water flushing can be accomplished by closing grout injection valve, opening water supply valve and running grout pump at full speeds.

   e. Depending on type of grouting operation, the grouting equipment and fittings shall be capable of, and furnished with, sufficient fittings to simultaneously grout up to five (5) grout connections.

D. Pipes and Fittings.

1. Provide 1- 1/2 inch or larger grout pipe.

2. Embed pipes in the rock surface, and/or concrete bulkheads for consolidation grouting connections and/or air vents.

3. Set the inner end of pipes not less than two inches back from the finished inside surface.

4. Set the grout pipes so that grout can flow freely to the voids and crevices.

5. For Final Exterior Grouting clean out the grout ports installed in the tunnel pipes by drilling through the pipe ports and two inches into unexcavated rock.

6. Provide suitable stop valve at collar of hole for use in maintaining pressure required until grout has set.

E. Mixers and Agitators.

1. Provide mixer with transfer pump for transferring grout to agitator holding tank.

2. Deliver grout to injection point at a steady pressure without pulsation, using a grout pump at agitator tank.

3. Provide sufficient tank capacity to ensure an uninterrupted supply of slurry to grout pump.

4. Provide means to increase or decrease water-cement ratio.

5. Equip water supply connection with accurate meter.

F. Grout Hose and Connections

1. Provide 1- 1/2 inch or larger grout hose capable of withstanding maximum anticipated water and grout pressures.

2. Make connections so as to prevent leakage.

3. Remove plugs on ends of grout holes or pipes to permit escape of air and water and the filling of spaces with grout.

4. At point of injection, provide suitable valves and accurate pressure gages so that pressure and grout flow at grout hole may be monitored and regulated by increasing or decreasing the flow in the grout return line.

5. Provide shutoff valve and flow-regulating diaphragm valve at each connection.

G. Pressure Gauges.

1. Provide one (1) at each point of injection on the manifold.

2. Provide one (1) at the grout pump.

3. Provide each gauge with seal preventing grout from entering gage.

4. Select gauge range so that maximum operating pressure is about two-thirds maximum capacity.

5. Do not grout without appropriate gauges in place and in working order.

6. Provide calibrated check gauge and check operating gages.

H. Voids

1. Completely fill voids outside the limits of excavation caused by collapse of ground or in areas indicated in the Drawings. Fill with gravity or pressure injected standard sand-cement grout as necessary to fill the void.

    a. Take care in grouting operations to prevent damage to adjacent utilities or public or private property. Grout at a pressure that will not distort or imperil any portion of the work or existing installations or structures.

    b. Verify that the void has been filled by volumetric comparisons and visual inspection. In the case of settlement under existing slabs, take cores as directed by Engineer, at no additional cost to Owner, to demonstrate that the void has been filled.

3.04 VOID REPAIR GROUTING

A. Immediately upon discovery of a void or void(s) outside the limits of excavation caused by over excavation, overbreak, boulder or obstruction removal, an existing void, or collapse of ground, contractor shall stop tunnel excavation activities and backfill void space to prevent enlargement of void space and potential for surface settlement. Pump bentonite slurry or bentonite-cement mix to temporarily fill void until completing installation of initial tunnel support. Upon completion of installation of initial tunnel support fill the voids in accordance with final exterior grouting requirements below.

3.05 FINAL EXTERIOR GROUTING

A. Pump structural grout to grout the annular space between initial tunnel support and excavation. The schedule for installing and methodology for installing this grout and will be in accordance with Section 02425 – Initial Tunnel Support.

3.06 ANNULAR BACKFILL GROUTING FOR RIBS AND LAGGING

A. Fill the annular space between the carrier pipe and the tunnel initial support or jacking pipe with grout as defined herein.

B. Placement

1. Placement Limits: The limits of each grout placement stage shall be predetermined by the size and capacity of the batching equipment and the initial set time of the proposed grout. Under no circumstances shall placement continue at an injection point longer than that period of time for the mix to take initial set. Grout hole spacing, and locations shall be located according to the number of stages necessary to complete the grouting process. A stage or lift cannot be installed on another lift until a proper set has been attained. Placement procedures shall be approved by the admixture or additive manufacturer and submitted in writing to the Engineer.

2. Limit pressure on the annular space to prevent damage or distortion to the carrier pipe or initial support. Define the limiting and estimated required pressure range. Provide an open ended, high point tap or equivalent vent and monitor it at the bulkhead opposite to the point of grouting.

3. Pump grout until the material discharging is similar in consistency to that at point of injection.

4. Length of carrier pipe installed between grouting shall not exceed the annular backfill grouting maximum reach (lift segment) requirements in Specification Section 02426 – Installation of Carrier Pipe in Tunnel unless Contractor can clearly demonstrate that placement beyond these lengths can be accomplished with complete backfill of the annulus (no voids), no pressure damage to the carrier pipe and no thermal damage to the carrier pipe. Repeat this cycle until all carrier pipe is installed and grouted.

C. Protection and Clean Up

1. Take all necessary precautions to protect and preserve the interior of the carrier pipe from damage. Spills shall be minimized and shall be cleaned up immediately. Any damage to the pipe caused by or occurring during the backfilling operations shall be repaired by a method approved by the Engineer, at no additional cost to the Owner.

2. During backfill grouting work, provide for adequate disposal of all waste and wastewater. Remove and properly dispose of all waste resulting from backfill grouting operations.

3.07 STRUCTURAL GROUTING

A. Completely fill voids or structures as indicated on the Drawings. Fill with gravity or pressure injected structural sand-cement grout as necessary to fill the void.

B. Take care in grouting operations to prevent damage to adjacent utilities or public or private property. Grout at a pressure that will not distort or imperil any portion of the work or existing installation or structures.

C. Verify that the void or structure has been filled by volumetric comparisons and visual inspection.

3.08 FIELD QUALITY CONTROL

A. General. Field control tests, including unit weight (wet density), and compression tests shall be performed by the Contractor and the results submitted to the Engineer.

1. The frequency specified herein for each field control test is approximate. A greater or lesser number of tests may be made, as required by the Engineer.

2. Test specimens shall be collected within the tunnel at or near the connection where the grout is being injected.

3. The Contractor shall assist the Engineer in obtaining test cylinders. Supply all materials necessary for obtaining the test cylinders, including cylinder molds.

4. Monitor carrier pipe temperature for one week after grout placement no less than once per day. Submit temperature readings for the entire period to the Engineer.

B. Unit Weight. Unit weight (wet density) tests shall be made from the first batch mixed each day, after a change in mix design, every 30 minutes during pumping, and from each batch of grout from which compression test cylinders are made. Unit weight shall be determined in accordance with ASTM C 567. Unit weight at the point of placement shall be within plus or minus 5 percent of the unit weight established for the mix design being placed. Adjust mix as required to obtain the specified wet density.

C. Compression test cylinders shall be made in the field, cured and stored in the laboratory, and tested in accordance with ASTM C 495.

D. Each set of compression test cylinders shall be marked or tagged with the date and time of day the cylinders were made, the location (station) in the work where the grout represented by the cylinder was placed, batch number, and unit weight (wet density).

E. Each set of test cylinders shall consist of six (6) cylinders. Two cylinders from each set will be tested at an age of 3 days, two cylinders from each set will be tested at an age of 28 days and two cylinders from each set shall be kept as spares in case further testing is required.

F. Compressive strength of grout shall be considered satisfactory if both of the following requirements are met:

1. Average of three consecutive compressive strength tests equal or exceed the specified unconfined compressive strength. (A strength test shall be the average of two compressive strengths of two cylinders made from the same concrete sample and tested at the age specified.)

2. No individual compressive strength test (average of the two cylinders) is below the specified unconfined compressive strength by more than 20 percent.

G. Contractor to provide testing of grout as follows:

1. Annular Grouting for final lining in Tunnels or Tunnel Casings.

a. Make one set of six (6) compressive test specimens for every 100 cubic yards of grout installed in two-pass tunnel.

2. Ground Stabilization Grouting.

a. Make one set of four (4) compressive test specimens for every 100 cubic yards where ground stabilization grouting is performed.

3. Structural Grouting

a. Make one set of four (4) compressive test specimens for every 100 cubic yards where ground stabilization grouting is performed.

END OF SECTION

SECTION 02432
LOW DENSITY CELLULAR CONCRETE

PART 1 – GENERAL

1.01 SCOPE

A. This section includes filling the annular space and any voids outside the carrier pipe installed in the tunnels utilizing ribs and lagging, with low density cellular concrete (LDCC). In the event of conflicts with Section 02431 – Tunnel Grout, this specification takes precedence.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 02426 – Installation of Carrier Pipe in Tunnels

B. Section 02431 - Tunnel Grout

1.03 DEFINITIONS

A. Low Density Cellular Concrete (LDCC). A lightweight cementitious material that contains stable air or gas cells uniformly distributed throughout the mixture of a volume percentage greater than 20 percent.

B. Annular Backfill Grouting. Grout used to fill the annular space between the tunnel carrier pipe and the initial support system/casing.

C. Foamed Density. The Foamed Density for this specification section shall mean the final low-density mixture (unit weight) of the in-place LDCC which includes the combined mixed volume of wet concrete slurry and the added foaming agent.

1.04 REFERENCE SPECIFICATIONS, CODES AND STANDARDS.

A. American Concrete Institute (ACI):

1. ACI 523.1 R, Guide for Cast-in-Place Low Density Concrete.

2. ACI 523.3R, Guide for Cellular Concretes above 50 pcf, and for Aggregate Concretes above 50 pcf with Compressive Strengths Less than 2500 psi.

B. American Society for Testing and Materials (ASTM):

1. ASTM C 94, Specification for Ready-Mixed Concrete.

2. ASTM C 138, Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.

3. ASTM C 150, Specifications for Portland Cement.

4. ASTM C 495, Standard Test Method for Compressive Strength of Lightweight Insulating Concrete.

5. ASTM C 567, Standard Test Method for Unit Weight of Structural Lightweight Concrete.

6. ASTM C 618, Specifications for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

7. ASTM C 796, Standard Method of Testing Foaming Agents for Use in Producing Cellular Concrete Using Preformed Foam.

8. ASTM C 869, Standard Specification for Foaming Agents Used in Making Preformed Foam for Cellular Concrete.

1.05 SUBMITTALS

A. The following shall be submitted in accordance with Section 01300 - Submittals.

1. Quality Control. Submit qualifications of Contractor/Subcontractor, personnel, and manufacturer in accordance with the requirements of this section.

2. Qualifications. The Contractor or Subcontractor supplying and placing LDCC shall be capable of developing a mix design, and batching, mixing, handling and placing low density cellular concrete under tunnel conditions; shall have furnished and placed low density cellular concrete on at least four (4) tunnels within the last eight (8) years of the general type and the size specified herein and have been in successful operation; and shall have a record of experience and quality of work using low density cellular concrete that is satisfactory to the Engineer. Provide written evidence of these qualification requirements including project name, location, owner's name and contact information.

3. Personnel Qualifications. Workers, including the LDCC Contractor's superintendent and foreman, shall be fully qualified to perform the work. The LDCC Contractor's superintendent shall have previous experience under similar ground and tunnel conditions consisting of at least four (4) completed tunnels. At the discretion of the Engineer, placement of the LDCC shall be performed under the supervision of the foaming agent supplier's representative.

4. Product Data. Mix designs for each cellular concrete mix proposed for use. Each mix design shall show the ingredients of the mix and shall include:

   a. Type, brand, source, and amounts of cement, pozzolans, admixtures, and other additives.

   b. Source and amount of water.

c. Representative samples of materials for materials testing and mix proportion testing.

d. Combined grading of each mix design.

e. Specific gravity of all materials.

f. Results of required tests.

g. A certificate of compliance signed by the supplier identifying the type of fly ash and stating that the fly ash is in accordance with ASTM C 618 and these specifications. Supporting test data shall be furnished when requested by the Engineer. All testing and sampling procedures shall be in accordance with ASTM C 311.

h. Water: Use potable water. Verify with foaming agent supplier that water supplied contains no substance deleterious to the foaming agent.

i. Concrete Admixtures: Material specifications and instructions for use.

j. Air content, unit weight, and compressive strength test results for proposed mix design.

5. Equipment and associated manufacturer's specifications and operation instructions for equipment.

   a. Pumps.

   b. Foam generators and ancillary equipment.

6. Work Plan. The work plan for placing low density cellular concrete including sequence of work, type(s) of equipment, location of equipment, placing procedures, (i.e., batching, mixing, and pumping procedures), pump line arrangement (including moving and breaking), intermediate and end bulkhead details, communications provisions, methods for monitoring mix, testing procedures, and cleanup procedures. The work plan shall include pumping pressures, pumping rates, volumes to be placed per day, injection locations, valving at injection locations to facilitate testing, method for monitoring carrier pipe temperature, and sequence of placement and pumping.

7. Test Reports and Certifications

   a. Mill test reports for cement.

   b. Certificates of compliance for each load of cement and pozzolan.

   c. Certificates of compliance for all admixtures.

d. A delivery ticket with the information stated in section 16 of ASTM C 94; excepting actual scale weights of materials shall be furnished to the Engineer with each batch of concrete before unloading at the site.

e. A printout of the actual scale weights for all loads batched shall be submitted to the Engineer at the end of each working day.

f. Daily reports and records of LDCC placement, including but not limited to, volumes placed, stationing of placement, injection locations, pressures, unit weight and air content testing results, time of placement, and designation of cylinder samples prepared that day.

g. Test reports indicating the results of compressive strength tests from a certified testing laboratory.

8. Provide grouting pressure calculations showing grout pressure during annular space grouting will not exceed the carrier pipe manufacturer's recommendations for allowable grouting pressure and safety factor for each lift segment. Annular volume, grade, length of lift segment, carrier pipe material, groundwater pressure, and subsurface conditions outside the initial tunnel lining shall be accounted for in submitted calculations.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Cement. Portland Cement, ASTM C 150, Type I or 11.

B. Water. Use potable water free from deleterious amounts of alkali, acid, and organic materials which would adversely affect the setting time or strength of the LDCC.

C. Admixtures. Admixtures may only be used when specifically approved by foaming agent supplier in writing.

D. Foaming Agent. Foaming agent shall comply with ASTM C 869 when tested in accordance with ASTM C 796.

E. type and Manufacturer. Aerlite, Aerlite iX, or Mearl Geofoam Liquid Concentrate manufactured by Aerix Industries, Golden, CO, Foam Liquid Concentrate manufactured by Cellufoam Concrete Systems, Rheocell 30 manufactured by BASF Construction Chemicals, LLC of Cleveland, OH, or Elastizell EF by Elastizell Corporation of America of Ann Arbor, MI or approved equal.

F. Fly ash. Type F.

2.02 MIX DESIGN

A. General. Low density cellular concrete mix shall be designed in accordance with the requirements of ACI 523.1R, ACI 523.3R and the additional requirements specified herein. Mixes shall be adjusted in the field as necessary to meet the requirements of these specifications. The foaming agent material manufacturer's field services representative shall approve all changes to the mix designs.

B. Minimum 28-day compressive strength (ASTM C495): 200 psi. Minimum 56-day compressive strength (ASTM C495): 250 psi.

C. Limiting Requirements. Each LDCC mix shall be designed and controlled for the purposes of filling all annular voids, displacing water, and within the following limits unless otherwise specified:

1. Foamed Density (unit weight) of the LDCC shall be not less than 80 pcf, plus or minus 5 pcf, at the point of placement, unless a higher density is required to achieve strength requirements.

2. Only Type F flyash will be permitted. Flyash/cement ratios shall not exceed 1.0 by weight.

D. Preformed Foam. Preformed foam shall be generated by combining controlled quantities of air, water, and foaming agent under pressure. Foam shall retain its stability until the cement sets to form a self-supporting matrix. The resulting LDCC shall have essentially closed cell and low water absorptive characteristics. The concentration of foam agent shall be in accordance with the foaming agent material manufacturer's recommendations.

1. Admixtures: The admixture content, batching method, and time of introduction to the mix shall be in accordance with the manufacturer's recommendations for minimum shrinkage and for compliance with these specifications. Admixtures may be used when specifically approved by foaming agent material manufacturer and shall be in accordance with their recommendations. No calcium chloride or admixture containing chloride, other than impurities from admixture ingredients, will be acceptable.

2. A test mix shall be designed and tested in accordance with ASTM C 796 for each consistency intended for use. These results will be compared with field test results to confirm consistent properties are obtained in the field. Testing for each mix shall be as follows:

a. Two sets of compression test cylinders (3 inches by 6 inches), three cylinders per set, shall be made from each proposed LDCC mix.

b. One set of three cylinders shall be tested at an age of 7 days and the other set shall be tested at an age of 28 days. LDCC test specimens shall be made, cured, stored, and tested in conformity with ASTM C 495.

c. Determine total air content of each proposed LDCC mix in accordance with ASTM C 796.

d. Determine unit weight of each proposed LDCC mix in accordance with ASTM C 567.

2.03 EQUIPMENT

A. Use equipment for mixing and injecting LDCC which is designed for underground backfill grouting service. Provide batching, mixing and pumping equipment that is compatible and of sufficient size and capacity to place LDCC to distances and volumes proposed by the Contractor.

B. LDCC shall be made using preformed foam process equipment approved by the foaming agent material manufacturer.

C. Maintain equipment in good operating condition, capable of satisfactorily mixing, agitating, and forcing LDCC backfill into injection ports at a uniform flow rate under the required constant pressure.

D. Backfill grouting equipment shall be configured so flushing can be accomplished with grout intake valves closed, with water supply valve open, and with grout pump running at full speed.

E. An adequate inventory of spare parts or backup equipment shall be provided to ensure that operable backfill grouting equipment is available at all times during the work. Maintain sufficient quantities of spare pressure gauges, stop valves, and other wear parts on site.

F. Batch system shall provide graphical or digital printout records of batch scale readings, accurate to one (1) pound of the dry mix ingredients before delivery to mixer.

G. At the point of injection, suitable valves and calibrated pressure gauges shall be provided so that the pressure and grout flow at the grout hole may be regulated and monitored. Provide at or very near the point of injection, a system of valves in the line transporting the grout that will allow easy access for collection of test specimens. Provide an automatic bypass valve set to the maximum pressure specified. Provide suitable stop valves at the injection point for use in maintaining pressure, as required, until grout has set. Use hoses or pipes of proper type and diameter to withstand maximum injection pressures used.

2.04 QUALITY ASSURANCE

A. Field Services. The foaming agent material manufacturer shall provide engineering field services to review the project and the material application prior to any preparation; to approve the applicator, the material used, the equipment, and the procedure to be used; to approve setup before production of LDCC; and to observe during initial application. The field representative of the material manufacturer shall submit, in writing, approvals of proposed material, equipment, application procedures, applicator, and setup before production.

B. Pipe Manufacturer Representative. Refer to Section 02426 – Installation of Carrier Pipe in Tunnel for pipe manufacturer field services employee requirements during annular backfill grouting.

PART 3 – EXECUTION

3.01 GENERAL

A. Low density cellular concrete shall be placed in accordance with the approved work plan.

B. Bulkheads shall be constructed at the end of each reach of pipe (lift segment) to be backfilled.

1. Bulkheads shall be constructed so the annular space will be completely backfill grouted.

2. Bulkheads shall incorporate a minimum 1-inch diameter drainpipe in the invert of the tunnel and invert of each grout lift to facilitate drainage of water during backfill grouting. This pipe shall be securely capped and plugged once LDCC backfill begins to flow from the drain line.

3. A minimum 1-inch diameter vent pipe shall be provided in the tunnel crown to allow entrapped air to escape and allow for visual confirmation that the annular space is filled. Vent outlets shall be provided where required by the contractor's bulkhead design.

C. Inform the Engineer at least 24 hours in advance of the times and locations where placement of LDCC is anticipated.

3.02 BATCHING AND MIXING

A. General. Conform to the requirements of accepted submittals and the foaming agent manufacturer's recommendations.

B. Mixing. All LDCC shall be mechanically mixed to produce a uniform distribution of the materials with a suitable consistency and the specified limiting requirements. Excessive

mixing shall be avoided in order to reduce the possibility of changes in unit weight and consistency.

1. In batch mixing operations, follow the manufacturer's recommendations concerning the order of charging the mixer with the various ingredients. The as-cast unit weight shall be monitored at the point of placement. Allowance should be made for any additional mixing that may result from the method of placement, such as mechanical or pneumatic pumping, and for any unit weight changes that may result from these methods.

2. For continuous mixing operations, provision shall be made for reasonably uniform and continuous rate of addition of all mix components at appropriate positions in the mixing machine, and in the correct ratio, to assure uniformity and the specified limiting requirements at the point of placement.

3.03 PLACING LDCC

A. General Requirements. All void space outside of the carrier pipe shall be completely filled with low density cellular concrete. Force LDCC into all irregularities around the tunnel to completely fill the tunnel annulus to the crown with low density cellular concrete to the maximum extent possible. Place LDCC in accordance with approved submittals.

B. Monolithic pours shall only be permitted if the carrier pipe is completely filled with water and Contractor can demonstrate that his placement techniques will not induce movement of the pipe.

C. If Contractor elects to not fill carrier pipe with water, Contractor shall place LDCC in three or more equal volume lifts.

D. Contractor shall submit calculations demonstrating that his method of placement shall not cause the carrier pipe temperature to exceed the maximum allowable temperature as designated by the pipe manufacturer from the heat of hydration of the LDCC.

E. Before installing carrier pipe in sections of tunnel that require structural sand-cement mortar grout for annular backfill, installation of upstream or downstream carrier pipe shall be temporarily suspended; a bulkhead shall be constructed, and the annulus backfilled with LDCC.

F. Similarly, when pipe installation is completed in a section of tunnel requiring structural sand-cement mortar grout in the annulus; installation of pipe shall be temporarily suspended; a bulkhead shall be constructed, and the annulus backfilled with the required material.

G. Length of carrier pipe installed between LDCC pours shall not exceed the annular backfill grouting maximum reach (lift segment) requirements in Specification Section 02426 – Installation of Carrier Pipe in Tunnel unless Contractor can clearly demonstrate that placement beyond these lengths can be accomplished with complete backfill of the

annulus (no voids), no pressure damage to the carrier pipe and no thermal damage to the carrier pipe. Repeat this cycle until all carrier pipe is installed and grouted.

H. Pressure gauges of appropriate range for monitoring the low density cellular concrete injection pressures shall be located in the line transporting the LDCC as close to the point of injection as possible.

I. Volume of LDCC injected shall be calculated on an indirect basis and compared with the anticipated volume per foot of pipe backfilled.

J. Provide a means of direct communication between the injection point and the pump operator.

3.04 FIELD QUALITY CONTROL

A. General. Field control tests, including unit weight (Foamed Density), air content test, and compression tests shall be performed by the Contractor and the results submitted to the Engineer.

1. The frequency specified herein for each field control test is approximate. A greater or lesser number of tests may be made, as required by the Engineer.

2. Test specimens shall be collected within the tunnel at or near the connection where the LDCC is being injected.

3. The Contractor shall assist the Engineer in obtaining test cylinders. Supply all materials necessary for obtaining the test cylinders, including cylinder molds.

4. Monitor carrier pipe temperature for one week after LDCC placement no less than once per day. Submit temperature readings for the entire period to the Engineer.

B. Unit Weight. Unit weight (Foamed Density) tests shall be made from the first batch mixed each day, after a change in mix design, every 30 minutes during pumping, and from each batch of LDCC from which compression test cylinders are made. Unit weight shall be determined in accordance with ASTM C 567. Unit weight at the point of placement shall be within plus or minus 5 percent of the unit weight established for the mix design being placed. Adjust mix as required to obtain the specified Foamed Density.

C. Air Content. An air content test shall be made from the first batch mixed each day, and from each batch of LDCC from which concrete compression test cylinders are made. Air content at the point of placement will be the difference between the Foamed Density at the point of placement less the Foamed Density at the point immediately before the addition of preformed foam. Air content shall be determined in accordance with ASTM C 138 except there will be no vibration or rodding of the sample.

D. Compression test cylinders shall be made in the field, cured and stored in the laboratory, and tested in accordance with ASTM C 495. One set of six (6) test cylinders (3 inches by 6 inches) shall be made for each shift when LDCC is placed. Each set of compression

test cylinders shall be marked or tagged with the date and time of day the cylinders were made, the location in the work where the LDCC represented by the cylinder was placed, batch number, unit weight (Foamed Density), and the air content. One additional set shall be made from each additional 200 cubic yards, or major fraction thereof, placed in any one shift. Two cylinders from each set will be tested at an age of 28 days and two cylinders from each set will be tested at an age of 56 days.

E. Compressive strength of LDCC shall be considered satisfactory if both of the following requirements are met:

1. Average of three consecutive compressive strength tests equal or exceed the specified unconfined compressive strength. (A strength test shall be the average of two compressive strengths of two cylinders made from the same concrete sample and tested at 28 days.)

2. No individual compressive strength test (average of the two cylinders) is below the specified unconfined compressive strength by more than 20 percent.

3.05 PROTECTION AND CLEAN UP

A. Take all necessary precautions to protect and preserve the interior of the pipe from damage. Spills shall be minimized and shall be cleaned up immediately. Any damage to the pipe caused by or occurring during the backfilling operations shall be repaired by a method approved by the Engineer, at no additional cost to the Owner.

B. During backfilling work, provide for adequate disposal of all waste and wastewater. Remove and properly dispose of all waste resulting from backfill grouting operations.

END OF SECTION

SECTION 02446

TUNNEL BY GUIDED BORE AND JACK METHOD (GB&J)

PART 1 – GENERAL

1.01 SCOPE

A. The work described by this Section consists of furnishing all labor, equipment, materials, and incidentals required install casing pipe by trenchless hydraulic jacking within the limits of work as defined on the Contract Drawings and in the Tunneling Method Table in Project Specific Notes (PSN).

B. Work shall be done in accordance with all Federal, State, and local laws, regulations and requirements as shown on the Drawings and as specified herein.

C. All available and known geotechnical reports, logs, borings, and laboratory testing that have been performed within close proximity of the project corridor have been made available as "technical data" and not part of the Contract Documents. This provided as information only and solely for the convenience of Bidders. The Owner and/or the Consultant do not warrant or guarantee the accuracy or correctness of this material with respect to actual subsurface conditions. Subsurface conditions are considered unclassified and no expectation of quantity, specific location of ground conditions, or geotechnical baselines are provided or assumed herein.

D. Contractor shall review all available geotechnical reports and data and perform any additional subsurface investigations he deems necessary at his own expense for the planning and the selection of tunneling techniques and methods in order to enable proper construction as shown on the Drawings and other requirements of Contract Documents.

E. Dewatering shall be controlled such that the launching and exit shafts are free of water, but the surrounding groundwater table is not substantially lowered such that settlement along the tunnel drive or nearby existing structures and foundations does not occur.

F. For all excavations defined under this Section, Contractor shall install steel casing using techniques and methods selected by the Contractor that, based on past experience, will be capable of handling the various anticipated ground conditions and is capable of minimizing loss of soil ahead of and around the machine providing full support of the excavated face.

G. The work, as detailed on the Drawings and described in these Specifications, shall include, but not be limited to, the following:

1. Pipe jacking by track type boring machine or hydraulic jacking frame.

2. Casing/tunnel excavation by mechanized cutting face appropriate for the prevailing subsurface conditions.

3. The use of an advanced guidance method such as laser guidance, steerable cutting heads, or a pre-bore pilot tube to meet line and grade tolerance requirements.

4. Removal of casing/tunnel spoil by helical spiral auger.

5. Supplying and installing casing/jacking pipe as initial excavation support.

6. Installation of carrier pipe and associated blocking and support.

7. Bulkheads and concrete cradles.

8. Filling of voids with grout between casing/jacking pipe and earth, if required.

9. Design and construction of launch and receiving shafts.

10. Dewatering at the shafts.

11. Dewatering of the tunnel alignment

12. Appropriate disposal of groundwater effluent.

13. Location markers and miscellaneous appurtenances as required to complete the installation.

H. The work shall include furnishing, installing and monitoring a settlement monitoring system.

I. Boring/tunneling activities shall not cause any damage to nearby structures, railroad tracks, utilities or pavement.

J. The Contractor shall be familiar with the conditions under which the work will be performed and with all necessary details as to the orderly prosecution of the work. Review and interpret available geotechnical reports and investigate work site soil conditions before bidding.

K. Contractor may choose to increase the casing diameter, at no additional cost to the Owner, as needed to account for the Contractor's selected means and methods, operational procedures, and to provide adequate internal tolerance to account for the prevailing project site and subsurface conditions. If Contractor elects to modify casing diameter from size shown in the Contract Documents, the Contractor accepts all responsibility for acquiring approval for any modification or addenda to all right-of-way encroachment agreements, occupancy permits, or other established requirements and specifications of the entity being crossed.

L. Follow all OSHA regulations regarding confined space for casing installation and temporary shaft excavations.

M. Conform with all Kentucky Transportation Cabinet (KYTC) and Federal Highway Administration requirements for work within their respective highway rights-of-way and any additional requirements of the contiguous property and utility owners.

N. The use of a rescue shaft requires approval from all parties impacted by its excavation, dewatering, traffic effects, and/or disturbance. It is the responsibility of the Contractor to acquire such permission.

O. Direct jacking of carrier pipe without casing by the methods defined herein is prohibited.

P. The Contractor shall retain the service of a Professional Engineer registered in the Commonwealth of Kentucky to prepare boring/tunneling design and submittals described herein.

Q. If required by permit, boring/tunneling operations under roads or railroads will be on a continuous basis, 24 hours per day, 7 days a week until casing installation is complete.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 02222 – Excavation for Tunnel Shafts

B. Section 02225 – Excavating, Backfilling, and Compacting for Sewers

C. Section 02426 – Installation of Carrier Pipe in Tunnels

D. Section 02431 – Tunnel Grout

E. Section 02432 – Low Density Cellular Concrete

F. Tunneling Method Table in Project Specific Notes (PSN)

1.03 REFERENCE STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. Applicable codes, ordinances, statutes and governing rules and regulations of governing municipalities and counties, the Commonwealth of Kentucky, and the Federal Government.

2. American Association of State Highway and Transportation Officials (AASHTO).

3. American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual for Railway Engineering.

4. Occupational Safety and Health Administration (OSHA) Regulations and Standards for Underground Construction 29 CFR Part 1926, subpart S and other applicable OSHA parts.

5. Applicable ASTM and AWWA Standards for materials and methods.

6. Kentucky Transportation Cabinet (KYTC) Permit Guidance Manual

7. All applicable guidelines and restrictions of the United States Army Corps of Engineers (USACE) and Department of Environmental Protection (DEP).

1.04 DEFINITIONS

A. Unless otherwise stated or particular context otherwise requires, the definitions and provisions contained in this section shall govern the construction, meaning and application of words and phrases utilized in this specification. For purposes of this specification, the following terms are defined as follows:

1. Annular Space: The void created between the outside of the initial support system being installed and the extreme outer excavation limits created by TBM. Also, the void space between the initial support and the carrier pipe when a two-pass tunnel is installed.

2. Carrier Pipe: A pipe used for conveyance of water or sewer. Carrier pipe shall be as specified in the Tunneling Method Table in Project Specific Notes (PSN).

3. Drive: Section of jacking pipe installed by tunneling from launching shaft to exit shaft.

4. Entrance and Exit Seals: Seals placed at the breakout into and out of the shafts. The seals are intended to prevent groundwater inflow and loss of ground into the shafts.

5. Exit Shaft or Retrieval Shaft: Shaft utilized for retrieval of the tunneling equipment.

6. Jacking Pipe: A casing pipe used as the initial support in a two-pass tunneling operation. The casing pipe is not a carrier pipe.

7. Launching Shaft: Excavation from which tunneling equipment is launched.

8. Spoil: Excavated soil and bedrock material that has been generated by the tunneling process.

9. Thrust block: Concrete or steel wall at the back of the launching shaft providing a reaction for jacks pushing the pipe.

10. Tunneling Methodology: A written description, together with supporting documentation that defines Contractor's plans and procedures for the tunneling operations.

11. Two-Pass Tunneling: Tunneling where initial support is installed concurrent with the excavation process to stabilize the tunnel excavation and a carrier pipe is installed in a subsequent phase or the second pass.

1.05 DESIGN CRITERIA

A. Tunneling equipment selected for the project shall be compatible with the geologic conditions described in all available geotechnical data provided as Technical Data, and not included in the Contract Documents, and any additional geologic testing performed the Contractor deems necessary to select appropriate equipment.

B. Design of the jacking pipe, including pipe joints, reinforcement, stiffness, compressive strength, and determining acceptable pipe fabrication tolerances is the responsibility of the Contractor as it relates to all loading on the pipe due to installation. Maximum compressive stresses applied to the pipe shall not exceed the manufacturer's recommended allowable stresses.

C. Contractor's Engineer shall design the launching and exit shafts in accordance with Section 02222 – Excavation.

D. Design backstops, thrust block and concrete seal for all earth loads, and to prevent significant water intrusion. The thrust block shall be perpendicular to the proposed pipe alignment and shall be designed to withstand the maximum jacking pressure to be used, with a factor of safety of at least 2.0, without excessive deflection or displacement.

E. All thrust wall and floor reaction concrete designs shall be the responsibility of the Contractor, if needed.

F. All design calculations provided by the Contractor as part of the required submittals shall be sealed by a licensed Professional Engineer registered in the Commonwealth of Kentucky.

1.06 SUBMITTALS

A. Conform to Section 01300 – Submittals

B. Detailed Tunnel Methodology sufficient to convey the following:

1. Casing/Jacking pipe shop drawings and material data from casing pipe manufacturer.

2. Bore pit excavation details including footprint drawing of bore pit, design and calculations for any sheeting or shoring utilized signed and sealed by a licensed Professional Engineer registered in the Commonwealth of Kentucky.

3. Construction sequence plan comprised of sketches, redline markups of Drawings or graphical representation, as well as a schedule or timeline and descriptions. The construction sequence plan shall include:

    a. Shaft excavation, dewatering, and shoring.

    b. Assembly and setup of rail-type hydraulic jacking frame or auger boring machine.

    c. Tunnel excavation equipment and procedures including cutter heads and attachments.

    d. Spoil removal.

    e. Installation of carrier pipe including arrangement and manufacturer's information and shop drawings for casing spacers or blocking design.

    f. Procedures for annular grouting of the space between the casing and the earth and installation of bulk head.

4. Settlement Monitoring Plan and Site Assessment:

    a. Submit a settlement monitoring plan meeting the requirements outlined in Article 3.08 for review prior to construction. The plan shall identify the location of settlement monitoring points, reference benchmarks, survey frequency and procedures, and reporting formats.

1.07 QUALIFICATIONS

A. The Contractor or Subcontractor performing tunnel construction must demonstrate in writing that he has requisite past project experience constructing tunnels similar to those on this Project.

B. The Contractor or Subcontractor shall have the following minimum experience related to Tunnel by Bore and Jack Method (GB&J):

1. Five (5) years' experience performing bore and jack steel casing installation of similar diameter and scope.

2. Installed a minimum of 5,000 linear feet of steel casing by bore and jack methods.

3. Installed a minimum of 2,000 linear feet of 36-inch or larger steel casing.

4. Three (3) tunnel projects completed in the last 10-years performed using bore and jack methods including laser guidance, steerable cutting heads, or pilot-tube pre-bore with individual, single drives of 200 linear feet or greater.

5. Two (2) tunnel projects completed in the last 10-years performed in rock.

6. Three (3) underground construction projects completed in the last ten (10) years that involved the design and construction of a temporary or permanent jacking shaft with dewatering.

PART 2 – MATERIALS

2.01 STEEL CASING PIPE

A. The casing pipe shall be in accordance with Section 02425 – Initial Tunnel Support.

2.02 CARRIER PIPE

A. The carrier pipe shall be in accordance with the Tunneling Method Table in Project Specific Notes (PSN).

2.03 GROUT

A. Grout shall be in accordance with Section 02431 – Tunnel Grout or Section 02432 – Low Density Cellular Grout, but the annular space between the carrier pipe and tunnel walls is only grouted when ribs and lagging is utilized.

2.04 SLURRY LUBRICATION

A. Slurry lubrication shall be the responsibility of the Contractor.

PART 3 – EXECUTION

3.01 INSTALLATION - GENERAL

A. Contractor shall follow the approved methods, sequence, and contingency plans submitted and approved.

B. Prior to beginning boring operations, the Contractor shall install a settlement monitoring system in accordance with Article 3.07.

C. If a combination of casing and tunnel is required, details of the proposed junction shall be submitted to and approved by the Engineer.

D. The Contractor shall be prepared to bore through weathered or partially weathered rock, if encountered, with a specialized bit or hand-mine if necessary. Encountering rock or water will not entitle Contractor to additional compensation.

E. When impossible to advance borehole or pipe, notify Engineer and submit a rescue plan for review.

F. If abandonment of the tunnel is required fill with grout, unless otherwise directed by the Engineer. Grout shall be in accordance with Section 02431 – Tunnel Grout.

G. The recommended methods and details shown on the Drawings and specified herein, are intended to indicate the minimum acceptable standard of quality required for the casing/tunnel installation. Other methods of installation, based on acceptable industry standards and techniques, may be acceptable for the installation. Under no conditions shall jetting or wet boring of the casing/tunnel be allowed.

H. All excavations and pits shall be well sheeted and braced as necessary for safe and adequate access for workmen, inspections, and materials and shall be of a size suitable to equipment and material handling requirements.

I. Shaft shoring shall be in accordance with plans and details provided by the Contractor's Engineer under Article1.04.

J. Shafts shall be excavated and backfilled in accordance with Section 02222 – Excavation and Section 02225 – Excavating, Backfilling and Compacting for Sewers, and meet all Federal and state OSHA requirements for a safe excavation.

K. If any surface movement, settlement, or heaving occurs which causes or might cause damage to an existing pavement, structure, or utility, located over, along or adjacent to the work, Contractor shall immediately stop all work except that which assists in making the work secure and in preventing further movement, settlement or damage. Resume boring/tunneling only after:

1. All necessary precautions have been taken to prevent further movement, settlement or damage, and all damage has been repaired at the Contractor's expense and to the satisfaction of the Engineer.

2. The Contractor selected method of tunnel excavation is appropriate and capable of further casing installation without expectation of similar unacceptable movement, settlement, or structural damage.

3.02 SHAFT DEWATERING

A. When water is encountered, develop and maintain a dewatering system of sufficient capacity to remove water continuously, keeping excavations free of water until backfill operation is in progress.

B. Keep removal of soils particles from dewatering to a minimum.

C. Dewater into sediment filter bags or construct sediment traps in accordance with State and local erosion, sediment, and stormwater controls.

D. Observe surface facilities to verify there is no settlement or displacement occurring due to dewatering.

E. Should settlement or displacement be detected, notify Engineer immediately and act to maintain safe conditions and prevent damage.

3.03 BORING AND JACKING

A. As the boring operation progresses, each new section of the casing pipe shall be 360° butt-welded to the next section previously jacked into place unless special interlocking joints are allowed. Butt welds shall conform to industry standards for boring operations.

B. The boring equipment to be used for installing the jacked casing shall be of such size and capacity to allow the boring to proceed in a safe and expeditious manner. The installation of the casing and boring of the hole shall be done as rapidly as possible and shall be done simultaneously to avoid voids, cave-ins or settlement and for safety of traffic above.

C. Provide slurry lubricant as needed to facilitate movement or lessen the danger of the jacking pipe seizing.

D. Maintain face of cutting head to preclude free flow of soft or poor soils material.

E. Grout ports shall be installed in the top section of the casing pipe at an interval sufficient for all voids to be filled by pressure grouting in accordance with Section 02431 – Tunnel Grout.

F. Notify Engineer immediately if an obstruction stopping forward motion of operation is encountered during installation. If the casing pipe is at least 30-inches in diameter, the auger shall be withdrawn, and the obstruction removed. If a bolder is encountered and is removed by blasting or other approved method, the void shall be filled with grout, as previously specified. No blasting shall be permitted until a detailed blasting plan is submitted to and approved by the Engineer.

3.04 GROUTING OF EXTERIOR ANNULAR SPACE FOR CASING PIPE

A. Promptly following completion of the casing installation, pressure grout to fill all voids existing outside of the casing pipe for all casings 36-inches and larger in outside diameter. If the outside diameter is less than 36-inches, then the annular space outside the casing is to be grouted if the excavated diameter is more that 1-inch larger than the outside diameter of the casing.

B. For casings 36-inches and larger in outside diameter, grouting shall be performed from the interior of the casing pipe through grouting holes. Lubricant shall be displaced by the grout. Grouting shall be started in the lowest connections and shall proceed until grout begins to flow from upper connections. The void shall be completely filled. Displaced lubricant shall be disposed of off-site in accordance with applicable regulations and codes of all Federal, State, and local agencies.

C. Grout shall be in accordance with Section 02431 – Tunnel Grout.

D. Liquid grout pressure shall not exceed one-half of the existing overburden pressure.

E. After grouting is complete, pressure shall be maintained by means of stopcocks or other suitable devices until the grout has set sufficiently in the judgment of the Engineer, or for a minimum of 24 hours, whichever is longer. After the grout is set, grout holes shall be completely filled with dense concrete and finished neatly without evidence of voids or projections.

3.05 CASING/TUNNEL ALIGNMENT

A. Contractor shall select and use proper equipment and operational procedures including advanced line and grade control systems to meet the horizontal and vertical alignment requirements of the project as identified on the Drawings within the acceptance criteria listed below. Contractor shall determine the need for and select systems and methods for achieving the adequate line and grade control appropriate for the ground conditions and constraints of the project including:

1. Water-level grade monitoring or laser-level line and grade monitoring systems.

2. Methods for tracking location of cutter head such as sonde receivers, or other systems.

3. Pilot tube pre-drilling to set and maintain alignment as necessary to meet Contract Documents.

4. Articulated, steerable cutterhead or other hydraulically actuated steering system.

B. The Contractor shall check the vertical and horizontal alignment of the casing by survey instrument in spacing intervals as deemed appropriate by the Contractor to meet the line and grade requirements and subsurface conditions of the project.

C. If excavated alignment is found to be off line or grade and the tunnel progresses, make alignment corrections to the installation of the casing as needed to meet required carrier pipe tolerances.

D. Following completion of tunnel, the Contractor shall set the line and grade modifications and spacer settings as needed to install the carrier pipe within the contract tolerances.

3.06 CARRIER PIPE INSTALLATION

A. Contractor shall install carrier pipe in casing in accordance with Section 02426 – Installation of Carrier Pipe in Tunnels.

3.07 ACCEPTANCE CRITERIA FOR LINE AND GRADE

A. Prior to installing the carrier pipe, Contractor shall verify that the casing has been installed so that the carrier pipe may be placed in conformance with the line and grade specified on the Drawings.

B. If the carrier pipe cannot be installed to the invert elevation shown on the Drawings, notify the Engineer and establish a plan for adjusting the grade of the pipeline to meet slope requirements.

C. Pipe installed and subsequently abandoned shall be fully grouted in accordance with either Section 02431 – Tunnel Grout, or Section 02432 – Low Density Cellular Concrete.

3.08 SURFACE MONITORING:

A. The Contractor will be held solely responsible for damages to highway and street surfaces, railroads, pavements, structures, structural embankments, sidewalks, curbing, and public utilities resulting from subsidence, failure of initial support system, or ground losses into the initial support system and for the refilling of voids with grout. Where such ground losses are so severe that they result in damage to underground or surface pavement, existing utilities or structures, the Contractor shall be solely responsible for remedying such damage. Where the filling of voids cannot be effectively carried out from below, the Engineer reserves the right to order the Contractor, at no additional cost to the Owner, to make openings from the surface for the purpose of backfilling the voids.

B. As a minimum, surface monitoring points shall be established consisting of settlement markers to detect surface movement of roadway and pavement.

C. Survey the site showing locations and elevations of existing ground, pavement, and other permanent features to establish a baseline for existing conditions along the centerline of the proposed pipe/tunnel, and along two parallel lines 20-feet on either side of the centerline.

D. Surface settlement marks:

1. Surface settlement markers shall be located at 25-foot centers along the tunnel center line.

E. All markers/points shall be surveyed as follows:

1. Prior to beginning any work.

2. At 50% completion of the tunnel.

3. The same points shall also be surveyed 90 days after the work is completed and both shafts have been backfilled.

F. Ground Surface Movement:

1. The tunneling machine shall be operated so as to prevent both surface heave and loss of ground during tunneling.

1. Unless more stringent requirements are set forth by third party agencies, settlement or heave of the ground surface along the alignment shall not exceed 1 inch.

2. If the ground subsidence or heave exceeds 1 inch the tunneling operations shall stop and remedial measures approved by the Engineer shall be implemented.

2. If any movement or settlement occurs which causes or might cause damage to an existing structure over, along or adjacent to the work, immediately stop any or all work except that which assists in making the work secure and in preventing further movement, settlement or damage. Resume tunneling only after all necessary precautions have been taken to prevent further movement, settlement or damage, and repair the damage at the Contractor's expense and to the satisfaction of the Engineer.

3. Restrict the excavation of materials to only those that are physically displaced by the equipment itself in order to prevent loss of ground and settlement or possible damage to overlying structures. Monitor the volume of material excavated and adjust operations as required to avoid loss of ground, over excavation or surface heave.

G. Lateral Displacements: Unless more stringent requirements are set forth by third party agencies, lateral movement or deflection of shaft excavation support system shall be limited to 0.5 inch.

H. Report any settlement or movement immediately to the Engineer.

3.09 SITE AND WORK SAFETY:

A. Comply with applicable regulations of Federal Government, OSHA 29CFR 1926, and applicable criteria of ANSI A 10.16 "Safety Requirements for Tunnels, Shafts, and Caissons", as amended to date.

B. Safety is the full responsibility of the Contractor.

3.10 SITE RESTORATION:

A. Site restoration shall be in accordance with the Drawings and applicable sections of these specifications.

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.

PART 2 – PRODUCTS

2.01 DUCTILE IRON (DI) PIPE

A. Ductile iron pipe shall be furnished cement lined in accordance with ANSI/AWWA C104/A21.4 with bituminous seal coat unless otherwise noted on the drawings or in Bid Form. 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. **All DI pipe and fittings shall be lined with Protecto 401 coating, or approved equal as specified hereinafter.**

B. Thickness design of ductile iron shall conform in all aspects to the requirements of ANSI/AWWA C150/A 21.50 latest revision.

C. Manufacture and testing of ductile iron pipe shall conform in all aspects to the requirements of ANSI/AWWA C151/A 21.51 latest revision.

D. 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 interior of all ductile iron pipe and fittings shall be lined with Protecto 401 Ceramic Epoxy as manufactured by Induron Protective Coatings, Permox CTF as manufactured by The Permite Corporation, or Perma-Shield PL Series 431 as manufactured by Tnemec Company, Inc. Any request for substitution must be accompanied by a successful history of lining pipe and fittings for sewer service, a test report verifying appropriate properties to be used in wastewater piping, and a certification of the test results.

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. 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 epoxy. 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 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

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 undergo holiday inspection in accordance with American Waterworks Association Standard AWWA C210. Holiday inspection may be conducted any time after the coating has reached sufficient cure based on the coating manufacturer's recommendation.

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

a) 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

1) Epoxy 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

a. 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.

E. 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.

F. All ductile and cast iron fittings shall be ductile iron grade 70-50-05, 65-45-12, or 60-42-10 in compliance with AWWA C153 and AWWA C110.

G. 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.

H. Pipe shall be as manufactured by U.S. Pipe & Foundry Company, McWane Ductile, American Pipe Company, or equal.

I. 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 POLYVINYL CHLORIDE (PVC) PIPE (SOLID WALL)

A. Bury depth 20 feet or less or encased in steel pipe: 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 conform to ASTM D-1784. For depths 15 feet and less, pipe shall have a pipe diameter to wall thickness ratio (SDR) of 35. For depths greater than 15 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. Bury depth 20 feet or less or encased in steel pipe: PVC pipe and fitting with diameters 18-inch and larger shall conform to the requirements of ASTM D-1784 and ASTM F-679. For depths 15 feet and less, pipe shall have pipe stiffness 46 (SDR 35). For depths greater than 15 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. Bury depth greater than 20 feet: PVC pipe 8 inches through 36-inch PVC plastic pipe shall conform to ANSI/AWWA C900. Pipe shall be pressure Class 165, DR 25. PVC pipe shall have 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.

D. 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.

E. Pipe shall be furnished in lengths of at least 12 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.

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". C900 for sewer would require the use of C900 sewer fittings.

G. PVC pipe fittings shall be compatible with selected pipe.

H. Pipe color shall be green.

I. PVC pipe installation shall conform to ASTM D-2321 latest revision.

J. Pipe shall be manufactured by JM Eagle, Diamond Plastics, 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 Elastomeric 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.

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 D3262.

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.**

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 36 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 POLYPROPYLENE (PP) PIPE (TRIPLE-WALL)

A. Only Polypropylene Pipe with a triple-wall construction shall be acceptable. Triple wall pipe shall meet ASTM F2764.

B. Pipe shall have a minimum pipe stiffness of 46 psi when tested in accordance with ASTM D2412.

C. Bury depth shall be in accordance to the table below. The table below does not consider hydrostatic pressure. The presence of hydrostatic pressure will lower the maximum bury depths listed. Compaction levels shown are for standard Proctor density.

Maximum Cover Pipe, ft.			
Diameter, in.	Class 1	Class 2	
	Compacted	95%	90%
30	30	21	15
36	29	21	15
42	32	22	16
48	33	23	16
60	31	21	15

D. Pipe shall be joined using a bell and spigot joint meeting the requirements of ASTM F2764. The joint shall be watertight according to the requirements of ASTM D3212. Gaskets shall meet the requirements of ASTM F477. 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. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gaskets are free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly. 30- through 60-inch diameters shall have a reinforced bell with a polymer composite band installed by the manufacturer.

E. Fittings shall conform to ASTM F2764. Bell and spigot connections shall utilize a welded or integral bell and valley or inline gaskets meeting the watertight joint performance requirements of ASTM D3212.

F. To assure watertightness, field performance verification may be accomplished by testing in accordance with ASTM F1417 or ASTM 2487. Appropriate safety precautions must be used with field-testing any pipe material. Contact the manufacturer for recommended leakage rates.

G. Polypropylene compound for pipe and fitting production shall be an impact modified copolymer meeting the material requirements of ASTM F2764.

H. Installation shall be in accordance with ASTM D2321 and manufacturers recommended installation guidelines.

I. When backfilling trench with flowable fill, Contractor shall use an anchoring system and incremental lifts to avoid pipe flotation. Contractor shall consult pipe manufacturer for requirements to avoid pipe flotation in flowable fill installations.

J. Pipe shall be manufactured by Advanced Drainage Systems, Inc. or equal.

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 like sizes of PVC pipe shall use a PVC GXG Repair Coupling.

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 UNDERGROUND WARNING TAPE

A. All pipe shall include detectable underground warning tape. Warning tape shall have a minimum thickness of 5 mils, constructed of a minimum 0.0003" (0.3 mils) aluminum foil laminated between polyester and polyethylene sheeting, color coded to sewer, and suitable for direct bury.

B. Warning tape installed per LFUCG standard drawings.

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.

F. Pipe will have the same material specification between manholes.

3.02 PIPE ASSEMBLY

A. All bell and spigot surfaces shall be cleaned immediately before homing 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 pipe assembly shall follow the direction of the manufacturers 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 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.

3.04 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, FRP, DI, and PP) 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), Ductile Iron (DI), and Polypropylene (PP) 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.

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

THIS PAGE LEFT BLANK INTENTIONALLY

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

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.

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 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, for up to 5' manholes, 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, Xypex Bio-San C500, or approved equal. This admixture**

would be in addition to the cementitious crystalline admixture listed in paragraph 2.01.C above.

E. Manholes located in the 100-year floodplain shall have a concrete base that includes an anti-flotation collar. The collar shall have a minimum radius 6-inches larger than the exterior wall of the base section. Contractor shall submit buoyancy calculations for all manholes within the 100-year floodplain to determine the actual width of the anti-floatation collar. Contractor shall assume buoyance of the manhole to an elevation equal to the 100-year flood elevation. Buoyancy calculations shall have a factor of safety of 1.2.

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 iCast, Oldcastle Infrastructure 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.

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. 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 10-1/2 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 pipe to manhole connectors shall conform to the latest revision of ASTM-C923. The pipe to manhole connectors shall be A-Lok Manhole Pipe Seal A-Lok Premium manufactured by A-Lok Corporation, Trenton, NJ; or an approved equal. Z-Lok Cast In Boot Connector manufactured by A-Lok Corporation may be used for pipe connections up to 18-inches in diameter.

2.06 MANHOLE DIAPHRAGM

A. Diaphragm manhole inserts shall be provided for all manholes with pipe connection diameters of 12-inches and greater.

B. 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 all manholes per the General Notes.

C. 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.

D. 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.

E. 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.

F. 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.

G. 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.

H. Diaphragm shall be Rainstopper manufactured by Rainstopper, Inc., 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.

B. All outside drop manholes are to be precast. No field casting of drop manholes shall be allowed unless directed by the Engineer.

C. Drop invert shall be at the springline of the mainline pipe.

2.09 EXTERNAL SEALS

A. All manhole section joints shall receive an external seal. The external seal shall be installed per the manufacturer's recommendations and shall meet ASTM C 877 (Type II). External seals for standard manholes shall be MARMAC MacWrap with straps. External seals for external drop manholes shall be ConWrap CS-212.

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 3 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 manhole section joints shall receive an external seal. The external seal shall be installed per the manufacturer recommendations and shall meet ASTM C 877 (Type II) and have Type 316 stainless steel ratcheting straps. External seals shall be MARMAC MacWrap for manholes with straps.

D. 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 and precast and cast in place drop manholes, 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

1. All lift holes and any pipes entering the manhole are to be plugged. All drop piping (precast or cast in place) shall be tested and included in the pressure testing zone). 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

1. 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.

   a. 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.

   b. All drop piping (precast or cast in place) shall be tested and included in the pressure testing zone).

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

1. 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

THIS PAGE LEFT BLANK INTENTIONALLY

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

THIS PAGE LEFT BLANK INTENTIONALLY

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

THIS PAGE LEFT BLANK INTENTIONALLY

SECTION 02700
ASHPALT PAVING

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. The asphalt 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 in Fayette County shall be constructed in accordance with the following sections of the Kentucky Transportation Cabinet's (KTC) Standard Specifications for Road and Bridge Construction. Items not covered by the KTC specifications shall require a special design by the Engineer and shall be approved by LFUCG.

1.	Embankment	Division 200
2.	Excavation	Division 200
3.	Subgrade	Division 200
4.	Dense Graded Aggregate	Division 300
5.	Bituminous Concrete (Asphalt)	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 (Zone 3 per LFUCG-RMP Standard Drawing 201-1) shall be applied in thicknesses of no less 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.

END OF SECTION

THIS PAGE LEFT BLANK INTENTIONALLY

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 03200
REINFORCING STEEL

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Provide all concrete reinforcing including all cutting, bending, fastening and any special work necessary to hold the reinforcing steel in place and protect it from injury and corrosion in accordance with the requirements of this section.

B. Provide deformed reinforcing bars to be grouted into reinforced concrete masonry walls.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03100 - Concrete Formwork

B. Section 03300 - Cast-in-Place Concrete

C. Section 03400 – Precast Concrete

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. Kentucky Building Code
2. CRSI - Concrete Reinforcing Institute Manual of Standard Practice
3. ACI SP66 - ACI Detailing Manual
4. ACI 315 - Details and Detailing of Concrete Reinforcing
5. ACI 318 - Building Code Requirements for Structural Concrete
6. WRI - Manual of Standard Practice for Welded Wire Fabric
7. ASTM A 185 - Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcing
8. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcing

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300, Submittals.

1. Detailed placing and shop fabricating drawings, prepared in accordance with ACI 315 and ACI Detailing Manual - (SP66), shall be furnished for all concrete reinforcing. These drawings shall be made to such a scale as to clearly show joint locations, openings, and the arrangement, spacing and splicing of the bars.

2. Mill test certificates - 3 copies of each.

3. Description of the reinforcing steel manufacturer's marking pattern.

4. Requests to relocate any bars that cause interferences or that cause placing tolerances to be violated.

5. Proposed supports for each type of reinforcing.

6. Request to use splices not shown on the Drawings.

7. Request to use mechanical couplers along with manufacturer's literature on mechanical couplers with instructions for installation, and certified test reports on the couplers' capacity.

8. Request for placement of column dowels without the use of templates.

9. Request and procedure to field bend or straighten partially embedded reinforcing.

1.05 QUALITY ASSURANCE

A. If requested by the Engineer, the Contractor shall provide samples from each load of reinforcing steel delivered in a quantity adequate for testing. Costs of initial tests will be paid by the Owner. Costs of additional tests due to material failing initial tests shall be paid by the Contractor.

PART 2 – PRODUCTS

2.01 REINFORCING STEEL

A. Bar reinforcing shall conform to the requirements of ASTM A 615 for Grade 60 Billet Steel reinforcing. All reinforcing steel shall be from domestic mills and shall have the manufacturer's mill marking rolled into the bar which shall indicate the producer, size, type and grade.

B. Welded wire fabric reinforcing shall conform to the requirements of ASTM A 185 and the details shown on the Drawings.

C. A certified copy of the mill test on each load of reinforcing steel delivered showing physical and chemical analysis shall be provided, prior to shipment. The Engineer reserves the right to require the Contractor to obtain separate test results from an independent testing laboratory in the event of any questionable steel. When such tests are necessary because of failure to comply with this Specification, such as improper identification, the cost of such tests shall be borne by the Contractor.

D. Field welding of reinforcing steel will not be allowed.

E. Use of coiled reinforcing steel will not be allowed.

2.02 ACCESSORIES

A. Accessories shall include all necessary chairs, slab bolsters, concrete blocks, tie wires, dips, supports, spacers and other devices to position reinforcing during concrete placement. Slab bolsters shall have gray plastic-coated legs.

B. Concrete blocks (dobies), used to support and position bottom reinforcing steel, shall have the same or higher compressive strength as specified for the concrete in which it is located.

2.03 MECHANICAL COUPLERS

A. Mechanical couplers shall develop a tensile strength which exceeds 125 percent of the yield strength of the reinforcing bars being spliced at each splice. The reinforcing steel and coupler used shall be compatible for obtaining the required strength of the connection.

B. Where the type of coupler used is composed of more than one component, all components required for a complete splice shall be supplied.

C. Hot-forged sleeve type couplers shall not be used. Acceptable mechanical couplers are Dayton Superior Dowel Bar Splicer System by Dayton Superior, Dayton, Ohio. Mechanical couplers shall only be used where shown on the Drawings or where specifically approved by the Engineer.

2.04 DOWEL ADHESIVE SYSTEM

A. Where shown on the Drawings, reinforcing bars anchored into hardened concrete with a dowel adhesive system shall use a two-component adhesive mix which shall be injected with a static mixing nozzle following manufacturer's instructions. All holes shall be drilled with a carbide bit unless otherwise recommended by the manufacturer. Thoroughly clean drill holes of all debris and drill dust with compressed air followed by a wire brush prior to installation of adhesive and reinforcing bar. Where depth of hole exceeds the length of the static mixing nozzle, a plastic extension hose shall be used to ensure proper adhesive injection from the back of the hole. Injection of adhesive into the hole shall utilize a piston plug to minimize the formation of air pockets. The embedment depth

of the bar shall be per manufacturer's recommendations, so as to provide a minimum allowable bond strength that is equal to 125 percent of the yield strength of the bar, unless noted otherwise on the Drawings. The adhesive system shall be "Epcon System C6 or G5" as manufactured by ITW Redhead. "SET Epoxy-Tie" or "SET-XP" as manufactured by Simpson Strong-Tie Co. or "PE-1000 SD" and "T308" by Powers Fasteners. Engineer's approval is required for use of this system in locations other than those shown on the Drawings. **Fast-set epoxy formulations shall not be acceptable.**

B. Where identified on the Contract Drawings or for installation of concrete where anchorage failure could present a life-threatening hazard, the adhesive system shall be "PE-1000 SD" by Powers Fasteners, "SET-XP" by Simpson Strong-Tie Co. or "Epcon System G5" as manufactured by ITW Redhead. Alternate adhesive systems shall be IBC compliant for use in both cracked and uncracked concrete in all Seismic Design Categories, must comply with the latest revision of ICC-ES Acceptance Criteria AC308, and shall have a valid ICC-ES report in accordance with the applicable building code. Installation of adhesive system shall be per manufacturer's recommendations and as required in Item A above.

PART 3 – EXECUTION

3.01 TEMPERATURE REINFORCING

A. Unless otherwise shown on the Drawings or in the absence of the concrete reinforcing being shown, the minimum cross sectional area of horizontal and vertical concrete reinforcing in walls shall be 0.0033 times the gross concrete area and the minimum cross sectional area of reinforcing perpendicular to the principal reinforcing in slabs shall be 0.0020 times the gross concrete area. Temperature reinforcing shall not be spaced further apart than five times the slab or wall thickness, nor more than 18 inches.

3.02 FABRICATION

A. Reinforcing steel shall be accurately formed to the dimensions and shapes shown on the Drawings and the fabricating details shall be prepared in accordance with ACI 315 and ACI 318, except as modified by the Drawings.

B. The Contractor shall fabricate reinforcing bars for structures in accordance with the bending diagrams, placing lists and placing Drawings.

C. No fabrication shall commence until approval of Shop Drawings has been obtained. All reinforcing bars shall be shop fabricated unless approved by the Engineer to be bent in the field. Reinforcing bars shall not be straightened or rebent in a manner that will injure the material. Heating of bars will not be permitted.

D. Welded wire fabric with longitudinal wire of W9.5 size or smaller shall be either furnished in flat sheets or in rolls with a core diameter of not less than 10 inches. Welded wire fabric with longitudinal wires larger than W9.5 size shall be furnished in flat sheets only.

3.03 DELIVERY, STORAGE AND HANDLING

A. All reinforcing shall be neatly bundled and tagged for placement when delivered to the job site. Bundles shall be properly identified for coordination with mill test reports.

B. Reinforcing steel shall be stored above ground on platforms or other supports and shall be protected from the weather at all times by suitable covering. It shall be stored in an orderly manner and plainly marked to facilitate identification.

C. Reinforcing steel shall at all times be protected from conditions conducive to corrosion until concrete is placed around it.

D. The surfaces of all reinforcing steel and other metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar and other foreign substances immediately before the concrete is placed. Where there is delay in depositing concrete, reinforcing shall be reinspected and if necessary recleaned.

3.04 PLACING

A. Reinforcing steel shall be accurately positioned as shown on the Drawings and shall be supported and wired together to prevent displacement, using annealed iron wire ties or suitable clips at intersections. All reinforcing steel shall be supported by concrete, plastic or metal supports, spacers or metal hangers which are strong and rigid enough to prevent any displacement of the reinforcing steel. Where concrete is to be placed on the ground, supporting concrete blocks (or dobies) shall be used in sufficient numbers to support the reinforcing bars without settlement. In no case shall concrete block supports be continuous.

B. The portions of all accessories in contact with the formwork shall be made of plastic or steel coated with a 1/8 inch minimum thickness of plastic which extends at least 1/2 inch from the concrete surface. Plastic shall be gray in color.

C. Tie wires shall be bent away from the forms in order to provide the specified concrete coverage.

D. Reinforcing bars additional to those shown on the Drawings, which may be found necessary or desirable by the Contractor for the purpose of securing reinforcing in position, shall be provided by the Contractor at no additional cost to the Owner.

E. Reinforcing placing, spacing, and protection tolerances shall be within the limits specified in ACI 318 except where in conflict with the Building Code, unless otherwise specified.

F. Reinforcing bars may be moved within one bar diameter as necessary to avoid interference with other concrete reinforcing, conduits, or embedded items. If bars are

moved more than one bar diameter, or enough to exceed placing tolerances, the resulting arrangement of bars shall be as acceptable to the Engineer.

G. Welded wire fabric shall be supported on slab bolsters spaced not less than 30 inches on centers, extending continuously across the entire width of the reinforcing mat and supporting the reinforcing mat in the plane shown on the Drawings.

H. Reinforcing shall not be straightened or rebent unless specifically shown on the drawings or authorized in writing by the Engineer. Bars with kinks or bends not shown on the Drawings shall not be used. Coiled reinforcement shall not be used.

I. Dowel Adhesive System shall be installed in strict conformance with the manufacturer's recommendations. A representative of the manufacturer must be on site when required by the Engineer. At least 25 percent of the dowels installed shall be proof tested to 1.33 times the allowable load specified by the manufacturer, or as indicated on the Drawings. If the dowels are required to have a hook at the end to be embedded in the new work, an approved mechanical coupler shall be provided at a convenient distance from the face of existing concrete to facilitate the testing.

3.05 SPLICING

A. Reinforcing bar splices shall only be used at locations shown on the Drawings. When it is necessary to splice reinforcing at points other than where shown, the splice shall be as acceptable to the Engineer.

B. The length of lap for reinforcing bars, unless otherwise shown on the Drawings shall be in accordance with ACI 318 for a class B splice.

C. Laps of welded wire fabric shall be in accordance with ACI 318. Adjoining sheets shall be securely tied together with No. 14 tie wire, one tie for each 2 running feet. Wires shall be staggered and tied in such a manner that they cannot slip.

D. Mechanical splices shall be used only where shown on the drawings or when approved by the Engineer.

E. Couplers which are located at a joint face shall be a type which can be set either flush or recessed from the face as shown on the Drawings. The couplers shall be sealed during concrete placement to completely eliminate concrete or cement paste from entering. After the concrete is placed, couplers intended for future connections shall be plugged and sealed to prevent any contact with water or other corrosive materials. Threaded couplers shall be plugged with plastic plugs which have an O-ring seal.

3.06 INSPECTION

A. The Contractor shall advise the Engineer of his intentions to place concrete and shall allow him adequate time to inspect all reinforcing steel before concrete is placed.

B. The Contractor shall advise the Engineer of his intentions to place grout in masonry walls and shall allow him adequate time to inspect all reinforcing steel before grout is placed.

END OF SECTION

THIS PAGE LEFT BLANK INTENTIONALLY

SECTION 03250
CONCRETE ACCESSORIES

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish all materials, labor and equipment required to provide all concrete accessories including waterstops, expansion joint material, joint sealants, expansion joint seals, contraction joint inserts, epoxy bonding agent, and concrete anchors.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03100 - Concrete Formwork

B. Section 03290 - Joints in Concrete

C. Section 03300 - Cast-in-Place Concrete

D. Section 07900 - Joint Sealers

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. Federal Specification TT-S-00227 E (3)
2. ASTM C881 Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
3. ASTM D412 Standard Tests for Rubber Properties in Tension
4. ASTM D 624 Standard Test method for Rubber Property - Tear Resistance
5. ASTM D 638 Standard Test Method for Tensile Properties of Plastics
6. ASTM D1751 Standard Specifications for Preformed Expansion Joint fillers for Concrete Paving and Structural Construction (nonextruding and resilient bituminous types)
7. ASTM D 1752 Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300, Submittals.

1. Manufacturer's literature on all products specified herein including material certifications.

2. Proposed system for supporting PVC waterstops in position during concrete placement

3. Samples of products if requested by the Engineer.

PART 2 – PRODUCTS

2.01 POLYVINYL CHLORIDE (PVC) WATERSTOPS

A. PVC waterstops for construction joints shall be flat ribbed type, 6 inches wide with a minimum thickness at any point of 3/8 inches.

B. Waterstops for expansion joints shall be ribbed with a center bulb. They shall be 9 inches wide with a minimum thickness at any point of 3/8 inch unless shown or specified otherwise. The center bulb shall have a minimum outside diameter of 1 inch and a minimum inside diameter of 1/2 inch.

C. The waterstops shall be manufactured from virgin polyvinyl chloride plastic compound and shall not contain any scrap or reclaimed material or pigment whatsoever. The properties of the polyvinyl chloride compound used, as well as the physical properties of the waterstops, shall exceed the requirements of the U.S. Army Corps. of Engineers' Specification CRD-C572. The waterstop material shall have an off-white, milky color.

D. The required minimum physical characteristics for this material are:

1. Tensile strength - 1,750 psi (ASTM D-638).

2. Ultimate elongation - not less than 280% (ASTM D-638).

E. No reclaimed PVC shall be used for the manufacturing of the waterstops. The Contractor shall furnish certification that the proposed waterstops meet the above requirements.

F. PVC waterstops shall be as manufactured by DuraJoint, Vinylex Corp., Greenstreak, Inc.

G. All waterstop intersections, both vertical and horizontal, shall be made from factory fabricated corners and transitions. Only straight butt joint splices shall be made in field.

2.02 RETROFIT WATERSTOPS

A. Retrofit waterstops shall be used where specifically shown on Drawings for sealing joints between existing concrete construction and new construction.

B. Retrofit waterstops shall be PVC waterstops fabricated from material as described in Section 2.01 of this Specification.

C. Retrofit waterstop shall be attached to existing concrete surface as shown on Drawings.

D. Use of split waterstop in lieu of specially fabricated retrofit waterstop will not be acceptable.

E. Retrofit Waterstop manufacturer must provide a complete system including all Waterstop, stainless steel anchoring hardware, and epoxy for installation.

F. For construction joints, retrofit waterstop shall be style number 609 by Sika Greenstreak, RF-638 by BoMetals, Inc., Type 18 kit by DuraJoint Concrete Accessories, or approved equal. For expansion joints, retrofit waterstop shall be style number 667 by Sika Greenstreak, Type 18-9 kit by DuraJoint Concrete Accessories, or approved equal.

2.03 CHEMICAL RESISTANT WATERSTOPS

A. Where specifically noted on Contract Drawings, chemical resistant waterstops shall be used instead of PVC waterstops.

B. Chemical resistant waterstops for construction joints shall be ribbed with a center bulb. They shall be 6 inches wide with a minimum thickness at any point of 3/16 inches.

C. Chemical resistant waterstops for expansion joints shall be ribbed tear web. They shall be 9 inches wide with a tear web designed to accommodate 1 inch of free movement minimum.

D. Chemical resistant retrofit waterstop shall be a minimum of 2½" wide along the ribbed side and a minimum 5" wide along the side attached to the existing concrete surface. Retrofit waterstop shall include a centerbulb and shall have a minimum thickness of 3/16". Retrofit waterstop manufacturer shall provide a complete system including waterstop, stainless steel anchoring hardware and epoxy for installation.

E. Chemical resistant waterstops shall be manufactured from a fully crosslinked thermoplastic vulcanizate rubber.

F. Waterstops shall be TPE-R by BoMetals, Inc., Earth Shield TPV/TPE-R by JP Specialties, Inc., Westec TPE-R by Westec Barrier Technologies, or TPE-R by DuraJoint Concrete Accessories.

2.04 HYPALON RUBBER WATERSTOPS

A. Hypalon rubber waterstops shall be Sikadur Combiflex by Sika Corporation or approved equal. Minimum width of waterstop material shall be twelve (12) inches unless shown otherwise on Contract Drawings.

2.05 EXPANDING RUBBER WATERSTOP

A. Expanding rubber shall be designed to expand under hydrostatic conditions. Waterstops shall be Adeka Ultra Seal MC-2010M by Adeka Ultra Seal/OCM, Inc., or Hydrotite CJ-1020-2K by Sika Greenstreak, for concrete thickness greater than nine inches. For thicknesses less than nine inches, Adeka Ultra Seal KBA-1510FF or Hydrotite CJ-1020-2K shall be used.

B. Waterstop shall be a chemically modified natural rubber product with a hydrophilic agent.

C. Waterstop has a stainless steel mesh or coextrusion of non-hydrophilic rubber to direct expansion in the thickness direction and restrict the expansion in the longitudinal direction.

2.06 WATERSTOP ADHESIVE

A. Adhesive between waterstops and existing concrete shall be 20+F Contact Cement by Miracle Adhesives Corporation, Neoprene Adhesive 77-198 by JGF Adhesives, Sikadur 31 Hi-Mod Gel by Sika Corporation, DP-605 NS Urethane Adhesive by 3M Adhesive Systems.

2.07 JOINT SEALANTS

A. Joint sealants shall comply with Section 07900, Joint Sealers.

2.08 EXPANSION JOINT MATERIAL

A. Preformed expansion joint material shall be non-extruding, and shall be of the following types:

1. Type I - Sponge rubber, conforming to ASTM D1752, Type I.
2. Type II - Cork, conforming to ASTM D1752, Type II.
3. Type III - Self-expanding cork, conforming to ASTM D1752, Type III.
4. Type IV - Bituminous fiber, conforming to ASTM Designation D1751.

2.09 EXPANSION JOINT SEAL

A. Expansion Joint Seal System shall consist of a preformed neoprene profile, installed using the same dimensions as the joint gap, bonded with a two-component epoxy adhesive and pressurized during the adhesive cure time.

B. The expansion joint system shall be Hydrozo/Jeene Structural Sealing joint system by Hydrozo/Jeene, Inc, or equal.

2.10 CONTRACTION JOINT INSERTS

A. Contraction joint inserts shall be ZipCap Control Joint former by Greenstreak Plastic Products.

2.11 EPOXY BONDING AGENT

A. Epoxy bonding agent shall conform to ASTM C881 and shall be Sikadur 32 Hi-Mod, Sika Corporation, Lyndhurst, N.J.; Euco #452 Epoxy System, Euclid Chemical Company, Cleveland, OH, Concresive LV1 by BASF Construction Chemicals.

2.12 EPOXY RESIN BINDER

A. Epoxy resin binder shall conform to the requirements of ASTM C-881, Type III, Grade 3, Class B and C for epoxy resin binder and shall be Sikadur 23, Low-Mod-Gel, manufactured by the Sika Corporation, Lyndhurst, N.J., Flexocrete Gel manufactured by Tamms Industries Co. or Euco #352 Gel, Euclid Chemical Company, Concresive Paste LPL or SPL by BASF Construction Chemicals.

2.13 CONCRETE ANCHORS

A. Mechanical Anchors:

1. Wedge Anchors: Wedge anchors shall be "Kwik Bolt TZ" by Hilti, Inc., "TruBolt +" by ITW Redhead, "Strong-Bolt" or "Strong-Bolt 2" by Simpson Strong-Tie Co. or "Powerstud SD-1" or "Powerstud SD-2" by Powers Fasteners.

2. Screw Anchors: Screw anchors shall be "Kwik HUS-EZ" and "KWIK HUS-EZ-I" by Hilti, Inc., "Titen HD" by Simpson Strong-Tie Co., or "Wedge-Bolt +" by Powers Fasteners. Bits specifically provided by manufacturer of chosen system shall be used for installation of anchors.

3. Sleeve Anchors: Sleeve anchors shall be "HSL-3 Heavy Duty Sleeve Anchor" by Hilti, Inc. or "Power-Bolt +" by Powers Fasteners.

4. Undercut Anchors: Undercut anchors shall be "HDA Undercut Anchor" by Hilti, Inc., "Torq-Cut Undercut Anchor" by Simpson Strong-Tie Co., "Atomic + Undercut Anchor" by Powers Fasteners

B. Adhesive Anchors:

1. Adhesive anchors shall be "Epcon G5" by ITW Redhead, "HIT HY-150 Max SD" by Hilti, Inc., "SET-XP" by Simpson Strong-Tie Co., or "Powers 1000+" by Powers Fasteners.

2. Adhesive anchor systems shall be IBC compliant and capable of resisting short term wind and seismic loads (Seismic Design Categories A through F) as well as long term and short term sustained static loads in both cracked and uncracked concrete in all Seismic Design Categories. Structural adhesive anchor systems shall comply with the latest revision of ICC-ES Acceptance Criteria AC308, and shall have a valid ICC-ES report in accordance with the applicable building code. **No "or equal" products will be considered unless prequalified and approved by the Engineer and Owner.**

C. Concrete Anchor Materials:

1. Concrete anchors used to anchor structural steel shall be a threaded steel rod per manufacturer's recommendations for proposed adhesive system, but shall not have a yield strength (fy) less than 58 ksi nor an ultimate strength (fu) less than 72.5 ksi, unless noted otherwise. Where steel to be anchored is galvanized, concrete anchors shall also be galvanized unless otherwise indicated on the Drawings.

2. Concrete anchors used to anchor aluminum, FRP, or stainless steel shall be Type 304 stainless steel unless noted otherwise. All underwater concrete anchors shall be Type 316 stainless steel.

3. Nuts, washers, and other hardware shall be of a material to match the anchors.

2.14 MASONRY ANCHORS

A. Anchors for fastening to solid or grout-filled masonry shall be adhesive anchors as specified above for concrete anchors.

B. Anchors for fastening to hollow masonry or brick shall be adhesive anchors consisting of threaded rods or bolts anchored with an adhesive system dispensed into a screen tube inserted into the masonry. The adhesive system shall use a two-component adhesive mix and shall inject into the screen tube with a static mixing nozzle. Thoroughly clean drill holes of all debris and drill dust with nylon (not wire) brush prior to installation of adhesive and anchor. Contractor shall follow manufacturer's installation instructions. The adhesive system shall be "Epcon System A7 or C6" as manufactured by ITW Ramset/Redhead, "HIT HY-70 System" as manufactured by Hilti, Inc., "SET Epoxy-Tie" or "AT Acrylic-Tie" as manufactured by Simpson Strong-Tie Co., or "AC100+ Gold by Powers Fasteners.

C. Masonry anchors used to anchor steel shall be a threaded steel rod per manufacturer's recommendations for proposed adhesive system, but shall not have a yield strength (fy) less than 58 ksi nor an ultimate strength (fu) less than 72.5 ksi, unless noted otherwise. Where steel to be anchored is galvanized, masonry anchors shall also be galvanized.

D. Masonry anchors used to anchor aluminum, FRP, or stainless steel shall be Type 304 stainless steel unless noted otherwise. All underwater anchors shall be Type 316 stainless steel.

2.15 MANHOLE STEPS

A. Manhole or access steps shall be plastic, constructed of copolymer polypropylene meeting the requirements of ASTM D 2146 for Type II, Grade 16906 material. Step shall be reinforced with ASTM A 615, Grade 60, #4 deformed steel reinforcing bar, be 9" deep, 14" wide, provided with notched tread ridge, foot retainer lugs on each side of tread and penetration stops for press fit installation. Plastic steps shall be PS2-PF as manufactured by M.A. industries, Inc., Peachtree City, Georgia. Steps shall be installed by drilling 1" diameter holes, minimum 3-3/4 inches deep into the wall, and then driving steps into hole to the penetration stop, resulting in a press fit condition.

2.16 PRESSURE RELIEF VAVLES

A. Tank pressure relief valves shall be 6" diameter Neenah Foundry Company R-5001-1, American Valve & Hydrant B315.1, or equal, floor type, with outside hooks or inside self-contained lock; quantity and spacing as shown on structural drawings. No part of pressure relief valves shall project above the neat line of the tank floor to prevent fouling of scraper mechanisms where used.

PART 3 – EXECUTION

3.01 PVC AND CHEMICAL RESISTANT WATERSTOPS

A. PVC and chemical resistant waterstops shall be provided in all construction and expansion joints in water bearing structures and at other such locations as required by the Drawings.

B. Waterstops shall be carefully positioned so that they are embedded to an equal depth in concrete on both sides of the joint. They shall be kept free from oil, grease, mortar or other foreign matter. To ensure proper placement, all waterstops shall be secured in correct position at 12" on center along the length of the waterstop on each side, prior to placing concrete. Such method of support shall be submitted to the Engineer for review and approval. Grommets or small pre-punched holes as close to the edges as possible will be acceptable for securing waterstops.

C. Splices in PVC waterstops and chemical resistant waterstops shall be made with a thermostatically controlled heating element. Splices in chemical resistant waterstops

may also be made with adhesive system approved by manufacturer of waterstop. Only straight butt joint splices will be allowed in the field. Factory fabricated corners and transitions shall be used at intersections. Splices shall be made in strict accordance with the manufacturer's recommended instructions and procedures. At least three satisfactory sample splices shall be made on the site. The Engineer may require tests on these splices by an approved laboratory. The splices shall exhibit not less than 80 percent of the strength of the unspliced material.

D. All splices in waterstops will be subject to rigid review for misalignment, bubbles, inadequate bond, porosity, cracks, offsets, and other defects which would reduce the potential resistance of the material to water pressure at any point. All defective joints shall be replaced with material which will pass said review and all faulty material shall be removed from the site and disposed of by the Contractor at no additional cost to the Owner.

E. Retrofit waterstops shall be installed as shown on Contract Drawings using approved waterstop adhesive and Type 316 stainless steel batten bars and expansion anchors.

F. Waterstop installation and splicing defects which are unacceptable include, but are not limited to the following:

1. Tensile strength not less than 80 percent of parent material.

2. Overlapped (not spliced) Waterstop.

3. Misalignment of Waterstop geometry at any point greater than 1/16 inch.

4. Visible porosity or charred or burnt material in weld area.

5. Visible signs of splice separation when splice (24 hours or greater) is bent by hand at sharp angle.

3.02 HYPALON RUBBER AND EXPANDING RUBBER WATERSTOPS

A. Waterstops shall be installed only where shown on the Drawings.

B. Waterstops shall be installed in strict accordance with manufacturer's recommendations.

3.03 WATERSTOP ADHESIVE

A. Adhesive shall be applied to both contact surfaces in strict accordance with manufacturer's recommendations.

B. Adhesive shall be used where waterstops are attached to existing concrete surfaces.

3.04 INSTALLATION OF EXPANSION JOINT MATERIAL AND SEALANTS

A. Type I, II, or III shall be used in all expansion joints in structures and concrete pavements unless specifically shown otherwise on the Drawings. Type IV shall be used in sidewalk and curbing and other locations specifically shown on the Drawings.

B. All expansion joints exposed in the finish work, exterior and interior, shall be sealed with the specified joint sealant. Expansion joint material and sealants shall be installed in accordance with manufacturer's recommended procedures and as shown on the Drawings.

C. Expansion joint material that will be exposed after removal of forms shall be cut and trimmed to ensure a neat appearance and shall completely fill the joint except for the space required for the sealant. The material shall be held securely in place and no concrete shall be allowed to enter the joint or the space for the sealant and destroy the proper functions of the joint.

D. A bond breaker shall be used between expansion joint material and sealant. The joint shall be thoroughly clean and free from dirt and debris before the primer and the sealant are applied. Where the finished joint will be visible, masking of the adjoining surfaces shall be carried out to avoid their discoloration. The sealant shall be neatly tooled into place and its finished surfaces shall present a clean and even appearance.

E. Type 1 joint sealant shall be used in all expansion and contraction joints in concrete, except where Type 7 or Type 8 is required as stated below, and wherever else specified or shown on the Drawings. It shall be furnished in pour grade or gun grade depending on installation requirements. Primers shall be used as required by the manufacturer. The sealant shall be furnished in colors as directed by the Engineer.

F. Type 8 joint sealant shall be used in all concrete pavements and floors subject to heavy traffic and wherever else specified or shown on the Drawings.

G. Type 7 joint sealant shall be used for all joints in chlorine contact tanks and wherever specified or shown on the Drawings.

3.05 EXPANSION JOINT SEAL

A. The expansion joint seal system shall be installed as shown on the Drawings in strict accordance with the manufacturer's recommendations.

3.06 CONTRACTION JOINT INSERTS

A. For contraction joints in slabs, inserts shall be floated in fresh concrete during finishing.

B. For contraction joints in walls, inserts shall be secured in place prior to casting wall.

C. Inserts shall be installed true to line at the locations of all contraction joints as shown on the Drawings.

D. Inserts shall extend into concrete sufficient depth as indicated on the Drawings or specified in Section 03290, Joints in Concrete.

E. Inserts shall not be removed from concrete until concrete has cured sufficiently to prevent chipping or spalling of joint edges due to inadequate concrete strength.

3.07 EPOXY BONDING AGENT

A. The Contractor shall use an epoxy bonding agent for bonding all fresh concrete to existing concrete as shown on the Drawings.

B. Bonding surface shall be clean, sound and free of all dust, laitance, grease, form release agents, curing compounds, and any other foreign particles.

C. Application of bonding agent shall be in strict accordance with manufacturer's recommendations.

D. Fresh concrete shall not be placed against existing concrete if epoxy bonding agent has lost its tackiness.

3.08 EPOXY RESIN BINDER

A. Epoxy resin binder shall be used to seal all existing rebar cut and burned off during demolition operations. Exposed rebar shall be burned back 1/2-inch minimum into existing concrete and the resulting void filled with epoxy resin binder.

3.09 ANCHOR INSTALLATION

A. Concrete Anchors and Masonry Anchors

1. Overhead adhesive anchors, and base plates or elements they are anchoring, shall be shored as required and securely held in place during anchor setting to prevent movement during anchor installation. Movement of anchors during curing is prohibited.

2. The Contractor shall verify that all concrete and masonry anchors have been installed in accordance with the manufacturer's recommendations and that the capacity of the installed anchor meets or exceeds the specified safe holding capacity.

3. Concrete anchors shall not be used in place of anchor bolts without Engineer's approval.

4. All stainless steel threads shall be coated with antiseize lubricant.

B. Concrete Anchors

1. Concrete at time of anchor installation shall be a minimum age of 21 days.

2. All concrete anchors shall be installed in strict conformance with the manufacturer's printed installation instructions. A representative of the manufacturer shall be on site when required by the Engineer.

3. All holes shall be drilled with a carbide bit unless otherwise recommended by the manufacturer. No cored holes shall be allowed unless specifically approved by the Engineer. If coring holes is allowed by the manufacturer and approved by the Engineer, cored holes shall be roughened in accordance with manufacturer requirements. Thoroughly clean drill holes of all debris and drill dust with compressed air followed by a wire brush prior to installation of adhesive and threaded rod/bolt unless otherwise recommended by the manufacturer. Degree of hole dampness shall be in strict accordance with manufacturer recommendations. Where depth of hole exceeds the length of the static mixing nozzle, a plastic extension hose shall be used to ensure proper adhesive injection from the back of the hole. Injection of adhesive into the hole shall utilize a piston plug to minimize the formation of air pockets. Wipe rod free from oil that may be present from shipping or handling.

C. Other Bolts

1. All dissimilar metal shall be connected with appropriate fasteners and shall be insulated with a dielectric or approved equal.

2. All stainless steel bolts shall be coated with antiseize lubricant.

END OF SECTION

THIS PAGE LEFT BLANK INTENTIONALLY

SECTION 03290
JOINTS IN CONCRETE

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Provide all materials, labor and equipment required for the construction of all joints in concrete specified herein and shown on the Drawings.

B. Types of joints in concrete shall be as follows:

1. Construction Joints - Joints between adjacent concrete placements continuously connected with reinforcement.

2. Expansion Joints - Joints in concrete which allow thermal expansion and contraction of concrete. Reinforcement terminates within concrete on each side of joint.

3. Contraction Joints - Joints formed in concrete to provide a weakened plane in concrete section to control formation of shrinkage cracks.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03100 - Concrete Formwork

B. Section 03250 - Concrete Accessories

C. Section 03300 - Cast-in-Place Concrete

D. Section 07900 - Joint Sealers

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. ACI 301 - Specifications for Structural Concrete for Buildings

2. ACI 318 - Building Code Requirements for Structural Concrete

3. ACI 350 - Code Requirements for Environmental Engineering Concrete Structures

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300, Submittals.

1. Layout drawings showing location and type of all joints to be placed in each structure.

2. Details of proposed joints in each structure.

PART 2 – MATERIALS

2.01 MATERIALS

A. All materials required for joint construction shall comply with Section 03250 - Concrete Accessories, and Section 07900 - Joint Sealers.

PART 3 – EXECUTION

3.01 CONSTRUCTION JOINTS

A. Construction joints shall be as shown on the Drawings. Otherwise, Contractor shall submit description of the joint and its location to Engineer for approval.

B. Unless noted otherwise on the Drawings, construction joints shall be located near the middle of the spans of slabs, beams, and girders unless a beam intersects a girder at this point. In this case, the joints in the girders shall be offset a distance equal to twice the width of the beam. Joints in walls and columns shall be at the underside of floors, slabs, beams, or girders and the top of footings or floor slabs unless noted otherwise on Drawings. Beams, girders, brackets, column capitals, haunches, and drop panels shall be placed at the same time as slabs. Joints shall be perpendicular to the main reinforcement.

C. Maximum distance between horizontal joints in slabs and vertical joints in walls shall be 45'-0". For exposed walls with fluid or earth on the opposite side, the spacing between vertical and horizontal joints shall be a maximum of 25'-0".

D. All corners shall be part of a continuous placement, and should a construction joint be required, the joint shall not be located closer than five feet from a corner.

E. All reinforcing steel and welded wire fabric shall be continued across construction joints. Keys and inclined dowels shall be provided as shown on the Drawings or as directed by the Engineer. Longitudinal keys shall be provided in all joints in walls and between walls and slabs or footings, except as specifically noted otherwise on the Drawings. Size of keys shall be as shown on the Drawings.

F. All joints in water bearing structures shall have a waterstop. All joints below grade in walls or slabs which enclose an accessible area shall have a waterstop.

3.02 EXPANSION JOINTS

A. Size and location of expansion joints shall be as shown on the Drawings.

B. All expansion joints in water-bearing structures shall have a center-bulb type waterstop. All expansion joints below grade in walls or slabs which enclose an accessible area shall have a center-bulb type waterstop. Waterstop shall be as shown on Drawings and specified in Section 03250, Concrete Accessories.

3.03 CONTRACTION JOINTS

A. Location of contraction joints shall be as shown on the Drawings.

B. Contraction joints shall be formed with contraction joint inserts as specified in Section 03250, Concrete Accessories.

C. Sawcutting of contraction joints in lieu of forming will not be allowed unless otherwise noted on the Drawings. Where sawcutting is allowed, joints shall be sawed as soon as the concrete can support foot traffic without leaving any impression, normally the same day as concrete is placed and in no case longer than 24 hours after concrete is placed.

D. Unless noted otherwise on Drawings, depth of contraction joints shall be 1-1/2 inches in reinforced concrete and 1/3 of concrete thickness in unreinforced concrete.

3.04 JOINT PREPARATION

A. No concrete shall be allowed to enter the joint or the space for the sealant and destroy the proper functions of the joint.

B. The surface of the concrete at all joints shall be thoroughly cleaned and all laitance removed by wire brushing, air or light sand blasting.

C. The joint shall be thoroughly clean and free from dirt and debris before the primer and the sealant are applied. Where the finished joint will be visible, masking of the adjoining surfaces shall be carried out to avoid their discoloration. The sealant shall be neatly tooled into place and its finished surface shall present a clean and even appearance.

D. All joints shall be sealed as shown on the Drawings and specified in Section 03250, Concrete Accessories.

END OF SECTION

THIS PAGE LEFT BLANK INTENTIONALLY

SECTION 03300

CAST-IN-PLACE CONCRETE (LINE WORK)

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Provide all labor, equipment, materials and services necessary for the manufacture, transportation and placement of all plain and reinforced concrete work, as shown on the Drawings or as ordered by the Engineer.

B. Concrete shall be in accordance with the latest edition of Standard Specifications for Road and Bridge Construction issued by the Kentucky Transportation Cabinet.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03600 - Grout

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the Specifications, all work herein shall conform to or exceed the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. Kentucky Dept. of Transportation Standard Specifications for Road and Bridge Construction, Latest Edition.
2. Kentucky Building Code
3. ACI 214 Recommended Practice for Evaluation of Strength Test Results of Concrete
4. ACI 304 Guide for Measuring, Mixing, Transporting, and Placing Concrete
5. ACI 305 Hot Weather Concreting
6. ACI 306 Cold Weather Concreting
7. ACI 318 Building Code Requirements for Structural Concrete
8. ACI 350 Code Requirements for Environmental Engineering Concrete Structures
9. ASTM C 31 Standard Methods of Making and Curing Concrete Test Specimens in the Field

10. ASTM C 39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

11. ASTM C 42 Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

12. ASTM C 94 Standard Specification for Ready-Mixed Concrete

13. ASTM C 143 Standard Test Method for Slump of Portland Cement Concrete

14. ASTM C 172 Standard Method of Sampling Fresh Concrete

15. ASTM C 260 Standard Specification for Air-Entraining Admixtures for Concrete

16. ASTM C 457 Standard Recommended Practice for Microscopical Determination of Air-Void Content and Parameters of the Air-Void System in Hardened Concrete

17. ASTM C 1567 Standard Test Method for Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300, Submittals.

1. Sources of all materials and certifications of compliance with specifications for all materials.

2. Certified current (less than 1 year old) chemical analysis of the Portland Cement or Blended Cement to be used.

3. Certified current (less than 1 year old) chemical analysis of fly ash or ground granulated blast furnace slag to be used.

4. Aggregate test results showing compliance with required standards, i.e., sieve analysis, aggregate soundness tests, petrographic analysis, mortar bar expansion testing per ASTM C 1567, etc.

5. Manufacturer's data on all admixtures stating compliance with required standards.

6. Concrete mix design for each class of concrete specified herein.

7. Field experience records and/or trial mix data for the proposed concrete mixes for each class of concrete specified herein.

PART 2 – PRODUCTS

2.01 CONCRETE

A. Sidewalks, entrance pavements, concrete pavement subbase for asphaltic surface course, concrete pavement, curb gutter, and thrust blocking shall be Class A.

B. Concrete shall be as specified in the following table excerpted from Standard Specifications for Road and Bridge Construction, Edition of 2012, Kentucky Transportation Cabinet:

CONCRETE PROPORTIONIZING AND REQUIREMENTS KYDOT 601.03.03							
INGREDIENT PROPORTIONS AND REQUIREMENTS FOR VARIOUS CLASSES OF CONCRETE							
Class of Concrete	**Approximate Percent Fine to Total Aggregate**		**Maximum Free Water by W/C Ratio (lb/lb)**	**28-Day Compressive Strength(1) (psi)**	**Slump(4) (inches)**	**Minimum Cement Factor (lb/yd³)**	**Air Content (%)**
	Gravel	**Stone**					
A(5)	36	40	0.49	3,500	2-4(7)	564	6 ± 2
A Mod	36	40	0.47	3,500	4-7	658	6 ± 2
AA(2)	36	40	0.42	4,000	2-4 (12)	620	6 ± 2(11)
AAA(8)	36	40	0.40	5,500	3-7	686	6 ± 2(11)
B	40	44	0.66	2,500	3-5	451	6 ± 2
D(3)	35	39	0.44	4,000	3-5(6)	639	6 ± 2
D Mod(3)	35	39	0.42	5,000	3-5(6)	733	6 ± 2
M1(8) w/Type I Cement	36	40	0.33	4,000(9)	7 max.	800	6 ± 2
M2(8) w/Type III Cement	36	40	0.38	4,000(9)	7 max.	705	6 ± 2
P(5)	35	38	0.49	3,500	---(13)	564(10)	6 ± 2(11)

(1) The Department may direct non-payment, additional construction, or removal and replacement for concrete which test cylinders indicate low compressive strength and follow-up investigations indicate inadequate strength. The Department may require some classes to attain the required compressive strength in less than 28 hours.

(2) When the ambient air temperature while placing slab concrete is 71°F or more, add to the concrete a water-reducing and retarding admixture. The Engineer may require or allow, water-reducing and retarding admixture in slab concrete for ambient air temperatures of less

than 71°F. Only use one type of admixture for concrete placed during any individual contiguous pour.

(3) The Department will require a compressive strength of 5,000 psi or greater when specified in the Contract, at or before 28 days of prestressed members.

(4) The Engineer will allow slumps less than the minimum provided concrete is workable.

(5) The Department will allow the use of JPC pavement mixture for non-structural construction.

(6) At the option of the prestressed product fabricator, the Department will allow the slump of Class D or Class D Modified concrete to be increased to a maximum of 8 inches for all items, except products with voids. For products with voids, the slump may be increased to 7 inches. Provide a high range water reducer (Type F or G) in an amount not to exceed the following water/cement ratios:

Summer mix designs – 0.39

Spring and Fall mix designs – 0.37

Winter mix designs – 0.34

(7) The precast fabricator may increase the slump of Class A concrete to a maximum of 7 inches provided the fabricator uses a high range water reducer (Type F or G) and maximum water/cement ratio of 0.46.

(8) Use a high range water reducer (Type F or G).

(9) The Department will require 3,000 psi compressive strength before opening to traffic and 4,000 psi at 28 days.

(10) 611 lb/yd^3 when using coarse aggregate sizes No. 8, 78, or 9-M.

(11) 7 ± 2% when using coarse aggregate sizes No. 8, 78 or 9-M.

(12) The Department may allow the slump of AA concrete to be increased up to a 6 inch maximum, provided the W/C ratio does not exceed 0.40 and a high range water reducer (Type F or G) is used. Trial Batches will be required if producer has not previously supplied.

(13) The Department does not have slump requirements for Class P concrete mixes except for the edge slump requirements of Section 501.03.19.

2.02 FLOWABLE FILL

A. Flowable fill shall conform to Section 601 of the Standard Specifications for Road and Bridge Construction, Edition of 2012.

B. Flowable fill shall consist of a mixture of cement, sand, fly ash, and water. The loss on ignition for Class F fly ash shall not exceed 12 percent. Ensure that the concrete producer certifies mix proportions for flowable fill as follows:

Flowable Fill for Pipe Backfill. Proportion 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

C. Flowable fill shall obtain an average compressive strength of 50 to 100 psi at 28 days for application as pipe backfill. For applications requiring early opening to traffic or placement of pavement as soon as possible, the mixture shall conform to the following general guidelines:

1. Mixture bleeds freely within 10 minutes

2. Mixture supports a 150-pound person within three hours.

PART 3 – EXECUTION

3.01 PRODUCTION OF CONCRETE

A. All concrete shall be machine mixed. Hand mixing of concrete will not be permitted. The Contractor shall supply concrete from a ready mix plant. In selecting the source for concrete production the Contractor shall carefully consider its capability for providing quality concrete at a rate commensurate with the requirements of the placements so that well bonded, homogenous concrete, free of cold joints, is assured. Ready mixed concrete shall be in accordance with ASTM C94.

B. Each and every concrete delivery shall be accompanied by a delivery ticket containing at least the following information:

1. Date and truck number

2. Ticket number

3. Mix designation of concrete

4. Cubic yards of concrete

5. Cement brand, type and weight in pounds

6. Weight in pounds of fine aggregate (sand)

7. Weight in pounds of coarse aggregate (stone)

8. Air entraining agent, brand, and weight in pounds and ounces

9. Other admixtures, brand, and weight in pounds and ounces

10. Water, in gallons, stored in attached tank

11. Water, in gallons, maximum that can be added without exceeding design water/cement ratio

12. Water, in gallons, actually used (by truck driver)

13. Time of loading

14. Time of delivery to job (by truck driver)

C. Any truck delivering concrete to the job site, which is not accompanied by a delivery ticket showing the above information will be rejected and such truck shall immediately depart from the job site.

3.02 CONCRETE PLACEMENT

A. No concrete shall be placed prior to approval of the concrete mix design. Concrete placement shall conform to the recommendations of ACI 304.

3.03 CONCRETE WORK IN COLD WEATHER

A. Cold weather concreting procedures shall conform to the requirements of ACI 306.

B. The Engineer may prohibit the placing of concrete at any time when air temperature is 40°F. or lower. If concrete work is permitted, the concrete shall have a minimum temperature, as placed, of 55°F. for placements less than 12" thick, 50°F. for placements 12" to 36" thick, and 45°F. for placements greater than 36" thick. The temperature of the concrete as placed shall not exceed the aforementioned minimum values by more than 20°F, unless otherwise approved by the Engineer.

C. The addition of admixtures to the concrete to prevent freezing is not permitted. All reinforcement, forms, and concrete accessories with which the concrete is to come in contact shall be defrosted by an approved method. No concrete shall be placed on frozen ground.

3.04 CONCRETE WORK IN HOT WEATHER

A. Hot weather concreting procedures shall conform to the requirements of ACI 305.

B. When air temperatures exceed 85°F, or when extremely dry conditions exist even at lower temperatures, particularly if accompanied by high winds, the Contractor and his/her concrete supplier shall exercise special and precautionary measures in preparing, delivering, placing, finishing, curing and protecting the concrete mix. The Contractor shall consult with the Engineer regarding such measures prior to each day's placing operation and the Engineer reserves the right to modify the proposed measures

consistent with the requirements of this Section of the Specifications. All necessary materials and equipment shall be on hand an in position prior to each placing operation.

C. Preparatory work at the job site shall include thorough wetting of all forms, reinforcing steel and, in the case of slab pours on ground or subgrade, spraying the ground surface on the preceding evening and again just prior to placing. No standing puddles of water shall be permitted in those areas which are to receive the concrete.

D. The temperature of the concrete mix when placed shall not exceed 90°F.

E. Delivery schedules shall be carefully planned in advance so that concrete is placed as soon as practical after it is properly mixed. For hot weather concrete work (air temperature greater than 85°F), discharge of the concrete to its point of deposit shall be completed within 60 minutes from the time the concrete is batched.

F. The Contractor shall arrange for an ample work force to be on hand to accomplish transporting, vibrating, finishing, and covering of the fresh concrete as rapidly as possible.

3.05 QUALITY CONTROL

A. Field Testing of Concrete

1. The Contractor shall coordinate with the Owner's testing firm personnel as required for concrete testing.

2. Concrete for testing shall be supplied by the Contractor at no additional cost to the Owner, and the Contractor shall provide assistance to the testing laboratory in obtaining samples. The Contractor shall dispose of and clean up all excess material.

3. For every placement of concrete that is 10 cubic yards or less, the following tests shall be performed (as described in paragraphs B through E below):

   a. Consistency

   b. Unit Weight

   c. Air content

   d. Compressive Strength

   e. Temperature

4. For every placement of concrete that is larger than 10 cubic yards, the following tests shall be performed for every 50 cubic yards (as described in paragraphs B through E below):

a. Consistency – test the first truck and one additional truck randomly selected by the Owner's Resident Project Representative (RPR).

b. Unit Weight – test one truck randomly selected by the RPR

c. Air content - test the first truck and one additional truck randomly selected by the RPR.

d. Compressive Strength - test one truck randomly selected by the RPR

e. Temperature - test one truck randomly selected by the RPR

The sampling of concrete is approved at the truck discharge. If a concrete pump is employed, the Contractor is advised that 1.5-3.0% air is lost in pumping and such should be accounted for at the point of testing. Therefore, the air content should be adjusted to ensure that the air content meets the specification at the point of placement.

The first truck is defined as the first truck as accepted by the RPR. The RPR shall have the authority of the Owner to accept or reject all concrete.

5. Sampling is at the discretion of the RPR.

6. Additional testing may be required as deemed necessary by the Owner.

B. Consistency

1. The consistency of the concrete will be checked by the Owner's testing firm by standard slump cone tests. The Contractor shall make any necessary adjustments in the mix as the Owner or Engineer may direct and shall upon written order suspend all placing operations in the event the consistency does not meet the intent of the specifications. No payment shall be made for any delays, material or labor costs due to such eventualities.

2. Slump tests shall be made in accordance with ASTM C 143.

3. Concrete with a specified nominal slump shall be placed having a slump within 1" (higher or lower) of the specified slump. Concrete with a specified maximum slump shall be placed having a slump less than the specified slump.

C. Unit Weight

1. Samples of freshly mixed concrete shall be tested for unit weight by the Owner's testing firm in accordance with ASTM C 138.

D. Air Content

1. Samples of freshly mixed concrete will be tested for entrained air content by the Owner's testing firm in accordance with ASTM C 231.

2. In the event test results are outside the limits specified, additional testing shall occur. Upon discovery of incorrect air entrainment, the concrete shall be removed from the jobsite.

E. Compressive Strength

1. Samples of freshly mixed concrete will be taken by the Owner's testing firm and tested for compressive strength in accordance with ASTM C 172, C 31 and C 39, except as modified herein.

2. Each sampling shall consist of at least five (5) 6x12 cylinders or eight (8) 4x8 cylinders. Each cylinder shall be identified by a tag, which shall be hooked or wired to the side of the container. The Owner's testing firm will fill out the required information on the tag, and the Contractor shall satisfy himself that such information shown is correct.

3. The Contractor shall be required to furnish labor to the Owner for assisting in preparing test cylinders for testing. The Contractor shall provide approved curing boxes for storage of cylinders on site. The insulated curing box shall be of sufficient size and strength to contain all the specimens made in any four consecutive working days and to protect the specimens from falling over, being jarred or otherwise disturbed during the period of initial curing. The box shall be erected, furnished and maintained by the Contractor. Such box shall be equipped to provide the moisture and to regulate the temperature necessary to maintain the proper curing conditions required by ASTM C 31. Such box shall be located in an area free from vibration such as pile driving and traffic of all kinds and such that all specimen are shielded from direct sunlight and/or radiant heating sources. No concrete requiring inspection shall be delivered to the site until such storage curing box has been provided. Specimens shall remain undisturbed in the curing box until ready for delivery to the testing laboratory but not less than sixteen hours.

4. The Contractor shall be responsible for maintaining the temperatures of the curing box during the initial curing of test specimens with the temperature preserved between 60°F and 80°F as measured by a maximum-minimum thermometer. The Contractor shall maintain a written record of curing box temperatures for each day curing box contains test specimens. Temperature shall be recorded a minimum of three times a day with one recording at the start of the workday and one recording at the end of the workday.

5. When transported, the cylinders shall not be thrown, dropped, allowed to roll, or be damaged in any way.

F. Evaluation and Acceptance of Concrete

1. Evaluation and acceptance of the compressive strength of concrete shall be according to the requirements of ACI 214, ACI 318, and ACI 350.

2. The strength level of concrete will be considered satisfactory if all of the following conditions are satisfied.

    a. Every arithmetic average of any three consecutive strength tests equals or exceeds the minimum specified 28-day compressive strength for the mix (see Article 2.07).

    b. No individual compressive strength test results fall below the minimum specified strength by more than 500 psi.

    c. No more than 10% of the compressive tests have strengths greater than the maximum strength specified.

3. In the event any of the conditions listed above are not met, the mix proportions shall be corrected for the next concrete placing operation.

4. In the event that condition 2B is not met, additional tests in accordance with Article 3.10, paragraph H shall be performed.

5. When a ratio between 7-day and 28-day strengths has been established by these tests, the 7-day strengths shall subsequently be taken as a preliminary indication of the 28-day strengths. Should the 7-day test strength from any sampling be more than 10% below the established minimum strength, the Contractor shall:

    a. Immediately provide additional periods of curing in the affected area from which the deficient test cylinders were taken.

    b. Maintain or add temporary structural support as required.

    c. Correct the mix for the next concrete placement operation, if required to remedy the situation.

6. All concrete which fails to meet the ACI requirements and these specifications is subject to removal and replacement at no additional cost to the Owner.

G. Additional Tests

1. In the event the 28-day test cylinders fail to meet the minimum strength requirements as outlined in Article 3.10, paragraph F, the Contractor shall have concrete core specimens obtained and tested from the affected area immediately.

    a. Three cores shall be taken by the Owner's testing firm for each sample in which the strength requirements were not met.

    b. The concrete in question will be considered acceptable if the average compressive strength of a minimum of three test core specimens taken from a given area equal or exceed 85% of the specified 28-day strength and if the lowest core strength is greater than 75% of the specified 28-day strength.

2. Concrete placed with compressive strengths greater than the maximum strength specified shall be removed and replaced or repaired as deemed necessary by the Engineer.

3.06 CARE AND REPAIR OF CONCRETE

A. The Contractor shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance by the Owner. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Care shall be exercised to avoid jarring forms or placing any strain on the ends of projecting reinforcing bars. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior to the final acceptance of the completed work, or which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete at no additional cost to the Owner.

B. Areas of honeycomb shall be chipped back to sound concrete and repaired as directed by the Engineer.

C. Concrete formwork blowouts or unacceptable deviations in tolerances for formed surfaces due to improperly constructed or misaligned formwork shall be repaired as directed by the Engineer. Bulging or protruding areas, which result from slipping or deflecting forms shall be ground flush or chipped out and redressed as directed by the Engineer.

D. Areas of concrete in which cracking, spalling, or other signs of deterioration develop prior to final acceptance shall be removed and replaced or repaired as directed by the Engineer. This stipulation includes concrete that has experienced cracking due to drying or thermal shrinkage of the concrete. Structural cracks shall be repaired using an epoxy injection system approved by the Engineer. Non-structural cracks shall be repaired using a hydrophilic resin pressure injected grout system approved by the Engineer, unless other means of repair are deemed necessary and approved by the Engineer. Extensive repair or replacement will be considered for concrete placed having compressive strengths greater than maximum strength specified. All repair work shall be performed at no additional cost to the Owner.

END OF SECTION

THIS PAGE LEFT BLANK INTENTIONALLY

SECTION 03350
CONCRETE FINISHES

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish all materials, labor, and equipment required to provide finishes of all concrete surfaces specified herein and shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03300 - Cast-in-Place Concrete

B. Section 03600 - Grout

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. ACI 301 - Specifications for Structural Concrete for Buildings

2. ACI 318 - Building Code Requirements for Structural Concrete

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300 - Submittals.

1. Manufacturer's literature on all products specified herein.

PART 2 – PRODUCTS

2.01 CONCRETE FLOOR SEALER

A. Floor sealer shall be Diamond Clear VOX or Super Diamond Clear VOX by the Euclid Chemical Company, Sonneborn Kure N Seal 30 by BASF Construction Chemicals.

2.02 CONCRETE LIQUID/SEALER DENSIFIER

A. Concrete liquid sealer/densifier shall be a high performance, deeply penetrating concrete densifier. Product shall be odorless, colorless, VOC-compliant, non-yellowing siliconate based solution designed to harden, dustproof and protect concrete floors subjected to heavy vehicular traffic and to resist black rubber tire marks on concrete surfaces. The

product must contain a minimum solids content of 20% of which 50% is siliconate. Acceptable products are Diamond Hard by the Euclid Chemical Company and Seal Hard by L&M Construction Chemicals. Liquid sealer/densifier shall be applied in strict accordance with directions of manufacturer and specifications.

B. Aggregate floor hardener shall be non-metallic. Hardener shall be Harcol by Sonneborn, Maximent by BASF, or Surflex by Euclid Chemical.

2.03 NON-METALLIC FLOOR HARDENER

A. The specified non-metallic mineral aggregate hardener shall be formulated, processed, and packaged under stringent quality control at the manufacturer's owned and controlled factory. The hardener shall be a factory-blended mixture of specifically processed graded mineral aggregate, selected Portland cement, and necessary plasticizing agents. Acceptable products shall be "Surflex" by the Euclid Chemical Company, "Harcol" by Sonneborn, "Maximent" by BASF, and "Mastercon" by BASF.

2.04 NON-OXIDIZING HEAVY DUTY METALLIC FLOOR HARDENER

A. Non-oxidizing heavy duty metallic floor hardener shall be formulated, processed, and packaged under stringent quality control at the manufacturer's owned and controlled factory. The hardener shall be a mixture of specifically processed non-rusting aggregate, selected Portland cement, and necessary plasticizing agents. Product shall be "Diamond-Plate" by the Euclid Chemical Company, or Masterplate by BASF Construction Chemicals.

2.05 NON-SLIP AGGREGATE

A. Shake-on aggregate for non-slip floors shall be non-metallic. Shake-on aggregate shall be Frictex NS by BASF Construction Chemicals, A-H Acox by Anti-Hydro, or Non-Slip by the Euclid Chemical Company.

PART 3 – EXECUTION

3.01 FINISHES ON FORMED CONCRETE SURFACES

A. After removal of forms, the finishes described below shall be applied in accordance with Article 3.05 - Concrete Finish Schedule. Unless the finish schedule specifies otherwise, all surfaces shall receive at least a Type I finish. The Engineer shall be the sole judge of acceptability of all concrete finish work.

1. Type I - Rough: All fins, burrs, offsets, marks and all other projections left by the forms shall be removed. Projections, depressions, etc. below finished grade required to be removed will only be those greater than ¼-inch. All holes left by removal of ends of ties, and all other holes, depressions, bug holes, air/blow holes or voids shall be filled solid with cement grout after first being thoroughly wetted and then struck off flush. The only holes below grade to be filled will be tie holes

and any other holes larger than ¼-inch in any dimension. Honeycombs shall be chipped back to solid concrete and repaired as directed by the Engineer. All holes shall be filled with tools, such as sponge floats and trowels, that will permit packing the hole solidly with cement grout. Cement grout shall consist of one part cement to three parts sand, epoxy bonding agent (for tie holes only) and the amount of mixing water shall be as little as consistent with the requirements of handling and placing. Color of cement grout shall match the adjacent wall surface.

2. Type II - Grout Cleaned: Where this finish is required, it shall be applied after completion of Type I finish. After the concrete has been predampened, a slurry consisting of one part cement (including an appropriate quantity of white cement in order to produce a color matching the surrounding concrete) and 1-1/2 parts sand passing the No. 16 sieve, by damp loose volume, shall be spread over the surface with clean burlap pads or sponge rubber floats. Mix proportions shall be submitted to the Engineer after a sample of the work is established and accepted. Any surplus shall be removed by scraping and then rubbing with clean burlap.

3. Type III - Smooth Rubbed: Where this finish is required, it shall be applied after the completion of the Type I finish. No rubbing shall be done before the concrete is thoroughly hardened and the mortar used for patching is firmly set. A smooth, uniform surface shall be obtained by wetting the surface and rubbing it with a carborundum stone to eliminate irregularities. Unless the nature of the irregularities require it, the general surface of the concrete shall not be cut into. Corners and edges shall be slightly rounded by the use of the carborundum stone. Brush finishing or painting with grout or neat cement will not be permitted. A 100 square foot example shall be established at the beginning of the project to establish acceptability.

3.02 SLAB AND FLOOR FINISHES

A. The finishes described below shall be applied to floors, slabs, flow channels and top of walls in accordance with Article 3.05 - Concrete Finish Schedule. The Engineer shall be the sole judge of acceptability of all such finish work.

1. Type "A" - Screeded: This finish shall be obtained by placing screeds at frequent intervals and striking off to the surface elevation required. When a Type "F" finish is subsequently to be applied, the surface of the screeded concrete shall be roughened with a stiff brush or rake prior to final set.

2. Type "B" - Wood or Magnesium Floated: This finish shall be obtained after completion of a Type "A" finish by working a previously screeded surface with a wood or magnesium float or until the desired texture is reached. Floating shall begin when the water sheen has disappeared and when the concrete has sufficiently hardened so that a person's foot leaves only a slight imprint. If wet spots occur, water shall be removed with a squeegee. Care shall be taken to prevent the formation of laitance and excess water on the finished surface. All edges shall be edged with an 1/8-inch tool as directed by the Engineer. The

finished surface shall be true, even, and free from blemishes and any other irregularities.

3. Type "C" - Cork Floated: This finish shall be similar to Type "B" but slightly smoother than that obtained with a wood float. It shall be obtained by power or band floating with cork floats.

4. Type "D" - Steel Troweled: This finish shall be obtained after completion of a Type "B" finish. When the concrete has hardened sufficiently to prevent excess fine material from working to the surface, the surface shall be compacted and smoothed with not less than two thorough and complete steel troweling operations. In areas which are to receive a floor covering such as tile, resilient flooring, or carpeting, the applicable Specification Sections and Contract Drawings shall be reviewed for the required finishes and degree of flatness. In areas that are intermittently wet such as pump rooms, only one troweling operation is required to provide some trowel marks for slip resistance. All edges shall be edged with an 1/8-inch tool as directed by the Engineer. The finish shall be brought to a smooth, dense surface, free from defects and blemishes.

5. Type "E" - Broom or Belt: This finish shall provide the surface with a transverse scored texture by drawing a broom or burlap belt across the surface immediately after completion of a Type "B" finish. All edges shall be edged with an 1/8-inch tool as directed by the Engineer.

6. Type "F" - Swept in Grout Topping: This finish shall be applied after a completion of a Type "A" finish. The concrete surface shall be properly cleaned, washed, and coated with a mixture of water and Portland Cement. Cement grout in accordance with Section 03600 shall then be plowed and swept into neat conformance with the blades or arms of the apparatus by turning or rotating the previously positioned mechanical equipment. Special attention shall be paid to true grades, shapes and tolerances as specified by the manufacturer of the equipment. Before beginning this finish, the Contractor shall notify the Engineer and the equipment manufacturer of the details of the operation and obtain approval and recommendations.

7. Type "G" Hardened Finish: This finish shall be applied after completion of a Type "B" or Type "C" finish and prior to application of a Type "D" finish. Hardeners shall be applied in strict accordance with the manufacturer's requirements. Hardeners shall be applied using a mechanical spreader. The hardener shall be applied in two shakes with the first shake comprising 2/3 of the total amount. Type "D" finish shall be applied following completion of application of the hardener.

    a. Non-metallic floor hardener shall be applied where specifically required on the Contract Drawings at the rate of 1.0 pounds/ft.^{2}.

b. Non-oxidizing heavy duty metallic floor hardener shall be applied at the loading docks and where specifically required on the Contract Drawings or specified herein at the rate of 1.5 pounds/ft.^{2}.

8. Type "H" - Non-Slip Finish: This finish shall be provided by applying a non-slip shake-on aggregate concurrently with the application of a Type "D" finish. Application procedure shall be in accordance with manufacturer's instructions.

9. Type "J" - Raked Finish: This finish shall be provided by raking the surface as soon as the condition of the concrete permits by making depressions of ±1/4 inch.

3.03 CONCRETE SEALERS

A. Concrete sealers shall be applied where specifically required on the Contract Drawings or specified herein.

B. Sealers shall be applied after installation of all equipment, piping, etc. and after completion of any other related construction activities. Application of sealers shall be in strict accordance with manufacturer's requirements.

C. Sealers shall be applied to all floor slabs not painted and not intended to be immersed.

D. Floor slabs subjected to vehicular traffic shall be sealed with the concrete liquid densifier and sealer.

E. All other floor slabs to receive sealer shall be sealed with concrete floor sealer.

3.04 FINISHES ON EQUIPMENT PADS

A. Formed surfaces of equipment pads shall receive a Type III finish.

B. Top surfaces of equipment pads, except those surfaces subsequently required to receive grout and support equipment bases, shall receive a Type "D" finish, unless otherwise noted. Surfaces which will later receive grout shall, before the concrete takes its final set, be made rough by removing the sand and cement that accumulates on the top to the extent that the aggregate will be exposed with irregular indentations in the surface up to 1/2 inch deep.

3.05 CONCRETE FINISH SCHEDULE

A. Concrete Finish Schedule

Item	Type of Finish
Concrete surfaces indicated to receive textured coating (as noted on Drawings and in Section 09800, Special Coatings)	I
Inner face of walls of tanks, flow channels, wet wells, perimeter walls, and miscellaneous concrete structures:	
From 1 feet below water surface to bottom of wall	I
From top of wall to 1 feet below water surface	I
Exterior concrete walls below grade	I
Exterior exposed concrete walls, ceilings, beams, manholes, hand holes, miscellaneous structures and columns (including top of wall) to one foot below grade. All other exposed concrete surfaces not specified elsewhere	I
All interior exposed concrete walls and vertical surfaces	I
Interior exposed ceiling, including beams	III
Floors of process equipment tanks or basins, wetwells, flow channels and slabs to receive roofing material or waterproof membranes	B
All interior finish floors of buildings and structures and walking surfaces which will be continuously or intermittently wet	D
All interior finish floors of buildings and structures which are not continuously or intermittently wet	D
Floors to receive tile, resilient flooring, or carpeting	D
Exterior concrete sidewalks, steps, ramps, decks, slabs on grade and landings exposed to weather	E
Floors of process equipment tanks indicated on Drawings to receive grout topping	F
Garage and storage area floors	G
Precast concrete form panels, hollow core planks, double tees	J

END OF SECTION

SECTION 03370
CONCRETE CURING

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Protect all freshly deposited concrete from premature drying and from the weather elements. The concrete shall be maintained with minimal moisture loss at a relatively constant temperature for a period of time necessary for the hydration of the cement and proper hardening of the concrete in accordance with the requirements specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03300 - Cast-In-Place Concrete

B. Section 03350 - Concrete Finishes

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. ACI 301 - Specifications for Structural Concrete for Buildings
2. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete
3. ACI 305 - Hot Weather Concreting
4. ACI 306 - Cold Weather Concreting
5. ACI 308 - Standard Practice for Curing Concrete
6. ASTM C171 - Standard Specifications for Sheet Materials for Curing Concrete
7. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
8. Federal Specification TT-C-800

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300, Submittals.

1. Proposed procedures for protection of concrete under wet weather placement conditions.

2. Proposed normal procedures for protection and curing of concrete.

3. Proposed special procedures for protection and curing of concrete under hot and cold weather conditions.

4. Proposed method of measuring concrete surface temperature changes.

5. Manufacturer's literature and material certification for proposed curing compounds.

PART 2 – PRODUCTS

2.01 LIQUID MEMBRANE-FORMING CURING COMPOUND

A. Clear curing and sealing compound shall be a clear styrene acrylate type complying with ASTM C 1315, Type 1, Class A with a minimum solids content of 25%. Moisture loss shall not be greater than 0.40 kg/m^2 when applied at 300 sq.ft./gal. Manufacturer's certification is required. Acceptable products are Super Diamond Clear VOX by the Euclid Chemical Company, Sonneborn Kure N Seal 30 by BASF Construction Chemicals, and Cure & Seal 30 Plus by Symons Corporation.

B. Where specifically approved by Engineer, on slabs to receive subsequent applied finishes, compound shall conform to ASTM C 309. Acceptable products are "Kurez DR VOX" or "Kurez W VOX" by the Euclid Chemical Company. Install in strict accordance with manufacturer's requirements.

2.02 EVAPORATION REDUCER

A. Evaporation reducer shall be BASF, "Confilm", or Euclid Chemical "Euco-Bar".

PART 3 – EXECUTION

3.01 PROTECTION AND CURING

A. All freshly placed concrete shall be protected from the elements, flowing water and from defacement of any nature during construction operations.

B. As soon as the concrete has been placed and horizontal top surfaces have received their required finish, provision shall be made for maintaining the concrete in a moist condition for at least a 5-day period thereafter except for high early strength concrete, for which the period shall be at least the first three days after placement. Horizontal surfaces shall be kept covered, and intermittent, localized drying will not be permitted.

C. Walls that will be exposed on one side with either fluid or earth backfill on the opposite side shall be continuously wet cured for a minimum of five days. Use of a curing compound will not be acceptable for applications of this type.

D. The Contractor shall use one of the following methods to ensure that the concrete remains in a moist condition for the minimum period stated above.

1. Ponding or continuous fogging or sprinkling.

2. Application of mats or fabric kept continuously wet.

3. Continuous application of steam (under 150°F).

4. Application of sheet materials conforming to ASTM C171.

5. If approved by the Engineer, application of a curing compound in accordance with Article 3.04.

E. The Contractor shall keep absorbent wood forms wet until they are removed. After form removal, the concrete shall be cured by one of the methods in paragraph D.

F. Any of the curing procedures used in Paragraph 3.01-D may be replaced by one of the other curing procedures listed in Paragraph 3.01-D after the concrete is one-day old. However, the concrete surface shall not be permitted to become dry at any time.

3.02 CURING CONCRETE UNDER COLD WEATHER CONDITIONS

A. Suitable means shall be provided for a minimum of 72 hours after placing concrete to maintain it at or above the minimum as placed temperatures specified in Section 03300, Cast-In-Place Concrete, for concrete work in cold weather. During the 72-hour period, the concrete surface shall not be exposed to air more than 20°F above the minimum as placed temperatures.

B. Stripping time for forms and supports shall be increased as necessary to allow for retardation in concrete strength caused by colder temperatures. This retardation is magnified when using concrete made with blended cements or containing fly ash or ground granulated blast furnace slag. Therefore, curing times and stripping times shall be further increased as necessary when using these types of concrete.

C. The methods of protecting the concrete shall be approved by the Engineer and shall be such as will prevent local drying. Equipment and materials approved for this purpose shall be on the site in sufficient quantity before the work begins. The Contractor shall assist the Engineer by providing holes in the forms and the concrete in which thermometers can be placed to determine the adequacy of heating and protection. All such thermometers shall be furnished by the Contractor in quantity and type which the Engineer directs.

D. Curing procedures during cold weather conditions shall conform to the requirements of ACI 306.

3.03 CURING CONCRETE UNDER HOT WEATHER CONDITIONS

A. When air temperatures exceed 85°F, the Contractor shall take extra care in placing and finishing techniques to avoid formation of cold joints and plastic shrinkage cracking. If ordered by the Engineer, temporary sun shades and/or windbreakers shall be erected to guard against such developments, including generous use of wet burlap coverings and fog sprays to prevent drying out of the exposed concrete surfaces.

B. Immediately after screeding, horizontal surfaces shall receive an application of evaporation reducer. Apply in accordance with manufacturer's instructions. Final finish work shall begin as soon as the mix has stiffened sufficiently to support the workmen.

C. Curing and protection of the concrete shall begin immediately after completion of the finishing operation. Continuous moist-curing consisting of method 1 or 2 listed in paragraph 3.01D is mandatory for at least the first 24 hours. Method 2 may be used only if the finished surface is not marred or blemished during contact with the coverings.

D. At the end of the initial 24-hour period, curing and protection of the concrete shall continue for at least four (4) additional days using one of the methods listed in paragraph 3.01D.

E. Curing procedures during hot weather conditions shall conform to the requirements of ACI 305.

3.04 USE OF CURING COMPOUND

A. Curing compound shall be used only where specifically approved by the Engineer. Curing compound shall never be used for curing exposed walls with fluid or earth backfill on the opposite side. A continuous wet cure for a minimum of five days is required for these applications. Curing compound shall not be used on surfaces exposed to water in potable water storage tanks and treatment plants unless curing compound is certified in accordance with ANSI/NSF Standard 61.

B. When permitted, the curing compound shall maintain the concrete in a moist condition for the required time period, and the subsequent appearance of the concrete surface shall not be affected.

C. The compound shall be applied in accordance with the manufacturer's recommendations after water sheen has disappeared from the concrete surface and after finishing operations. Maximum coverage for the curing and sealing compound shall be 300 square feet per gallon for trowel finishes and 200 square feet per gallon for floated or broom surfaces. Maximum coverage for compounds placed where subsequent finishes will be applied shall be 200 square feet per gallon. For rough surfaces, apply in two directions at right angles to each other.

3.05 EARLY TERMINATION OF CURING

A. Moisture retention measures may be terminated earlier than the specified times only when at least one of the following conditions is met:

1. The strength of the concrete reaches 85 percent of the specified 28-day compressive strength in laboratory-cured cylinders representative of the concrete in place, and the temperature of the in-place concrete has been constantly maintained at 50 degrees Fahrenheit or higher.

2. The strength of concrete reaches the specified 28-day compressive strength as determined by accepted nondestructive methods or laboratory-cured cylinder test results.

END OF SECTION

THIS PAGE LEFT BLANK INTENTIONALLY

SECTION 03400
PRECAST CONCRETE

PART 1 – GENERAL

1.01 REQUIREMENTS

A. The Contractor shall construct all precast concrete items as required in the Contract Documents, including all appurtenances necessary to make a complete installation.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 02608 - Manholes

B. Section 03200 - Reinforcing Steel

C. Section 03300 - Cast-in-Place Concrete

D. Section 03350 - Concrete Finishes

E. Section 03370 - Concrete Curing

F. Section 03415 – Precast Prestressed Concrete Hollow Core Planks

G. Section 03600 - Grout

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of other requirements of these Specifications, all work specified herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the end of the Bid.

1. Kentucky Building Code

2. ACI 318-Building Code Requirements for Structural Concrete

3. PCI Standard MNL-116 - Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products

4. PCI Design Handbook

1.04 SUBMITTALS

A. The Contractor shall submit the following for review in accordance with Section 01300, Submittals.

1. Shop drawings for all precast concrete items showing all dimensions, locations, and type of lifting inserts, and details of reinforcement and joints.

2. A list of the design criteria used by the manufacturer for all manufactured, precast items.

3. Design calculations, showing at least the design loads and stresses on the item, shall be submitted. Calculations shall be signed and sealed by a Professional Engineer registered in the State of Kentucky.

4. Certified reports for all lifting inserts, indicating allowable design loads.

5. Information on lifting and erection procedures.

1.05 QUALITY ASSURANCE

A. All manufactured precast concrete units shall be produced by an experienced manufacturer regularly engaged in the production of such items. All manufactured precast concrete and site-cast units shall be free of defects, spalls, and cracks. Care shall be taken in the mixing of materials, casting, curing and shipping to avoid any of the above. The Engineer may elect to examine the units at the casting yard or upon arrival of the same at the site. The Engineer shall have the option of rejecting any or all of the precast work if it does not meet with the requirements specified herein or on the Drawings. All rejected work shall be replaced at no additional cost to the Owner.

B. Manufacturer Qualifications

C. The precast concrete manufacturing plant shall be certified by the Prestressed Concrete Institute, Plant Certification Program, prior to the start of production. Certification is only required for plants providing prestressed structural members such as hollow core planks, double-T members, etc.

D. Plant production and engineering must be under direct supervision and control of an Engineer who possesses a minimum of five years experience in precast concrete work.

PART 2 – PRODUCTS

2.01 CONCRETE

A. Concrete materials including Portland cement, aggregates, water, and admixtures shall conform to Section 03300, Cast-in-Place Concrete.

B. For prestressed concrete items, minimum compressive strength of concrete at 28 days shall be 5,000 psi unless otherwise specified. Minimum compressive strength of concrete at transfer of prestressing force shall be 3,500 psi unless otherwise specified.

C. For non-prestressed concrete items, minimum compressive strength of concrete at 28 days shall be 4000 psi unless otherwise specified.

2.02 GROUT

A. Grout for joints between panels shall be a cement grout in conformance with Section 03600, Grout.

B. Minimum compressive strength of grout at 7 days shall be 3,000 psi.

2.03 REINFORCING STEEL

A. Reinforcing steel used for precast concrete construction shall conform to Section 03200, Reinforcing Steel.

2.04 PRESTRESSING STRANDS

A. Prestressing strands shall be 7-wire, stress-relieved, high-strength strands Grade 250K or 270K.

2.05 STEEL INSERTS

A. Steel inserts shall be in accordance with Section 05010, Metal Materials.

B. All steel inserts protruding from or occurring at the surface of precast units shall be galvanized in accordance with Section 05010, Metal Materials.

2.06 WELDING

A. Welding shall conform to Section 05120, Structural Steel.

2.07 BEARING PADS

A. Neoprene bearing pads shall be nominal hardness 50 and shall be cut from new neoprene compound. Pads shall be cut to the lengths, widths and thicknesses as shown on the Drawings. Durometer hardness shall be determined in accordance with ASTM D 2240. Adhesive for use with bearing pads shall be Sikadur 31, Hi-Mod Gel by Sika Corporation or approved equal.

B. Plastic bearing pads shall be multi-monomer plastic strips which are non-leaching and support construction loads with no visible overall expansion, manufactured specifically for the purpose of bearing precast concrete.

PART 3 – EXECUTION

3.01 FABRICATION AND CASTING

A. All precast members shall be fabricated and cast to the shapes, dimensions and lengths shown on the Drawings and in compliance with PCI MNL-116. Precast members shall be straight, true and free from dimensional distortions, except for camber and tolerances permitted later in this clause. All integral appurtenances, reinforcing, openings, etc., shall be accurately located and secured in position with the form work system. Form materials shall be steel and the systems free form leakage during the casting operation.

B. All cover of reinforcing shall be the same as detailed on the Drawings.

C. Because of the critical nature of the bond development length in prestressed concrete panel construction, if the transfer of stress is by burning of the fully tensioned strands at the ends of the member, each strand shall first be burned at the ends of the bed and then at each end of each member before proceeding to the next strand in the burning pattern.

D. The Contractor shall coordinate the communication of all necessary information concerning openings, sleeves, or inserts to the manufacturer of the precast members.

E. Concrete shall be finished in accordance with Section 03350, Concrete Finishes. Grout all recesses due to cut tendons which will not otherwise be grouted during erection.

F. Curing of precast members shall be in accordance with Section 03370, Concrete Curing. Use of a membrane curing compound will not be allowed.

G. The manufacturer shall provide lifting inserts or other approved means of lifting members.

3.02 HANDLING, TRANSPORTING AND STORING

A. Precast members shall not be transported away from the casting yard until the concrete has reached the minimum required 28 day compressive strength and a period of at least 5 days has elapsed since casting, unless otherwise permitted by the Engineer.

B. No precast member shall be transported from the plant to the job site prior to approval of that member by the plant inspector. This approval will be stamped on the member by the plant inspector.

C. During handling, transporting, and storing, precast concrete members shall be lifted and supported only at the lifting or supporting points as indicated on the shop drawings.

D. All precast members shall be stored on solid, unyielding, storage blocks in a manner to prevent torsion, objectionable bending, and contact with the ground.

E. Precast concrete members shall not be used as storage areas for other materials or equipment.

F. Precast members damaged while being handled or transported will be rejected or shall be repaired in a manner approved by the Engineer.

3.03 ERECTION

A. Erection shall be carried out by the manufacturer or under his supervision using labor, equipment, tools and materials required for proper execution of the work.

B. Contractor shall prepare all bearing surfaces to a true and level line prior to erection. All supports of the precast members shall be accurately located and of required size and bearing materials.

C. Installation of the precast members shall be made by leveling the top surface of the assembled units keeping the units tight and at right angles to the bearing surface.

D. Connections which require welding shall be properly made in accordance with Section 05120, Structural Steel.

E. Grouting between adjacent precast members and along the edges of the assembled precast members shall be accomplished as indicated on the drawings, care being taken to solidly pack such spaces and to prevent leakage or droppings of grout through the assembled precast members. Any grout which seeps through the precast members shall be removed before it hardens.

F. In no case shall concentrated construction loads, or construction loads exceeding the design loads, be placed on the precast members. In no case shall loads be placed on the precast members prior to the welding operations associated with erection, and prior to placing of topping (if required).

G. No Contractor, Subcontractor or any of his employees shall arbitrarily cut, drill, punch or otherwise tamper with the precast members.

H. Precast members damaged while being erected will be rejected or shall be repaired in a manner approved by the Engineer.

END OF SECTION

THIS PAGE LEFT BLANK INTENTIONALLY

SECTION 03600
GROUT

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Furnish all materials, labor, and equipment required to provide all grout used in concrete work in accordance with the Contract Documents.

1.02 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. CRD-C 621	Corps of Engineers Specification for Non-shrink Grout
2. ASTM C 109	Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch or 50 mm cube Specimens)
3. ASTM C 531	Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts and Monolithic Surfacings
4. ASTM C 579	Test Method for Compressive Strength of Chemical-Resistant Mortars and Monolithic Surfacings
5. ASTM C 827	Standard Test Method for Early Volume Change of Cementitious Mixtures
6. ASTM C 144	Standard Specification for Aggregate for Masonry Mortar
7. ASTM C 1107	Standard Specification for Packaged Dry, Hydraulic Cement Grout (Nonshrink)

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01300 - Submittals.

1. Certified test results verifying the compressive strength and shrinkage and expansion requirements specified herein.

2. Manufacturer's literature containing instructions and recommendations on the mixing, handling, placement, and appropriate uses for each type of grout used in the work.

1.04 QUALITY ASSURANCE

A. Field Tests (required for pump station and storage tank projects)

1. Compression test specimens will be taken during construction from the first placement of each type of grout and at intervals thereafter as selected by the Engineer to ensure continued compliance with these Specifications. The specimens will be made by the Contractor and observed by Engineer.

   a. Compression tests and fabrication of specimens for cement grout and non-shrink grout will be performed as specified in ASTM C 109 at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at seven days, 28 days and any additional time period as appropriate.

   b. Compression tests and fabrication of specimens for epoxy grout will be performed as specified in ASTM C 579, Method B, at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at seven days and any other time period as appropriate.

2. The cost of all laboratory tests on grout will be borne by the Owner, but the Contractor shall assist the Engineer in obtaining specimens for testing. The Contractor shall be charged for the cost of any additional tests and investigation on work performed which does not meet the specifications. The Contractor shall supply all materials necessary for fabricating the test specimens, at no additional cost to the Owner.

3. All grout, already placed, which fails to meet the requirements of these Specifications, is subject to removal and replacement at no additional cost to the Owner.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Non-Shrink Cement Grout (Applicable for projects with Gravity Sewers and Force Mains)

1. Non-shrink grout shall conform to CRD-C 621 and ASTM C 1107, Grade B or C when tested at a max. fluid consistency of 30 seconds per CDC 611/ASTM C939 at temperature extremes of 45°F and 90°F and an extended working time of 15 minutes. Grout shall be non-metallic, non-stain, and non-shrink and color similar to concrete. Grout shall have a min. 28-day strength of 7,000 psi. Non-shrink grout shall be, "Euco N-S" by the Euclid Chemical Company, "Sikagrout 212" by Sika Corporation, Conspec 100 Non-Shrink Non-Metallic Grout by Conspec, Masterflow 555 Grout by BASF Construction Chemicals.

B. Epoxy Grout (Applicable for projects with Structures)

1. Epoxy grout shall be "Sikadur 32 Hi-Mod" by Sika Corporation, "Duralcrete LV" by Tamms Industries, or "Euco #452 Series" by Euclid Chemical, Concresive 1090 by BASF Construction Chemicals.

2. Epoxy grout shall be modified as required for each particular application with aggregate per manufacturer's instructions.

C. Epoxy Base Plate Grout (Applicable for projects with Structures)

1. Epoxy base plate grout shall be Sikadur 42, Grout-Pak by Sika Corporation, or Masterflow MP by BASF Construction Chemicals.

PART 3 – EXECUTION

3.01 GENERAL

A. Concrete surfaces shall be cleaned of all dirt, grease and oil-like films. Additionally, concrete surfaces shall be free of debris, including chipping or roughening the surface if a laitance or poor concrete is evident. The finish of the grout surface shall match that of the adjacent concrete.

B. All mixing, surface preparation, handling, placing, consolidation, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.

C. The Contractor, through the manufacturer of a non-shrink grout and epoxy grout, shall provide on-site technical assistance upon request, at no additional cost to the Owner.

3.02 CONSISTENCY

A. The consistency of grouts shall such that it is able to completely fill the space to be grouted. Dry pack consistency is such that the grout is plastic and moldable but will not flow.

3.03 MEASUREMENT OF INGREDIENTS

A. Measurements for cement grout shall be made accurately by volume using containers. Shovel measurement shall not be allowed.

B. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

3.04 GROUT INSTALLATION

A. Grout shall be placed quickly and continuously, shall completely fill the space to be grouted and be thoroughly compacted and free of air pockets. The grout may be poured in place, pressure grouted by gravity, or pumped. The use of pneumatic pressure or dry-

packed grouting requires approval of the Engineer. For grouting beneath base plates, grout shall be poured form one side only and thence flow across to the open side to avoid air-entrapment.

END OF SECTION

APPENDIX A – GEOTECHNICAL DATA

GEOTECHNICAL REPORT(S) INCLUDED

CORNERSTONE
GEOTECH SERVICES
Strong team. Smart solutions.

February 12, 2024

Mr. Joe Herman, PE
Stantec
3-52 Beaumont Centre Circle
Lexington, KY 40513

Re: Geotechnical Investigation
Floyd Drive Trunk Sewer Improvements
Lexington-Fayette Urban County Government
Lexington, Kentucky
Project Number 23-116G

Dear Mr. Herman:

Attached is the report of the geotechnical investigation that we carried out for the above referenced right-of-way crossings by trunk sewer. Both crossings are very close to bedrock at points along their alignment, be fall in soil based on the four borings. Groundwater and soft soils are present within the soil profile. Further details on these and other geotechnical considerations are provided in the body of the attached report.

If you have any questions regarding this report, please call.

Sincerely,

CORNERSTONE GEOTECH SERVICES LLC

Sandor R. Greenbaum

Sandor R. Greenbaum, P.E.
Director of Geotechnical Services

GEOTECHNICAL INVESTIGATION

FOR

FLOYD DRIVE TRUNK SEWER IMPROVEMENTS

LEXINGTON-FAYETTE URBAN COUNTY GOVERNMENT

LEXINGTON, KENTUCKY

FOR

STANTEC

3052 BEAUMONT CENTRE CIRCLE

LEXINGTON, KY 40513

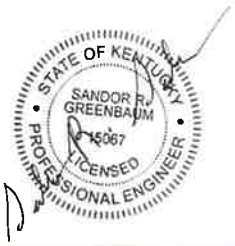
BY

CORNERSTONE GEOTECH SERVICES LLC

994 LONGFIELD AVENUE

LOUISVILLE, KENTUCKY 40215

FEBRUARY 12, 2024



CORNERSTONE GEOTECH SERVICES
Strong team. Smart solutions.

Table of Contents

APPENDIX

1.0 Introduction

Lexington-Fayette Urban County Government has contracted Stantec to design improvements to the Floyd Drive trunk sewer in Lexington, Kentucky. Sewer improvements are to take place in the area where the trunk sewer is to cross East New Circle Road towards Dartmoor Court and the Kentucky Utilities right-of-way south of Dartmoor Court. A boring location plan is included in the appendix of this report that shows the approximate locations of the borings and the proposed alignment of the trunk sewer. A site location plan is also included as is a map of site geology.

We were contracted by Stantec Consulting Services Inc. to carry out a geotechnical investigation directed at determining the depth of the rock and nature of the soil and rock at the sections to be tunneled. Work was coordinated through Mr. Joe Herman, PE, of Stantec Consulting Services Inc.

2.0 General Geology

Soils at this site are shown by the Kentucky Geological Survey to be residuum, a residual product of weathering product of the local bedrock. Bedrock at this site lies across two lithologic contacts between the Brannon Member and the Grier Member of the Lower Part of the Lexington Limestone.

The Kentucky Geological Survey describes the Brannon Member as:

> Limestone and shale: Limestone (50 percent), medium- to dark-gray, micrograined, some medium-grained, locally siliceous or cherty; tabular bedded, beds less than 1/2 foot thick; interbedded with shale, fossiliferous in part. Shale, medium- to dark-gray, limy, thin-bedded. Unit weathers to buff or tan soil. Convolute "flow rolls"occur locally and are prominent in thinned extensions of the unit to the north; unit absent in northern half of quadrangle.

The Kentucky Geological Survey describes the Grier Member of the Lower Part of the Lexington Limestone as:

> Limestone and shale, irregularly bedded: Limestone (80 percent), mostly blue-gray in fresh outcrops to brownish-gray where weathered; nodular, thin to medium bedded, slightly phosphatic, fossiliferous; interbedded with shale, medium- to dark-gray, limy, in thin irregular laminae separating nodular limestone beds; some limestone light-gray, micrograined, tabular-

and thin-bedded with small gastropods and ostracodes weathering to light gray float. Unit generally weathers to orange-gray soil. Tongues of the Tanglewood Limestone Member mapped separately on the Coletown quadrangle to the south are interbedded with the Brannon and the Grier Limestone Members as shown in the columnar section. Where the Brannon Member is absent in the northern part of the quadrangle the Grier Limestone Member is not mapped separately but included with the Tanglewood Limestone Member.

3.0 Investigation

Four borings were carried out to depths of approximately 10 feet below proposed invert elevation of the pipe installations, at either end of the proposed pipe alignments. Borings were drilled in soil by standard penetration procedures and were core drilled in rock using NQ wireline coring tools. A Diedrich D-25 track-mounted drill rig was used to carry out the borings using 3 ¼-inch inside diameter hollow stem augers and an automatic hammer. Structure locations were staked in advance by others and borings were staked using a nylon tape from those structure locations.

The standard penetration procedure involves driving a standard 2-inch diameter split spoon in the formation at selected intervals using a 140-pound hammer falling through 30 inches. The blow counts for each 6 inches of drive, to a total of 18 inches, are recorded and the number of blows for the 12 inches after the first 6 inches is a standard measure of the condition of the soil. As the split spoon is removed from the ground, it retrieves a sample of the soil in a disturbed condition. Nevertheless, this sample is suitable for certain classification tests and is representative of the soils at the depth tested.

Soil samples were returned to the laboratory where a program of testing was carried out. This testing included two grain size analyses, two Atterberg Limits' tests and two natural moisture determinations.

One sample of limestone was subject to an array of tests. These tests included Mohs Hardness, Abrasiveness of Rock using the Cerchar Method (ASTM D7625), Axial Point Load Strength Index of Rock (ASTM D5731), Splitting Tensile Strength of Intact Rock Core Specimens (ASTM D3967), Punch Penetration Index Testing and Bulk Density and Compressive Strength of Rock Core Specimens (ASTM D7012).

Grain size determination arrives at a curve of grain size against that fraction of the soil that is finer than that grain size. It also allows the determination of the clay fraction, silt fraction, sand fraction, etc. in any particular soil sample. Based on this division of grain sizes, the field soils classifications are refined and the boring logs adjusted. In the case of fine-grained soils, the soils are largely silt and clay; thus requiring that the soils be suspended in an aqueous medium and the rate at which the particles drop out is measured in order to arrive at the grain size distribution. Silt and clay grains are so fine that sieve analysis alone will not function in this range. The coarse fraction of this sample is separated from the fine and run through a nest of sieves in order to further detail the grain size distribution in the coarse range.

The Atterberg Limits determination arrives at those moisture contents at which the soil turns from a solid state to a plastic condition (the Plastic Limit) and then from a plastic condition to a liquid condition (The Liquid Limit). The points in question are arrived at by standard procedures that accept specific cohesive and flow properties of the soil as standards for these limits. Knowing the moisture content of the soil in relation to these limits provides a broad measure of the soil strength and soil characteristics. The arithmetic difference between these two limits is called the Plasticity Index and all three together are used for classifying the soils in a number of standard systems.

The natural moisture determination arrives at the in-situ moisture content of the soil and is useful for correlating the strength of various samples of like texture and in conjunction with the Atterberg limits, gives a strong measure of the strength range the soils are likely to be found in.

4.0 Findings

4.1 Boring Results

The boring locations are covered by either topsoil or pavement, mostly by about 6 inches of topsoil but boring B-4 was drilled through pavement consisting of about 6 inches of asphalt over about 5 inches of crushed stone. Below this, soils are moist, soft to very stiff, brown, lean clay with sand. In boring B-2 highly weathered limestone was present in the soils encountered above auger refusal. Boring B-1 found crushed stone within the soils at a depth of 3.5- to 6-feet indicating that these soils are fill. Auger refusal was encountered between 10.5- to 16.4-feet depth. **Groundwater was encountered in boring B-2 at a depth of 6**

feet. groundwater was not encountered in any of the other borings, but is probably present in those locations as well.

The table below provides a tabulation of N-values as measured by the standard penetration test, corrected for the energy of the automatic hammer, along with depth to auger refusal.

Depth	B-1	B-2	B-3	B-4
1 – 2.5 feet	8	13	16	14
3.5 – 5 feet	25	7	4	12
6 – 7.5 feet	16	13	10	7
8.5 – 10 feet	4	50/4"	14	12
13.5 – 15 feet	18			
Auger Refusal	16.4'	10.5'	11.1'	13.3'

The table below provides a tabulation of core recovery for each run of rock core with Rock Quality Designation (RQD) for that core run indicated in parenthesis.

Depth	B-1	B-2	B-3	B-4
Core Run 1	92 (0)	100 (52)	100 (38)	63 (29)
Core Run 2	77 (0)	100 (46)	100 (29)	100 (7)
Core Run 3				67 (42)

The table at the top of the following page summarizes elevations including that of the ground surface, top of competent rock (taking into account clay seams, highly fractured rock and voids), proposed pipe invert, boring termination as well as providing the type of strata that the sewer excavation will encounter based on the findings at the boring locations.

	Elevations			
	B-1	B-2	B-3	B-4
Ground Surface	992.0	978.1	975.3	981.4
Auger Refusal	975.6	965.6	964.2	968.1
Top of Competent Rock	975.0	965.6	963.8	968.1
Proposed Sewer Bore Invert	976.0	972.4	969.8	968.0
Boring Termination	966.6	957.6	954.2	956.1
Invert above Auger Refusal?	0.4' above (in soil)	6.4' above (in soil)	5.6' above (in soil)	0.1' above (in soil)

4.2 Laboratory Results

A sample of soil from shallow depth was tested and classified and was found to be lean clay with sand. The result of this testing is summarized in the table below with more detailed results provided in the appendix of this report. Moisture content is shown graphically on the boring logs.

Soil Sample	Grain Size Distribution			Atterberg Limits			Soil Classification	
	Percent Sand	Percent Silt	Percent Clay	Liquid Limit	Plastic Limit	Plasticity Index	Unified	AASHTO
B-3 @ 1' – 2.5'	22	40	38	42	25	17	CL	A-7-6

One sample of limestone was tested for various properties and the result of that testing is provided below.

Rock Sample	Mohs Hardness	Abrasiveness by Cherchar Method		Rock Strength Testing				
		Average CAIs	Average CAI	Axial Point Load Strength Index	Splitting Tensile Strength	Compressive Strength by ASTM D7012	Punch Penetration Test (Peak Slope Index)	Punch Penetration Test (Peak Slope Index)
B-4 @ 13.4 – 14.5 ft.	3.5	1.02	1.49	15,200 psi	870 psi	12,017 psi	46.4 kips/in.	46.4 kips/in.

4.3 Historic Aerial Photographs

Aerial photographs dating back to 1985, available on Google Earth, were examined. The 1985 photograph of such poor quality that nothing useful can be discerned from the images. In the next photograph, from 1993, the area is the same as today to the degree that can be discerned with the exception that the building on the property to the south or the sewer alignment on the west side of East New Circle Road has a building that is much smaller than that which is present today, currently housing Tri City Auto Mart Inc.

4.4 Seismicity

According to the 2018 edition of the Kentucky/2015 International Building Code, this is a Very Dense Soil and Soft Rock Profile, Site Class C. The Spectral Response Acceleration Coefficients, for this area, as provided by U.S.G.S., FEMA Design Parameters are:

$S_S = 0.189$ g $\quad S_{MS} = 0.227$ g $\quad S_{DS} = 0.152$ g

$S_1 = 0.091$ g $\quad S_{M1} = 0.155$ g $\quad S_{D1} = 0.103$ g

5.0 Recommendations

5.1 East New Circle Road Crossing

The proposed invert elevation of this 336-foot long, 20-inch steel pipe installation running between test borings B-1 and B-2 lies between approximately elevations 976.5 and 972.39 placing the sewer above the bedrock surface by between 0.4- and 6.4-feet. This pipe is very close to the bedrock surface over part of its alignment so it may encounter pinnacles in the limestone bedrock or boulders that float above the bedrock surface. If it is elected to place the pipe completely in bedrock it would be necessary that the pipe be lowered by approximately 8- to 10-feet and, if lowered in that range, it is still likely to encounter solution widened joints in the bedrock. Also, water was encountered in boring B-2 at 6 feet depth and soft soils were encountered between approximately 8- and 13-feet depth in boring B-1 and between 6- and 8.5-feet depth in boring B-2, so the pipe is likely to encounter soft, wet soils with groundwater.

Soil and rock properties are provided in section 4.2 of this report.

5.2 Electric Right-of-Way Crossing

The proposed invert elevation of this 148-foot long, 24-inch steel pipe installation running between test borings B-3 and B-4 lies between approximately elevations 969.8 and 968.0 placing the sewer above the bedrock surface by between 0.1- and 5.6-feet. This pipe is very close to the bedrock surface so it may encounter pinnacles in the limestone bedrock or boulders that float above the bedrock surface. If it is elected to place the pipe completely in bedrock it would be necessary that the pipe be lowered by approximately 8- to 10-feet and, if lowered in that range, it is likely to encounter solution widened joints in the bedrock. Also, soft soils were encountered between approximately 3- and 6-feet depth in boring B-3 and between 6- and 8.5-feet depth in boring B-4, so the pipe is likely to encounter soft, wet soils and probably groundwater.

Soil and rock properties are provided in section 4.2 of this report.

5.3 Earth Pressures

For design purposes, the shear strength of the soil should be based on an internal angle of friction of 28 degrees and a cohesion intercept of zero with a soil

with a wet unit weight of 120 pounds per cubic foot. This results in the following earth pressures.

The table below summarizes the design earth pressures.

	Active Earth Pressure Coefficient (K_a)	Passive Earth Pressure Coefficient (K_p)	Coefficient of Earth Pressure at Rest (K_0)	Equivalent Fluid Pressure on Cantilever Walls	Equivalent Fluid Pressure on Rigid Walls
Undisturbed Native Soils	0.36	2.77	0.47	43.2 pcf	56.4 pcf
Highly Disturbed Native Soils (residual values)	0.43	2.33	0.60	50.4 pcf	72.0 pcf

Surcharge above the wall will add additional load. A uniform surcharge must be multiplied by the appropriate coefficient of earth pressure to determine the additional load applied to the structure.

Any structure or shoring design must use appropriate factors of safety. It is critical that drainage be provided in order to avoid hydrostatic pressure. Hydrostatic pressure would increase pressure against the wall substantially.

5.4 Earthwork

All fill should be placed in lifts not exceeding 8 inches in uncompacted thickness and must be compacted to at least 98 percent of the soils maximum dry density as determined by the Standard Proctor (ASTM D-698). Soil moisture content should be within 2 percent of optimum as determined from the Standard Proctor.

Soil from any off-site borrow sources should be tested and approved by this office prior to being used on the site. Satisfactory borrow materials are those falling in one of the following classifications: GC, SM, SC, ML, or CL. Soil types MH, CH and OH soils and peat are unsatisfactory borrow materials.

The placement of compacted fill should be carried out by an experienced excavator with the proper materials. The excavator must be prepared to adapt his procedures, equipment and materials to the type of project, to weather conditions, and the structural requirements of the engineer. Methods and materials used in

summer may not be applicable in winter; soil used in proposed fill may require wetting or drying for proper placement and compaction. Conditions may also vary during the course of a project or in different areas of this site. These needs should be addressed in the project drawings and specifications.

During freezing conditions, the fill must **not** be frozen when delivered to the site. It also must not be allowed to freeze during or after compaction. Since the ability to work the soil while keeping it from freezing depends in part on the soil type, the specifications should require the contractor to submit a sample of his proposed fill before construction starts, for laboratory testing. If the soil engineer determines that it is not suitable, it should be rejected. In general, silty sand, clayey sand, and cohesive/semi-cohesive soils should not be used as fill under freezing conditions. All frozen soil of any type should be rejected for use as compacted fill.

It is important that compacted fill be protected from freezing after it is placed. The excavator should be required to submit a plan for protecting the soil. The plan should include details on the type and amount of material (straw, blankets, extra loose fill, topsoil, etc.) proposed for use as frost protection. The need to protect the soil from freezing is ongoing throughout construction and applies both before **and** after concrete is placed, until backfilling for final frost protection is completed. Foundations placed on frozen soil can experience heaving and significant settlement, rotation, or other movement as the soil thaws. Such movement can also occur if the soil is allowed to freeze **after** the concrete is placed and then allowed to thaw. The higher the percentage of fines (clay and silt) in the fill, the more critical is the need for protection from freezing.

The contractor should be required to adjust the moisture content of the soil to within a narrow range near the optimum moisture content (as defined by the applicable Proctor or AASHTO Test). In general, fill should be placed within 2% of optimum moisture. The need for moisture control is more critical as the percentage of fines increases. Naturally occurring cohesive/semi-cohesive soil are often much wetter than the optimum. Placing and attempting to compact such soils to the specified density may be difficult. Even if compacted to the specified density, excessively wet soils may not be suitable as pavement subgrades due to pumping under applied load. This is especially true when wet cohesive/semi-cohesive soil is used as backfill in utility trenches and like situations. Excessively wet soil in thick fill sections may cause post-construction settlement beyond that estimated for fill placed at or near (±2%) the optimum moisture content.

5.5 Groundwater

Groundwater was encountered at 6 feet depth in boring B-2. Soft, wet soils were encountered in the other borings as well, so groundwater should be expected at both crossings.

5.6 Temporary Earth Slopes or Cuts

Temporary earth cuts necessary to construct this sewer should be no deeper than 4 feet without benching or sloping. If vertical faces deeper than 4 feet are used, bracing designed for short term loads may be used. Excavations should comply with OSHA regulations. If soft soils are encountered, Greenbaum Associates, Inc. should view the cut face prior to personnel entering the excavation.

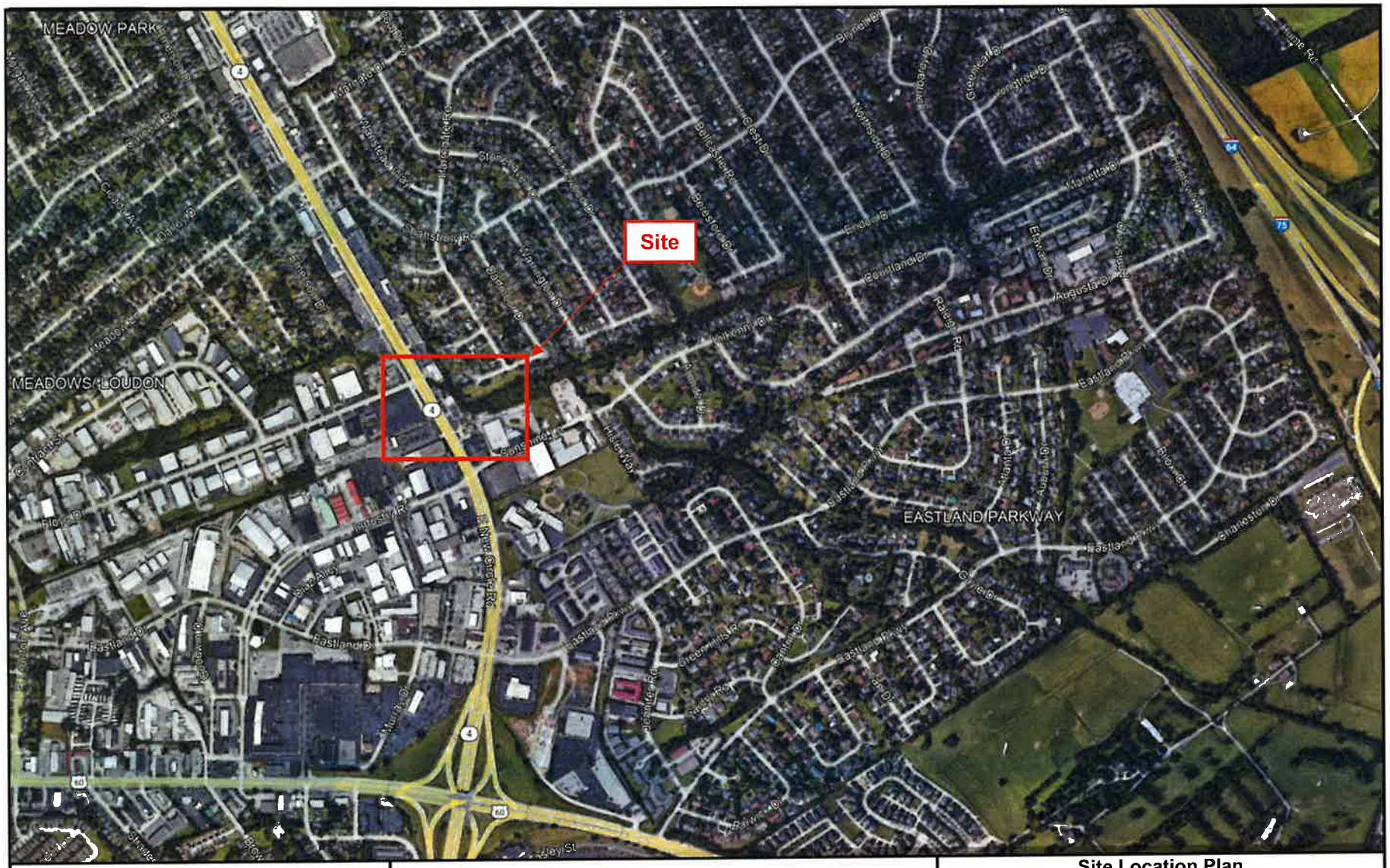
5.7 Limitations

We strongly recommend that bearing surfaces and compaction be monitored by Cornerstone Geotech Services LLC. Our technicians will be available to further assist you in providing these and other normally specified quality control services. The report is preliminary until such time as these examinations are completed to confirm conditions consistent with those discovered in the investigation.

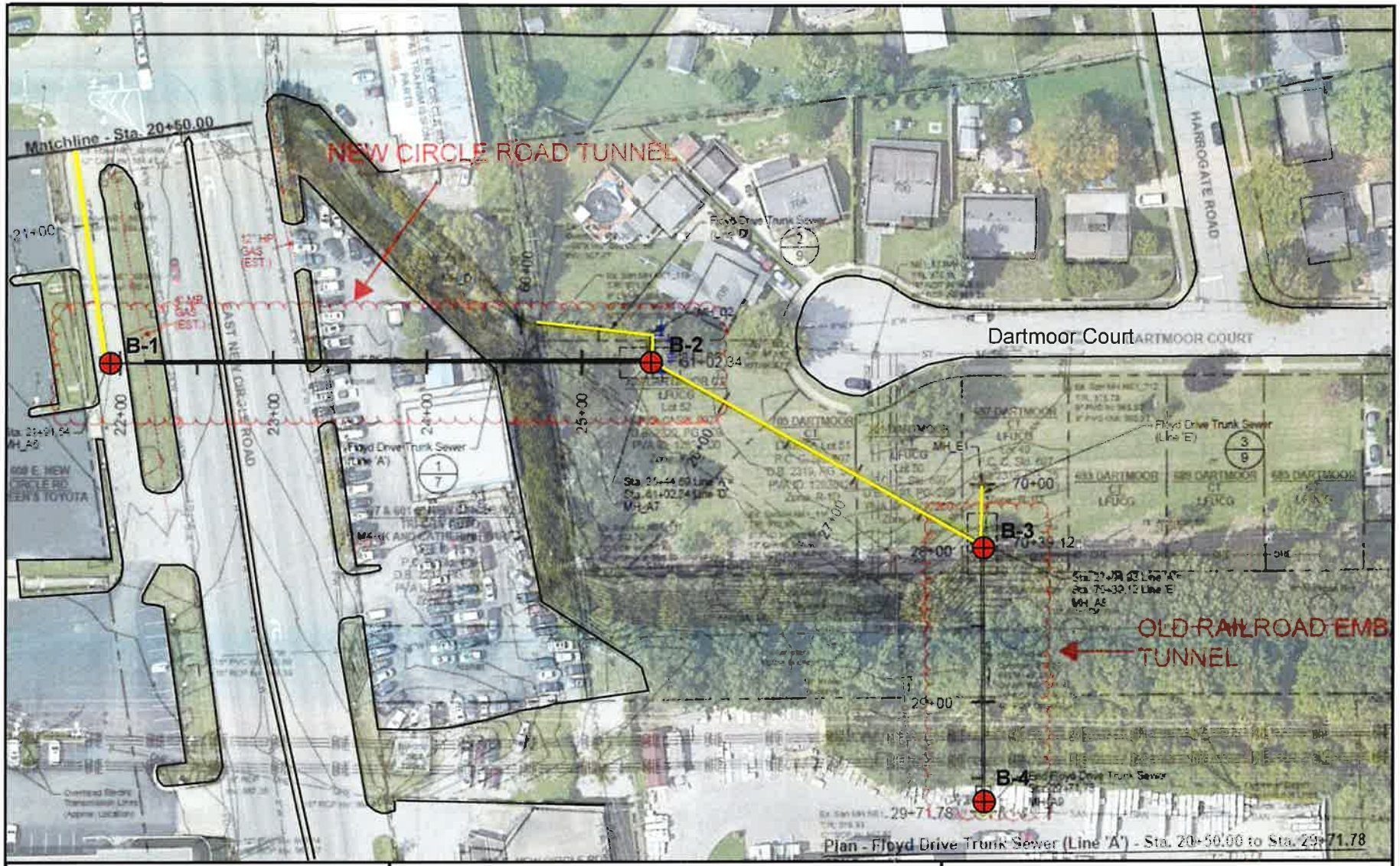
The conclusions and recommendations offered in this report are based on the subsurface conditions encountered in the borings. No warranties can be made regarding the continuity of conditions between or beyond borings. If, during construction, soil conditions are encountered that differ from those indicated in this report, a representative of Cornerstone Geotech Services LLC. should inspect the site to determine if design modification is required.

This study was directed at specific pipe crossings at specific locations on this site to be constructed within a reasonably short period after this study. Use for any other location, structures or substantial changes in construction period may invalidate the recommendations. The geotechnical engineer should be consulted relative to any substantial change in these.

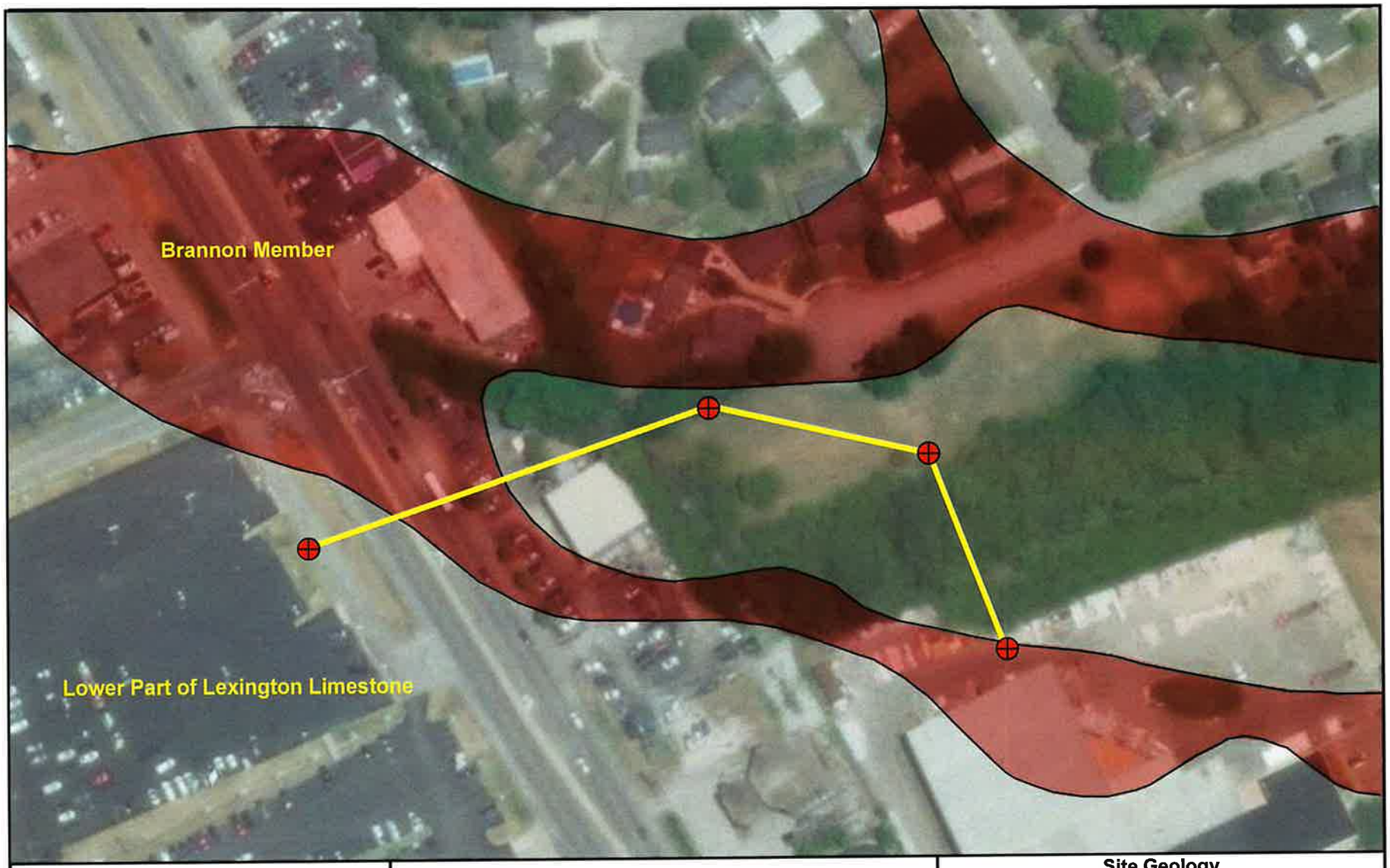
This study is directed at mechanical properties of soils and includes no sampling, testing or evaluation for environmental considerations.



Stantec Consulting Services Inc.	CORNERSTONE GEOTECH SERVICES Strong team. Smart solutions.	**Site Location Plan** Floyd Trunk Sewer Improvements East New Circle Road, Lexington, KY Cornerstone Project Number: 23-116G



Stantec Consulting Services Inc.	CORNERSTONE GEOTECH SERVICES Strong team. Smart solutions.	**Boring Location Plan** Floyd Drive Trunk Sewer Improvements East New Circle Road, Lexington, KY Cornerstone Project Number: 23-116G



Stantec Consulting Services Inc.	CORNERSTONE GEOTECH SERVICES Strong team. Smart solutions.	**Site Geology** Floyd Drive Trunk Sewer Improvements East New Circle Road, Lexington, KY Cornerstone Project Number: 23-116G

SOIL DESCRIPTION TERMINOLOGY

Soils are identified and classified in this report according the the Unified Classification System with the following modifiers:

RELATIVE DENSITY OF GRANULAR SOILS

Description	Blows/Foot
Very Loose	0 to 4
Loose	5 to 10
Medium Dense	11 to 30
Dense	31 to 50
Very Dense	51 to 80
Extremely Dense	81+

CONSISTENCY OF COHESIVE SOILS

Description	N-value	q_u (tsf)
Very Soft	0 to 2	0 to 0.25
Soft	3 to 4	0.26 to 0.50
Medium Stiff	5 to 8	0.51 to 1.0
Stiff	9 to 15	1.1 to 2.0
Very Stiff	16 to 30	2.1 to 4.0
Hard	>30	4.1 to 8.0
Very Hard		8.1+

PARTICAL SIZES

Components		Size or Sieve No.
Boulders		over 12 inches
Cobbles		3 to 12 inches
Gravel -	Coarse	$^3/_4$ to 3 inches
	Fine	No. 4 to $^3/_4$ inch
Sand -	Coarse	No. 10 to No. 4
	Medium	No. 40 to No. 10
	Fine	No. 200 to No. 40
Fines (silt and clay)		Finer than No. 200

SOIL MOISTURE

	Descriptive Term
Dry	Dry of Standard Proctor Optimum
Damp	Moist (sand only)
Moist	Near Standard Proctor Optimum
Wet	Wet of Standard Proctor Optimum
Saturated	Free Water in Sample

ROCK DESCRIPTION TERMINOLOGY

The Rock Quality Determination (Deere et. Al., 1969) method of determining rock quality as reported here was obtained by summing up the total length of core recovered in each run, counting only those pieces of core which are four inches (10 cm.) in length or longer and which are hard and sound. The sum is then represented as a percentage over the length of the run. If the core is broken by handling or by the drilling process, the fresh broken pieces are fitted together and counted as one piece provided that they the requisite length of four inches (10 cm.). RQD is reported as a percentage.

RELATIONSHIP BETWEEN RQD AND ROCK QUALITY

RQD (%)	Description of Rock Quality
0 to 25	Very Poor
26 to 50	Poor
51 to 75	Fair
76 to 90	Good
91 to 100	Excellent

Cornerstone Geotech Services LLC
Louisville, Kentucky

Client: Stantec Consulting Services Inc.	**HOLE No. B-1**
Project: Floyd Drive Trunk Sewer Improvements, Lexington, Kentucky	Sheet 1 of 1
Project No.: 23-116G	

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **D-25 Track Mounted Drill w/ Auto Hammer** Drilling Method: **3 1/4 Inch Hollow Stem Auger**

Depth to water immediately: **Dry** Overburden: **16.4** Rock: **9** Total Depth: **25.4**

Logged By: **L. Van Nevel** Driller: **R. Gonzalez** Date Logged: **7/5/23 - 7/5/23**

DEPTH (feet)	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	N VALUE
				Topsoil (6 inches) OL	Ground	
	SPT			Moist, Medium Stiff, Brown, Lean Clay with Sand CL		6
	SPT			Same, Very Stiff, with Crushed Stone CL		19
5	SPT					12
	SPT			Same, Soft CL		3
10						
	SPT			Same, Very Stiff CL		14
15				AUGER REFUSAL @ 16.4 FEET		
	NX	92	0	Light Gray, Thin Bedded, Limestone		
				Clay Seam		
20				Light Gray, Thin Bedded, Limestone		
				Clay Seam		
	NX	77	0	Gray, Thin Bedded, Limestone with Dark Bands Interbedded with Shale		
25				TERMINATED @ 25.4 FEET		

STANDARD PENETRATION TEST (blows/ft)

MC

PL ⊢▲⊣ LL

10 20 30 40 50 60 70 80 90

LOG WITH WELL AND SPT GRAPH 23-116.GPJ 08-053.GPJ 12/18/23

SAMPLER TYPE

SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD

HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-1**

Cornerstone Geotech Services LLC
Louisville, Kentucky

Client:	Stantec Consulting Services Inc.	**HOLE No. B-2**
Project:	Floyd Drive Trunk Sewer Improvements, Lexington, Kentucky	
Project No.:	23-116G	Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **D-25 Track Mounted Drill w/ Auto Hammer** Drilling Method: **3 1/4 Inch Hollow Stem Auger**

Depth to water immediately: **6.0** Overburden: **10.5** Rock: **10** Total Depth: **20.5**

Logged By: **L. Van Nevel** Driller: **R. Gonzalez** Date Logged: **7/3/23 - 7/3/23**

DEPTH (feet)	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)
	SPT			Topsoil (6 inches)	Ground
				Moist, Stiff, Brown, Lean Clay with Sand	OL / CL
	SPT			Same, Medium Stiff, Gray	CL
5	SPT			Same, Wet, Stiff	CL
	SPT			Same, with Highly Weathered Limestone	CL
10				AUGER REFUSAL @ 10.5 FEET	
	NX	100	52	Gray, Medium Bedded, Limestone with Dark Bands	
				Gray, Thin- to Medium-Bedded, Limestone with Dark Bands Interbedded with Shale	
15				Gray, Thick Bedded, Limestone with Calcite	
	NX	100	46	Light Gray, Shale	
				Gray, Thick Bedded, Limestone with Calcite	
20				Light Gray, Shale	
				Gray, Thin Bedded, Limestone with Calcite	
				Light Gray, Shale	
				Gray, Thin- to Medium-Bedded, Limestone with Calcite	
				TERMINATED @ 20.5 FEET	

STANDARD PENETRATION TEST (blows/ft)

MC: PL — LL

10	20	30	40	50	60	70	80	90

N VALUE: 10, 5, 10, >> 50/4"

SAMPLER TYPE

SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD

HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-2**

LOG WITH WELL AND SPT GRAPH 23-116.GPJ 08-053.GPJ 12/18/23

Cornerstone Geotech Services LLC
Louisville, Kentucky

Client: Stantec Consulting Services Inc.	**HOLE No. B-3**
Project: Floyd Drive Trunk Sewer Improvements, Lexington, Kentucky	Sheet 1 of 1
Project No.: 23-116G	

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **D-25 Track Mounted Drill w/ Auto Hammer** Drilling Method: **3 1/4 Inch Hollow Stem Auger**

Depth to water immediately: **Dry** Overburden: **11.1** Rock: **10** Total Depth: **21.1**

Logged By: **L. Van Nevel** Driller: **R. Gonzalez** Date Logged: **7/3/23 - 7/3/23**

DEPTH (feet)	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	N VALUE
				Topsoil (6 inches)	OL	
	SPT			Moist, Very Stiff, Brown, Lean Clay with Sand	CL	12
	SPT			Same, Soft, Brown and Gray Mottled	CL	3
5	SPT			Same, Stiff	CL	8
	SPT					11
10				AUGER REFUSAL @ 11.1 FEET		
	NX	100	38	Gray, Thin Bedded, Limestone Clay Seam Gray, Thick Bedded, Limestone		
15				Light Gray, Shale Gray, Medium- to Thick-Bedded, Limestone Light Gray, Shale Gray, Thin Bedded, Limestone		
	NX	100	29	Light Gray, Shale Gray, Thin- to Medium-Bedded, Limestone Interbedded with Shale		
20				Gray, Thin- to Medium-Bedded, Limestone		
				TERMINATED @ 21.1 FEET		

Ground

STANDARD PENETRATION TEST
● (blows/ft)
PL ▲ MC LL
10 20 30 40 50 60 70 80 90

LOG WITH WELL AND SPT GRAPH 23-116.GPJ 08-053.GPJ 12/18/23

SAMPLER TYPE

SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD

HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-3**

Cornerstone Geotech Services LLC
Louisville, Kentucky

Client:	Stantec Consulting Services Inc.
Project:	Floyd Drive Trunk Sewer Improvements, Lexington, Kentucky
Project No.:	23-116G

HOLE No. B-4

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **D-25 Track Mounted Drill w/ Auto Hammer** Drilling Method: **3 1/4 Inch Hollow Stem Auger**

Depth to water immediately: **Dry** Overburden: **13.3** Rock: **12** Total Depth: **25.3**

Logged By: **L. Van Nevel** Driller: **R. Gonzalez** Date Logged: **7/3/23 - 7/3/23**

DEPTH (feet)	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	N VALUE
				Asphalt (6 inches)	Ground	
				Crushed Stone (5 inches)	GW	
	SPT			Moist, Stiff, Brown, Lean Clay	CL	11
5	SPT					9
	SPT			Same, Medium Stiff	CL	5
	SPT			Same, Stiff	CL	9
10						
				AUGER REFUSAL @ 13.3 FEET		
15	NX	63	29	Gray, Thin Bedded, Limestone		
				Gray, Shale		
				Gray, Medium Bedded, Limestone with Calcite		
				Gray, Shale		
20	NX	100	7	Gray, Thin- to Medium-Bedded, Limestone with Dark Bands Interbedded with Shale		
	NX	67	42	Gray, Thin- to Thick-Bedded, Limestone with Calcite		
25				TERMINATED @ 25.3 FEET		

STANDARD PENETRATION TEST (blows/ft)

MC

PL — LL

10 20 30 40 50 60 70 80 90

SAMPLER TYPE

SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD

HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-4**

LOG WITH WELL AND SPT GRAPH 23-116.GPJ 08-053.GPJ 12/18/23

Boring B-1 from 16.4- to 25.4-feet depth

Boring B-2 from 10.5- to 20.5-feet depth

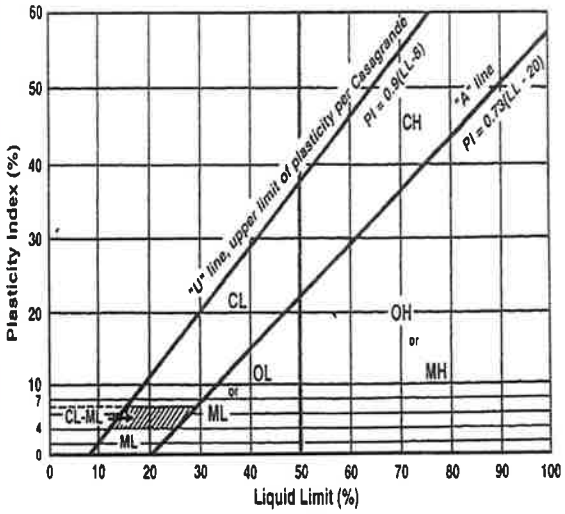
Boring B-3 from 11.1- to 21.1-feet depth

CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

ASTM D2487 and D2488

Major Divisions			Group Symbols	Typical Names	Laboratory Classification Criteria
Coarse-grained soils (More than half of material is *larger* than No. 200 sieve size)	**Gravels** (More than half of coarse fraction larger than No. 4 sieve)	**Clean Gravels** (Little or no fines)	**GW**	Well-graded gravels, gravel-sand mixtures, little or no fines	$C_u=D_{60}/D_{10}$ greater than 4 $C_u=(D_{30})^2/(D_{10}\times D_{60})$ between 1 and 3
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW
		Gravels with fines (Appreciable amount of fines)	**GM**[a] d / u	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line with P. I. less than 4 / Above "A" line with P. I. between 4 and 7 are *borderline* cases requireing us of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures	Atterberg limits below "A" line with P. I. greater than 7
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	**Clean Sands** (Little or no fines)	**SW**	Well-graded sands, gravelly sands, little or no fines	$C_u=D_{60}/D_{10}$ greater than 6 $C_u=(D_{30})^2/(D_{10}\times D_{60})$ between 1 and 3
			SP	Poorly graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW
		Sands with fines (Appreciable amount of fines)	**SM**[a] d / u	Silty sands, sand-silt mixtures	Atterberg limits above "A" line or P.I. < 4 / Limits plotting in hatched zone with P.I. between 4 and 7 are *borderline* cases requireing use of dual symbols
			SC	Clayey sands, sand-clay mixtures	Atterberg limits above "A" lime with P.I. > 7
Fine-grained soils (More than half meterial is smaller than No. 200 sieve)	Silts and clays (Liquid limit less than 50)		**ML**	Inorganic silts and very fine sands, silty or clayey fine sands, or clayey silts with slight plasticity	
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
			OL	Organic silts and organic siltyclays of low plasticity	
	Silts and clays (Liquid limit less that 50)		**MH**	Inorganic silts, micaceous or diatomaceous fine sand or silty soils, elastic silts	
			CH	Inorganic slays of high plasticity, fat clays	
			OH	Organic clays of medium to high plasticity, organic silts	
	Highly organic soils		**Pt**	Peat and other highly organic soils	

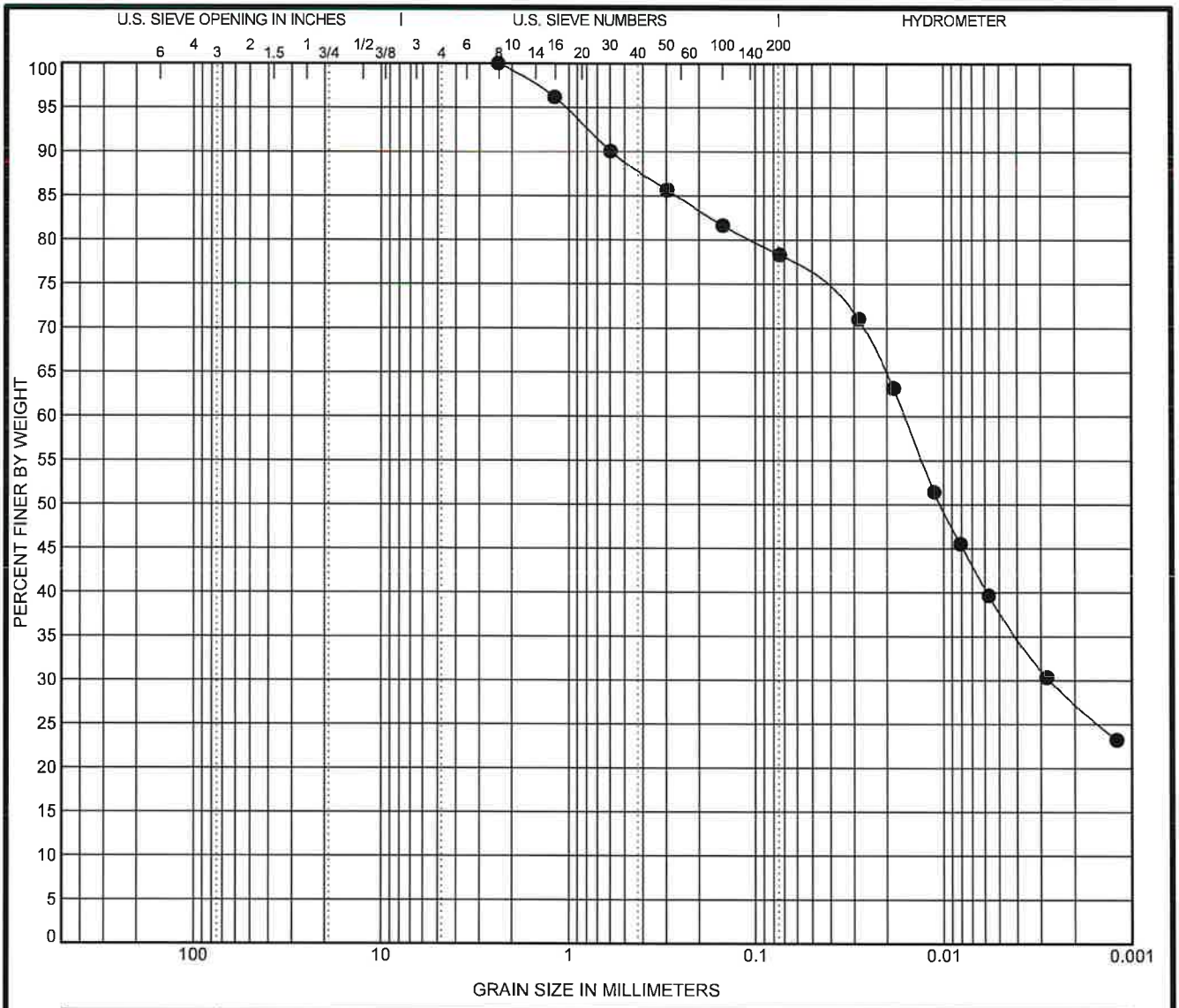
Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller that No. 200 sieve size), coarse-grained soils are classified as follows:
Less than 5 percent — GW, GP, SW, SP
More than 12 percent — GM, GC, SM, SC
5 to 12 percent — *Borderline* cases requireing dual symbols[b]



Plasticity Chart

[a] Division of GM and SM groups into subdivisions of d and u are for roads and airfields only. Subdivision is based on Atterberg limits :suffix d used when L. L. is 28 or less and the P. I. is 6 or les; the suffix u used when L. L. is greater than 28.

[b] Borderline classifications, used for soils possessing characeristics of two groups, are designated by combinations of group symbols. For exampls: GW-GC, well-graded gravel-sand misture with clay binder.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-3	2.0	LEAN CLAY with SAND(CL)	42	25	17		

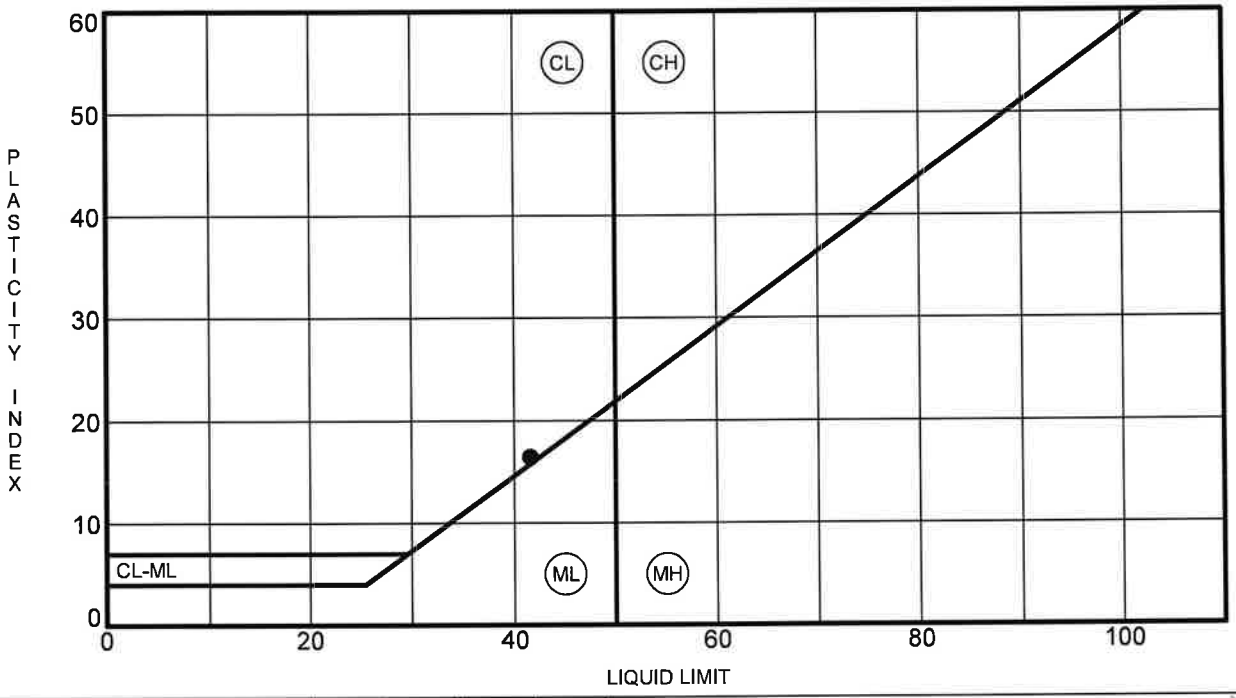
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-3	2.0	2.38	0.016	0.003		0.0	21.6	40.5	38.0

Cornerstone Geotech Services
Louisville, Kentucky

GRAIN SIZE DISTRIBUTION

Project: Floyd Drive Trunk Sewer
Location: Lexington, Kentucky
Number: 23-116 G

US GRAIN SIZE 23-116.GPJ GREENBAUM.GDT 12/18/23



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**B-3**	**2.0**	**42**	**25**	**17**	**78**	**LEAN CLAY with SAND(CL)**

Cornerstone Geotech Services
Louisville, Kentucky

ATTERBERG LIMITS' RESULTS

Project: Floyd Drive Trunk Sewer

Location: Lexington, Kentucky

Number: 23-116 G

US ATTERBERG LIMITS 23-116.GPJ GREENBAUM.GDT 12/18/23

GeoTesting EXPRESS

Client:	Greenbaum Associates, Inc.				
Project:	Floyd Drive Trunk Sewer				
Location:	Frankfort, KY			Project No:	GTX-317840
Boring ID:	B-4	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	---	Test Date:	09/20/23	Checked By:	smd
Depth :	13.4-14.5 ft	Test Id:	734559		
Test Comment:	---				
Visual Description:	---				
Sample Comment:	---				

Mohs Hardness Test

Boring ID	Sample ID	Depth	Scale of Hardness Number
B-4	---	13.4-14.5 ft	3.5

Notes: The value listed above is an estimate of the hardness of the rock sample provided using the Mohs Hardness method. This method is intended to represent the hardness of individual minerals not rock hardness

Tests performed on cut surface of rock core samples provided by client.

Mohs Table of Hardness Scale

1	Talc	6	Orthoclase
2	Gypsum	7	Quartz
3	Calcite	8	Topaz
4	Fluorite	9	Corundum
5	Apatite	10	Diamond

printed 10/2/2023 12:21:04 PM

GeoTesting EXPRESS

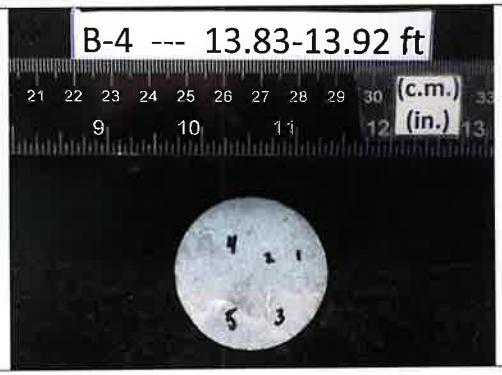
Client:	Greenbaum Associates, Inc.				
Project:	Floyd Drive Trunk Sewer				
Location:	Frankfort, KY			Project No:	GTX-317840
Boring ID:	B-4	Sample Type:	cylinder	Tested By:	jab
Sample ID:	---	Test Date:	09/28/23	Checked By:	smd
Depth :	13.4-14.5 ft	Test Id:	734555		
Test Comment:	---				
Visual Description:	---				
Sample Comment:	---				

Abrasiveness of Rock Using the Cerchar Method by ASTM D7625

Boring ID	Sample ID	Depth	Stylus No	Reading 1	Reading 2	Average	Comments
B-4	---	13.83-13.92 ft	1	2.2	1.2	1.70	
			2	0.4	0.6	0.50	
			3	1.4	1.1	1.25	
			4	0.5	0.5	0.50	
			5	1.3	1.0	1.15	
			Average CAIs			1.02	
			Average CAI *			1.49	
			CERCHAR Abrasiveness Index Classification			**Medium abrasiveness**	

Notes

Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 54/56 HRC
Stylus Displacement Relative to Rock Fabric:
Styli 1-3: Normal; Styli 4-5: Parallel
* CAI = (0.99 * CAIs) + 0.48
CAIs = CERCHAR index for smooth (saw cut) surface
CAI = CERCHAR index for natural surface
Comments:



GeoTesting EXPRESS

Client:	Greenbaum Associates, Inc.				
Project:	Floyd Drive Trunk Sewer				
Location:	Frankfort, KY			Project No:	GTX-317840
Boring ID:	B-4	Sample Type:	cylinder	Tested By:	jss
Sample ID:	---	Test Date:	09/27/23	Checked By:	smd
Depth :	13.4-14.5 ft	Test Id:	734556		
Test Comment:	---				
Visual Description:	---				
Sample Comment:	---				

Splitting Tensile Strength of Intact Rock Core Specimens by ASTM D3967

Specimen Depth	Test No	Thickness (L), in	Diameter (D), in	Thickness to Diameter Ratio (L/D)	Failure Load (P), lbs	Splitting Tensile Strength, psi	Failure Type
14.01-14.10 ft	ST-1	0.85	1.86	0.46	2,163	870	1

Notes: Strain rate: 2.5%/min.

ASTM requires the thickness-to-diameter ratio (L/D) of each test specimen to be between 0.2 and 0.75.

The reported thickness (L) is the average of three measurements.

The reported diameter(D) is the average of three measurements.

Failure Type: 1 = Intact Material Failure; 2 = Discontinuity Failure; 3 = Intact Material and Discontinuity Failure (See attached photographs)

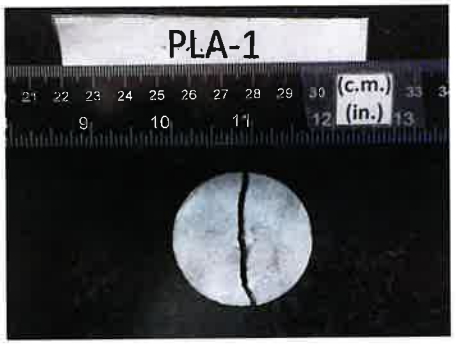
GeoTesting EXPRESS

Client:	Greenbaum Associates, Inc.		
Project:	Floyd Drive Trunk Sewer		
Location:	Frankfort, KY	Project No:	GTX-317840
Boring ID:	B-4	Sample Type: cylinder	Tested By: jss
Sample ID:	---	Test Date: 09/27/23	Checked By: smd
Depth :	13.4-14.5 ft	Test Id: 734557	
Test Comment:	---		
Visual Description:	---		
Sample Comment:	---		

Axial Point Load Strength Index of Rock by ASTM D5731

Test No.	Specimen Depth	Diameter, in	Thickness, in	Failure Load (P), lbs	De, sq in	De, in	Is, psi	F	Is(50mm), psi	Generalized Correction Factor, K	Estimated Compressive Strength, psi
PLA-1	13.92-14.01 ft	1.86	1.02	1,924	2.41	1.55	799	0.898	718	19	15,200

Before



After

Intact Material Failure

Notes: Generalized correction factor, K, used to estimate the compressive strength based on the specimen depth and ASTM D5731 Table 1.

The reported thickness (L) is the average of three measurements.

The reported diameter(D) is the average of three measurements.

De = the equivalent core diameter

Is = the uncorrected point load strength index

F = the size correction factor

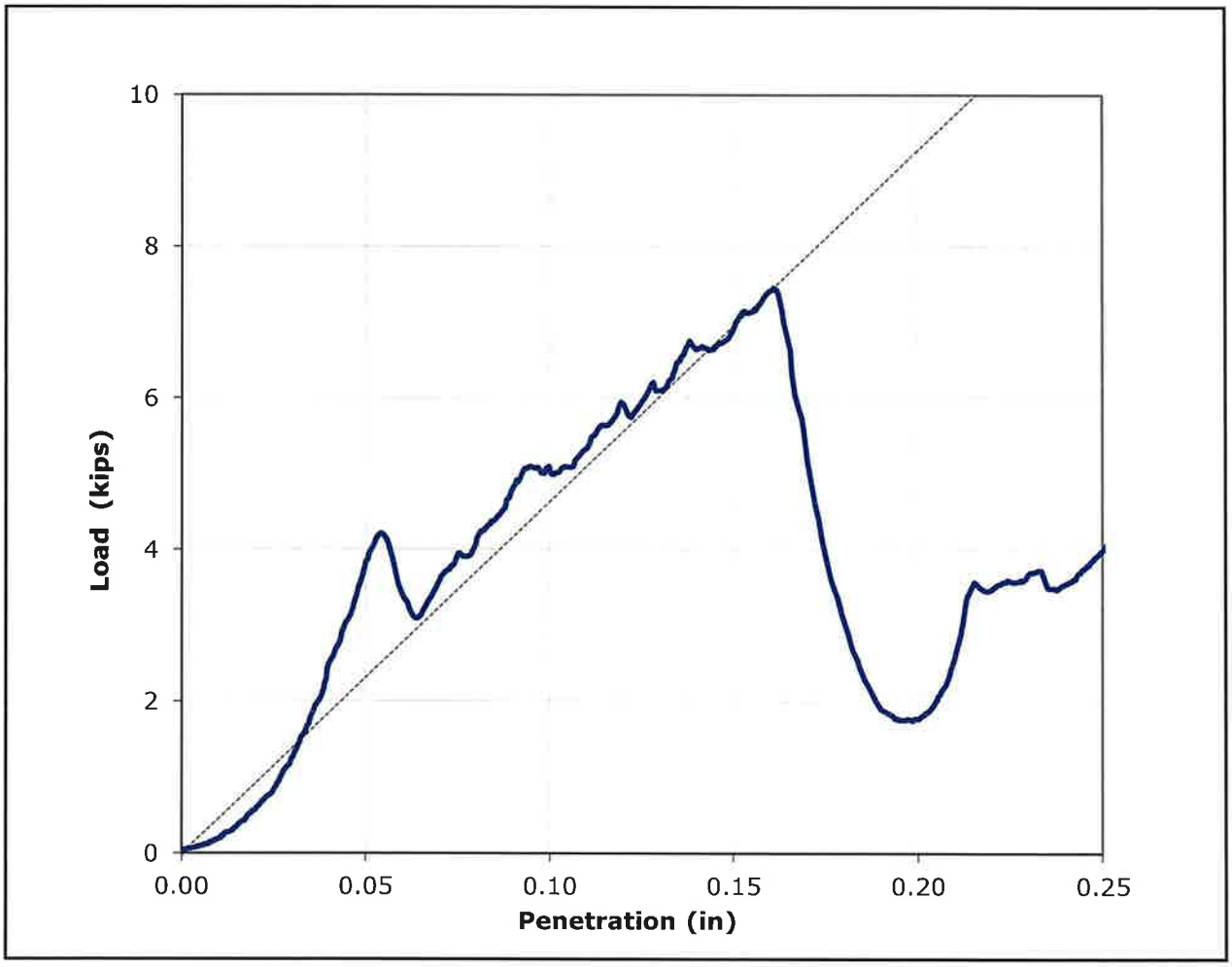
Is(50) = the size corrected point load strength index

GeoTesting EXPRESS

Client:	Greenbaum Associates, Inc.
Project Name:	Floyd Drive Trunk Sewer
Project Location:	Frankfort, KY
GTX #:	317840
Test Date:	10/10/2023
Tested By:	te
Checked By:	jsc
Boring ID:	B-4
Sample ID:	---
Depth, ft.:	14.21-14.32
Visual Description:	---

Punch Penetration Index Test

Moisture Condition:	as-received	Maximum Load, lbs:	7457
Penetration Rate, in/sec:	0.001	Peak Slope Index, kips/in:	46.4



GeoTesting EXPRESS

Client:	Greenbaum Associates, Inc.				
Project:	Floyd Drive Trunk Sewer				
Location:	Frankfort, KY			Project No:	GTX-317840
Boring ID:	B-4	Sample Type:	cylinder	Tested By:	te
Sample ID:	---	Test Date:	10/12/23	Checked By:	smd
Depth :	13.4-14.5 ft	Test Id:	734554		
Test Comment:	---				
Visual Description:	See photograph(s)				
Sample Comment:	---				

Bulk Density and Compressive Strength of Rock Core Specimens by ASTM D7012 Method C

Boring ID	Sample Number	Depth	Bulk Density, pcf	Compressive strength, psi	Failure Type	Meets ASTM D4543	Note(s)
B-4	---	13.45-13.80 ft	164	12017	1	No	4,*

Notes: Density determined on core samples by measuring dimensions and weight and then calculating.

All specimens tested at the approximate as-received moisture content and at standard laboratory temperature.

The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.

Failure Type: 1 = Intact Material Failure; 2 = Discontinuity Failure; 3 = Intact Material and Discontinuity Failure (See attached photographs)

1: Best effort end preparation. See Tolerance report for details.
2: The as-received core did not meet the ASTM side straightness tolerance due to irregularities in the sample as cored.
3: Specimen L/D < 2.
4: The as-received core did not meet the ASTM minimum diameter tolerance of 1.875 inches.
5: Specimen diameter is less than 10 times maximum particle size.
6: Specimen diameter is less than 6 times maximum particle size.

*Because the indicated tested specimens did not meet the ASTM D4543 standard tolerances, the results reported here may differ from those for a test specimen within tolerances.

printed 10/12/2023 1:38:27 PM

GeoTesting EXPRESS

Client:	Greenbaum Associates, Inc.	Test Date:	10/10/2023
Project Name:	Floyd Drive Trunk Sewer	Tested By:	te
Project Location:	Frankfort, KY	Checked By:	smd
GTX #:	317840		
Boring ID:	B-4		
Sample ID:	---		
Depth:	13.45-13.80 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.04	4.04	4.04
Specimen Diameter, in:	1.85	1.85	1.85
Specimen Mass, g:	469.54		
Bulk Density, lb/ft^3	164	**Minimum Diameter Tolerence Met?**	NO
Length to Diameter Ratio:	2.2	**Length to Diameter Ratio Tolerance Met?**	YES

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.
Straightness Tolerance Met? YES

END FLATNESS AND PARALLELISM (Procedure FP1)

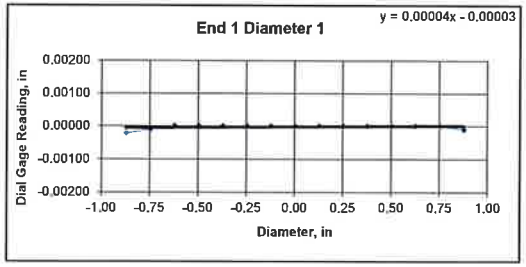
	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
END 1															
Diameter 1, in	-0.00020	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010
Diameter 2, in (rotated 90°)	-0.00010	0.00000	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

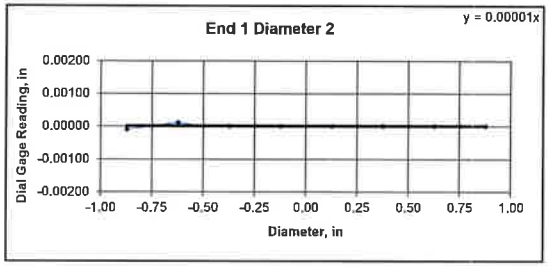
Difference between max and min readings, in:
0° = 0.00020 90° = 0.00020

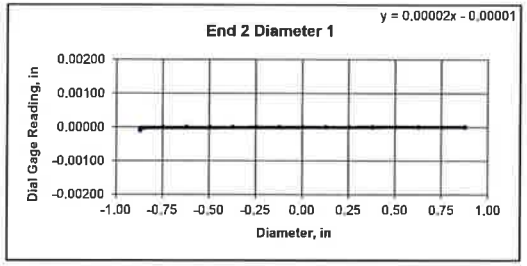
	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
END 2															
Diameter 1, in	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Diameter 2, in (rotated 90°)	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

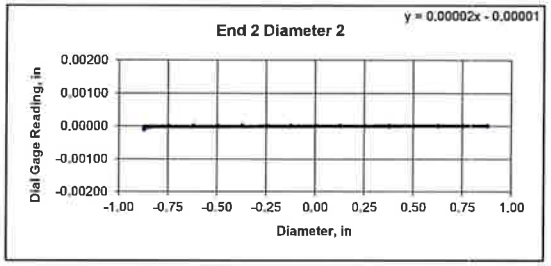
Difference between max and min readings, in:
0° = 0.0001 90° = 0.0001

Maximum difference must be < 0.0020 in. Difference = ± 0.00010
Flatness Tolerance Met? YES









DIAMETER 1

End 1:
Slope of Best Fit Line 0.00004
Angle of Best Fit Line: 0.00213

End 2:
Slope of Best Fit Line 0.00002
Angle of Best Fit Line: 0.00115

Maximum Angular Difference: 0.00098

Parallelism Tolerance Met? YES
Spherically Seated

DIAMETER 2

End 1:
Slope of Best Fit Line 0.00001
Angle of Best Fit Line: 0.00033

End 2:
Slope of Best Fit Line 0.00002
Angle of Best Fit Line: 0.00115

Maximum Angular Difference: 0.00082

Parallelism Tolerance Met? YES
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00020	1.850	0.00011	0.006	YES
Diameter 2, in (rotated 90°)	0.00020	1.850	0.00011	0.006	YES
END 2					
Diameter 1, in	0.00010	1.850	0.00005	0.003	YES
Diameter 2, in (rotated 90°)	0.00010	1.850	0.00005	0.003	YES

Maximum angle of departure must be ≤ 0.25°
Perpendicularity Tolerance Met? YES

Client:	Greenbaum Associates, Inc.
Project Name:	Floyd Drive Trunk Sewer
Project Location:	Frankfort, KY
GTX #:	317840
Test Date:	10/12/2023
Tested By:	jss
Checked By:	smd
Boring ID:	B-4
Sample ID:	---
Depth, ft:	13.45-13.80

After cutting and grinding

After break